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Maximilianus Hell (1720-1792) and the Eighteenth-Century Transits of Venus

A Study of Jesuit Science in Nordic and Central European Contexts

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ACKNOWLEDGEMENTS

This study of the history of astronomy during the eighteenth century was undertaken by a classical scholar with no previous training in either History, Astronomy or Eighteenth-Century Studies. Now that I finally find myself able to submit it, I have become obliged to a number of institutions and individuals who have helped along the way.

First of all, I should like to thank my first Latin lecturers back in the university year 1993/94, Jens Lauesen and Espen Karlsen, for inspiring me to pursue my studies of the language far longer than I had originally intended. Espen was also the one who pointed out the existence of a travel account by a Jesuit priest named Hell. Since I received my *candidatus philologiae* degree at the University of Oslo in 2001 for a thesis on the first century BCE author Cornelius Nepos, a new project on Father Hell has gradually materialised.

Thanks to travel grants from the Centre for Sámi Studies and the Geophysical Observatory in Tromsø I was able to visit the Viennese University Observatory in the summer of 2003, where I photographed the main part of Hell's surviving manuscripts (cf. Hansen & Aspaas 2005; Aspaas 2012*a* & 2012*b*). I thank Prof. Maria G. Firneis and Mag. Thomas Löger for their help during that visit; Prof. Firneis even helped facilitate another visit in 2006. Nils Voje Johansen from the University of Oslo joined me on my first trip to Vienna, and we later wrote a couple of popular articles on the subject (Aspaas & Voje Johansen 2004*a* & 2004*b*; see also Voje Johansen's own publications). Nils has given me access to his entire collection of archival materials and offered all sorts of advice over the years. It goes without saying that his assistance has been vital to my studies.

Truls Lynne Hansen of Tromsø Geophysical Observatory hired me as a scientific assistant in the autumn of 2003, with the specific task of studying Father Hell's previously unpublished geomagnetic observations from Norway (cf. Hansen & Aspaas 2005; Aspaas & Hansen 2007; Aspaas 2008*e*). Truls has been supporting my research in various ways – including financially – and served as a *de facto* co-supervisor ever since. Without his constant encouragement and help over the years, I doubt that I would ever have been able to finish this work.

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The Nordic Sámi Institute in Kautokeino (Guovdageaidnu) supported my research with a four-month scholarship in the winter of 2007/2008. I also received a two-month *stipendium* from the Research Council of Norway in the autumn of 2008 for a related project with Teemu Ryymin of the Stein Rokkan Centre in Bergen. Although historical encounters with the Sámi and the (pre-)history of Finno-Ugrian Studies form no prominent part of the present monograph, I have pursued those subjects in various articles (Aspaas 2008*c*; Ryymin & Aspaas 2009*a* & 2009*b*; Aspaas in press).

Special thanks are due to Marie-Theres Federhofer and Michael Schmidt of the *Forschungsgruppe Dilettantismus* of the University of Tromsø. Michael even read through my entire thesis before I submitted it (see also my contribution to Federhofer & Hodacs, eds., 2011). I also thank the organisers of gatherings for Norwegian classical philologers in Rosendal 2004 and Rome 2005; colleagues in a Nordic network on the history of research into the Aurora Borealis; a Norwegian network for historians of science initiated by Vidar Enebakk; and a Tromsø-based network led by professors Henning Howlid Wærp, Einar-Arne Drivenes and Robert Marc Friedman (the *Narrating the High North* group), for moral support and stimulating discussions.

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Finally, a more personal remark. This doctorate was begun in March 2004 by a father of one son and finished nearly eight years later by the father of four sons. The combination of family life with extensive research and voluntary work – as a secretary of the Norwegian Society for Eighteenth-Century Studies, secretary of Historisk Forening in Tromsø and co-editor of the journal *Sjuttonhundratal* – has been challenging. Frankly, it feels as though I have gained personal experience with that old Callimachean slogan, *μέγα βιβλίον μέγα κακόν* (‘a big book is a big evil’).[1] Traditionally interpreted as an aesthetic stance – the Alexandrian poet and scholar Callimachus advocated the *epyllion* (‘little epic’) in favour of the *epos* (‘grand epic’) – I personally find it applicable also for modern scholarship. A big book can be a big evil, not only to those who are to read it, but even more so to the writer himself, not to speak of his closest friends and family members. I acknowledge the robust patience and empathy of my friends, my parents, my oldest son Sindre and above all my dear Kari. *Takk alle sammen!*

Tromsø, Friday 13 January 2012 (quod felix faustumque sit!)

Per Pippin Aspaas

[1] Callimachus (Καλλίμαχος), *fragmentum* 465 in the edition of Pfeiffer 1949.

Part I

INTRODUCTION AND BIOGRAPHICAL ESSAY

I.1 MAXIMILIANUS HELL, THE EIGHTEENTH-CENTURY TRANSITS OF VENUS AND THE ROLE OF THIS THESIS

In the years 1768-1770, a scientific expedition led by Maximilianus Hell, court astronomer of Empress Maria Theresa, made its way from Vienna to a settlement on the remote, north-eastern coast of Norway, by the name *Wardoehus* (now Vardø). The principal goal of the expedition was that the Jesuit Father Hell on behalf of King Christian VII of Denmark and Norway should make observations of a 'transit', or passage of Venus in front of the Sun. This rare celestial event was to take place during midnight 3-4 June 1769. Similar expeditions were dispatched to various corners of the earth for the same occasion, the idea being that a combination of data sets obtained by skilled astronomers would lead to an accurate determination of the so-called 'solar parallax', or true distance between Sun and Earth. In characteristic eighteenth-century spirit, Maximilianus Hell and his team also conducted research into several subjects besides the astronomical main task of the expedition. One such sub-branch of their research was investigation of the local Sámi ("Lappish") language, resulting in an elaborate 'Demonstration that the Hungarian and Lappish Language is the same', now a classic of Finno-Ugric linguistics. Another sub-branch were geophysical observations resulting in an equally elaborate, but mistaken, 'New Theory of the Aurora Borealis'. The team also succeeded to observe the Venus transit itself, and it is chiefly for this achievement that the leader of the expedition has entered the annals of European astronomy.

This thesis explores the scientific career of the Jesuit Father Maximilianus Hell, with a special emphasis on his works in relation to the transits of Venus. It is first and foremost a source-based, historical case study. As a case study, its overarching aim is to contribute to a fuller and more nuanced understanding of the Venus transit projects of the eighteenth century, seen as an international enterprise. Furthermore, by focusing on Latin texts and discussing certain socio-linguistic aspects of eighteenth-century science, the thesis also seeks to use insights acquired from the field of philology to enrich the historiography of science.

The present study has two *foci*. First, it explores the history of Nordic and Central-European participation in the Venus transit projects of the eighteenth century. Second, it contextualises the career of the astronomer Maximilianus Hell as an example of Jesuit science in the age of European Enlightenment. In terms of structure, the thesis consists of discussions of various themes with concluding remarks at the end of each chapter (parts I and II), followed by editions of primary sources (part III), a summary and lists of sources and literature.

Until now, most historical studies of the transits of Venus have focused on the roles of French and British protagonists. Maximilianus Hell has generally been depicted as a somewhat peripheral figure on the larger canvas of Enlightenment figures following in the footsteps of Kepler and Newton. At first sight, such a depiction appears justified. For as it turned out, this Central-European Jesuit was accused of having seen little or nothing of the Venus transit in Vardø. Instead, according to the allegations of certain colleagues, he must have fabricated his sets of data after he had gained access to corresponding observations made at other sites. Although later investigations have proven these allegations wrong, this does not mean that Father Hell deserves to be characterised as an eminent astronomer at the scale of a Halley or a Cassini. But how should he then be depicted? Does a vocabulary associated with peripheral and exotic phenomena render justice to his expedition and to the debates that followed in its wake?

Historians of science have of late been inclined to reject ‘big histories’ (surveys) and have instead investigated how knowledge production is embedded in local contexts. Contrary to what popular science writing tends to postulate, that certain characters through history have been able to break out of ‘extra-scientific’ challenges posed upon them by religion, politics, prejudice or financial constraints in order to produce ‘pure science’, professional historians of science have tried to demonstrate how even the greatest of minds have always been entangled in an age, a place, a milieu – in other words, a *context*. That realisation permeates the present study as well. However, although the thesis is cast as a case study on the role of an individual, the Jesuit Father Maximilianus Hell, it is far from any *microstoria*. Instead, it draws upon primary sources preserved in several countries and in various languages in an attempt to analyse a set of local, regional, national and international contexts, into which the works of Hell and other contemporaneous astronomers are inscribed. Rather than looking for the singular genius, the thesis seeks to clarify the conditions for astronomical research in Central Europe and the Nordic countries in the latter half of the eighteenth century.

The planet Venus passed in front of the sun on two occasions in the eighteenth century, in 1761 and 1769. Both events entailed large-scale, international co-operation as well as competition and controversy. The role of *Jesuit science* in this highlighted chapter of world astronomy has so far received scarce attention in the historiography. Given the lack of comprehensive studies, it comes as no great surprise that a recent publication offering an overview of 'The Jesuits and World Science, 1540-1773', concludes that the Society of Jesus[1]

> played only a secondary role in the most important scheme for coordinated observations in the eighteenth century, the observations of the transits of Venus across the face of the Sun in 1761 and 1769.

This thesis makes a different case. In exploring the scientific capability and international orientation of Maximilianus Hell and some selected colleagues of his, it seeks to demonstrate that although their Society came increasingly under pressure since the mid eighteenth century until it was finally dissolved by the Pope in 1773, the Jesuits were still able to influence greatly on the spatial distribution, scientific design and sheer scale of the global Venus transit enterprise. Jesuit astronomy should not be seen as exotic or peripheral *per se*.

The subtitle of the thesis promises a study of Jesuit science in Nordic and Central-European contexts. To take *Central Europe* first: two factors were fundamental to Maximilianus Hell's scientific career, namely the provincial division of the Society of Jesus to which he belonged and the territorial expanse of the House of Habsburg that paid him. The "Austrian Province" of the Jesuit order encompassed present-day Austria and Hungary along with regions now known as Slovakia, western Romania, Croatia, Slovenia and northeastern Italy. The Vienna-administered state, whose court astronomer Hell remained until his death in 1792, had territorial interests across this entire vista and beyond. Considered by some as a "state within the state", the Society of Jesus was capable of making decisions concerning, for example, whether or not an astronomical observatory was to be founded at a particular university and how it was to be equipped. It did so in southern Styria as well as in far-eastern Transylvania. After the Society of Jesus became suppressed in 1773, the state took over the role as the principal decision maker concerning higher education and research in the region. This changed the working conditions for most Central-European astronomers. Furthermore, due to territorial expansions, Galicia and Silesia became a matter of importance to former Jesuit astronomers of Central Europe. There exists nothing resembling a 'general history of astronomy in Central Europe', or a comprehensive study of the 'history of astronomy in the Austrian Province of the Jesuits' for that matter. So far, the few studies that exist have tended

[1] Burns 2011, chapter on "The Jesuits and World Science, 1540-1773", here pp. 85-86.

to take the modern borders as their point of departure. This thesis employs a different perspective, by exploring developments in the entire region as a whole.

Bits and pieces of the *Nordic* history of eighteenth-century astronomy will be known to specialists in the field. A scholar like Pehr Wargentin in Stockholm, an eminent 'networker' in his own age, has been able to make his way into the international historiography alongside a handful of his Swedish contemporaries. It is also known that the polymath Leonhard Euler stayed in Russia during parts of his career, and his contemporary Mikhail Lomonosov is hailed by many as a discoverer of the atmosphere of Venus. Denmark-Norway is less known for its contributions to the exact sciences in the same period. As for astronomy, Tycho Brahe had left Danish-ruled Hven more than a century and a half before the transits of the 1760s.

Academic historians, including historians of science, have of late turned increasingly towards comparative studies. Nordic scholars are no exception in this respect. However, the tendency so far has been that developments in a single Nordic country are compared to some distant entity like Britain or France. Another choice has been made in the case of this thesis. There exists no 'comparative history of the exact sciences (or astronomy) in early-modern Russia, Sweden and Denmark-Norway'. By exploring the contrasting stories of the eighteenth-century Venus transit enterprise in the three Nordic powers, this thesis aims at forming a step in that direction.[2]

Highlighting the impact of Central Europe and the European North necessitates a different selection of primary sources than what is current in history of science nowadays. *Language* is a case in point here. The history of science of Central Europe and the Nordic Countries offers a wider spectrum of vernacular languages in terms of both primary sources and historiography than does Western Europe. While it is true that use of German, Swedish, Danish and Russian (not yet Finnish or Norwegian) for scientific publications had gained currency by the latter half of the eighteenth century, it remains a fact that none of these languages were read to any large extent in more westerly centres of learning. In the worlds of Maximilianus Hell and Pehr Wargentin, it was Latin, alongside French, which was the only truly universal language for scientific communication. And it worked. Thanks to the Latin language, it was possible for them to communicate directly with the centres of science in Western Europe. In the

[2] By 'comparative' I mean the kind of "contrasts of contexts" that are used to make the specific character of each case stand out more clearly, as described in for example Skocpol & Somers 1980 (see also Kjeldstadli 1988).

historiography of eighteenth-century science, despite the importance of the Latin language to international communication in the midst of the Age of Reason, Latin sources are often neglected. By taking into account the Latin writings not only of Father Hell, but also of other savants of international reputation such as Pehr Wargentin, Anders Johan Lexell, Roger Boscovich, Christianus Mayer, Nevil Maskelyne and Jérôme de Lalande, this thesis will hopefully constitute a small step towards a more complete picture of international astronomy in the latter half of the eighteenth century. In brief, I hope to demonstrate that the study of cutting-edge astronomy high on the international agenda, as manifested in the Venus transit projects of 1761 and 1769, should not be reduced to the English and French writings that emanated from the astronomical centres of London and Paris.

While this thesis does not adhere to a microstoria approach, neither is it universal in scope. Rather it is ‘plurilocal’, in the sense that it compares how scientific activity in relation to the Venus transits unfolded in the Habsburg lands, Denmark-Norway, Sweden and Russia. At the same time, it examines how astronomical activity in those regions was perceived elsewhere; that is, in France and Britain in particular. Participation from an individual like Maximilianus Hell is here only one part of a broader picture, described in contemporaneous texts as the *Respublica litteraria*, or ‘Republic of Letters’. The early-modern ideal of a Republic of Letters implied that knowledge seeking should be a collaborative, supra-national and – in terms of religious denomination – truly neutral undertaking. It is often claimed by historians that this ideal was incapable of passing the test of reality.[3] And there is indeed no shortage of examples of how national, political or confessional antagonisms have prevailed over real collaboration in science. However, one may argue that the astronomical ‘sub-republic’ of the wider, cross-disciplinary Republic of Letters offers especially intriguing material in this respect. Astronomy is a branch of learning that has always been international in its very nature, in the sense that most astronomical data sets are useless unless compared with corresponding observations from other sites. A too narrow focus on a specific individual, region or nation – or sources in just one or two vernaculars – runs the risk of missing that fact.[4] Hence the broader approach of the present analysis.

[3] Examples of scholars arguing for a real ‘Republic of Letters’ during the eighteenth century are Daston 1991; Bots & Waquet 1997 (in French); Boedecker 2002 (in German). Examples of scholars questioning the historical reality of this ‘Republic’: Eskildsen 2005 and numerous contributions in Passeron (ed., 2008 [in French]).

[4] It may be appropriate here to specify my use of the term ‘international’. Certain historians are inclined to define this concept quite narrowly, using instead ‘cosmopolitan’ to designate the networks of early-modern – and modern – astronomers (see for example Sörlin 1993; Ratcliff 2008). I do not find the distinction fruitful. Accordingly, in this thesis ‘international’ is used quite broadly, as a means of describing contact or impact across

A final ambition of this study is more distinctly philological. By editing in a separate section two central texts of Maximilianus Hell and presenting throughout numerous quotations from texts in various languages and of a wide range of genres – scientific treatises, journal and newspaper articles, official and private correspondence, even diaries – I hope to contribute to the field of Neo-Latin philology itself.

For one thing, I have become convinced that Latin texts from the Age of Reason should be studied alongside vernacular texts. To use Antiquity as an example: every student of Cicero or Virgil is made immediately aware of the necessity to acquire at least a working knowledge of Ancient Greek, simply because all Roman authors of the Classical Age related to the Hellenistic world. Correspondingly, even though Father Hell preferred to use Latin for producing scientific texts, his texts were part of a dialogue with other statements in German, French and other Romance languages, which he read and heard on the streets of Vienna every day. Thus, Neo-Latin text production in the period of European Enlightenment was just as embedded in bilingual or even polyglot discourses as the classical Latin of Greco-Roman Antiquity.

My other comment to Neo-Latin studies is more technical. I disagree with a *modus operandi* that has many proponents among text editors, that one should standardise early-modern texts in keeping with conventions that are followed for editions of Ancient texts. Instead of emending the spelling, punctuation and typography to make a text look more familiar to the eye that is used to the classical Latin of a Cicero or a Virgil, I plead the case that the conventions of the autograph should be respected. While this choice perhaps appears conventional to the historian who is used to work according to the motto ‘do not meddle with your sources’, we shall see in a later part of this thesis that it is not as obvious to every classical scholar (Chapter III.1). There is, however, a huge difference between an early-modern author like Maximilianus Hell and the texts of Cicero and Virgil. In the latter case we have no autographs, but are forced to take resort to transcripts dating from a much later age. When editors of such material disregard the spelling and punctuation used by medieval copyists and instead try to convert the text according to certain modern conventions, this is perfectly legitimate. No one knows exactly how the authors of that ‘Golden Age’ wrote

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borders, whether on a personal or official level. Brosche 2009*b* (in German) offers a succinct discussion of the kind of ‘internationalism’ that is investigated in this thesis.

anyway. By contrast, for a writer like Father Hell, in whose hand numerous autograph manuscripts are preserved, the situation is vastly different. It is not a good way of enhancing our appreciation for Neo-Latin philology as a field of study in its own right to make an early-modern text look like a twenty first-century edition of Cicero.

I.1.1 HISTORIOGRAPHY AND FURTHER OUTLINING OF AIMS AND SCOPE

The contributions of Maximilianus Hell to the eighteenth-century efforts to calculate the size of the solar system is treated in various scholarly discourses. For the sake of convenience, four such discourses may be singled out. The present investigation will seek to contribute to all four discourses, and they will therefore be described in some detail here.

First and foremost, the story of Hell's expedition figures invariably in *historical accounts of the transits of Venus*. A great deal of literature on this topic has been published in recent years, particularly since the Venus transits became the object of a renewed historical interest as the first transit since more than a century took place in 2004. Studies of *the history of Jesuit science* make up another discourse in which at least the name of Maximilianus Hell can be found. A third discourse is works on the *history of astronomy in Nordic or Central-European countries*, as well as general histories of science and learning in these countries, where the court astronomer of Maria Theresa is a frequent ingredient. And last but not least, *biographical studies of the life and career of Maximilianus Hell* naturally describe his famous expedition and the debates that it entailed. Historical *accounts of the Vardø expedition* as such, whether it is told from a local historian's point of view or with a view to analyse some aspect of the scientific investigations undertaken in its course, may also be labelled as part of this biographical interest.

Despite a general awareness of Maximilianus Hell's expedition among historians of early modern science, no comprehensive study of the sources has been undertaken for more than fifty years. Instead, drawing upon the same, late nineteenth- or early twentieth-century literature and slighting the primary sources, recent storytelling tends to follow exactly the same, 'hagiographic' pattern, which may be summarised thus:

> *1)* A highly qualified Jesuit astronomer was invited to travel to faraway Lapland on behalf of the Danish King; *2)* He succeeded to observe the transit of Venus, but was wrongly accused of having cheated because he was a member of the

> Society of Jesus; *3)* He was freed from these accusations by an American astronomer named Simon Newcomb, and this is where the story ends.

This pattern is recognisable in all major books on the transits of Venus that have been published in English during the last fifty years or so, namely Harry Woolf (1959), Eli Maor (2000) and David Sellers (2001), as well as numerous international articles.[5] Important biographical reference works, like the *Dictionary of Scientific Biography* (vol. VII, 1973) or the more recent *Biographical Encyclopedia of Astronomers* (vol. I, 2007), also recount the same story,[6] as do several biographical articles and book chapters covering Maximilianus Hell. Moreover, studies of Jesuit science tend to repeat it, witness for example the influential works of Agustín Udías (2003) or Mordechai Feingold (2003).[7] Accounts of Hell's expedition as such usually follow in the same vein, without presenting new sources or more balanced conclusions. Over the following pages, I shall attempt to draw a broader picture of the state of knowledge as seen in all the scholarly contexts mentioned.

I.1.1.1 STUDIES OF THE TRANSITS OF VENUS AS SUCH

What do we know about the Venus transits of the eighteenth century? As mentioned, two transits took place in that century, in 1761 and 1769, and both were associated with a considerable degree of interest. Activities in various countries have been explored by scholars over the last half-century, beginning with the impressive survey by the US American historian of science Harry Woolf (1923-2003), *The Transits of Venus. A Study of Eighteenth-Century Science* (1959). Originally a doctoral thesis defended at Cornell University in 1955, it was revised and published by Princeton University Press four years later, and remains indispensible to this day.[8] More recent monographs and conference proceedings by Eli Maor (2000), David Sellers (2001), Peter Aughton (2004), Jean Eudes Arlot & Jean-Pierre Luminet (in French, 2004), Christophe Marlot (in French, 2004), William Sheehan & John Westfall

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[5] Woolf, *The transits of Venus. A study of eighteenth-century science* 1959, pp. 176-179; Maor *June 8, 2004: Venus in Transit* 2000, pp. 126-133; Sellers, *The Transit of Venus. The Quest to find the True Distance of the Sun* 2001, pp. 140-144. The French monographs of Jean Eudes Arlot & Jean-Pierre Luminet, *Le passage de Vénus* 2004, p. 19 and Christophe Marlot, *Les passages de Vénus. Histoire et observation d'un phénomène astronomique* 2004, p. 168 are exceptions to this rule in that they merely mention that Hell was sent to Vardø without pursuing the story further. For details of individual articles, see the introduction to chapter II.3.

[6] Ferrari d'Occhieppo in Gillispie (ed.), vol. VII (1973), pp. 233-235; László Szabados in Hockey *et al.* (eds.), vol. I (2007), pp. 519-520.

[7] Udías 2003, pp. 28-29; Feingold 2003, p. 1.

[8] Woolf has also published at least two shorter works on the same topic (Woolf 1953 and 1962 [in French]). The latter work reiterates much of the same material as the dissertation, but focuses especially on how the transits of Venus functioned as a vehicle for disseminating scientific knowledge in eighteenth-century France. For Woolf's biography, see Kargon 2003.

(2004), Don Kurtz (ed., 2005), David Aubin (ed., in French and English, 2007) and Jessica Ratcliff (2008) provide additional information on the transits that took place before and after the eighteenth century, but as regards the 1760s they include no fundamentally new information or conclusions that are not already present in Woolf's book. Given its status as a classic in its field, a brief assessment of the achievements and shortcomings of *The Transits of Venus* may be worthwhile.

Woolf's monograph is universal in scope. Its boundaries are temporal rather than spatial; it is '*the* book' about virtually 'everything' that took place in the eighteenth century in conjunction with the transits of Venus. It should be said that Woolf did have models to draw upon, mainly Johann Franz Encke's *Die Entfernung der Sonne von der Erde aus dem Venusdurchgange von 1761 hergeleitet* ('The Distance of the Sun from the Earth as Deduced from the Venus Transit of 1761', 1822) and the same author's *Der Venusdurchgang von 1769 als Fortsetzung der Abhandlung über die Entfernung der Sonne von der Erde* ('The Venus Transit of 1769. A Sequel to the Treatise on the Distance of the Sun from the Earth', 1824), as well as Richard Proctor's *The Transits of Venus. A Popular Account* (1875) and Simon Newcomb's long article, "Discussion of Observations of the Transits of Venus in 1761 and 1769" (1890). However, Woolf's contribution was pioneering in the sense that it was the first synthesis to be undertaken by a professional historian of science, basing himself on a variety of primary sources from the eighteenth century. It is also distinctly *historical*, since he takes into account a whole range of institutional, ideological and political contexts of relevance to Venus transit activities in various countries, something none of his predecessors had emphasised. As Jessica Ratcliffe puts it, Woolf's study was even conceived "in an almost Kuhnian sense", despite the fact that it antedates Thomas Kuhn's *The Structure of Scientific Revolutions* (1962) by several years.[9] Even so, as a global study of 'everything' it has its limitations. The archives visited by Woolf are confined to France, England and the United States of America, and contemporaneous publications from those countries dominate the printed sources he has placed under scrutiny as well. France and Britain were the Great Powers of eighteenth-century astronomy, no doubt, and when the international picture was to be drawn, this was the obvious place to start. His choice of sources has nonetheless, as I hope to demonstrate, resulted in a rather too strong predominance for Anglo-French perspectives. Activities in other regions, including the Nordic countries and Central Europe, are described by Woolf in a

[9] Ratcliff 2008, p. 19.

much more cursory, at times even downright sloppy, manner. However, these are precisely the regions that are fundamental for our understanding of the career of Maximilianus Hell.

Admittedly, Woolf does mention activities in Central and Nordic Europe as well, and such observations as he has been able to track down, he has entered in his much-quoted tables of successful Venus transit observations from all over the world in 1761 and 1769. However, when it comes to details of observations as well as the broader picture of the history of astronomy in the regions in question, Woolf's account is not satisfactory. Unfortunately, historical studies of the transits of Venus that have been published in English or French in recent years have strengthened, rather than weakened, the notion that virtually every step of international significance to the eighteenth-century Venus transit projects was taken by the French and British academies and societies of science. As I shall argue presently, this notion should not remain unchallenged.

The Vardø expedition took Maximilianus Hell from the metropolis of the Habsburg Empire through the present-day Czech Republic, Germany, Denmark, Norway and parts of Sweden to his destination in north-easternmost Norway. Apart from that, Hell's entire life was spent in ecclesiastical and erudite circles in territories that are now known as Slovakia, Hungary, Romania and Austria. He was educated – and taught – at Jesuit schools and academic institutions in these parts of the Habsburg lands, and remained a loyal supporter of the Society of Jesus even after its suppression in 1773. From 1755 to his death in 1792, he kept the position as court astronomer of the successive rulers Maria Theresa, Joseph II and Leopold II in Vienna. As regards the transits of Venus, Father Hell delivered a strong contribution even in 1761, as we shall see in chapter II.1 below. His educational background and his networks as a member of the Jesuit order no doubt had a decisive impact on his achievement in that year. And when it comes to the transit taking place eight years later, his interaction with amateur and professional astronomers in the Scandinavian countries was equally important, as will be demonstrated in chapter II.3. The Nordic, Central and Eastern parts of Europe are thus the geographical areas of principal interest for the present thesis, and the scientific networks of the Jesuit order constitute the core institutional, ideological and even political basis for Hell's scientific career. Unfortunately, this is where neither Woolf nor any of his successors have much to offer.

In search of information on what took place in the regions in question, it is necessary to turn to publications not only in English and French, but also in German, Hungarian, Slovak, Swedish, Finnish, Danish, Norwegian and Russian, many of which do not contain the words "Venus transit" or "solar parallax" in their titles. I cannot boast of possessing the full overview here, and the risk of having missed out important scholarly work is always present. However, in order to get a sense of the regional contexts of relevance to Father Hell's work, one is simply obliged to attempt to widen the scope beyond the Anglo-French historiography of the Venus transits as such. First, the status of knowledge on the (mainly Jesuit and Central-European) setting of Hell's work in conjunction with the 1761 transit of Venus needs to be assessed, before we proceed to the (mainly non-Catholic and Nordic) setting of his work on the transit of 1769. I shall thereupon turn to the overall picture of Maximilianus Hell's life and career, including the various scientific activities undertaken during his expedition, as drawn in scholarly literature.

I.1.1.2 STUDIES OF JESUIT SCIENCE OF RELEVANCE TO THE EIGHTEENTH-CENTURY TRANSITS OF VENUS

It is now widely recognised that the Society of Jesus as a whole constituted a major factor in the development of the mathematical sciences in Catholic Europe, in both the seventeenth and the eighteenth centuries. Astronomy was among its prime interests. The notion that Jesuit science in general was backward-looking and resilient to new insights, as seen in famous anecdotes of Jesuits spearheading resistance against the Copernican worldview and bringing about the condemnation of Galileo in the early seventeenth century, has in recent decades given way to a more balanced picture of the teaching and research activities of the Society of Jesus.

A brief glance at some pieces of quantitative evidence can be illustrative. The historically oriented geophysicist Agustín Udías, himself a member of the Jesuit order, in 2003 published an ambitious survey of Jesuit observatories in the 'Old Society' (that is, the period from the foundation of the order in the 1530s until its suppression in 1773). Udías here concludes that about 30 of the 120-odd astronomical observatories that existed world-wide in 1773, had been established by Jesuits.[10] A large proportion of these observatories were located within the so-

[10] Udías 2003, espec. pp. 1-2.

called ‘German Assistancy’, that is, precisely the administrative division of the Society in which Hell’s influence was most noticeable.

Another kind of statistics has been provided by the prominent historian of Jesuit science Steven J. Harris, who has studied the rate of publication of scientific works by Jesuit (and ex-Jesuit) authors in the entire period from 1560 to 1800. His statistics demonstrate a rapid growth in the number of such publications starting in the 1730s and 1740s and culminating soon after the suppression of the order in 1773 (after which year quite a few former Jesuits nonetheless continued to publish scientific works). Again, the German Assistancy emerges as an important factor in what Harris describes as a “dramatic revival of Jesuit scientific activity” in the period in question.[11]

Book historians have pointed to the same trend. The German book historian Reinhard Wittmann, in a programmatic article on the need for research into Jesuit printing and publishing activity in the early modern period, states that “no other order has attributed such a prominent status to the printed word as have the Jesuits”.[12] Although a detailed analysis of Jesuit printing and publishing in the Habsburg lands is to my knowledge still pending,[13] it seems safe to conclude that the increased number of scientific publications issued by Jesuits around the mid-eighteenth century reflects an increase in scientific activity ‘on the ground’, be it in dusty libraries, in sizzling laboratories or lofty observatories.

It is well documented that Father Hell personally contributed to the construction of new observatories within the German Assistancy. And as the main editor of the almanac-journal *Ephemerides (Astronomicae) ad Meridinianum Vindobonensem* for 35 years, he included in the form of supplements (*appendices*) a vast amount of data sets and theoretical expositions written either by himself or by fellow Jesuit astronomers. He even published separately (in 1768) a two-volume collection of astronomical observations made by Jesuits in China in the entire period from 1717 to 1752. His career, then, fits well to the increase in scientific activity, at least among Jesuits in the Habsburg lands, that took place during his lifetime.

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[11] Harris 1993, here p. 530; cf. Harris 1996 and 1999. All three works appear to be relating to his PhD dissertation, *Jesuit Ideology and Jesuit Science: Religious Values and Scientific Activity in the Society of Jesus, 1540-1773* (University of Wisconsin-Madison, 1988), which I have not seen.

[12] Wittmann 2000, p. 1: “Kein anderer Orden hat dem gedruckten Wort einen so herausragenden Stellenwert beigemessen wie die Jesuiten”.

[13] At least no such publication is listed in Johannes Frimmel’s thorough survey of research into the field of history of books in Austria (2011).

For the broader picture of Jesuit science in the period, numerous studies that have been published in recent years are of relevance.[14] For example, the outstanding anthologies *The Jesuits* (1999) and *The Jesuits II* (2006), edited by John W. O'Malley in collaboration with the above-mentioned Harris and other scholars, contain several articles on the history of Jesuit science in early modern Europe. Particularly useful to grasp the general institutional framework for Jesuit science is Harris' own "Mapping Jesuit Science" in the first of these volumes. Another fundamental work providing overviews of teaching and research by Jesuit professors in the mathematical sciences in the German, French and Italian assistancies as well as north-eastern parts of the Continent has been provided by Karl Adolf Franz Fischer (catalogues published 1978, 1983 and 1984). However, Fischer does not venture beyond a mere catalogue of 'who were active where and when', essential though that it is.

Despite my decision to use it in the subtitle of this thesis, I find the tag 'Jesuit science' somewhat problematic in the case of an astronomer firmly integrated in the European Republic of Letters. On the one hand, Hell collaborated closely with several other Jesuit astronomers. Thus, close collaboration between Hell and the Hungarian Jesuit Franciscus Weiss has been demonstrated in the works of the Hungarian authors Ferenc Pinzger (two volumes, published 1920-1927) and Magda Vargha (two volumes, 1990-1992), and the equally important co-operation between Hell and the Jesuit Josephus Stepling in Prague has recently been studied by the Czech astronomers Josef Smolka and Martin Šolc (2008).[15] On the other hand, as Imperial and Royal Astronomer of Vienna, Father Hell did not confine himself to cooperation with and publication of the observations of his *confrères*. Thus, the historically oriented astronomer Konradin Ferrari d'Occhieppo (1907-2007) has described Maximilianus Hell and his contemporary, the Benedictine abbot Placidus Fixlmillner of the Cremifanum (Kremsmünster) Monastery, as "the founders of modern astronomy in Austria". The two even cooperated closely, he points out in an article published in 1957.[16] The correspondence of Fixlmillner and Hell has since then been edited by the late director of the

[14] Apart from examples mentioned elsewhere in this chapter, I should like to point to the studies of the role of Jesuits in the transfer of learning between Europe and Asia by Antonella Romano 2000 and 2005; Harris 2005; Catherine Jami 2004. See also the review article of Ditchfield 2007.

[15] See also the study of Zdeněk Horský (1970), who singles out his contacts with Weiss, Fixlmillner and Stepling as especially important to Hell's scientific career.

[16] Ferrari d'Occhieppo 1957, article subtitled "Die Begründer der neueren Astronomie in Österreich".

Kremsmünster Observatory, Father Ansgar Rabenalt (1911-1994), whose work corroborates the conclusions drawn by Ferrari d'Occhieppo.[17]

'Central Europe' poses another problem. I use it for the former Kingdom of Hungary and Austria proper, more or less as a synonym for the *Provincia Austriae* of the Jesuit order. However, the word "Austria" can also be used in a less restricted sense, to extend to the entire Habsburg Empire.[18] Hell's collaboration with numerous other astronomers both within the Habsburg lands and beyond, emerges from the letters edited by Pinzger in the 1920s and Vargha in the 1990s. In a recent article, I have analysed the contacts between Hell and French astronomers, in particular Jérôme de Lalande (in French, 2010). However, none of the works mentioned analyses how Father Hell's – mainly Jesuit – network influenced his role in the Venus transit project of 1761, during which year he stayed in Vienna. Harry Woolf, for his part, mentions Maximilianus Hell as one of the most "distinguished names" in a "German-speaking group" of Venus transit observers in 1761, but says nothing about Hell's activities as a 'networker', actively encouraging, coordinating and publishing the observations of others, both within the Habsburg empire and beyond.[19] The term "German-speaking group", furthermore, does not render justice to the multi-linguistic Kingdom of Hungary, which – as we shall see – remained important to Hell's identity throughout his life.

No other study that I am aware of has analysed the extent to which Father Hell and other Central-European Jesuits were integrated in the international Venus transit projects of the 1760s. Chapter II.1 of this thesis, on 'The 1761 Transit of Venus and the Role of Maximilianus Hell', aims to fill that gap in the literature.

I.1.1.3 STUDIES OF THE NORDIC COUNTRIES AND THE EIGHTEENTH-CENTURY TRANSITS OF VENUS

With the Vardø expedition of 1768-70 Maximilianus Hell entered for a while the service of the King of Denmark and Norway, conducting prestigious observations on behalf of this sovereign. He also entered a region, namely 'Lapland', as the northernmost parts of Fenno-

[17] Rabenalt 1986. Extracts of several of these letters were edited already by Pinzger 1927 (cf. Unprinted Sources, 1*a* and 1*b*), but Rabenalt appears to have been unaware of that publication.
[18] See Klingenstein 1997 for an illuminating discussion of the shifting historical meanings of the word *Österreich* ('Austria').
[19] See Section II.1.5 for details.

scandia were called. This region was ideally suited for observations of the transit of 1769 because that transit was to take place during the middle of the night, meaning that the Midnight Sun facilitated the observation. The same region was, however, divided between three states: the Kingdom of Denmark and Norway, the Kingdom of Sweden (including modern Finland) and the Empire of Russia. These entities will for the sake of convenience be referred to as 'Nordic' countries in the present thesis.[20] As we shall see, scientific societies in all the Nordic states participated in the Venus transit projects of 1761 and 1769. In the latter year, the three powers in fact organised observational attempts at several sites in northernmost Fennoscandia, Father Hell's Vardø being merely one out of eight Nordic-sponsored sites of observation in the region. In addition, two sites near the North Cape, that is, within Danish-Norwegian territory, were covered by the Royal Society of London. There are few studies focusing on activities relating to the transits of Venus in this part of the world.

As was the case for the Jesuit context, we must approach the Nordic countries and their role in the eighteenth-century Venus transit projects from an indirect angle, by asking: what can be said about the present state of knowledge concerning the history of astronomy in the Nordic countries in the latter half of the eighteenth century?

Books covering the history of astronomy (or science in general) in single countries, as well as histories of national academies and societies of science, provide convenient starting points for an overall understanding of the period in question. National participation in the Venus transit projects are frequently mentioned in such works, albeit rarely in the detail required for a case study like the present one.

For the source-based investigation of *Danish-Norwegian astronomy* two works merit particular mention. First, the five-volume 'History of the Royal Danish Society of Sciences' by Asger Lomholt (in Danish, 1942-1973) and second, the three-volume 'Four Hundred Years of Danish Astronomy' by Claus Thykier, Kjeld Gyldenkerne and Per Barner Darnell (in Danish, 1990). For the latter work Mr Darnell has written a brief chapter summarising Danish participation in the Venus transit projects of the eighteenth and nineteenth centuries,[21] and the Venus transit projects are described elsewhere in these multi-volume works as well. However, drawing largely upon national rather than international literature, these contributions do not

[20] See the introduction to chapter II.2 for a discussion of the terms *Lapland*, *Fennoscandia* and *Nordic countries*.
[21] Darnell in Thykier *et al*. vol. II (1990), pp. 251-253.

deliver adjustments of the current state of knowledge of the Venus transit projects seen as *international* campaigns – Woolf's book is for example not mentioned at all among their references. Instead, the 'Four Hundred Years of Danish Astronomy' as well as Lomholt's history of the Danish Royal Society are firmly placed within their national historiographical context, in the sense that they are hardly concerned with comparison with scientific activities in other countries.[22]

A more internationally oriented history of the Royal Danish Society of Sciences (which in later years has preferred to call itself an Academy) has been written by the Danish professor of history of science Olaf Pedersen, published as *Lovers of Learning* (1992). Here, the Venus transit activities of Denmark-Norway are briefly analysed in their international setting. The academic value of this work is, however, detracted by the absence of an apparatus of references to primary sources.[23] An equally internationally oriented line of analysis is followed in the more recent *Dansk Naturvidenskabs Historie* ('History of Danish Science'), the second volume of which covers the period 1730-1850 and has been edited by the prolific Danish historian of science, Helge Kragh (2005). For this volume, Kragh has written a chapter that includes an account of Venus transit expeditions organised from Denmark.[24] Although both Pedersen and Kragh display magisterial knowledge of the main developments of European science in the period, a knowledge they are capable of disseminating in a readable form, their accounts of the Danish (including Norwegian) Venus transit activities are not flawless. Some important activities have been left out of the story, and certain significant bibliographical details are plainly wrong.[25]

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[22] Thus, Darnell in his chapter treats the 'foreplay' to the Danish Venust transit observations by pointing to the works of Kepler (1629) and Halley (1716), but here the international orientation ends, and we find no comparisons with the activities in other countries in the years the Venus transits actually took place.

[23] See the chapter "Measuring the Country" in Pedersen 1992, pp. 89-104, espec. pp. 102-104.

[24] Kragh 2005, chapter 6. There is also an English, one-volume version of the entire work, with the title *Science in Denmark. A Thousand Year History* (Aarhus University Press, 2007). I have not had access to that version.

[25] Thus, Pedersen claims that Hell's Venus transit report "had to be translated into Danish before it could appear in the Writings [i.e., the *Skrifter* of the Danish Society of Sciences]. His original Latin version appeared separately at Vienna in 1770 and was sent to Lalande, who complained of the delay […]" (Pedersen 1992, pp. 103-104). The first edition (Hell 1770*a*1) was in fact published in Latin in Copenhagen in February 1770, whereas both the Danish translation (Hell 1770*a*3) and the Viennese edition (Hell 1770*a*4) appeared several months later. It was the late arrival of the *editio princeps* that Lalande complained about, not the Viennese edition. Kragh, for his part, claims that the Royal Astronomer Christian Horrebow played no part whatsoever in the Venus transit project of 1769 and leaves the impression that Hell's was the only Danish-sponsored expedition in northern Norway that year (Kragh 2005, pp. 218-219). This is not correct. Horrebow did try to observe the event from Rundetårn, and he even delivered an oral report "on the not observed transit of Venus" for the Royal Society in Copenhagen 6 April 1770 (Sajnovics' travel diary, 6 April 1770 [WUS Vienna]: "in Societate prælegit Horrebow de non observato Transitu Veneris"; cf. Royal Danish Society of Sciences, 'Protocoll 1742-1770', p. 333 [KDVS Copenhagen]). He also arranged, after some hesitance, for his younger brother Peder Horrebow to be dispatched on an official expedition to Tromsø. Even though P. Horrebow made it

In Norway, there was also a Society of Sciences, based in Trondheim, the northernmost town of Denmark-Norway at the time. The Trondheim Society, which was established in 1760 and granted a Royal epithet in 1767, has had its history described in a recent work in English by Håkon With Andersen, Brita Brenna, Magne Njåstad & Astrid Wale, *Aemula Lauri: The Royal Norwegian Society of Sciences and Letters, 1760-2010* (2009).[26] However, astronomy was never a main issue in the early history of this Society, whose founding fathers focused on natural history, agriculture and history. Thus, although earlier works on the history of the Trondheim Society include some material from Hell's expedition, those documents are not concerned with the astronomical programme of the expedition.[27]

When turning to the history of *Swedish (including Finnish) astronomy,* works of amongst others the prominent professors of history of science Sten Lindroth (1914-1980) and Sven Widmalm provide good vantage points, as do the pioneering works of Nils Victor Emanuel Nordenmark (1862-1967) and the more recent contributions by Päivi Maria Pihlaja and Mathias Persson.

In the third volume of his grand synthesis *Svensk Lärdomshistoria* ('History of Swedish Learning'), Lindroth treats the period from 1719 to 1772, or the so-called 'Age of Freedom' in Swedish history (*Frihetstiden*, 1978). All institutions of science and higher education in the entire expansion of the Swedish realm are described, including the Royal Swedish Academy in Stockholm and its secretary, the above-mentioned astronomer Pehr Wargentin. In fact, Wargentin's international network and his decisive role in the Swedish participation in international research projects, including the transits of Venus, are among the topics treated at length in Lindroth's book. The same author had already treated Wargentin and the Venus transits in the first volume of his 'History of the Swedish Academy of Science' (in Swedish, 1967), although the wider scope of the 'Swedish Learning' furnishes the reader with an even broader picture of the period.

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no further than Dønnes, this place is still within the region of North Norway. Besides, the Copenhagen professor Kratzenstein travelled to Trondheim where he unfortunately failed to observe the transit due to clouds (see chapter II.2 for details).

[26] In this work, Brita Brenna has written the chapter on the eighteenth century. See also her article "Dilettantism and Discipline: The learned milieu around the establishment of the Royal Norwegian Society of Sciences" (in Norwegian, 2011) and Monica Aase & Mikael Hård, "'The Norwegian Athens': Trondheim as a town of learning during the second half of the eighteenth century" (in Swedish, 1998).

[27] See especially the works of Ove Dahl on the founding father Gunnerus, published 1892-1911.

Sven Widmalm investigates the history of geodesy in Sweden in the entire period from 1695 to 1860 in his doctoral thesis *Mellan kartan och verkligheten* ('In-Between Map and Reality', in Swedish, 1990). No survey could of course be undertaken without astronomical knowledge, and Widmalm in his thesis explores at length the international orientation of Swedish astronomers, a topic that he has later pursued in a particularly condensed way in his study *A Commerce of Letters* (originally printed as a report in 1991, then edited for publication in *Science Studies*, 1992). Here, Widmalm analyses the international correspondence of Swedish astronomers throughout the eighteenth century, exemplified by the characters Celsius, Wargentin, Melanderhielm and Svanberg. Informal though it may seem, the frequent exchange of letters between Wargentin and his peers was crucial for establishing Sweden as a major player in international astronomy in the latter half of the eighteenth century.

Päivi Maria Pihlaja, who defended her doctoral thesis on 'Science under the Polar Star: Northern Research and the Contacts between the Swedish Academy of Sciences and France during the Eighteenth Century' in 2009 (in Finnish), has studied the contacts between Swedish researchers and the *Académie Royale des Sciences* in Paris.[28] Although astronomy is merely one of a series of subjects that are studied by Pihlaja, her contributions are valuable starting points for our understanding of the Venus transit campaigns in eighteenth-century Sweden, seen in an international context.

Whereas Pihlaja focuses on the Swedish relationship with the leading scientific body of France, Mathias Persson in his doctoral thesis 'The Proximate Other: Swedish Erudition and Politics in a German Journal, 1753-1792' (in Swedish, 2009) investigates how Swedish science and politics was portrayed in the leading German scientific journal, the *Göttingische Anzeigen von gelehrten Sachen*. In general, the 'foreignness' of Sweden was neither exoticised nor denigrated, Persson concludes. Rather, eighteenth-century Sweden was portrayed as a closely related scientific culture that in many ways resembled that of the highly successful University of Göttingen.[29]

[28] Lacking knowledge of Finnish, my sense of Pihlaja's thesis has primarily been acquired from personal communication as well as from a review by Peter Stadius (in Swedish, 2010). However, her articles 2005*a* (in English), 2005*b* (in English) and 2006 (in Swedish) are all noteworthy.

[29] In the vein of Persson, Ingemar Oscarsson (2011) has traced the presence of Swedish science in various international journals, in particular the *Journal des Savants*.

For his above-mentioned history of the Royal Academy of Science in Stockholm (1967), Lindroth covered much of the same ground as Pihlaja and Persson, albeit in less detail. His conclusion was that contacts with German-speaking regions and France were particularly important to the Stockholm Academy in the eighteenth century, whereas contacts with Britain and Russia played only minor roles.[30] This impression has been corroborated by Widmalm, who concludes that "[in] the case of Swedish astronomers, their internationalism favoured participation in French and German but not British networks of communication".[31]

What about the history of *astronomy in Russia*, arguably the third Nordic power of the eighteenth century? Articles and miscellaneous works apart, the best available survey of the history of Russian science in a western language is probably Alexander Vucinich's (1914-2002) *Science in Russian Culture* (two volumes, 1963-1970). A professor of sociology and anthropology at San Jose State College in the USA at the time he began this work, Vucinich drew upon his advantages as a Russian-speaking scholar in a western academic milieu when analysing the plight of various institutions, disciplines and individuals in the field of science in eighteenth-century Russia. Unfortunately, astronomy as a discipline is not emphasised by Vucinich, and the Venus transits are mentioned only in passing. Worse still, of a total of three Venus transit expeditions organised by the academy of St. Petersburg in the year 1761, and eight in 1769, Vucinich mentions only the ones made by Stepan Rumovskii in each year.[32] And while Vucinich does describe the numerous natural history expeditions undertaken in the eighteenth century at some length, he fails to mention that several of these came about as a direct result of the Venus transit enterprise of 1769. This does not render Vucinich's work irrelevant for the present thesis, however, for he does provide a valuable survey of the broader cultural context of Russian science in the eighteenth century.

The first volume of the 'History of the Russian Academy of Sciences' edited by Konstantin Vasil'evich Ostrovitianov (in Russian, 1958), provides a more detailed account of the Venus transit activities of the St. Petersburg academy in both 1761 and 1769. However, with its strong nationalistic bias this publication underestimates the international collaboration involved and grossly overestimates the roles played by the Russian-speaking academicians

[30] Lindroth 1967, vol. I, pp. 167-208.
[31] Widmalm 1991, pp. 8-13, here p. 13.
[32] Vucinich 1964, p. 148.

Lomonosov and Rumovskii.[33] A more balanced picture is drawn in other general works, such as the brilliant *Russia in the Age of Enlightenment* by Erich Donnert (1986), although the Venus transits are not treated at any length in that book.

Thus, 'big histories' covering the history of astronomy or general science in specific countries are indeed helpful. For more empirically detailed accounts, however, it is necessary to turn to other kinds of scholarly works. In-depth studies of individual savants count among these. Again, I cannot claim to have grasped anything near the full picture of what is at hand, and shall have to limit myself to a few works that have proven themselves especially valuable. These are Nils Victor Emanuel Nordenmark's biography of the above-mentioned *Pehr Wilhelm Wargentin* (in Swedish, 1939); Michel Mervaud's introduction to his edition of Chappe d'Auteroche's *Voyage en Sibérie* (in French, 2004); Georges Dulac's article on *Johann Albrecht Euler*'s period as secretary of the Imperial Academy in St. Petersburg (in French, 2000); and Alexander Moutchnik's doctoral thesis on the Jesuit *Christianus Mayer*, who visited St Petersburg in 1769 (in German, 2006). In sum, these studies provide a good framework for a clearer understanding of the degree of integration of Nordic scientific milieux in the international Venus transit projects of the 1760s.

With the exception of a recent article in Norwegian by the author of this thesis,[34] no comparative analysis of Venus transit activities in the Nordic countries has been made until now. Studies of the history of science in the region in question tend to focus on a single country and its relations with major European powers, not to engage in inter-Nordic comparison.[35] As I shall argue, the Venus transit campaigns appear to be highly suitable for precisely that comparative approach.

Chapter II.2 will outline in detail the shortcomings of the predominant historiography of the transits of Venus as far as the Nordic countries are concerned. It would be harsh to blame Harry Woolf and other historians from the Cold War era for their limited knowledge of the history of Nordic science. As for Russia, the archives held by the Soviet Union were at that

[33] See Ostrovitianov (ed.) 1958, espec. pp. 220-221 & 357-362. I am indebted to Kari Aga Myklebost for translating this and other Russian texts for me. As for the peculiar blending of nationalism with communist ideology in Stalinist historiography of science, see for example Kragh 1987, p. 110 (with references).
[34] Aspaas, 'The Contributions of Nordic Amateur Astronomers to the Venus Transit Projects of 1761 and 1769' (in Norwegian) 2011*a*.
[35] In addition to Pihlaja 2009 on Sweden vis-à-vis France and Persson 2009 on Sweden vis-à-vis Germany, one might mention a range of similar studies for Russian relations with the West in the Enlightenment period. To quote but one, the set of articles edited by Conrad Grau *et al.* 1997 contains many fine examples.

time largely inaccessible to western scholars. Furthermore, the available historiography was mainly available in Russian only, whereas the principal primary sources were either in Latin, Russian or German. Turning to Denmark, Norway, Sweden and Finland, the western historian was faced with the challenge of sources and secondary literature in the Scandinavian languages in addition to Latin and German. None of the languages mentioned seem to have been understood, or at least read to any large extent, by either Woolf or subsequent Anglo- and Francophone Venus transit historians.

There appears to be a need for a comparative study, placing the Venus transit activities in Nordic and Central Europe in perspective. No downgrade of the ground-breaking achievement of Harry Woolf is called for. Rather, one should attempt to shift the focus away from those Great Powers of European intellectual history for a while, without forgetting that they were precisely that. By reading texts in other languages than French and English and by tracing activities in other centres of learning besides the *Académie Royale des Sciences* of Paris and the *Royal Society* of London, we might arrive at a more nuanced and truly 'global' vision of the history of the eighteenth-century transits of Venus. At least that is the aim of part II of this thesis.

I.1.1.4 STUDIES OF THE LIFE AND CAREER OF MAXIMILIANUS HELL

The life and career of Maximilianus Hell fills a long chapter in this thesis (I.2), with its own historiographical remarks. Here, only a few strains in the predominant depictions of his career will be sketched out. An apologetic Hungarian-Jesuit strain, as represented by Ferenc Pinzger, will be described first. Then follow the contributions of the USA-based historian of science George Sarton, the Dane Axel V. Nielsen, the Norwegian Helge Kragemo, and – far more cursory – a selection of Austrian, Slovak, Hungarian, German, Hungarian and Romanian contributions.

A fundamental, source-based study of Hell's biography was undertaken by a Hungarian Jesuit by the name Ferenc Pinzger, teacher at the High School in Pécs, in the first quarter of the twentieth century. The main result of his study was published by the Hungarian Academy of Sciences as *Hell Miksa Emlékezete* ('In Memory of Maximilianus Hell'), in two volumes, 1920-1927. The first volume, which is entirely in Hungarian (apart from quotations in other languages), treats Hell's career with special emphasis on the Vardø expedition, drawing upon his entire printed œuvre in addition to letters and other manuscript sources preserved in official archives in Vienna, Copenhagen and Budapest, as well as in the monasteries of Kremsmünster and Pannonhalma. The second volume presents transcriptions from altogether 74 letters in Latin, German and French accompanied by extracts from the Latin travel diary that Hell's assistant Joannes Sajnovics kept during the Vardø expedition. There is also a German summary at the end of that volume.

The manuscripts edited by Pinzger illustrate the many-sided research interests of Father Hell and offer glimpses of his close collaboration (in the form of frequent correspondence) with leading astronomers in various parts of the Habsburg Empire, Denmark-Norway and France. Pinzger's depiction of Hell's scientific career is, however, firmly rooted in what we might call an apologetic or even hagiographic tradition. His work indeed constitutes, from beginning to end, a passionate vindication of Father Hell. Thus, Pinzger claims to have found "modesty, steadfastness in trouble, well-doing" to be characteristic traits of the personality of his biographee, and adds to this his "love of his country".[36] Furthermore, Hell's many-sided scientific theories and experiments are extolled as ingenious and ahead of their time, even in cases where leading scientists of Pinzger's own generation had arrived at contradictory results.[37] Such a line of argument might seem rather odd today, but it no doubt reflects Pinzger's background both as a Jesuit and a Hungarian.

The nineteenth century has been described as "the golden age of literary Jesuitphobia", involving politicians, historians and *littérateurs* in most countries of Europe.[38] In order to remedy this situation, Jesuits of the 'New Society' (that is, the restored Society of Jesus in existence since 1814) began publishing original documents, bibliographies, biographical studies and other genres of historical writings covering all epochs of the history of the 'Old Society'. The biography of Pinzger clearly belongs to this process of vindication. His work was furthermore undertaken in an age still characterised by nationalistic historiography in

[36] Pinzger 1927, Deutsche Zusammenfassung, pp. 10-11: "Bescheidenheit, Standhaftigkeit in Schwierigkeiten, Wohltätigkeit waren in der Tat seine charakteristischen Eigenschaften […]". And: "Wir könnten noch einen Charakterzug Hells erwähnen […], und das ist seine Vaterlandsliebe".
[37] Witness for example his remarks on Hell's 'New Theory of the Northern Light' (Hell 1776) in the German summary, Pinzger 1927, pp. 19-21.
[38] See John W. O'Malley's invaluable article "The Historiography of the Society of Jesus" in *The Jesuits* (1999), where he quotes Michel Leroy and Jean Lacouture for the tag *Jésuitophobie* (O'Malley 1999, p. 11).

most countries.[39] By depicting Father Hell not only as an ingenious scientist and an embodiment of Jesuit ideals, but also as a good patriot and a supporter of Hungarian culture, Pinzger was able to meet two ideological demands at the same time.

And the demands for a vindication of Father Hell were indeed pressing. As will be described in chapter II.3 below, Hell was suspected of having forged his data from Vardøhus in 1769. These accusations were never voiced in any serious publication on the solar parallax, but were nonetheless harmful to his reputation. It was not until the 1830s, however, that the suspicion of manipulated data sets became a case high on the agenda of serious astronomy, with the publication of Carl Ludwig Littrow's *P. Hell's Reise nach Wardoe* ('Father Hell's Journey to Vardø', 1835). Having gained access to Hell's surviving manuscripts, Littrow argued that they contained proof that the late Jesuit had forged his data sets before publication. His own edition of manuscripts by Hell and Sajnovics, partly in Latin with German commentary, partly in German translation, does not meet the standards of modern philology.

The American astronomer Simon Newcomb, a grand figure in the international Venus transit projects of 1874 and 1882, during a visit to the Vienna University Observatory, investigated the same manuscripts and came to the opposite conclusion with regard to the Venus transit manuscripts. Since Newcomb, there has been a general agreement amongst historians of astronomy that Father Hell must be freed from the accusations of having committed the worst thinkable scientific crime.[40]

Newcomb's rehabilitation aimed at an international, English-reading audience of astronomers helped remedy the situation, but there still existed numerous popular works in which Hell's alleged fraud was described as though it was a historical fact. Accordingly, Jesuit apologists repeatedly pointed to Newcomb's work, among them the Austrian-born Jesuit astronomer Johann Georg Hagen, director of the prestigious *Osservatorio Astronomico Vaticano*. In an article of 1917 (in German), Hagen emphasised Newcomb's vindication of Hell and used the opportunity to call for a new edition of the original travel diaries to replace Littrow's unreliable edition with its incompetent and all-too-hostile commentary, to be published preferably in conjunction with the 200th anniversary of Hell's birth in 1920. It was evidently

[39] For recent contributions to this topic, see the outstanding series *Writing the Nation: National Historiographies and the Making of Nation States in 19th and 20th Century Europe* (the first volume of which has been edited by Stefan Berger & Chris Lorenz [2008]).
[40] For details, see Section II.3.5 below.

this challenge Pinzger tried to meet, although his plans for a complete edition of Sajnovics' travel diary had to be postponed and eventually cancelled due to financial problems in the years of economic constraint following World War I.[41]

Attempts to restore the reputation of Maximilianus Hell have not been undertaken exclusively by Jesuit authors, or Hungarians for that matter. Thus, the Belgian-born historian of science George Sarton (1884-1956), professor at Harvard University, delivered a "Vindication of Father Hell" in his widely read journal *Isis* (1944). Drawing upon the writings of nineteenth-century astronomers, supplemented by incursions into a limited number of periodicals and other printed texts from the eighteenth century, Sarton assesses Maximilianus Hell's career in a balanced manner, emphasising both his weaknesses and his strengths (the former aspect had been effectively silenced by Pinzger, whose work Sarton in any case does not quote). However, because of his debt to the anachronistic and often quite biased accounts of nineteenth-century astronomers, Sarton's own account of Father Hell's career in fact resembles the hagiographic pattern of the Jesuit apologists, described above.[42] Nonetheless, his article remains the most authoritative and frequently quoted biographical work on Hell in the English language.[43]

Maximilianus Hell's career has also been studied by a limited number of *Scandinavian scholars*, whose interest in the Viennese Jesuit originates from the fact that he visited their lands during the expedition of 1769. The works of the historically oriented astronomer Axel V. Nielsen in Denmark and the astronomically trained librarian Helge B. Kragemo in Norway are especially valuable.

Axel Vilfred Nielsen (1902-1970) was for many years director of the Ole Rømer Observatory in Aarhus, Denmark, in which capacity he published several historical works. His contribution "Father Hell and the Venus transit of 1769" in the 'Nordic Journal for Astronomy' (in Danish, 1957) draws upon a much wider spectrum of primary and secondary sources than does Sarton. When describing Hell's scientific merits he is just as balanced as Sarton, although he – unlike the Harvard professor – extends this balance to include the behaviour of the Viennese Jesuit during the debates over the solar parallax. Instead of portraying a totally innocent Jesuit,

[41] Pinzger 1927, German summary, p. [1].
[42] Cf. Sarton 1944, espec. pp. 99-104.
[43] Sarton's article is, for example, the main source of information for Woolf's treatment of Maximilianus Hell in *The Transits of Venus* and for Eli Maor's chapter on Hell in *June 8, 2004* (2000).

Nielsen concludes that "Hell was not without responsibility [for the controversy] and he made things worse by his aggressive reaction" to the allegations of fraud.[44] He also suggests that his strife with Leonard Euler's assistant Anders Johan Lexell probably was about as vehement as that against Lalande. In brief, Nielsen demonstrates that he has read – and understood – Hell's original publications. He had even ordered copies of Hell's and Sajnovics' diaries from the archive of the Vienna University Observatory, and included in his article extracts of these manuscripts, partly in facsimile, partly in fine Danish translations.

Helge Bergh Kragemo (1897-1968) had, like Nielsen, a background in astronomy.[45] For the main part of his career, however, he was an academic librarian at the University Library of Oslo. In altogether three articles he treated the expedition of Hell and its various scientific results (1933, 1960 and 1968; all in Norwegian).[46] At least by 1960, Kragemo possessed copies of (parts of) the travel diary of Sajnovics as well as some other manuscripts from the expedition. His schooling in Latin appears to have been limited, but he compensated for this by collaborating with the eminent medievalist Lilli Gjerløw (1910-1998) at *Norsk Historisk Kjeldeskrift-Institutt* in Oslo.[47] As regards the Venus transits, nothing suggests that he has personally undertaken a read-through of the various Latin and French writings that were issued by Hell and others in the years following the expedition. Nonetheless, his conclusion is that Hell proved himself to be a "lousy debater" who "used all kinds of tricks; erroneous calculations, wrong longitude determinations and incorrect parallax effects."[48] In this respect, the assessment of Kragemo differs little from that of Nielsen (whose work he never quotes). The main achievement of Kragemo, however, consists in his application of the preserved letters and diaries as sources for the cultural history of Norway. Like Pinzger, Kragemo intended to make a new edition of Sajnovics' travel diary in replacement of Littrow's incompetent translation, but – like Pinzger before him – he failed to accomplish this work.[49]

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[44] Nielsen 1957*b*, p. 84: "Der kom et langt og artigt efterspil. Hell kan ikke siges fri for skyld deri og gjorde ondt verre ved sin voldsomme reaktion".
[45] His *cand.scient.* thesis, submitted at the University of Oslo in 1926, is entitled 'The pole height of Oslo, determined by observation in the first vertical' (*Oslo's polhøide bestemt ved observation i 1. vertikal [Struves metode]*). I am indebted to Nils Voje Johansen, lecturer of mathematics and historian of natural sciences at the University of Oslo, for this information.
[46] His article of 1960 was translated to German by A. Bamesreiter and published as a separate booklet by the Tornedalica Foundation in Luleå in 1997 (I have not had access to that publication).
[47] Cf. Kragemo 1960, p. 96 (where, however, her name is misspelled "Gierløff"). I am indebted to Dr. Espen Karlsen, expert of medieval Latin at the National Library of Norway, for information on Gjerløw.
[48] Kragemo 1960, pp. 121: "Her viser han seg imidlertid som en dårlig debattant"; and, referring to Encke, on p. 122: "Han [Encke] påviste hvordan Hell i sitt forsvar for sine observasjoners fortreffelighet hadde brukt alle slags knep: regnefeil, gale lengdegradsbestemmelser og feilaktige parallaksevirkninger".
[49] Cf. Kragemo 1968, p. 133.

More recent, source-based contributions on the expedition in Scandinavian languages include a handful of shorter articles by Nils Voje Johansen of the University of Oslo; by the author of this thesis; by Ole Mortensøn of Rudkøping Museum; and by Allan Sortkær of Aarhus University.[50]

Maximilianus Hell's expedition took place despite the fact that Danish-Norwegian legislation forbade the presence of Jesuits in the country. Although missionary work as such may not have been undertaken by Hell and Sajnovics, they were allowed to hold masses in both Trondheim and Gothenburg (Göteborg). This aspect of the expedition forms part of Kragemo's analysis, and has been further investigated by the Dutch-born monk Johannes J. Duin (in Norwegian, 1978), by the German historian of Catholicism Helmut Holzapfel (in Danish, 1979) and by the Norwegian professor of history Sølvi Sogner (in Norwegian, 2003). However, their works are contributions to the topic 'Jesuits on Scandinavian soil', and do not touch upon the astronomical activities as such. Further Scandinavian contributions, presenting primary sources on the expedition of Maximilianus Hell seen from a Swedish angle include works by Nordenmark (in Swedish, 1939) and Erik Tobé (in Swedish, 1991). It is striking, however, that very few of the Scandinavian authors cite publications from their neighbouring countries. Despite linguistic affinity, the national boundaries appear regrettably insurmountable to many scholars in the Scandinavian countries.

Austrian interest in Hell's career has obvious reasons. Although no full-length biographical work has been published since Littrow's book of 1835, source-based articles include contributions by the Jesuit Johann Steinmayr;[51] the historically oriented astronomer Konradin Ferrari d'Occhieppo;[52] and the Jesuit Anton Pinsker.[53] Maximilianus Hell is also treated at some length in recent *Diplomarbeiten* of Nora Pärr and Cornelia Maria Schörg and in a doctoral thesis of Hermann Haberzettl – all historians.[54] Biographical works on Hell's assistants Franciscus de Paula Triesnecker and Antonius Pilgram, respectively by Horst Kastner-Masilko (2005) and Thomas Posch & Karin Lackner (2008) are also noteworthy.

[50] Voje Johansen 2004, 2009 & 2011*b*; Aspaas & Voje Johansen 2004*a* & 2004*b*; Aspaas 2008*c*; Mortensøn 2004; Sortkær 2008.
[51] A series of lectures from the 1930s, published 2010 by Isolde Müller & Thomas Posch.
[52] Biographical studies from 1957 & 1973.
[53] Biographical lecture published in 1971.
[54] Pärr, 'Viennese Astronomers: Their Activities at Private Observatories and University Observatories' (in German, 2001); Schörg, 'The Presence of the Vienna University Observatory and its Research in the German-Language Astronomical Ephemerides and Journals, 1755-1830' (in German, 2009); Haberzettl, 'The Position of Ex-Jesuits in Austrian Politics and Culture at the End of the Eighteenth Century' (in German, 1973).

Thanks to these contributions, we know a great deal about the position of Maximilianus Hell in eighteenth-century Vienna. Nora Pärr has quite recently submitted a doctoral thesis on Maximilianus Hell to the University of Vienna. I have not had access to her monograph during the writing of this thesis, nor has she seen my own works in progress.

Slovak interest in Hell's career is manifest in a set of contextualised studies edited by Ján Novák in 1970 (in Slovak, with German summaries) as well as in a full-length biography by Elena Ferencová (in Slovak, 1995). These contributions contain many pieces of information, especially on Hell's childhood and youth in a region that is now found within the confines of Slovakia. As for the 'Slovakness' of Father Hell, however, this is often assumed, but has turned out to be rather difficult to prove.

Hungarian contributions to the study of Hell's career have multiplied since the days of Ferenc Pinzger. The tendency is to portray Hell, somewhat anachronistically, as a representative of the Hungarian nation state. Hell's patriotic remarks concerning the Kingdom of Hungary are all too often 'translated' as though they were uttered by a nineteenth- or twentieth-century nationalist. His alleged part in the discovery of the Finno-Ugrian language group is an important ingredient in many of these articles, few of which are based upon primary sources.[55] More promising is the intellectual historian at the European University of Budapest László Kontler's recent interest in the cultural-political context of Maximilianus Hell's career (2011 & in press).

As for *German authors*, the prolific historian of astronomy from the Observatorium Hoher List in Daun, Peter Brosche has investigated Hell's contacts with certain German contemporaries (in German, 1977 & 2010; in English, 2001). Alexander Moutchnik's doctoral thesis on Christianus Mayer (2006, mentioned above) is also noteworthy in this context. Finally, recent contributions by Elvira Botez (in English, 2004) and Ferenc Szenkovits (in Hungarian, 2006) treat Hell's period as a professor in present-day *Romania*.[56]

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[55] To cite but one example, the editors of an otherwise fine Hungarian edition of Sajnovics' *Demonstratio* have taken recourse to a report on archival studies made by Hungarian linguists in Vienna during the first half of the nineteenth century, instead of revisiting the manuscript collections of the Vienna University Observatory themselves (cf. the contribution of Szíj to Sajnovics 1994). The conclusions of nineteenth-century authors thus holds sway.

[56] I have been unable to get access to Victor Marian, "Maximilian Hell (Höll) şi activitatea sa la Cluj", *Gazeta Matematică* vol. 49 (1943-44), pp. 63-72 ('Maximilianus Hell and his activities in Claudiopolis', referred to in Hadobás 2008, p. 73 and by other authors).

Pieces for the puzzle of an overall understanding of Hell's career have been laid out, then, by representatives of various nation states, academic disciplines and religious denominations. Does this mean that a mere 'cut and paste' operation would provide a coherent story of his life, capable of shedding light on his contributions to the international Venus transit projects and how they were received? Unfortunately not. For one thing, various pieces do not match. The modern map is too often used to navigate in a terrain that looked so much different to Hell and his contemporaries. Breaking down national barriers in a search for the 'mental map' of the past is necessary. This does not mean that boundaries did not exist in the past, only that they were different, and that we need to appreciate this fact in our search for historical insight.

I.1.2 ANALYTICAL APPROACH, SELECTION OF SOURCES AND TECHNICAL REMARKS

Some gaps and shortcomings in the available historiography have already been outlined. In the remaining sections of this chapter, I will describe how I intend to meet the challenges posed by those gaps and shortcomings.

I.1.2.1 ANALYTICAL APPROACH

This thesis understands itself as a work in the field of history of science. History of science is, as an academic activity, a sub-branch of history. Not in the sense that this kind of research is exclusively, or even mainly, undertaken by professional historians, but because the same standards apply, whether an academic historian (or historically oriented sociologist, philosopher, scholar of literature, or similar) or a scientist (usually from the pertaining discipline) is involved. The questions posed to the sources will vary over time and between various co-existing and competing 'schools', as in any academic field, but they must be analysed according to the principles of source criticism.[57]

'Big histories' covering the main developments in particular branches of science, or even science and learning in the widest sense and over multiple centuries, were long ranked as the best way to proceed as a historian of science. The last decades have, however, witnessed a fragmentation of approaches and a general narrowing of spatial, geographical and linguistic

[57] See, however, Kragh's excellent *Introduction to the Historiography of Science* (1987) for examples of scholars that have argued for a more anachronistic (or "presentist") approach to the history of science.

limits. For example, international successes such as Carlo Ginzburg's *The Cheese and the Worms: The Cosmos of a Sixteenth-Century Miller* (London 1980, Italian orig. 1976) or *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* by Steven Shapin & Simon Schaffer (Princeton 1985) constitute a rather narrow approach, compared to the universalist scope of earlier classics in the vein of *Augustine to Galileo: The History of Science, A.D. 400-1650* by Alistair Crombie (London 1952) or *From the Closed World to the Infinite Universe*, a grand synthesis of European astronomy from the fifteenth to the early eighteenth century by Alexandre Koyré (Baltimore 1957). What is more, whereas the main line of conflict once used to run between the 'externalist' and the 'internalist' camps (that is, between humanists or social scientists on the one hand and scientists studying the history of their discipline on the other), there is now also a criss-crossing of conflicts between various groups of 'externalists'.[58]

A recently retired professor of history of science at Oxford University, Robert Fox has in a paper of 2006 discussed the main developments of the discipline that he represents.[59] While welcoming new approaches for their often illuminating insights into the scientific cultures of a particular region, institution or group of researchers, he deplores the "all-too-exclusive commitment" of some scholars, who tend to subscribe to the approach of some particular authority within the 'new history of science' and reject all others.[60]

It is easy to appreciate the attitude of Professor Fox and agree that the historian should seek to be eclectic in the most positive sense, that is, at the same time open-minded and sceptical. Throughout this thesis, efforts are made to analyse relevant textual sources in a contextual perspective. Over the following pages, I will describe three analytical perspectives that I have found convenient to apply in the process of contextualisation, however conventional and unoriginal they may appear.

The first of these perspectives has to do with *breaking down national barriers*, avoiding what historically oriented sociologists have coined "methodological nationalism".[61] Employing a

[58] This does not imply that the ancient conflict between 'internalists' and 'externalists' has in any way cooled down, see for example Enebakk 2008 or 2009 (both in Norwegian).
[59] Fox, "Faschioning the discipline: History of science in the European intellectual tradition" 2006.
[60] Fox 2006, p. 411.
[61] The concept appears in historical studies to be primarily attributed to Anthony Smith, but it does have roots in the 1970s, see for example Wimmer & Schiller 2002. As to its meaning in historical studies, readers of Norwegian may consult Myklebost 2009 or Kjeldstadli 2009.

comparative perspective is a means of achieving this. The second perspective is *socio-linguistics*, or more precisely an awareness that the language in which an expression is made is not always arbitrary. The final perspective implies study of the *interaction between professionals and amateurs in science*, an approach that some scholars prefer to call "dilettantism".

What do I mean by '*breaking down national barriers*'? In an article on "Nationalism and internationalism" in Routledge's *Companion to the History of Modern Science* (1990), the historian of science Brigitte Schroeder-Gudehus in a few sentences sums up what is commonly perceived as an important difference between eighteenth- and nineteenth-century science. The world of the eighteenth-century savant, Schroeder-Gudehus maintains, was characterised by cosmopolitanism and at least verbal adherence to the ideals of the so-called *Respublica litteraria*, or 'Republic of Letters':[62]

> This does not mean, however, that within this cosmopolitan republic of letters scientific achievement, as an intellectual exploit, had not been a matter of collective pride and envy and, therefore, a possible source of tension between co-operation and competition. Scientific discoveries were not only a matter of personal fame; the glory they brought to the scientist also accrued to his native country or, where national consciousness was still in its infancy, to his prince. […] However, difficult conflicts of loyalty between the principles of scientific internationalism and the fatherland's claim to undivided commitment, which were so common later on, hardly occurred before the nation state had gradually evolved into its modern form after the French Revolution and taken ideological hold of its citizenry and before the scientific research had become a factor of industrial and then military strength in the late nineteenth century.

The Swedish historian of science Sverker Sörlin has on several occasions explored what he calls the 'cosmopolitan' aspect of science. In one of his articles, entitled "National and International Aspects of Cross-Boundary Science" (1993), three scientific expeditions (or clusters of expeditions) are analysed – the French Pacific expedition of Lapérouse in 1785-1788, the Danish-sponsored expedition to *Arabia felix* in 1761-1767 and the travels of various pupils of Linnaeus from the 1740s to the 1770s. In this connection, Sörlin touches upon the Venus-transit enterprise of the 1760s and describes astronomy as an, in its very nature, particularly internationally oriented discipline. In the end, however, he persuasively concludes on a note contrasting that advocated by Schroeder-Gudehus and others, that "difficult conflicts of loyalty between the principles of scientific internationalism and the fatherland's

[62] Schroeder-Gudehus 1990, p. 910.

claim to undivided commitment" hardly existed before the French Revolution. Instead, Sörlin maintains that[63]

> [t]he 18th-century scientist lived in a rhetorical universe of paradoxes and conflicting ideals. He should be loyal to the Republic of Letters. He should be loyal to his state, which might consider certain cosmopolitan manoeuvres unpatriotic and treacherous.

The demands for loyalty to the state or sovereign on whose behalf scientific expeditions were undertaken manifest themselves in various ways in the sources investigated by Sörlin. It is important, however, to stress that the 'national' element did not necessarily imply that the scientist needed to be a member of a particular linguistic group.[64] Thus, the team of the "Danish" expedition to *Arabia felix* (i.e., roughly modern Yemen) was very international indeed, and the initiative even came from a prominent scholar at the University of Göttingen. Even so, care was taken that no scientific reports or specimens were to fall into the hands of foreign nations – the participants had to vow that everything was to be published first by Danish printers and stored in Danish collections.[65] In the final event, the only surviving member of the group, Carsten Niebuhr, published his account of the expedition in German, and edited the natural-history journal of his deceased colleague, the Swede Pehr (Petrus) Forrskål, in Latin.[66] Publishing took place in Copenhagen, however, and in that sense these were presumably classified as 'Danish' texts.

Following Sörlin, the US American historian of scientific institutions James McClellan III in an article in the seminal journal *Dix-Huitième Siècle* points to the many European academies and societies of science as ideal illustrations of the strains between national concerns and cosmopolitan commitments in the everyday life of the eighteenth-century savant (in French, 1993). For one thing, the academies of this century were distinctly 'European', and they were nurtured by a common intellectual climate and had similar *raisons d'être*. There were, however, disciplinary differences: not all academies and societies covered all branches of science and learning. Another important difference, not discussed by Sörlin, is the linguistic diversity of Europe – a diversity to which the academies contributed, with their proceedings in Latin, French, English, Danish, Swedish, Dutch, German, Italian and Spanish. Nonetheless,

[63] Sörlin 1993, p. 66.
[64] The concept of a chain between nation – *Volk* – language is more of a romanticist idea, as discussed in for example Iggers & Wang 2008, pp. 31-32 (on Johann Gottfried Herder) & 71-72 (on Johann G. Fichte).
[65] Sörlin 1993, pp. 60-61.
[66] Cf. e.g. Harbsmeier 2003.

McClellan maintains that the widespread use of 'corresponding members' and regular exchange of proceedings and other scientific publications contributed to binding the savants together, even formally, in a real 'Republic of Letters'. Without the truly international networks provided by the academies and societies of science, McClellan seems to suggest, the Venus transit projects of the 1760s could never have taken place.[67] On the other hand, he concludes that the national or regional element of these early-modern institutions was equally important, as seen in the emphasis placed on gaining recognition from the state or ruler in whose territory the institution flourished, represented by titles such as "*Royal* Society", "*Imperial* Academy" and the like. Official support of this kind hardly emanated from some sort of pan-European solidarity; quite the contrary, in fact. Instead, the academies and societies won the support of their sovereigns by appealing to the public benefits – economic, cultural, etc. – that were likely flow forth from their activities. For all their similarities, then, the European academies and societies of science were primarily geographically restricted phenomena that grew out of various national, local or even confessional realities – the Republic of Letters was hardly a prime reason for their existence. At best, it was a side-effect of their endeavours, McClellan argues.[68]

McClellan could not have arrived at his conclusions without employing a comparative, pan-European perspective and crossing linguistic barriers in his own investigations of the subject. In this respect, Sörlin, McClellan and other leading historians of science are *not* characteristic representatives of history as an academic discipline whose performers tend to investigate the past of individual nations rather than clusters of nations. Returning to Professor Fox' above-mentioned article, this was originally delivered as a paper at a gathering of the *European Society for the History of Science*, of which Fox is a founding father. The linguistic, ideological and historiographical traditions of the various countries of Europe constitute barriers that Fox and other historians of science are continuously struggling to overcome. It is an aim of this study to make a small contribution in precisely that direction.

There are, in my view, good reasons to treat Maximilianus Hell as a representative of the European Republic of Letters. First, he was an astronomer, and astronomy as such was – as

[67] McClellan 1993, espec. pp. 156-158.
[68] McClellan 1993, espec. pp. 159-165, with its series of poignant sentences: "Creations de l'État et des gouvernement, les académies furent moins 'd'Europe' que 'des nations de l'Europe'" (p. 160); "Dans une histoire complète et analytique des académies d'Europe, la République des Lettres semble si diversifiée qu'il n'en reste pas grand chose" (p. 163); etc.

has already been pointed out – a highly international discipline. Second, he himself subscribed to the ideals of the Republic of Letters and deplored the tendency of publishing scholarly work in other languages than Latin or French, which he judged to be the two only ‘universal languages’ of the sciences. Third, Father Hell’s central position in the Venus transit enterprise invites such an approach, since his contributions are referred to in writings by astronomers of all the leading ‘nations of science’ of the Enlightenment.

I would argue, then, that the international orientation of leading eighteenth-century astronomers calls for a breaking down of national barriers in our study of their careers. The above-mentioned study of Sven Widmalm, *A Commerce of Letters* (1991; 1992) convincingly demonstrates how practical demands inherent in the way astronomy was performed led astronomers to contact each other in order to engage in a mutually beneficial exchange of observations across national boundaries.[69]

However, Widmalm does not discuss the linguistic aspect of the correspondence and seems not to take Latin letters into consideration. The French letters of the astronomers Delisle, Jean Bernoulli III, Lalande and numerous others are, however, analysed and frequently quoted from in English translation. From the Latinist’s point of view, it might be added that the French term *commerce de lettres* that served as inspiration for the title of Widmalm’s report is in itself a mere translation of the Latin *commercium litterarium* (or *litterarum*). The letter itself, Widmalm points out, served as a “scientific instrument” to the astronomers involved.[70] I would add to this that the international languages, Latin and French, also served as ‘instruments’. Without knowledge of either or both, you could hardly claim membership in the Republic of Letters.[71] This observation leads to the second analytical perspective, *sociolinguistics*.

In the introduction to his magisterial survey of *Neo-Latin Literature in Sweden* (2004), the Latinist Hans Helander points to an astonishing paradox. The extremely rich profusion of Latin texts in the early-modern period, especially in the field of learning and science, renders this literature an invaluable source to all major cultural processes from the early renaissance to the dawn of the twentieth century, including “the rise of the nation state, the geographical

[69] See also Subsection I.1.1.3 above.
[70] Widmalm 1991 & 1992.
[71] For more on this aspect of eighteenth-century astronomy, see my article Aspaas 2011*a* (in Norwegian).

discoveries, the Protestant movement, the Counter-Reformation, the scientific revolution". Nevertheless, "[it] is remarkable that many learned scholars today are not aware of the existence of this huge treasury", Helander observes.[72] Historians of science are no exception. It is all too often forgotten how essential Latin was to nearly all the major debates in European science at least up to the year 1800. Helander also points out another paradox. Despite the vulgar notion that holds currency in many quarters today, of Latin as a 'difficult' and 'dead' language, it was quite common for early-modern savants to have difficulties explaining their scientific discoveries in their mother tongue. The world of learning, or *Respublica litteraria*, for a long period consisted of bilingual persons, who mastered one international language in both conversation and writing (Latin) and one or two national languages, primarily in conversation (for example Swedish).[73] For scientific purposes, Latin was in fact often easier for them to use than the vernacular. As the eighteenth century progressed, French for various reasons grew to become a 'universal language', even of the sciences, and fluency in Latin gradually abated. This explains why Helander has chosen to focus on the period from 1620 to 1720 in his survey.

As regards the latter half of the eighteenth century, I find that it is too often forgotten that although the use of French for scientific purposes expanded rapidly across Europe during the course of the Enlightenment period, the mother tongue of Voltaire, Diderot and d'Alembert did not obliterate Latin overnight. Rather, the old and the new co-existed, side by side. Across Europe, universities still required fluency in Latin of all their staff, and doctoral treatises were written and defended in that language up until well into the nineteenth century. Furthermore, although most scientific societies and academies issued their proceedings in the vernacular, Latin proved hard to kill there, too – witness for example the *(Novi) Commentarii* of the Imperial Academy of Saint Petersburg, where the likes of Leonhard Euler published their main works. The proceedings of the Imperial Academy remained a purely Latin periodical until 1778, in which year it was announced that French (not Russian!) would be allowed alongside Latin.[74] The English *Philosophical Transactions of the Royal Society of London* practised a language policy that allowed Latin articles to be published as they were, but

[72] Helander 2004, pp. 14-15; also found in Helander 2001, pp. 8-9. Helander is by no means alone in pointing out this paradox, see for example Waquet 2001 (French orig. 1998), pp. 80-81; Ludwig 1997 (in German), pp. 323-324. Sociolinguistic aspects of eighteenth-century Latin have been in treated in various works by Bo Lindberg, Peter Burke and Anthony Grafton (e.g. Lindberg 1984 [in Swedish]; Burke 2004; Grafton 2009).
[73] See for example Helander 2004, pp. 18-19.
[74] See the opening "Avertissement" of the *Acta Academiae Scientiarum Imperialis Petropolitanae* Tom. I. Pars I. pro Anno MDCCLXXVII (1778), pp. [i]-vi; cf. Bernoulli 1779*a*, p. 29.

required all French contributions to be translated into English before they were printed.[75] National sentiments are likely to have been at stake here: the ability to read French was probably as widespread as competence in Latin among the fellows of the Royal Society, but they obviously preferred not to see the language of their main rival on print in their own periodical. Latin, however, remained a neutral affair. Conversely, during the years 1768-1774 the *Philosophical Transactions* were issued in a cheaper edition in Wittenberg. The articles were all there, unabridged, but accompanied by extensive Latin prefaces to the benefit of readers in Germany and Central Europe.[76] To them, Latin was evidently easier to understand than English, whereas a German preface – while perhaps easy to read – might have been an offence to potential readers whose mother tongue was not German.

A similar lesson is learnt from the seminal *Journal des Sçavans* (or *Journal des Savants*, in a modernised spelling) that was issued in Paris. Here, scientific news from all countries of Europe was reviewed – in French, of course. Most French publishers had ceased to publish books in Latin by the latter half of the eighteenth century, but the *Journal* continued to review titles that had been published in Latin elsewhere in Europe, and letters to the editors in that language were rapidly translated into French, apparently by the editors themselves. In this way, a character like Maximilianus Hell, thanks to his fluency in Latin, could communicate with ease with his colleagues abroad without having to master French.[77]

Beginning in 1753, an analogous journal for the German-speaking part of Europe, the *Göttingische Anzeigen von Gelehrten Sachen*, was being issued by a leading body in the German Enlightenment, the Royal Society of Sciences in Göttingen. Scientific works in all European languages were reviewed here, and it is a cherished 'treasure chest' for historians studying the history of science and learning in the latter half of the eighteenth century. However, it is often forgotten that even a progressive group of scholars like the Royal Society in Göttingen also promoted Latin. Thus, already in 1751, they had founded another periodical devoted to scientific articles, not just reviews and summaries, named the *Commentarii Societatis Regiae Scientiarum Gottingensis*. This purely Latin periodical continued (later

[75] See for example the articles of Pehr Wargentin and Jérôme de Lalande in the *Philosophical Transactions*: their contributions in Latin were published as they were submitted, only with an English title added. By contrast, their French contributions were translated in their entirety before being printed.
[76] Kronick 1990, p. 260; cf. Bernoulli 1771*a*, pp. 149-150.
[77] Hell's contributions to the *Journal des Sçavans* were all submitted in Latin, but translated into French by the editorial board (cf. e.g. Hell 1767*a*). A separate journal presenting articles handed in to the *Académie des Sciences* by its foreign correspondents allowed articles in Latin alongside French.

under the name *Novi Commentarii*) until the year 1777. The choice of language might seem odd today, but in the contemporaneous world it was hardly that strange: still in 1778, the editors of the *Journal des Sçavans* had to send a copy of the important *Astronomisches Jahrbuch* of Berlin to a colleague in Switzerland in order to have it reviewed. At the end of the review, which ran to an impressive 15 pages, we find the editorial remark that:[78]

> We have included a rather lengthy review of this work for the benefit of those who do not understand German. Astronomers will be forced to study this language in the future, if the use of it continues for contributions of such importance to the advancement of their science.

By contrast, the *Ephemerides* of Hell was read with ease by the astronomers in Paris. Despite the increased use of various vernaculars for journals and other scientific writings in the Age of Reason, Latin remained an important – and neutral – language throughout the period covered by this thesis. Not only the *Philosophical Transactions*, the *Journal des Sçavans* and the *Göttingische Anzeigen* deserve our attention; Latin periodicals that were widely read and influential in the same period ought to be taken seriously by historians of science as well.

That said, one should bear in mind that membership in the Republic of Letters was not facilitated merely by a knowledge of Latin and French. You also needed status, or authority, in order to become visible beyond the local landscape of your home institution. That a text was printed in Latin was not in itself a means to secure pan-European readership. In fact, many scientific treatises were rather local and ephemeral affairs.[79] In order to have an impact beyond a local circle without actually going abroad, you needed a titulature capable of imposing respect and securing your membership in the informal *Respublica litteraria*. With this 'membership' established, you could wield your authority in various ways. Father Hell, as Imperial and Royal Astronomer of the Habsburg lands and director of the Imperial Observatory of Vienna, may be described as a *'nodal astronomer'*.[80] He was a nodal

[78] *Journal des Sçavans*, Décembre 1778, pp. 801-815, here p. 815: "Nous en avons rendu compte un peu au long en faveur de ceux qui n'entendent pas l'Allemand; les Astronomes seront obligés d'étudier cette Langue, si l'on continue de s'en servir pour des ouvrages aussi utiles au progrès de leur science".

[79] In my view, earlier contributions to the history of Neo-Latin literature have sometimes overestimated the dispersal of that literature (see for example IJsewijn 1990, pp. 31-40). While it is true that Latin texts had the *potential* to be read by erudites all over Europe, many printed works were never distributed or read outside a narrow, local circle (see for example Moutchnik 2006, pp. 50-51 on the doctoral theses at German universities; or the review article by Sutton 2007).

[80] In a recent publication in Norwegian, I use the word "knutepunktsastronom" ('nodal astronomer') to describe the roles of the Imperial Astronomer and observatory director, Hell in Vienna and his contemporary, the observatory director and secretary of the Royal Academy, Wargentin in Stockholm ("The Contributions of Nordic Amateur Astronomers in Relation to the Venus Transits of 1761 and 1769" [in Norwegian, 2011*a*]).

astronomer in at least two senses. He obviously contributed to fix the coordinates of his capital and link his observatory onto a net comprising other key nodal points such as Paris and Greenwich. But he also functioned as a node of communication inside his own composite state, as a 'networker' connected to various less famous – often amateur – astronomers in less conspicuous places. By encouraging, facilitating and publishing the observations of such astronomers, he attached even further nodes onto the web of contemporaneous astronomy, while at the same time bringing honour to his own home state as a 'nation of science'.

The question of 'membership' and 'non-membership' brings the issue of amateurs to the forefront. This leads to the theoretical approach known as *dilettantism*. Originally used by Italian noblemen who engaged in sciences or the arts "for joy's sake" (that is, not as a profession), the term *dilettante* corresponds to the French *amateur*. Dilettantism as a research field aims to reconstruct the interaction between professionals and amateurs in various segments of human culture, including the sciences.

"Dilettantismus" is a term that has been used primarily in German research on cultural and intellectual history.[81] Only in recent years has the focus in some of this research shifted towards history of science in particular, as manifest in the works of amongst others Marie-Theres Federhofer (in German, 2001; in Norwegian, 2011); Robert Seidel (ed., in German, 2001); Michael Schmidt (in German, 2005); several contributions to the volume on 'Dilettantism around 1800' edited by Stefan Blechschmidt & Andrea Heinz (eds., in German, 2007)[82] and in a similar volume on 'Dilettante Cultures in Scandinavian Art and Science' by Marie-Theres Federhofer & Hanna Hodacs (in Scandinavian languages, 2011).[83]

The 'professional/amateur' dichotomy has experienced shifting connotations through time and in various languages. As many of the above-mentioned scholars confess, terms such as 'amateur', 'non-professional' or 'dilettante' are especially problematic as far as the eighteenth century is concerned.[84] In most branches of science, the process of differentiation between professionals (in the sense of 'real experts') and 'dilettanti' (in its negative sense) had to await the nineteenth century. Categorisations based on whether an actor was paid for his scientific

[81] In English history of science the *dilettante* is frequently designated as an "amateur" and *Dilettantismus* as "amateur science", see for example Robert Darnton (1968); Philippa Levine (1986); or William Clark (2003).
[82] See Kohns; Blechschmidt; Federhofer; Bach; and Robin in *op.cit.*
[83] See Brenna; Hodacs; Lynne Hansen; Aspaas; Voje Johansen; Henriksen; Jensen; Spring; and Beckmann in *op.cit.*
[84] See Bach 2007 (in German) for a particularly illumating discussion.

works or not are equally problematic. In Swedish astronomy, for example, the leading astronomer Wargentin had to rely on a wealthy wife for most of his career, and none of the other leading Swedish astronomers of the same century enjoyed fully financed professorships, be it in astronomy, physics or mathematics.[85] I have chosen nonetheless to characterise Wargentin, Hell and their peers as 'professionals' because the positions they kept were, if not well paid, then at least associated with sufficient authority to set them apart from other contemporaries, who lacked a formal position at a University, Academy, Observatory or other institution of higher learning. Again, astronomy appears to form a special case. Whereas other branches of science were still ill-defined, lacking designated professorships and relying entirely upon amateurs and 'spare-time interest' of professors from neighbouring disciplines, astronomy was not in the same state of flux. In a recent contribution on the history of the sciences in eighteenth-century Europe, Irène Passeron has argued that astronomy was a sort of "discipline *avant la lettre*" because of the foundation of numerous observatories and dedicated professorships for astronomy during this century.[86] That said, the professionalised nature of astronomy did not imply that amateurs were excluded from the scientific discourse, only that their contributions in astronomy were likely to be attributed with a different level of authority.

In sum, breaking down national barriers, highlighting the role of Latin versus vernaculars and investigating the impact of dilettantism to eighteenth-century astronomy will be the three main theoretical perspectives of the present work.

I.1.2.2 SELECTION OF SOURCES

The sources investigated in this study are texts, both printed works and manuscripts. Maximilianus Hell was a productive author and editor of scientific texts, and his works were frequently commented upon by others. A fair amount of letters and unpublished manuscripts that shed further light on his career are also extant.

As an astronomer, Hell's main work was the *Ephemerides (Astronomicae) ad Meridianum Vindobonensem*. This large-format ephemeris, or almanac, also served as a scientific journal,

[85] Widmalm 1990*a*, pp. 172-175; Aspaas 2011*a*.
[86] See Passeron's introduction to the special issue of *Dix-huitième siècle* Numéro 40, *La République des Sciences*, in which several interesting investigations of the 'quasi-disciplinarity' of various branches of eighteenth-century science are found (Passeron 2008, here p. 20).

thanks to its lengthy appendices containing contributions to both theoretical and practical astronomy. It was within the framework of these appendices that most of Hell's works on the transits of Venus were issued.

In keeping with the aim of investigating the contributions of Father Hell in a Central-European and Nordic context, contemporaneous monographs and periodicals from several countries have been investigated. Relevant volumes of the official periodicals of various scientific bodies, namely the Royal Swedish Academy, the Royal Danish Society of Sciences, the French Royal Academy of Sciences, the Göttingen Society of Sciences, The Royal Society in Britain, the Academy of Sciences in Berlin and the Imperial Russian Academy of Sciences have been either leafed or scrolled through.[87] Furthermore, various Latin dissertations submitted to the universities of Åbo (Turku) and Copenhagen have been investigated. The *Göttingische Anzeigen von Gelehrten Sachen*, the *Journal encyclopédique* and *Journal des Sçavans*, as well as some contemporaneous newspapers published in Denmark and Norway have also been consulted, albeit not as systematically as the *Ephemerides Astronomicae*. The journal-like *Receuils* and *Cahiers* of Jean Bernoulli III in Berlin, and to a lesser degree his *Lettres Astronomiques*, *Sammlung von kurzer Reisebeschreibungen* and *Archiv zur neuern Geschichte,* have likewise been consulted.

The chief manuscript sources have been found at the Institut für Astronomie der Universität Wien (Wiener Universitätssternwarte, hereafter WUS) and at the Archiv der Universität Wien; at Riksarkivet (hereafter RA) and Nasjonalbiblioteket in Oslo; at the archive of Det Kongelige Danske Videnskabernes Selskab (KDVS), as well as at Kongelige Bibliotek (KB) and Rigsarkivet (RA) in Copenhagen; at Centrum för Vetenskapshistoria vid Kungl. Vetenskapsakademien (CVH) in Stockholm; at Universitätsbibliothek Basel (UB Basel); and at Rossiiskaia Akademiia Nauk (RAN) in St. Petersburg. Last but not least, I have profited greatly from archival research conducted by Nils Voje Johansen in various archives in Scandinavia; from similar research undertaken by Johan Stén in Sweden, Finland and beyond; and from the harvest that Magda Vargha has made in various Hungarian archives. All three have generously placed photocopies from their archival researches at my disposal.

[87] The digitisation services of numerous actors, such as Google Books; Bibliothèque nationale de France (Gallica); Göttingen Digitalisierungszentrum; or the "Aufklärung" project of the Universitätsbibliothek Bielefeld, to name but a few, have served as invaluable supplements to traditional library visits to various institutions in England (Oxford), Denmark (Copenhagen), Sweden (Stockholm), Norway (Tromsø, Trondheim, Oslo), Austria (Vienna) and Russia (Saint Petersburg).

The fate of the manuscripts of Maximilianus Hell merits particular consideration. As explained elsewhere in this thesis, Hell had plans for a grand work on his Vardø expedition, the three-volume *Expeditio litteraria ad Polum arcticum*. Most parts of this work were never published, but nothing suggests he destroyed the manuscripts or asked others to do so. Furthermore, his network of correspondents was wide and diverse, and like any astronomer seriously engaged in practical astronomy, he certainly cherished the letters he received. After his death in 1792, however, the manuscript collections of Hell passed onto private hands.

The prominent French astronomer Lalande, in his *Bibliographie astronomique* (Paris 1803), explains that he had been in contact with Hell's successor at the Vienna University Observatory, Franciscus de Paula Triesnecker, to learn about the fate of the *Expeditio litteraria*. Triesnecker answered by letter that he had "been unable to even look at the manuscripts", for[88]

> the inheritors have denied him this satisfaction: this is another reason to regret the loss of Father Hell. Perhaps Curiosity, which publishes what Jealousy has been able to hide away, will one day supply us with the publication of these manuscripts.

Jealousy prevailed beyond the lifetime of both Lalande and Triesnecker. In the copy of the Copenhagen edition of the Venus transit report from Vardø that is kept at the Vienna University Observatory, an unknown hand has scribbled (in German) that:[89]

> After the death of Hell, a Jesuit from Augsburg, by the name Rauscher, is said to have taken his many manuscripts – in particular the *Expeditio litteraria ad Polum arcticum* – to Mogilev, a place in Russia.

In the 1780s and 90s, the Jesuit order was suppressed in all Catholic countries, but it survived in the Russia of Catherine the Great. Mogilev was an important centre of the Jesuit order in

[88] Lalande 1803, p. 722: "M. Triesnecker, habile astronome de Vienne, m'écrit qu'il n'a pu parvenir à voir même les manuscrits; les héritiers lui ont refusé cette satisfaction: c'est un nouveau motif de regrets sur la perte du P. Hell. Peut-être que l'intérêt, qui publie ce que la jalousie aurait pu recéler, nous procurera la publication de ces manuscrits."
[89] Hell 1770*a*1 (WUS Vienna), note on the inside of the back cover: "Nach den Ende des *Hell* soll ein Augsburger Jesuit Nahmens Rauscher seine viele Handschriften besonders die *Expeditio litteraria ad polum Arcticum* nach *Mohilew* gebracht haben, welches in Ruslandt lieget." The entire copy has been digitised by staff at the Vienna University Observatory. The note is found on p. 101 of the pdf document on the internet (cf. http://www.univie.ac.at/hwastro/, accessed 3 March 2011). The same copy is also unique in its insertion of several illustration at the end. These were not found in the Copenhagen edition, but were included at a later date.

this period, as will be explained in chapter I.2. The somewhat mysterious character Rauscher is mentioned in the testament of Hell, but apart from that I have been able to find only few traces of him in the literature.[90] In January 1783, a certain "Father Rauscher" is mentioned in a letter from Hell to Franciscus Weiss in Buda, in the context of religious pamphlets dispatched between Vienna and Pest-Buda.[91] He is also mentioned by the Danish/German traveller Münter during his brief stay in Vienna in the year after.[92] As a devout ex-Jesuit, Hell remained loyal to the Society of Jesus and longed for its resurrection after the order had been suppressed by the Pope in 1773. Münter describes how Rauscher served as a postman for the conservative ex-Jesuits. He also points to Hell's colleague in Würzburg, Franciscus Huberti as one of the protagonists of pro-Jesuit activities in the German-speaking world. Huberti's manuscripts were for a long time lost until they re-emerged in Saint Petersburg, to which city they had made their way around 1820.[93] It is not unthinkable that substantial parts of Hell's manuscripts were sent to the same destination. One may hope, therefore, that part of his legacy is still awaiting discovery somewhere in Eastern Europe.

The main collection of known manuscripts, however, is preserved in Vienna, where it is now kept at the Vienna University Observatory (WUS). This institution acquired its collection of documents from private owners around 1830. The editor of the first selection of manuscripts pertaining to the Vardøhus expedition, Carl Ludwig Littrow, was well aware that this was no complete set of manuscripts. For example, the travel diary of Sajnovics exhibited a lacuna for the stay in Copenhagen in June 1768. Furthermore, Hell's correspondence was illogically incomplete. There must have existed far more manuscripts.

The heading "Selection of Sources" on this section is thus somewhat misleading. As far as manuscripts are concerned, I have not been in a position where I could pick and choose. Important stages in Hell's relationship with other astronomers has had to be reconstructed in an indirect manner, by investigating the correspondence of peers like Anders Johan Lexell in

[90] Pinzger came across the same note in the copy of the Venus transit report in question. In the Hungarian part of his work, Pinzger discusses the whereabouts of the manuscripts that are missing from the collection of the Vienna University Observatory (Pinzger 1920, pp. 42-44). According to Haberzettl 1773, p. 202, Rauscher was a former Jesuit whose full name was Johann Baptist Rauscher. In 1784-1791, this Rauscher issued a German edition of a French ecclesiastic history by Berault-Bercastel (ibid.). However, he is not included in Duhr's comprehensive survey of the history of the Jesuit order in German-speaking parts of Europe (1928*a*; 1928*b*).
[91] Hell to Weiss in Buda, dated Vienna 11 January 1783 (Vargha priv.).
[92] Münter 1837.
[93] Ingrid Hupp, internet article on "Franz Huberti", www.didaktik.mathematik.uni-wuerzburg.de/history/mathematik/hubertilebensbild.html (accessed 25 January 2008).

Saint Petersburg, Anders Planman in Åbo, Pehr Wargentin in Stockholm, Jean Benoulli III in Berlin, Franciscus Weiss in Tyrnavia, and so forth. As luck would have it, particularly the Swedish archives have proven themselves intact and well arranged. Hell is mentioned in numerous letters exchanged between Planman, Lexell and Wargentin. Furthermore, both Hell and his Hungarian counterpart, Weiss, corresponded with Wargentin in Stockholm. These letters appear never to have been used in the historiography of the transits of Venus. Even the largely preserved correspondence of Jean Bernoulli III in Berlin (now kept in UB Basel) proved itself to be a very interesting source, which – as far as Maximilianus Hell is concerned – seems to have been untapped until now.

I.1.2.3 TECHNICAL REMARKS

Given the widespread use of Latin in early-modern Central Europe, both place names and personal names have come down to us in Latin as well as various vernacular forms. Thus, the person known in Latin as *Maximilianus Hell* (or Höll, or even Hellius) is referred to in contemporaneous sources as Maximilian Hell (German and Danish) or Maximilien Hell (French). In more recent literature, he re-emerges as Hell Miksa (Hungarian) or Maximilián Hell (Slovak). His hometown *Schemnicium* is also known as Schemnitz or Schemniz (G), Selmecz or Selmecbánya (H), or currently as Banská Štiavnica (Sl). Throughout this thesis, the Latin forms are used, with vernacular variants given in footnotes or inside parentheses. The *Companion to the History of the Neo-Latin Studies in Hungary* by István Bartók *et al.* (2005); the catalogue on “Jesuiten-Mathematiker in der Deutschen Assistenz bis 1773” by Karl Fischer (1978); and the *Orbis Latinus* of Johann Grässe (2nd edn., 1909) have provided the Latin forms in nearly all cases. Where several Latin variants are recorded in the literature, I have followed the forms used in the texts of Hell and his contemporaries.

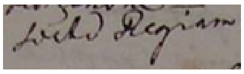
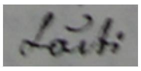
French, British, Scandinavian, Russian as well as most Eastern-European and German personal and place names are given in their current forms, with variant spellings given in footnotes. In transliterations from Russian, the system of Library of Congress has been used. Place names in present-day Finland are given in their Swedish forms, with their Finnish equivalents in footnotes or inside parentheses.

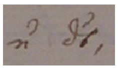
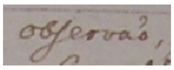
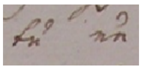
The use of quotation marks is not entirely consistent. In general, inverted commas, ‘…’, are used in the text to mark translations of book titles in languages other than English.

Furthermore, they are used for anachronistic terms not originating from the eighteenth century. By contrast, "…" are used for direct quotations.

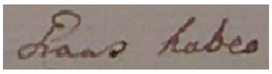
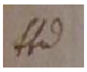
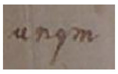
All quotations in languages other than English are translated or at least summarised in English, either in the text itself or in footnotes. Unless stated otherwise, all translations are by the author of the thesis.

Nearly all Latin abbreviations have been tacitly resolved. For example,

  = *societatem Regiam, societati* (Hell's own hand)

   = *non debet, observatio, tamen nomen* (Hell's secretary)

In cases where a word has been abbreviated without any sign added, the missing letters have been supplied in [brackets]. For example,

   = *Gra[ti]as habeo, t[an]tum, unq[ua]m* (his secretary)

However, certain Latin abbreviations have not been resolved. They are the following:

Cel., Celeb.	*Celebris* or *Celeberrimus*	famous or highly famous
Clar., Claris.	*Claris* or *Clarissimus*	able or highly able
D., (D.D.)	*Dominus, (Domini)*	Mister(s), Monsieur(s), Señor(es)
è S. J.	*è Societate Jesu*	of the Society of Jesus
N.	*Numerus*	no. (number, used for periodicals)
p., pag.	*pagina*	page
P.	*Pater*	Father (of a catholic priest)
R., Rev.	*Reverendus* or *Reverendissimus*	honourable or highly honourable
R^a V^a , $R^{æ}$ $V^{æ}$	*Reverentia(e) Vestra(e)*	His Honourable Father('s)
S.	*Sanctus, Sanctum* or *Sancta*	Saint, San, Santo
SJ, S. J.	see *è S. J.*	

As for other abbreviations, unless standard in academic writing or otherwise self-explicatory, these are all listed at the beginning of the sections on Unprinted Sources and Literature and Printed Sources and Literature below.

I.2 MAXIMILIANUS HELL SJ (1720-1792): A BIOGRAPHICAL ESSAY

non is sum, qui Summis cum Viris pari passu progrediar, sequor, ut possum, et si cogitata, atque labores meos qualescumque non inutiles censeant alij, gaudeo equidem, at tenuitatis meæ conscius, Summos in his Scientijs Viros tanquam à longe sequens suspicio, venerorque

Maximilianus Hell to Jean Bernoulli,
20 December 1771 [1]

Much has been written on the life, character and career of Maximilianus Hell. An online bibliography compiled by Sándor Hádobas currently lists more than 600 works on Maximilianus Hell and his assistant, Joannes Sajnovics.[2] Ranging from newspaper articles and other kinds of popular science writing through editions of primary sources to contributions in peer-reviewed journals, not all items listed in Hadobás' bibliography are worthy of taking into consideration here.

As a source-based study, this thesis aims to investigate primary sources and to contextualise them. Of particular relevance are therefore other source-based studies, including editions of texts written by Hell and his contemporaries. Two full-length books are devoted to the biography of Maximilianus Hell, published by Ferenc Pinzger and Elena Ferencová, in 1920-27 and 1995 respectively. Pinzger published his two-volume biography in Hungarian, but with extensive source quotations in Latin, German and French as well as a summary in German, in commemoration of Hell's 200th birthday. While his approach is somewhat dated, Pinzger's careful editing of primary sources in volume two gives his work a lasting value. As for Ferencová, her biography was issued in Slovak shortly after Slovakia had become an independent state and explores Hell's background and career from a Slovak perspective. Despite the lack of an apparatus of references in her book, her contribution is of scholarly value mainly thanks to her presentation of numerous sources in facsimile or in translation. In addition to these monographs comes a wide range of articles written primarily by Hungarian, Slovak, Austrian and Scandinavian scholars, devoted either to Hell's biography in its entirety

[1] Hell to Jean Bernoulli III in Berlin, dated Vienna 20 December 1771 (UB Basel): "I am not the kind of person who keeps pace with the greatest of men. I follow them the best that I can, and if my theories and my work, however trivial, are not considered entirely useless by others, that fills me with joy. However, in full awareness of my own insignificance, I try to follow the greatest of men in these [i.e., the mathematical] sciences as if from a long distance, admiring and revering them".
[2] Hádobas 2008, available at http://mek.oszk.hu/06200/06237/06237.pdf (accessed 17 February 2011).

or to certain aspects of it. As for editions of primary sources, the most relevant for this part of the thesis are volume two of Pinzger's biography (in Hungarian, 1927), Ansgar Rabenalt (in German, 1986) and Magda Vargha (in French, two vols., 1990-92).[3] Pinzger, Rabenalt and Vargha all present transcripts of letters illuminating various aspects of Hell's career, in the language of the original (Latin, German or French). In the present biographical essay, extensive source quotations will be made in English, with the original transcribed in footnotes. A considerable proportion of the letters and other archival sources presented here has not been published before, whereas others will be quoted from the works listed so far.[4]

It is not the aim of this biographical essay to break new ground with regard to the whereabouts or activities of Maximilianus Hell at all stages throughout his life. Given the overarching aim of this thesis, to give a source-based analysis of Maximilianus Hell's contribution to the eighteenth-century Venus transit enterprise, his biography is not a main issue *per se*. Contextualising his background and scientific career is nonetheless necessary in order to grasp the ideological climate in which his works on the transits of Venus were produced and how they were received. This does not imply a full-scale biography supplanting earlier efforts. Rather, building upon basic knowledge that has already been established by others and adding a couple of hitherto overlooked sources, I wish to contextualise his career path and discuss certain cultural-political sentiments that seem to be of particular relevance to the history of astronomy in Central Europe in the latter half of the eighteenth century. One issue is Hell's stance in relation to confessional questions, before and after the dissolution of the Society of Jesus in 1773. Another concerns his attitudes towards 'nationality' and towards Hungarian patriotism in particular. A third issue is his singular support of the Latin (and to some extent the French) language as opposed to his own vernacular. These issues will not be discussed on every page, but will be commented upon on various occasions throughout this essay before they are discussed in a more systematic manner in the concluding section.

Section I.2.1 traces the whereabouts of Maximilianus Hell from childhood to priest and professor, culminating in his appointment as Imperial and Royal Astronomer in September 1755. This part of Hell's life took place at various locations in present-day Slovakia, in the Austrian capital Vienna and in Transylvania, now a part of Romania. On each of these

[3] For further details, see the introductions to Chapters II.3 and III.1.
[4] It might be mentioned that in another part of this thesis, two texts by Maximilianus Hell concerning the transit of Venus expedition to Vardø are edited (Chapters III.2 and III.3).

stations in his life, information found in the biographies of Pinzger and Ferencová has been supplemented with other sources. For the Slovakian context, the proceedings of a conference held in Banská Štiavnica in celebration of Hell's 250th anniversary (in 1970), with papers in Slovak accompanied by summaries in German have proven to be of particular value. Also a more recent English-language contribution by Richard Kafka (2003) offers useful information on the region of Hell's childhood and youth. For Hell's student years in Vienna, articles in German by the Jesuit authors Johann Steinmayr (various papers from the 1930s) and Anton Pinsker (1971) offer insight into the activities of the various Viennese astronomers and physicists of Hell's generation. Unfortunately, however, for all their scholarly depth these articles are popular lectures and lack proper references. In Steinmayr's case this weakness is remedied by the editors Isolde Müller and Thomas Posch, who published his posthumous papers in a special issue of the *Acta Historica Astronomiae* in 2010, furnished with footnotes and introduction. As for Hell's period in Claudiopolis, a magisterial study of the place of the Jesuits in the intellectual and ideological climate of eighteenth-century Transylvania has been offered by Paul Shore (in English, 2007).[5] Finally, information on the obscure eighteenth-century observatory in Claudiopolis and its bigger sister in Tyrnavia/Budapest has been provided by Ferenc Szenkovits and Lajos Bartha (both in Hungarian, 2006).

In keeping with the overall aim of 'breaking down national barriers' exposited in Section I.1.2.1 above, Section I.2.1 seeks to interpret the stations in the early career of Maximilianus Hell in a broad regional context, which in geographical terms translates as the "Austrian Province" of the Society of Jesus. A useful guide in this context is László Scilaz' article on "Austria" in the *Diccionario histórico de la Compañía de Jesús* (in Spanish, 2001). However, the present thesis is first and foremost a study of the history of science, and astronomy in particular. There exists no book devoted to 'The History of Astronomy in Central Europe', meaning that various pieces of information has had to be culled from various sources. Especially rich in information on "Jesuit mathematicians" in the entire German Assistancy of the Society of Jesus (of which the Austrian Province was a part) is Karl Adolf Franz Fischer's comprehensive catalogue of the staff at the various Jesuit institutions in this part of Europe (in German, 1978). Thanks to Fischer, it is possible to trace the careers of hundreds of Jesuits that held chairs in the mathematical sciences in Central Europe all through the early modern

[5] Shorter contributions by Jean Nouzille (in French, 1998) and Paul Shore & Maurice Whitehead (in English, 2010) offer further information on the broader context of Jesuit activity in Transylvania. See also Paul Shore's article on the Jesuits in Bohemia (2000).

period. In recent years, Nora Pärr (in German, 2001) and Cornelia Maria Schörg (in German, 2009) have delivered *Diplomarbeiten* (somewhat more elaborate than an average master thesis) on the history of Viennese astronomy. These do present valuable information on the careers of Hell and several of his contemporaries, but without referring to that important catalogue. As a repertory of basic information on the various observatories in the Austrian Province of the Society of Jesus, the online database by Maria G. Firneis, Hermann Haupt and Peter Holl (in German, 2005) is likewise a helpful tool, but unfortunately it limits itself to present-day Austria alone.[6] Derek Howse's "Greenwich List of Observatories", issued as a special edition of the *Journal for the History of Astronomy* in 1986, is an earlier effort that is international in scope, but misses a few of the less conspicuous observatories of eighteenth-century Central Europe.[7] Agustín Udías has recently published a universal history of Jesuit observatories in English, but he unfortunately misinterprets several key pieces of information concerning Jesuit observatories in Central Europe as well (2003).

Given the confused and sometimes contradictory information given in the various contributions listed above, I have tried to make the most out of the primary sources available, both printed texts by Hell and his contemporaries and references in their correspondence. It is my hope that a source-based undertaking like this one can inspire further studies on the history of astronomy in the Central-European region as a whole.

Section I.2.2 gives an account of Hell's years as a Jesuit professor and court astronomer whose reputation in the Republic of Letters gradually grows, 1755-1768. This period takes place in Vienna only. Hell's Imperial Observatory has been studied in ample detail by Johann Steinmayr, with further contributions by Nora Pärr and Cornelia Schörg amongst others. Schörg's thesis traces the place of the activities of Hell and his assistants in German-language astronomical journals that were issued from the 1770s onwards, without neglecting the main activities of Hell and other Viennese astronomers in the 1750s and 1760s. In this section, however, as preparation to the international Venus-transit projects that are analysed in subsequent chapters of this thesis, particular attention will be given to Hell's international contacts. This aspect of his career has been mentioned only in passing in earlier studies on Hell's career. In a recent article in French I have traced Hell's contacts with French astronomers, based primarily upon the surviving parts of his correspondence and articles in

[6] http://hw.oeaw.ac.at/sternwarten (last visited 17 February 2011).
[7] The set of amendments published in 1994 did not offer a complete picture of the region, either (Howse 1994).

Hell's journal *Ephemerides Astronomicae ad Meridianum Vindobonensem* (Aspaas 2010). In the present contribution, I try to link the international aspect of his work to the local context of Viennese PR politics, based on the official work instruction that Hell received on his appointment as Imperial and Royal Astronomer of Vienna. In keeping with the regional context depicted above, that of the "Austrian Province" of the Society of Jesus, I also trace his role as a 'nodal astronomer' in the Central-European region. Precisely this aspect of his career, namely his networks and their political-ideological implications, has received scarce attention in previous studies. One highly welcome exception is the most recent contributions in the English language by the intellectual historian László Kontler (2011 & in press), who also has plans for further contextualised studies of Maximilianus Hell. The historian Nora Pärr, who in 2001 delivered her *Diplomarbeit* on Viennese astronomers, has just submitted a doctoral thesis on the scientific milieu of Hell in Vienna, a study which is likewise likely to bring our overall understanding of Hell's career a long step forward.[8]

A subsection – ***I.2.2.1***, offering 'minibiographies' of selected contemporaries of Hell – will primarily be based on biographical lexica such as Constantin von Wurzbach's nineteenth-century *Biographisches Lexikon des Kaiserthums Oesterreich*, the *Allgemeine Deutsche Biographie* and the *Neue Deutsche Biographie*, in addition to information found in primary and secondary sources such as Fischer's catalogue or the annotated edition of Franciscus Weiss' correspondence by Magda Vargha (in French, two vols., 1990-92). Again, this survey has been complicated by the lack of anything near a comprehensive, source-based study of the history of astronomy in Central Europe and its protagonists. This subsection will focus mostly on Jesuit astronomers, some whose names are no doubt familiar to experts on the history of early-modern science in this region and others who are far less conspicuous in the historiography. Furthermore, in order to offer a broader picture of the regional context, I will also strive to include a few individuals who were not Jesuits, such as Benedictines or amateurs.

Section I.2.3, gives an account of the gloriously infamous explorer who travelled to "the end of the European world", 1768-1773. It should be said that the expedition to northern Norway in 1768-70 and its immediate aftermath will not be treated here in anything near the detail it could be, given the wealth of primary sources and secondary literature available. Instead, the

[8] Title of thesis: *Maximilian Hell und sein wissenschaftliches Umfeld im Wien des 18. Jahrhunderts* ('Maximilianus Hell and his scientific milieu in eighteenth-century Vienna', Universität Wien, 2011 [not seen]). I have not had access to Nora Pärr's work in the course of my study, nor has she seen my works in progress.

place of the expedition in international and Nordic history of astronomy will be treated in ample detail in subsequent chapters of this thesis. In this section, it is mainly the Central-European and non-astronomical part of the research programme of the two Jesuits that will be placed under scrutiny. The journey as such is described in detail in Sajnovics' travel diary, as well as in numerous letters written by the two Jesuits during the expedition. In addition come references to their experiences in various published reports and testimonies from various persons whom they met during the expedition. There is no shortage of studies of the journey as such and its reception. Important source-based contributions include: Littrow's pioneering (but regrettably biased) study of the preserved manuscripts (in German, 1835); an article on the journey by the Norwegian historian Ludvig Daae (in Norwegian, 1895); the Hungarian natural historian Ottó Hermann's piece of travel literature based on an expedition in the footsteps of Father Hell (in Hungarian, 1893); the Norwegian linguist Bente Martinussen's work on the Danish-Norwegian context of the studies of the Sámi language undertaken by Sajnovics (in Norwegian, 1992); a host of works treating the same subject from a Hungarian perspective by amongst others György Lakó (in German, 1970), Jozsef Erdődi (in German, 1970), Zoltán Éder (in German, 1977), Lajos Bartha (in Hungarian, 1983), Anna Jászó (in French, 1983), Tiborc Fazekas (in German, 2001*a* & 2001*b*), Zsuzsa Vladár (in English, 2008) and the above-mentioned László Kontler (in English, 2011 & in press); contributions on the religious aspect of this visit of Jesuits on Danish-Norwegian soil by Helmut Holzapfel (in Danish, 1979), Johs. J. Duin (in Norwegian, 1984) and Sølvi Sogner (in Norwegian, 2003); a discussion of the impact of the expedition to the postal history of northern Norway by Hallvard Tjelmeland (in Norwegian, 1995, pp. 58-65), several articles on the broader Danish-Norwegian context of the expedition by the astronomer and university librarian Helge Kragemo (in Norwegian, 1933, 1960, 1968), by the physicist and university lecturer Nils Voje Johansen (in Norwegian, 2002; 2004; 2009, see also Aspaas & Voje Johansen, 2004*a* and 2004*b*); and by Truls Lynne Hansen and the author in the general introduction to the above-mentioned report (in English, 2005; see also Aspaas & Lynne Hansen 2007; Aspaas 2008*c* and 2008*d*). The main aim of this section is to present new sources illuminating the role of Maximilianus Hell in the discovery of what is now known as the Finno-Ugrian language group.

The fourth and final part of this essay, ***Section I.2.4***, recounts the story of the ex-Jesuit Maximilianus Hell, from the suppression of the Society in July 1773 to his death in April 1792. His highly controversial position in Viennese intellectual circles during a period when freemasonry, religious toleration and 'Germanisation' spread across the Habsburg lands, has been touched upon in previous studies such as those of Ferenc Pinzger and Johann Steinmayr in the 1920s and 1930s. I try here to link their findings onto broader studies of the cultural-political history of Central Europe, primarily the magisterial study on *Hungary and the Habsburgs* in the period 1765 to 1800 by Éva H. Balazs (in English, 1997) and works on Austrian ex-Jesuits by the historians Helmut Kröll, Hermann Haberzettl and Wilfried Müller (1971, 1973 and 1993 respectively, all in German).[9] More recent contributions on the Austrian Enlightenment in English include a collection of essays by Robert John Weston Evans (2006) and a paper by Ritchie Robertson (2009). A far earlier contribution, which is still of value because of its thorough examination of primary sources, is Joseph Feil's study of the failed attempts to establish an Academy of Sciences in Vienna during the reign of Maria Theresa (in German, 1861). The aim of this section, however, is not so much to accomplish any fundamental change of understanding of this period, but rather to single out Hell's position in a context that has already been depicted by others. I will include a couple of eye witness accounts, by the Danish travellers Hviid (1777/78) and Münter (1784), which have to the best of my knowledge never been used before in studies of Maximilianus Hell. Furthermore, seemingly neglected parts of Hell's correspondence, such as his letters to the astronomer Jean Bernoulli III in Berlin and to the Agrian bishop Carolus Eszterházy, will be used throughout this section.

One aspect of this biographical essay, which has not received much attention in previous studies on Maximilianus Hell, is his attitudes towards the Latin language. In contextualising this theme, I have used studies on the socio-linguistic situation in early-modern Central Europe by amongst others István György Tóth (in English, 2000 and in French, 2003) and Tomasz Kamusella (in English, 2009); on the pan-European context by Peter Burke (in English, 2004); and on the role of Latin in Jesuit education by Joseph Brucker (in French, 1919). Hell's stance in the debates concerning Latin versus the vernacular(s) surfaces on numerous occasions in his correspondence and his published works, and will emerge on various stages of this essay as well.

[9] Through Wallnig 2011, I became aware of Antonio Trampus' seemingly important book, *I gesuiti e l'illumismo: Politica e religione in Austria e nell'Europa centrale (1773-1798),* Florence: Olschki 2000, but too late to make use of it in the present study.

As to the length of this essay, my only apology is that apart from some brief and outdated works, there exists no biographical study of Maximilianus Hell in English. A western audience will hopefully appreciate the value in having the political, cultural and internal-scientific contexts of Jesuit science in early modern Central Europe explained in some length.

I.2.1 FROM CHILDHOOD TO PRIEST AND PROFESSOR, 1720-1755

Central Europe in the eighteenth century was a diverse area in which various ethnic, linguistic and religious identities co-existed. These were all influenced, to a greater or lesser degree, by the policies of the House of Habsburg in Vienna. Although Charles VI (1685-1740, ruler from 1711) and Maria Theresa (1717-1780, ruler from 1740) were both indisputably pro-Catholic,[10] Lutheranism and Eastern Orthodoxy still flourished in parts of the Kingdom of Hungary and the Principality of Transylvania. There was also a marked presence of German speakers in most parts of the empire, such as the mining areas in present-day Slovakia, where Maximilianus Hell was born. Furthermore, various forms of Slavic were the mother tongue of many inhabitants, in addition to *Magyar* (Hungarian). Broadly speaking, the intellectual and political elite of the time would tend to be fluent in at least three languages: German, Latin and French, and often Italian as well, plus the vernacular of their childhood, be it a Slavic or a Hungarian dialect. Education was in the hands of the church, although from the mid-century onwards, a set of reforms were implemented which gradually brought both lower and higher education under increased state control.

The first part of this essay will aim to contextualise Maximilianus Hell's path from a child raised in a prosperous mining town to a novice, student, teacher and finally priest and professor of the Society of Jesus. All stations in this part of his life are marked on Map 1.

Maximilianus Rudolphus Höll (later *Hell*) was baptised in the village *Windschacht*[11] just outside the town *Schemnicium*[12] 15 May 1720. His father, Matthäus Cornelius Höll (1650-1743) was an engineer ("Oberkunstmeister") in the mining industry. Church documents from Schemnicium call Matthäus Höll a *Gen[erosus] D[omi]nus*, that is a man from a well-to-do

[10] A key legal document in this respect is the *Carolina resolutio* of 1731, a patent which restricted the religious liberties of non-Catholics and secured certain privileges for Catholics. This patent lasted until 1781 (cf. Király 1969, pp. 117-122; Kontler 2009, p. 207).
[11] Windschacht or Wintschacht (L, G) = Vindšacht or Štiavnické Bane (Sl).
[12] Schemnicium or Schemnitzium (L) = Schemnitz (G), Selmecz or Selmecbánya (H), Banská Štiavnica (Sl).

family, and adds that he was *natione Bohemus ex Schlackenberg*, "a Bohemian by nation, from Schlackenberg". The place name "Schlackenberg" posed problems for the biographer Ferenc Pinzger, who could not find it on any maps.[13] Dušan Janota, however, locates the birthplace of Matthäus Höll to the village now known as Horní Slavkov ("Schlaggenwald" in German),[14] approximately 110 kilometres west of Prague. Other sources point to an origin for the Höll family in Bavaria (Bayern), indicating that Bohemia (Böhmen) may have been no more than a temporary station in their migration. Be that as it may, Matthäus Cornelius Höll installed himself as an engineer in Schemnicium in 1694 and was to stay there for the rest of his life. A widower, he remarried in 1707 with Julianna Victoria Staindl,[15] the daughter of an official auditor ("Überraiter")[16] in Windschacht. Maximilianus Rudolphus resulted from this second marriage. In total, the two marriages of Matthäus Cornelius Höll produced 22 sons and daughters. He was already in his seventieth year by the time Maximilianus was born.[17]

Since the sixteenth century, the Schemnicium area had been among the most prosperous mining regions in entire Europe. At the outset of the eighteenth century, however, the mines were in decline and threatened by a total standstill due to flooding of ground water in the mine shafts. Matthäus Cornelius Höll is said to have been well versed in mathematics, mechanics and chemistry. He is particularly remembered for his invention of cunning devices for emptying the shafts of water. Under his tutelage, and that of his oldest son Josephus Carolus Höll, channels and reservoirs were constructed and various other improvements introduced that turned decline into growth. Thus, in the year 1740 alone 2,429 *Mark* gold and 92,267 *Mark* silver were produced in Schemnicium. The population around 1750 is estimated to 20,000 individuals, making it the second largest town in the landmasses now known as Slovakia. By 1763, nearly 6,000 workers were employed in the mining industry alone.[18] Prosperity and success also stimulated an innovative and 'curious' spirit. In order to meet the demand for qualified staff, a "Montanistiche Schule" ('mining school') was established in Schemnicium in 1735, with a curriculum focusing on applied mathematics and physics. This

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[13] Pinzger 1920, p. 10. It might be added that "Schlackenberg" refers to mining activity: "Schlacke" means 'slag', whereas "Berg" signifies a 'mountain' or 'heap'.
[14] Janota 1970, p. 45. "Wald" means 'forest'.
[15] In an auto-bibliography, preserved in his own hand and dated Vienna 9 June 1773 (Vargha priv.), Hell spells the name of his mother "Juliana Steindlin".
[16] "Überraiter" is interpreted by Weyss 1986*a*, p. 4 as "kaiserliche[r] Rechnungskontrollor", by Pinzger 1920, p. 10, simply as "ellenőr" ('controller').
[17] Information on Hell's family has been culled mainly from Pinzger 1920 and 1927 (German summary), Janota 1970, Pinsker 1971 and Ferencová 1995. Quotations are from Pinzger 1927, German summary, pp. 6-7. Some authors speak of Maximilianus Hell as one of 23, not 22 sons and daughters of Matthäus Höll.
[18] Figures taken from Vlachovič 1970, pp. 31 & 42.

institution was followed by a "Praktische Lehrschule" in 1763, which in 1770 was renamed again, to become a "Bergbauakademie", or 'Technical University for the Art of Mining'. By this time, the mines in the Schemnicium area had already been established as a popular destination for the study trips of intending mining engineers from various parts of Europe. The proudest moment in the region's scientific history is probably the organising of a gathering for miners, metallurgists and natural scientists in *Glashütte*[19] (a few kilometres north of Schemnicium) in 1786, a meeting that resulted in the founding of the famous "Societät der Bergbaukunde", a truly international society for research in mining and associated industries.[20]

At least two of Maximilianus' brothers, the above-mentioned Josephus Carolus (1713-1789) as well as Joannes Michael, pursued the career of their father to become mining engineers in Schemnicium.[21] Maximilianus Rudolphus, however, was sent to the schools of the Jesuits. As in the case of numerous other Jesuits from the early modern period, it is not clear exactly when or why his path was diverted from his familiar milieu. It may not have been a conscious choice to begin with. One may assume that a teacher of his perceived the talents of the schoolboy and presented to his family the idea of recruiting him to the Society of Jesus. The boy's parents, who were both Catholics, are not likely to have raised any objections. To have a son in this prestigious society must have been a tremendous source of spiritual consolation and pride, besides the more mundane advantage of having one less mouth to feed. Josephus Carolus had by this time already established himself as an engineer in the footsteps of his father. For the young Maximilianus Rudolphus there was no prospect of inheriting that position. Besides, becoming a Jesuit did not mean a definite rupture with society at large.

[19] Glashütte, Glaserhau or Glaserhütte (G) = Szklenó or Turócnémeti (H), Skleno or Sklené Teplice (Sl).

[20] Unless otherwise stated, information on the history of the Schemnicium area is based upon Vlachovič 1970, Tibenský 1970, Ferencová 1995, Kafka 2003 and Suhling 2006. The old mining town Schemnicium is nowadays known as Banská Štiavnica, and lies in the heartland of Slovakia. It currently has a population of about 10,000, and has since 1993 been found on UNESCO's list of World Heritage (http://de.wikipedia.org/ and http://en.wikipedia.org/, entries on "Banská Štiavnica", accessed 8 December 2010). As for the "Praktische Lehrschule", the Technical University of Miskolc in northeastern Hungary (established 1949) prides itself to be the legitimate heir of this institution and gives the year 1735 as its date of foundation on its webpages (official web page of the University of Miskolc, http://oldwww.uni-miskolc.hu/uni/univ/booklet/4.html, accessed 5 January 2011). The legacy of the Societät der Bergbaukunde has for its part been taken over by the "Society of Mining Professors – Societät der Bergbaukunde", which in 1990 was (re-)established in Leoben in Austria (http://www.mineprofs.org/, accessed 13 January 2011).

[21] In fact, according to the *Kurzgefaßte Beschreibung der, bey dem Bergbau zu Schemnitz in Nieder-Hungarn, errichteten Maschinen* of Nicolaus Poda (also known as Boda, or Poda von Neuhaus), who served as a teacher at the Bergbauakademie, many of the cunning devices in place in Schemnicium around 1770 were invented by Josephus Carolus Höll, not his father (cf. Poda 1771, pp. 51, 54, 57, 61, 66, 70, 74). A particular device in Windschacht, however, is said to have been introduced by Matthäus Cornelius Höll in 1711 (Poda 1771, pp. 41-43).

Jesuits professors were teaching and preaching far and wide, both inside and outside of ecclesiastical institutions. They were not monks in the same sense as the members of certain other Catholic orders, known to have founded abbeys in the countryside where they lived lives in seclusion, withdrawn from the rest of society. Neither to his family nor to himself, then, a career path within the Jesuit system is likely to have been perceived as a bad idea.

After attending elementary school in Schemnicium and the Jesuit Gymnasium (preparatory school for university) in another mining town some 35 kilometres to the north, *Neosolium*,[22] Maximilianus applied for membership in the Jesuit order at the age of eighteen, in 1738. He was accepted and moved another 80-odd kilometres to the west as the crow flies, to the Jesuit Novitiate in *Trenchinium*[23] (near the present border with the Czech Republic), where he was to spend his two years as a novice. Trenchinium was at that time an important regional centre of the Jesuit order, hosting along with Vienna one of only two novitiates in the entire "Austrian Province". Like so many provinces of the Society of Jesus, the *Provincia Austriae* reached across ethnic boundaries and comprised, in addition to present-day Austria, even regions now known as Slovakia, Hungary, Romania, Croatia, Slovenia and northeastern Italy. Also known as the "Hungarian Novitiate", Trenchinium was the place where most novices from the old Kingdom of Hungary were sent in preparation for their lifelong service for the Society of Jesus.[24]

At the time of the suppression of the Society in 1773, there were a total of 1,845 Jesuits in the Austrian Province. The community may not have been large, but it was certainly diverse. Thanks to a form that was filled in at the entering of each novice (this usually took place when they were still in their teens, between 15 and 19 years old), it is possible to trace the geographical and linguistic background of nearly all these individuals. In his article on Austria for the *Diccionario histórico de la Compañía de Jesús*, László Scilaz presents the results of a survey of these novitiate documents.[25] Of the total number of "Austrian" Jesuits who were around in 1773, 44 per cent were from Austria, 41 per cent from the Kingdom of Hungary. The remaining fifteen per cent came largely from neighbouring territories under

[22] Neosolium (L) = Neusohl (G), Besztercebánya (H), Banská Bystrica (Sl).
[23] Trenchinium, Trenczinium or Trentschinium (L) = Trentschin (G), Trencsén (H), Trenčín (Sl).
[24] The Kingdom of Hungary was in itself highly diverse. Former territories of this kingdom is now found within the borders of eight countries: Austria, Slovenia, Croatia, Serbia and Montenegro, Slovakia, Romania and Ukraine, besides modern Hungary itself (see for example Kontler 2009, chapter V).
[25] L. Scilaz, entry on "Austria" in O'Neill & Domínguez (eds, 2001). See also Félix Litva, entry on "Eslovaquia" in *op.cit.*

Habsburg or at least Holy Roman rule, such as Bavaria, Bohemia, Moravia, Silesia or Tyrol. Knowledge of Latin had been instilled in all these Jesuits from childhood. Throughout the early-modern period, the Latin language formed the core of the curriculum in the Jesuit schools and use of this language was compulsory, even in conversation.[26] As for vernacular languages, Scilaz informs us that nearly 65 per cent of the "Austrian" Jesuits of Hell's generation were on record to have known German well (*bene*), whereas merely 30 per cent were in command of Hungarian. Nearly as many mastered a Slavic language (seventeen per cent Slovak, eleven per cent the language which in more recent times is known as Croatian),[27] followed by seven per cent Italian, one per cent Romanian and one per cent French speakers. If the heading *quas linguas calleat* ('what languages he masters') in the form was taken literally, then bilingualism and trilingualism must have flourished among the novices of the Austrian Province. The 18-year old Maximilianus was no exception. According to the list of novices at Trenchinium, he knew *Latinam, German[icam], Slav[icam] bene* ("Latin, German and Slavic well").[28] One notices the absence of Hungarian in this entry. Hungary in those days was a composite state, and in the mountainous regions now known as Slovakia, Hungarian was not commonly spoken. But as we shall see, even those who had no Hungarian could still speak of themselves as a *Hungarus* and characterise Hungary as their *patria* (literally "fatherland").[29]

In Austria as elsewhere in Catholic Europe, the Jesuit order was a dominant factor in the system of higher education. Despite their limited number, Jesuits ran numerous *gymnasia* (preparatory schools for university) and *collegia* (comprising "Hochschulen" as well as proper universities) in both urban and rural areas. To gain reputation as proponents of knowledge lay at the heart of the global strategy of the Society of Jesus to (re-)conquer the world for Catholicism and root out heresy. As spearheads of the Counter-Reformation in Europe and as missionaries overseas, the Jesuits used science to wield an influence reaching far beyond traditional spirituality. The founding fathers had already in 1540 drafted an instruction known as the *Ratio studiorum* (in full: *Ratio atque institutio studiorum Societatis Jesu*, 'Method and System of the Studies of the Society of Jesus'), which after several revisions was codified in 1599. The 1599-version of this document was to remain an invariable guideline for all Jesuit

[26] See for example Moutchnik 2006, pp. 40-41; Burke 2004, p. 54; Bruckner 1919, pp. 444-449.
[27] It is difficult to find a neutral designation for the Slavic languages of the eighteenth century. For an unusually well-informed discussion in English, see Kamusela 2009.
[28] *Nomina noviciorum secundum Ordinem, quo ingressi sunt in hanc domum probationis Trenchinij Provinciae Austriae Societatis Jesu*, under the heading *Quas linguas calleat* (quoted after Pinzger 1920, p. 13).
[29] As for the concept *Hungarus*, see below.

activity until the suppression of the Society in 1773. According to the *Ratio studiorum*, mathematical topics were to be taught at all Jesuit schools, a requirement that was quite radical at the outset of the scientific revolution.[30] One may assume that this, in its time controversial, emphasis on *mathematicae* ('mathematics') took on greater importance as interest in the study of natural sciences increased among Europe's intellectual elites. In order to succeed in their "ministries among the learned",[31] the Jesuits needed to produce professors who could teach these subjects with authority. Our biographee was to become one of them.

After his two years in the novitiate of Trenchinium, Maximilianus Höll – or, as he later in life preferred to name himself, *Hell*[32] – enrolled at the University of Vienna in 1740. Academic life in Vienna had by then been steeped in Jesuit erudition for more than a century. A Jesuit Collegium ("Hochschule") was opened in Vienna as early as 1550. After many political intrigues, it was finally incorporated in the University in 1622/23. This move gave the Jesuits a majority among the staff and virtually *carte blanche* to control academic life. Protestants were expelled and Jesuit professors gradually took over most chairs. As for astronomy, physics and other branches of 'mathematics', Jesuits soon became the undisputed professors of these subjects.[33] Beginning in 1746, the Jesuits also ran a "Hochschule" for young noblemen in Vienna, the so-called *Seminarium Nobilium* or *Collegium Theresianum Vindobonense* or simply the *Theresianum*, but this institution remained a separate entity. Another separate institution was the "Orientalische Akademie", a language school for future diplomats in the East, founded in 1754 and under Jesuit leadership from the start. As for the university, Gerhard Van Swieten (1700-1772) was to implement a sweeping set of reforms in 1749-52 at the request of Empress Maria Theresa (1717-1780, ruler from 1740). The reforms of Van Swieten aimed to modernise the education system according to utilitarian principles, and in this process, the dominance of the Jesuits was to some extent reduced. However, the faculties of Theology and Philosophy (under which mathematics, astronomy and experimental physics sorted) were still run by Jesuits until 1773.[34] In a way, the early career of

[30] See for example Smolarski 2002.
[31] The phrase used by Harris 1996. See also Bireley 2003 for a broad analysis of the counter-reforming strategies of the Jesuit order in the sixteenth and seventeenth centuries.
[32] *Höll* should, according to traditional transliteration, be Latinized *Hœll*. However, as Pinzger conjectures (Pinzger 1920, p. 9) the pious Jesuit probably wanted to avoid association with the German word for Hell – "die Hölle" – by changing his name to *Hell*. This spelling should instead allude to the German word for bright, "hell". When writing this text in English, it is hard not to see the irony of the story.
[33] For a detailed account on the Jesuits and the Vienna University in the period from the 1540s to the 1620s, see Perkmann 1866.
[34] On the impact of the university reforms imposed by the personal physician of Maria Theresa, Gerhard Van Swieten, see for example Müller 1993, pp. 229-233.

Maximilianus Hell was both protected from and promoted by these reforms. On the one hand, he enrolled at the university well before Van Swieten's reforms. On the other, he was later to profit from these very reforms, in the sense that they resulted in more funding for astronomy and other branches of 'mathematics' not only in the capital, but also in other university towns in the Habsburg lands. With his cultural background from a family of engineers, he was – to use the vocabulary of Bourdieu – in possession of a 'cultural capital' that was to fit well with the utilitarian ideology promoted by Van Swieten.

Among the teachers of the courses in philosophy and mathematics attended by Hell during the early 1740s, we find the polyhistor Erasmus Frœlich[35] SJ (1700-1758) and the astronomer and orientalist Josephus Franz[36] SJ (1704-1776). Notably, Father Franz was the director of the Vienna Jesuit Observatory, which he and Frœlich had constructed at one end of the compounds of the Jesuit Collegium back in 1733-34.[37] Franz soon recruited the young Maximilianus to make observations in his observatory, apparently around 1743.[38] Around the same time, the gifted student in his spare time constructed sun and moon dials, as well as globuses of the earth and the sky. These were probably included in the *Museum Mathematicum*, or laboratory of the collegium, which had been founded in 1714 and which occupied a lower floor underneath the observatory itself.[39] Hell also had his first (anonymous) work published, a revision of a textbook in mathematics that had originally been published in Italian in 1728, *Elementa Algebrae Joannis Crivelli magis illustrata et novis demonstrati-*

[35] Also spelled Fröhlich, Frölich, etc.
[36] Also spelled Frantz.
[37] This observatory was 45 meters high, rising above the neighbouring buildings by approx. 24 meters, according to Pinsker 1971, p. 102. See also Steinmayr 2010*a* (speech held in 1932) for further details. In the literature, the Jesuit Observatory is often confused with the Imperial Observatory established in 1755 (for instance in Fischer 1978; Udías 2003, p. 29; Wolfschmidt 2009, p. 4).
[38] Evidence is scanty. The only concrete mention of this year that I have come across in Hell's letters is in a letter to Bugge in Copenhagen, dated as late as Vienna 24 July 1789: "Quantos ego ab anno 1743., quo primae meae jam extant observationes, per annos 46 vitae meas caussae promovendae astronomiae exantlaverim labores, Posteri loquentur" = "How many strenuous works I have conducted in the service of astronomy for 46 years of my life, ever since 1743, from which year my first observations are extant, will be talked about by future generations" (quoted after Pinzger 1927, p. 154). Pärr 2001, p. 32, claims that Hell was hired as an assistant of Franz at his observatory in 1745, but does not quote any primary sources (cf. Ferrari d'Occhieppo 1957, p. 27: "Um 1745"). A manuscript biography that was probably written by Triesnecker and is today kept in the archives of the Academy of Sciences in Vienna, gives the years "1744 und 1745" (Akad Wien, Nachlass Littrow. A transcript is available on the internet: http://kastner-masilko.at/LebenslaufHell.pdf, accessed 13 January 2011). The anonymous necrologue on Hell in Schlichtegroll (ed.) 1793, states "seit 1745" = "since 1745". I have not had access to *Observationes astronomicae in speculo Viennensi 1734-50 factae* or other publications by Josephus Franz that might shed light on Hell's earliest career as an observer (see the titles listed for example by Heinrich Kellner, "Franz, Joseph", in *Allgemeine Deutsche Biographie* 7 (1878), pp. 318-319).
[39] Steinmayr 2010*e* (paper held in 1936), p. 263.

onibus et problematibus aucta ('Joannes Crivelli's Beginner's Course in Algebra, Further Explained and Expanded by New Demonstrations and Exercises', Vienna 1745).[40]

Having finished his three-year curriculum in Philosophy and two years in Mathematics, Hell spent the period from 1745 to 1747 as a teacher at the Jesuit Gymnasium in *Leuchovia*,[41] in the northeastern part of the Kingdom of Hungary. The subjects that he taught were "humaniora" (Latin grammar, syntax, poetry, rhetoric), history and mathematics. Besides teaching, during his Leuchovian years Hell also held occasional sermons in the church and served as an assistant of the local clergy (*Patris regentis socius*). This historic town lay more than 200 kilometres northeast of Hell's hometown Schemnicium, in an area that was diverse in terms of both denominations and ethnicity, known as *Scepusium*.[42] An old "Sprachinsel" for German-speaking inhabitants, Scepusium was a region where Protestantism early in the sixteenth century had gained a foothold that it was only slowly loosing with the arrival of the Counter-Reformation in these parts in 1674. Still well into the eighteenth century Leuchovia, along with other settlements in Scepusium, had a comparatively loose cultural-political affiliation to the Habsburg Empire not only because of the region's remoteness from Vienna. An exceptional degree of autonomy had been granted Leuchovia and other Scepusian towns by the Kingdom of Hungary since the thirteenth century, and the political picture was complicated even more by the fact that the right to tax these lands had been mortgaged to Poland by the King of Hungary in the fifteenth century, an arrangement that continued until 1772. It is probably no coincidence that a large-scale uprising led by Franciscus Rákóczi II at the outset of the eighteenth century, known as the War of Independence, had been nurtured by considerable support in this part of Hungary. The presence in Leuchovia of a Jesuit Gymnasium and other Catholic institutions may therefore be interpreted as part of Viennese efforts to stabilise this area as a loyal hinterland of the empire (see below, on Transylvania).[43]

Back in Vienna in 1747, the 27-year old Maximilianus began his study of theology, which he finished in 1751. In the latter year (or the year after) he was also ordained a priest of the Society of Jesus. In the meantime, Hell issued the first edition of another anonymous work, called *Adjumentum memoriae manuale chronologico-genealogico-historicum* ('Manual of

[40] I have not had access to this publication. According to Pinsker 1971, pp. 103-104, when compared to Crivelli's original, the amount of revision was considerable.
[41] Leuchovia or Leutschovia (L) = Leutschau (G), Lőcse (H), Lewocza (Polish), Levoča (Sl).
[42] Scepusium (L) = Zips (G), Spisz (P), Szepes (H); Spiš (Sl).
[43] The modern Slovak town Levoča currently holds a population of about 15,000 and is since 2009 inscribed on the UNESCO list of World Heritage (http://whc.unesco.org/en/list/620, accessed 6 January 2011).

Chronology, Genealogy and History for the Assistance of Memory', Vienna 1750), a chronicle of important names and events of relevance primarily to ecclesiastical history and the history of the Habsburg empire that was to enjoy ten editions, the final and posthumous in 1802.[44] Biographical evidence from this period is hard to find, and it is unclear to what extent the theology student participated in scientific activities during 1747-51. At some point, however, either in Leuchovia or in Vienna (the literature is not in agreement here), Hell is supposed to have given private courses in "Markscheidekunst" ('mine metrology') to a group of young noblemen in preparation for work in the mining industry. He first taught the son of a Count "Königsegg", then the sons of ten other aristocratic families.[45] He is even said to have been entrusted the task of translating into Latin the laws of the Hungarian mining industry, which had until then been available in German only. With his background from a family of engineers and the fluency in Latin he had acquired in the Jesuit schools, Maximilianus must have been well suited for this task, his biographer Ferencová concludes.[46]

Hell passed his obligatory third year of probation back in Neosolium, in 1751/52. Neosolium, where Hell had once been a pupil at the Jesuit gymnasium, was along with *Judenburgum* (Judenburg) in Styria (Steiermark) one of only two places in the Austrian Province where aspiring Jesuits were sent for their third and final year of probation. A prosperous mining town, Neosolium probably resembled his hometown in many ways. However, unlike Schemnicium, where the secular Bergbauakademie was of prime importance, the most important cultural institution in Neosolium was the Jesuit gymnasium. Maximilianus was thus back in his home region, but not in quite the same environment that he had been raised.[47]

Having finished his probation, in the summer and autumn of 1752 Maximilianus Hell was briefly involved as a consultant for the construction of an astronomical observatory at the

[44] I have only had access to an edition from Ingolstadt 1760 (Hell 1760*b*) and the Viennese edition from 1774. According to Sommervogel 1893, p. 251, Hell kept this work anonymous until he made a revision of it in 1773, published in Vienna the year after. This is confirmed by Hell's own preface to the 1774 edition (Hell 1774*b*).

[45] In Leuchovia, according to Pinzger 1920, p. 14 and Pinzger 1927 (German summary), p. 8. In Vienna, according to the necrologue in Schlichtegroll (ed.) 1793, pp. 284-285; Littrow 1835, p. 4; and Stefan Lindinger in *Biographisch-Bibliographisches Kirchenlexikon* Band XVII (2000). Place not specified, Ferencová 1995, p. 21. As to the identity of the Count, Rabenalt identifies him as Karl Ferdinand Graf Königseck (1696-1759), who served as *Hofkammerpräsident* from 1754 onwards (Rabenalt 1986, p. 109).

[46] Ferencová 1995, p. 21. The manuscript was allegedly delivered to Josephus Franz in 1749, but was apparently never published (Schlichtegroll, ed., 1793, pp. 285-286). Franz was at this time the "Bergrath", or senior official overseeing the mining industry.

[47] On the local history of Neosolium, see Ipolyi 1875.

Jesuit University in *Tyrnavia*.[48] The *Collegium Tyrnaviense* had been founded as early as 1561 and had since 1635 been classified as a university. By the eighteenth century it was well established as the leading institution for higher education in the entire Kingdom of Hungary. Tyrnavia was also an important city in Hungary because it was here the Bishop of *Strigonium*,[49] or Primate of Hungary resided ever since large parts of the Kingdom were captured by the Ottomans in the middle of the sixteenth century. The choice of Hell as a consultant for the construction of the observatory in Tyrnavia indicates that he had by now acquired a strong reputation in Jesuit circles. Construction works began in 1753 and were finished in 1755. Observations started the year after, with Franciscus Weiss SJ as the director. By then, however, Maximilianus Hell had already been given new tasks in another part of the Austrian Province of the Society of Jesus – in an area that is nowadays placed firmly within the borders of Romania.

Claudiopolis, or Klausenburg (German), Kolozsvár (Hungarian), Cluj-Napoca or simply Cluj (Romanian), was the capital of the Principality of *Transylvania*.[50] Although *de facto* ruled by imperial governors since 1711 and formally given status as a Grand Principality (*Magnus Principatus*) in 1765, Transylvania was considered to be a somewhat different spot on the 'mental map' of the Habsburg lands. Whereas vital parts of the Kingdom of Hungary, notably the regions west of the river Tiszla, had proved rather unproblematic to reconquer for Catholicism after the Ottomans were dispelled, the situation was quite different in eastern parts of Hungary. The same applied to the even more easterly mountain passes of Transylvania. At the time when Maximilianus Hell arrived to take over the chair as professor of mathematics in Claudiopolis for the university year 1752/53, the Jesuits had officially re-established themselves in this town since 1693.

[48] Tyrnavia or Tirnavia (L) = Tyrnau (G), Nagyszombat (H), Trnava (Sl).
[49] Strigonium (L) = Gran (G), Esztergom (H).
[50] Transylvania (L) = Siebenbürgen (G), Erdély (H), Erdel (Turkish), Ardeal or Transilvania (Romanian). The description of Transylvania in this and the following paragraphs will, unless otherwise stated, be based upon the book by Shore 2007 and articles by Nouzille 1998; Marton 2007 & 2009; Bálint 2010 and Shore & Whitehead 2010.

MAP 1 TOPOGRAPHY OF HELL'S LIFE, 1720-1755

Windschacht (Štiavnické Bane): birth place, childhood, 1720-

Schemnicium (Schemnitz, Selmecbánya, Banská Štiavnica): pupil in lower classes, -1736

Neosolium (Neusohl, Besztercebánya, Banská Bystrica): gymnasium pupil 1736-38, tertianship, 1751-52

Trenchinium (Trentschin, Trencsén, Trenčín): novice, 1738-40

Vienna (Wien, Bécs, Viedeň): university studies, 1740-45, 1747-51

Leuchovia (Leutschau, Lőcse, Lewocza, Levoča): gymnasium teacher, 1745-47

Tyrnavia (Tyrnau, Nagyszombat, Trnava): observatory planning, 1752

Claudiopolis (Klausenburg, Kolozsvár, Cluj-Napoca): collegium professor and observatory planning, 1752-55

Screenshot taken from Google Maps, map entitled "Topography of Hell's life, 1720-1755". Map data © GeoBasis-DE/BKG (© 2009), Google, Tele Atlas, Transnavicom.*


Olomouc
Nowy Sącz
Gorlice
Sanok
Ustrzyki Dolne
Sambir
Drohobych
Boryslav
Havlíčkův Brod
Jihlava
Velké Meziříčí
Blansko
Prostějov
Brno
Vyškov
Zlín
Žilina
Třebíč
Uherské Hradiště
Považská Bystrica
Ružomberok
Martin
Liptovský Mikuláš
Poprad
Levoča
Prešov
Bardejov
Svidník
Stropkov
Humenné
Spišská Nová Ves
Krompachy
Košice
Michalovce
Raabs an der Thaya
Laa an der Thaya
Hodonín
Prievidza
Brezno
Poysdorf
Piešťany
Rožňava
Trebišov
Uzhgorod
Sátoraljaújhely
Mukachevo
Stockerau
Nitra
Lučenec
Kazincbarcika
Kisvárda
St. Pölten
Bratislava
Perchtoldsdorf
Levice
Salgótarján
Ózd
Miskolc
Nyíregyháza
Vynohradiv
Khust
Bad Vöslau
Nové Zámky
Mosonmagyaróvár
Komárno
Esztergom
Vác
Gyöngyös
Eger
Újfehértó
Mátészalka
Satu Mare
Sopron
Ternitz
Győr
Dunakeszi
Gödöllő
Hajdúböszörmény
Carei
Baia Mare
Kapuvár
Budapest
Pécel
Jászberény
Debrecen
Pinkafeld
Pápa
Érd
Szigetszentmiklós
Hajdúszoboszló
Marghita
Şimleu Silvaniei
Jibou
Szombathely
Székesfehérvár
Cegléd
Karcag
Dej
Gleisdorf
Veszprém
Szolnok
Botean
Aleşd
Zalău
Graz
Ajka
Dunaújváros
Mezőtúr
Oradea
Gherla
Körmend
Kecskemét
Cluj-Napoca
Zalaegerszeg
Békés
Salonta
Keszthely
Kiskunfélegyháza
Szentes
Békéscsaba
Beiuş
E462
E65
E75
E58
E60
E71
E79
E59

The Transylvanian polity consisted of three groups, known as *Siculi* (or Shékely, Secui, speaking a language closely related to Hungarian), *Magyar* (ethnic Hungarians) and *Saxones* (or Sachsen, a German-speaking, largely Protestant group). In other parts of the Habsburg lands, the rights of protestants were severely restricted and protestantism as a competing cultural factor was effectively kept at bay by the pro-Jesuit policies of Vienna.[51] Not so in Transylvania, where religious freedom was observed and where Protestant groups were even represented in the Diet. In this situation, the Jesuits were collaborating closely with the Viennese court in their effort to integrate Transylvania in the Catholic and Vienna-oriented culture that flourished in the rest of the realm.

The population of Claudiopolis itself numbered about eight thousand, and of this total a large minority – if not the majority – were ethnic Romanians. Traditionally, nearly all Romanians in Transylvania were Eastern orthodox, but they enjoyed no political representation in the Principality. Since the re-arrival of the Jesuits in 1693, a double strategy had been launched: either to win the population over to the Roman Catholic faith, represented by the Jesuits, or at least to have them converted to the Uniate Church, or so-called Eastern Catholic faith. Despite his nominal independence from Rome, the bishop of the Uniate Church was soon to be supervised by a *theologus* "of Latin rite" who was to be consulted in all cases of importance. However, Romanians with their traditional affiliation to the orthodox faith were not the only challenge to the Habsburg Jesuits in Transylvania. There was also a marked presence of Jews and Roma ("gypsies") as well as Muslim Turks, Armenians and other 'remnants' of the Ottoman era in this region. The situation was complicated even more by the flourishing of both Calvinism and a special branch of Protestantism known as Unitarianism among the Hungarian- and German-speaking inhabitants in Claudiopolis and its surroundings.

The Society of Jesus is known for its use of science and education for missionary purposes, the Beijing court being perhaps the best known example. Astronomy was here the chief 'ticket of entry' to the inner circles at court. In Transylvania, a set of Jesuit gymnasia were founded to compete with the Lutheran schools. And perhaps most important, not long after the Society officially re-entered the region, an old Jesuit Collegium that had flourished in Claudiopolis

[51] It is estimated that Protestants made up almost one third of the population in the Kingdom of Hungary around the mid-eighteenth century (Balács 1997, p. 41; cf. however Király 1969, Appendix C, where the percentage of Protestants in the 1788 census is just short of 25%). In Austria itself, Protestantism was forbidden, but proved difficult to root out. Forced migration of Protestant farmers to Transylvania was among the tools used in efforts to combat 'crypto-Protestantism' during the reigns of both Emperor Charles VI and Empress Maria Theresa (see for example Pörtner 2005, pp. 392-394). See also Király 1969, pp. 117-122.

between 1579 and 1606 was re-opened. The collegium soon had two branches; a theological and a philosophical faculty. Included in the latter was mathematics in the widest sense. The number of students grew steadily, from 50 in 1703 and 186 in 1711 to 387 in 1747, 427 in 1753 and 493 in 1771.[52] Academic prestige also grew, and in 1753 the official designation of the institution changed from *Collegium Academicum* to *Alma Universitas*.[53]

As of 1752, the Jesuits in Claudiopolis were about to construct a new collegium building as well as a brand new astronomical observatory. This observatory was planned to become the fourth Jesuit observatory in the Austrian Province of the Society of Jesus – Vienna, *Graecium* (Graz) and Tyrnavia being the first three on the list. When Father Hell arrived, he was put in charge of this task, which he however left unfinished.[54] Besides planning and supervising the construction work, he undertook experiments on electricity in the collegium's *Museum Mathematicum*, lectured as a professor of mathematics, preached in German and "Slavic" and extended pastoral care for military personnel. He also published two textbooks, *Varia compendia praxesque operationum arithmeticarum* ('Various introductions and exercises in arithmetics') and *Elementa mathematica naturalis philosophiae ancillantia* ('Basic mathematics for the aid of natural philosophy'), both printed in Claudiopolis in the year 1755. Increased publishing of textbooks was part of the reform of higher education that had just been initiated by the Viennese authorities: instead of just listening to their teachers' dictation, students ought to be furnished with textbooks, a proper curriculum. Hell's textbooks were issued in keeping with that decree. Even though he soon left Claudiopolis and quit teaching mathematics for good, the two textbooks were reissued several times, in both *Posnania*[55] and Vienna, but apparently never revised. Thus, in the third edition of the *Elementa mathematica* (Vienna 1761) we read in the exercises an example like this:[56]

> A merchant in Claudiopolis, selling a Claudiopolitan short *ulna* [or 'ell', a measure of length] for the same price as a long *ulna* was bought in Vienna, wishes to know the profit per cent. Since five Claudiopolitan *ulnae* equal four Viennese, this means that for every four Viennese *ulnae* there is a gain of one Claudiopolitan. Accordingly, the sum should be stated thus [...].

[52] Figures taken from Nouzille 1998, p. 327 and confirmed by Szenkovits 2006, p. 105.
[53] Nouzille 1998, pp. 326-327; Marton 2007, p. 19.
[54] For the plight of this obscure observatory, see Subsection I.2.4.1 below.
[55] Posnania (L) = Posen (G), Poznán (Polish).
[56] Hell 1761*b*, appendix, p. 35: "Mercator Claudiopolitanus vendendo ulnam minorem Claudiopolitanam eodem pretio, quo empta est ulna major Viennensis, scire cupit lucrum pro 100. Constat autem quod 5 ulnæ Claudiopolitanæ faciant 4 ulnas Viennenses, seu quod idem est, in quatuor ulnis Viennensibus lucratur unam Claudiopolitanam dicatur ergo […]".

This is applied mathematics, adapted for a local audience. But the Hellian textbooks are examples of 'applied mathematics' in more than just one sense. In his introduction to a supplement of exercises for further study at home, Hell bids his students farewell in the wish that they "add to the Greater Glory of God through [them]selves and [their] efforts."[57] Incidentally, 'to the greater glory of God' (*ad majorem Dei gloriam*) was the motto of the Society of Jesus. Missionary work and mathematics went hand in hand.

Before the academic year 1755/56 had started, Maximilianus Hell was called from the outskirts of the Austrian Province to its very epicentre: he was to return to Vienna. His period in Claudiopolis lasted barely three years.

I.2.2 JESUIT PROFESSOR AND COURT ASTRONOMER, 1755-1768

We may safely assume that Hell's appointment as *astronomus caesareo-regius* ('Imperial and Royal Astronomer') resulted from talent, contacts and timing. His talent in the mathematical sciences, and astronomy in particular, had been noted in Vienna, Tyrnavia and Claudiopolis. To the extent that formal merits were of any value, the fact that Hell had already published three mathematical textbooks as well as a work of history of a kind that was frequently included in almanacs was probably not regarded with disfavour.[58] His contacts in Jesuit circles included influential men like his former teacher Josephus Franz. Franz was not only the head of the Jesuit observatory in Vienna and a prominent professor at the university, he was also the head of the prestigious "Orientalische Akademie" and a private teacher of Maria Theresa's oldest son, the future Emperor Joseph II (1741-1790, co-regent from 1765, ruler

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[57] Hell 1761*b*, appendix, no page: "Valere vos cupio ad DEI Gloriam Majorem per vos, vestrosque conatus augendam." See also the *Scholion* 362 on page 230 (*op.cit.*): "*Cursus Mathematici commendantur:* […] è quibus singulis prima Matheseos Elementa, si quando Tyrones petent, meminisse una mecum velim, moniti D. Pauli: *Omnia in Gloriam DEI facite.* I. Cor. 4. v. 31." = "The following courses of mathematics are recommended: […] If beginners are to seek their basic knowledge of mathematics in those textbooks, I hope they will keep in mind the words of Paul the Evangelist, *[whatever you do,] do all to the glory of God* (1 Corinthians 4:31)". Curiously, the reference to *I. Cor. 4. v. 31* is a misprint for *I. Cor. 10. v. 31*. The *gloriam DEI* part, however, resonates clearly enough.

[58] In the first non-anonymous edition of the *Adjumentum memoriae* the following statement is made (Hell 1774*b*, Preface, no page): "Quum ergo Chronologia, & Geographia sine Astronomia consistere nequeant; Historia autem sine Chronologia, & Geographia Matrona sit cæca, omni fere momento halucinans, necesse est fateamur; Historiam tantum debere Astronomiæ, quantum debet Chronologiæ, et Geographiæ, quantumque utraque Astronomiæ; Proprium itaque esse Astronomi solide tractare Chronologico-Historica" = "Since chronology and geography cannot subsist without astronomy, and history without chronology and geography is a blind matron hallucinating virtually every minute, we must confess that history is in debt to astronomy in the same measure as it is in debt to chronology and geography. Accordingly, it is the prerogative of the astronomer to treat chronological-historical subjects solidly." This quote is not found in the 1760 edition (Hell 1760*b*) and I assume that it was not included in the 1750 edition either. All the same, the linking of astronomy with chronology and history appears to be commonplace.

from 1780). As for timing, in January 1755 the court mathematician Joannes Jacobus de Marinoni (1676-1755) passed away. Marinoni had been active as a surveyor and astronomer, and had bought numerous instruments for a small observatory in his home in the centre of Vienna. In his will, Marinoni donated all the instruments of his private observatory to the court.[59] As it happened, in keeping with the university reforms introduced by Van Swieten, a new main building of the Vienna University was just then being erected. It was now decided to construct a new 'public', or 'Imperial and Royal Observatory' on top of this building. This decision gave the observatory a prominent position in the centre of the capital. The public observatory, conspicuously placed on top of the university's new assembly hall, would when finished tower some 37,9 meters above the street floor. While it should ideally have been even higher in order to prevent the spears of a church and other buildings nearby to block the view of parts of the sky, the fundaments of the building were not strong enough to support that.[60] To begin with, Father Franz was put in charge of the construction, but soon another person was called in to finish the task – the 35-year old Maximilianus Hell from the Jesuit University in Claudiopolis.

The new court astronomer was called to his home university in September 1755[61] and began formally in his new job in November. A work description dated 30 October 1755, preserved in the University Archives of Vienna, gives the freshly appointed *astronomus caesareo-regius* ('Imperial and Royal Astronomer') a wide range of tasks, which may be summarised thus:[62]

> 1) He is to maintain the stock of instruments; 2) He is to observe the trajectories of planets; 3) He is to inspire the populace to make observations by inviting people to his observatory; 4) He is to correspond with all major international observatories; 5) He is to supervise the calendars [i.e., almanacs] and edit an official calendar rid of superstition and astrology; 6) He is to hold courses in practical mechanics; 7) He is to deliver periodic reports to the *director* of the Faculty of Philosophy.

[59] A detailed account of the instruments of Marinoni's observatory was published in 1745, *De astronomica specula domestica et organico apparatu astronomico libri duo* (Vienna), cf. e.g. Lackner *et al.* 2006, pp. 117 & 374-376; Steinmayr 2010*a* (paper held in 1932), pp. 169-170. For key dates of his biography, see Lackner *et al.* 2006, p. 16; Pärr 2001, pp. 20-26; Felix Schmeidler in *Neue Deutsche Biographie* 16 (1990), pp. 212-213.
[60] Steinmayr 2010*e*, pp. 265-266.
[61] Hell, *Anleitung zum Nutzlichen Gebrauch der künstlichen Stahl-Magneten* 1762, p. 13: "da ich im Herbstmonat des 1755sten Jahrs ganz unverhoft und unverzüglich zu meinen gegenwärtigen Amt von Clausenburg anher beruffen wurde" = "since I in September of the year 1755 was called, totally unexpected and urgently, from Claudiopolis to the chair that I now keep here in Vienna".
[62] My summary, based on the document "Ernennung Maximilian Hells zum k.k. Astronomen, 1755.10.30 (Akt)", Archiv der Universität Wien, CA 1.2.102 (Universitätskonsistorium, Fasz. I/2, Studiensachen 102). 12 pp.

When discussing Maximilianus Hell's career in the period 1755-1768, his work instruction is a convenient point of departure. Although the document is frequently referred to in the biographical literature, it has – to the best of my knowledge – never been published in its entirety, in either German or English. In order to inspect it, as it were, from close range, each point on the list will therefore be presented here in translation, albeit not in a strictly numerical order. The last point on the list is formulated thus:[63]

> ***7)*** He shall report every week to the Director of Philosophy about all His observations and scientific correspondence. His further activities, what subject matters that are to be included in His calendars and mechanics courses and what works He is going to publish, He shall inform the Director about, to whom He is to turn on all matters relating to his work.

One notices that the periodic reports to the Director (dean) of the Faculty of Philosophy are supposed to be weekly, and the Imperial Astronomer is asked to turn to the director for advice on "all matters relating to his work". However, it is not stated that these reports ought to be *written*, and although a fair amount of documents in Hell's hand are included in an online inventory of the Vienna University Archives, the documents that have been catalogued for the internet mainly concern extraordinary issues such as renovation of the observatory rooms, new arrangements for his lodging, etc.[64] A detailed investigation of Hell's interaction with administrative and scientific staff at the university is in any case beyond the scope of this thesis. Suffice it to say that the court astronomer lived in the upper floors of the university building, directly underneath the observatory, along with his assistant (referred to as the *socius*, *bidellus* or *adjunctus*), a servant (*famulus*) and a secretary (*scriba*). Furthermore, his apartment had space enough to host a student of astronomy for shorter or longer periods. It was a normal arrangement for astronomers in those days to live in the observatory building itself. Given the nightly chores of an astronomer, this was convenient. Despite the formal requirement of delivering weekly reports to the dean and consult him on all matters of importance, there seems to have reigned an atmosphere of seclusion in the upper quarters of

[63] Ibid.: "Siebentens wird er wochentl: allen fürgenommenen *observation*en, und dem *Commercio Litterario* dem *Directori Philosophiæ* seinen bericht abstatten, und was ferner fürzunehmen, von welche *Materi*en in den Calendern, und *Collegijs* [scripsi; *Collegys* MS] *Mechanicis* meistens zu berühren und was zum Druck zu geben seyn, von ihm *Directore* zu verstehen haben, an welchen er in allen sein amt betreffenden Dingen angewiesen wird."

[64] Search on "Hell" at the server http://scopeq.cc.univie.ac.at/Query/volltextsuche.aspx (undertaken 4 January 2011).

the university building. In a letter of 1762, Hell refers to his apartment as "an almost sacred space", inhabited only by priests.[65] His living quarters, at least, were not public.

> ***6)*** The above-mentioned [i.e., Hell] is given responsibility for the courses for future mechanics in mechanical, practical and calculatorial astronomy, which He shall deliver in the German vernacular at a suitable time every Sunday in the Philosophical lecture hall, and illustrate by means of mechanical experiments. He is to announce these courses by way of posters of invitation hung up in advance.[66]

Hell's activity as a lecturer is in need of further study. Karl Littrow writes that he held lectures in "popular mechanics" for a year only, until he was forced to give them up because his other duties proved too time-consuming.[67] His background from Schemnicium was probably the main reason why he was asked to deliver courses for intending mechanics in the first place; his private teaching of noblemen a few years earlier may have been noticed as well. Hell's former teacher was probably influential here. In addition to his other duties, Franz was also an official supervisor of the mining industry and may have seen the utilitarian potential in having a court astronomer from a family of engineers recruited to the Vienna University. In contrast to Littrow's claim that Hell quit teaching mechanics after merely a year, Konradin Ferrari d'Occhieppo in the *Dictionary of Scientific Biography* claims that there was a "large attendance of Hell's lectures".[68] This seems to be an exaggeration. Nothing suggests that Hell ever became an "educator of the masses" in either astronomy or

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[65] Hell to Carolus Esterházy, Bishop of Agria, dated Vienna 6 August 1762 (Vargha priv.): "locus est ferè religiosus, quem præter me, et Socium meum atque famulum, et Scribam, nemo alter sæcularium incolit".
[66] "Ernennung Maximilian Hells zum k.k. Astronomen, 1755.10.30 (Akt)" (archival reference as above): "Sechstens werde obbenanter *Astronomiæ Mechanicæ practicæ*, und *Calculatoriæ* die *Collegia Mechanica* beygesezet, welche er alle Sonnstäge in der teutschen Lands-Sprache in dem *Philosophi*sch: Saal zu bequemer Stund halten mit *Mechan*isch: *Experiment*en verständlich machen, und mit vorläuffig aufgehangener Einladungs-*Tabell* kund machen solle."
[67] Littrow 1835, p. 5: "Trotz der vielen Geschäfte, die ihm [i.e., Hell] die Einrichtung der neuen Sternwarte verursachte, übernahm er noch das Lehrfach der populären Mechanik bei seiner Ankunft in Wien, eine Kanzel, die dem Staate geschickte Künstler und Handwerker zu bilden bestimmt war. Nach einem Jahre sah er sich jedoch gezwungen, dieselbe wieder abzugeben, da der Auftrag, jährlich Ephemeriden, nach dem Muster der Parisen, herauszugeben, den er erhalten hatte, ihm viele Zeit raubte" = "Despite the many challenges the construction of the new observatory occasioned for him, upon his arrival in Vienna he even took over the teaching of popular mechanics, a professorship that was designed for educating skilled mechanics and craftsmen for the state. However, after a year he found himself forced to give up this professorship because the task laid upon him to publish an ephemeris for every year after the paradigm of that of Paris [i.e. the *Connoissance des Temps*] proved too time-consuming for him." Littrow's account is repeated almost word for word by Bruhns in *Allgemeine Deutsche Biographie* Band 11 (1880), p. 691. See also Schlichtegroll (ed.) 1793, pp. 288-289.
[68] Ferrari d'Occhieppo, entry on "Hell, Maximilian" in Gillispie (ed.), vol. VI (1972), p. 234.

mechanics.[69] He did, however, host individual aspiring astronomers in his apartment in order to give them instruction in practical astronomy. Some students stayed for a few weeks or months, some up to several years. In coming sections, some of these students will be introduced. In the meanwhile, another point on the instruction needs scrutiny.

> ***1)*** The Imperial and Royal Astronomer is to set in place a perfect arrangement ("vollkommene Einrichtung") for all the instruments pertaining to this study and make sure they are calibrated when necessary and well taken care of.[70]

Interestingly, considering the fresh heritage of Marinoni's instruments, Hell's first task was to mount and maintain the stock of instruments. The word "Einrichtung" has a wide significance. However, contrary to Pinsker 1971, I do not interpret it as implying that Hell was supposed to undertake "regular perfection and modernisation of the instruments",[71] merely that he was to take good care of the instruments that were already to hand. Fair to say, however, Hell did acquire some instruments for his observatory over the years, but this act of modernisation was not something that was required of him in his work instruction. A recent publication on the history of the University Observatory of Vienna gives detailed information on the stock of instruments that was available to Hell.[72] It appears safe to conclude that the Viennese observatory had far from the most up-to-date set of instruments in this period. On this point, Hell was soon surpassed by for instance Christianus Mayer's observatories in Schwetzingen (established 1761) and Mannheim (established 1772), where considerable resources were set in motion to acquire an impressive set of instruments from the best instrument makers in England. In contrast, Hell had to make do with the heritage of Marinoni and some occasional acquisitions.

> ***2)*** It will be His responsibility to make daily observations of the trajectories of the planets, thereby taking heed of the journals of observations that were begun by, and continued through many years by the Gentleman de Marinoni, and to enter His observations meticulously in suitable notebooks.[73]

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[69] Thus, early in the year 1777 Hell announced public demonstrations of practical astronomy in the *Wiener Realzeitung*, but gave this up after less than a year, probably because of a failure to attract interest (Haberzettl 1973, p. 197).
[70] "Ernennung Maximilian Hells zum k.k. Astronomen, 1755.10.30 (Akt)" (archival reference as above): "Erstens wird der Kays: Königl: *Astronomus* die vollkommene Einrichtung aller zu diesem *Studio* gehöriger *Jnstrument*en ihre von Zeit zu Zeit anstellende *Rectification* und Verwahrung genau besorgen."
[71] Pinsker 1971, p. 105: "Laufende Vervollkommnung und Modernisierung der Instrumente".
[72] Hamel *et al.* 2010.
[73] "Ernennung Maximilian Hells zum k.k. Astronomen, 1755.10.30 (Akt)" (archival reference as above): "Andertens wird Jhme obliegen die tägliche *observationes* des *Planet*en-Laufs anzustellen, und hiemit die von Se[ine]n E[dl]en Herrn von *Marinoni* angefangenen, und durch viele Jahre fortgesezte *Ephemerides Astronomicas* aufzumercken, und in die hierzu gehörige bücher ordentlich einzutragen".

This task, to make "daily observations of the trajectories of planets" needs not be emphasised. Planets were of course an interesting phenomenon in themselves, but in the work instruction they are no doubt singled out merely because this was a specialty of Marinoni's. Hell published, for his part, all kinds of astronomical observations for years to come in his public *Ephemerides*, reserving no particular status to planets as opposed to other phenomena. The fate of Marinoni's journals is unknown, and even Hell's manuscripts of observations – with the notable exception of some of his diaries from the expedition in Denmark-Norway – have not been found.

> ***3)*** The populace ("das Publicum") is to be urged and invited to make observations of eclipses, occultations of stars, comets and other unusual astronomical phenomena by way of announcements in newspapers or posters at the door.[74]

This task points forward to the many "Urania-Sternwarten" ('Urania observatories') that were established, especially in the German-speaking world, beginning more than a hundred years later. The Urania observatories were institutions established with the specific aim of disseminating scientific knowledge, and had a much wider outreach than the Imperial Observatory of Vienna was ever expected to have.[75] "Das Publicum" was obviously a more narrow concept in Hell's age, and it should suffice to point to the singular event of the transit of Venus in 1761. At the day of the event, the Imperial Astronomer retreated to a provisional site of observation in the library of the Jesuit Collegium, while both the Jesuit observatory and Hell's own "public" observatory were crammed with people of the highest circles – the future Emperor Joseph II among them.[76] It is true, however, that throughout his career Hell did receive less high-profiled guests at the observatory, foreign diplomats and visiting students alike, like the travellers Hviid and Münter whom we will meet in a subsequent section of this essay. In that sense at least, his observatory was a public institution, an integral part of the 'public space' of the Austrian capital.

[74] Ibid.: "Drittens solle d[a]s *Publicum* zu denen *Observation*en der Finsternissen, Sternbedeckungen, Cometen oder andern ausserordentlichen *Astronomi*schen Erscheinungen durch die öffentlichen oder auf d[a]s Thor aufgehangene *Tabell*en vermahnet, und eingeladen werden".
[75] See for example Wolfschmidt 2008 or Molvig 2010.
[76] Hell 1761*a*, pp. 1-20.

> ***5)*** all supervision of the calendars [i.e., almanacs][77] is bestowed and laid upon Him. This responsibility will not only consist in making sure that everything that may originate from the superstition of the ancients and the crowd or from the unfounded astrology, giving advice on weather, pharmacy, bloodletting, growth of plants or human coincidences, shall be completely avoided: he is also to edit an astronomical calendar every year and to publish it in time.[78]

The main achievement of Hell was the *Ephemerides ad meridianum Vindobonensem*, the first volume of which covered the year 1757 and which continued until the year 1806 (published 1805). In 1760, without revision of contents or lay-out it was renamed the *Ephemerides Astronomicae ad meridianum Vindobonensem*, a name it retained until the very end. This periodical not only contained tables of the rising and setting of the Sun and other standard contents of astronomical almanacs: it also included articles and monographs on various scientific subjects as appendices.[79] The choice of Latin as the language of this publication may seem odd today. Hell was, after all, supposed to disseminate astronomical knowledge to the populace at large and to edit an official almanac for the Austrian lands, as stated in the third and fifth tasks above. Why not use the vernacular, as the French did with their *Connoissance des Tems*,[80] published since 1679, an example that later was followed by most other countries? The simplest way to answer this question is twofold. On the one hand, there existed no single vernacular that covered all the Habsburg lands. On the other, knowledge of Latin was widespread: it still functioned as a *lingua franca*, especially in the Hungarian part of the composite state of which Hell was an official representative.[81] In order to meet the requirement of inspiring "das Publicum", the Imperial and Royal Astronomer anno 1756 did fine with Latin. Another issue that may have influenced his choice of language is that the Latin of the *Ephemerides* proved excellent for international co-operation (see below).

[77] "Calender" (or "Kalender") in early-modern German is a broad designation corresponding to the English word "almanac". The German word "Almanach" is a late eighteenth-century import from French, which initially was reserved for almanacs with poems (frequently referred to as "Musen-Almanach"), cf. Sühring 1979.

[78] "Ernennung Maximilian Hells zum k.k. Astronomen, 1755.10.30 (Akt)" (archival reference as above): "Fünftens wird ihm alle obsorg über die Calend[ern] überlassen, und aufgeleget. Diese wird nicht nur in jenem bestehen, d[as]s alles, was von dem aberglauben d[er] alten und des Pöbels, und von der ungründl[ich]en *Astrologia* für die Witterungen, Arzneyen, Aderlassen, Wachsthum der Pflanzen, und menschlichen Zufällen herrühren kan, volkommen weggelassen werde, sond[er]n seiner obsorg wird beynebens obliegen, jährlich einen *Astronomi*schen Calend zu verfertigen, und zu rechter Zeit in Druck zu geben."

[79] See Sommervogel 1893 for a complete list of items published in the *Ephemerides.*

[80] In more modernised spelling, *Connaissance des temps*. During 1762-67, it was renamed *Connoissance des Mouvemens Célestes*, but changed back to its old name again after that.

[81] Contrary to what is often claimed, that Latin was a specialty of the educated elite, István Tóth in his *Literacy and Written Culture in Early Modern Central Europe* presents numerous examples of Latin spoken among soldiers, merchants and other ordinary people in eighteenth-century Hugary (Tóth 2000, espec. pp. 130-145).

If Hell edited the official calendar in the large *quarto* format and stately Latin language, this does not imply that his *Ephemerides* was the only almanac issued in the Habsburg lands. Lesser format calendars flourished in the vulgar and sold tens of thousands each year.[82] A work of 1760, apparently Hell's first publication in German, was related to his duty to supervise the calendars. The title page of the work is telling:[83]

> By Maximilianus Hell, Priest of the Austrian Province of the Society of Jesus, Astronomer of the Imperial and Royal Majesties: A Brief Introduction to the Paschal Celebration for the Common Lay Person, Including a Thorough Refutation of a Work that Christoph Sigismund Schumacher, Calendar Author in Dresden has Published in the Year 1760, Entitled 'Investigation of the Paschal Celebration from the Year 1700 to 2500' (Vienna 1760).

Here we find the Imperial Astronomer refuting unorthodox views on one of the main Christian celebrations. He does so as a Jesuit Priest and as the Imperial and Royal Astronomer of Vienna. A couple of letters from Christoph Sigismund Schumacher to Hell, both dated Posonium in the spring of 1759, are preserved. Schumacher there presents himself as an almanac editor and astronomer who has previously stayed in Transylvania and eastern parts of Hungary. He has had little success so far, but is determined to linger on in Hungary until God decides otherwise for him.[84] Apparently, Dresden was the next station in Schumacher's life. According to Pinzger, Schumacher was a Protestant, which could explain some of his problems.[85] As for Hell, he explains that he wrote this text on the paschal celebration "in der gänz gemeinen bürgerlichen Muttersprach" ("in the truly vulgar civic mother tongue") because he wanted to reach the "gemeine Mann" ("common man").[86] Latin functioned well – up to a point. Certain laymen could not read it, and when necessary, Hell switched language in order to reach this segment of society.

> ***4)*** In order to promote the honour of this capital and its university and to administer it to the common good, the Imperial and Royal Astronomer shall entertain a perpetual scientific correspondence (*Commercium litterarium*) with

[82] See Tóth 2003 (various less detailed pieces of information are even found in Tóth 2000). A survey of the various vernacular almanacs published in the Habsburg lands during the eighteenth century would be very welcome (the lack of a separate section on almanacs in Kókay 1990 is regrettable).
[83] *Maximiliani Hell S.J. der Oesterreichischen Provinz Priestern Ihro beyder Kaiserl. Königl. Majest. Astronomi bey der uralten hohen Wienerischen Universität Kurzer Unterricht der Oster-Feyer für den gemeinen Mann samt der gründlichen Wiederlegung einer Schrift, welche Herr Christoph Sigismund Schumacher, Calender-Schreiber in Dreßden unter der Innschrift Untersuchung der Oster-Feyer von Anno 1700. bis 2500. verfasset und Anno 1760. in Druk gegeben hat* (Hell 1760*c*).
[84] Schumacher to Hell in Vienna, dated Posonium (now Bratislava), March and 1 May 1759 (WUS Vienna, secretary's copy).
[85] Pinzger 1920, p. 62.
[86] Hell 1760*c*, preface.

all famous observatories abroad, and in so doing make sure that all observations that are necessary for the advancement of geography be communicated to this observatory by the foreign ones, and that no observations of the kind that other astronomers are eager to receive, shall be neglected by him.[87]

From early on, Hell started to make international contacts. This can be perceived not only from the *appendices* ('Supplements') of his *Ephemerides*, which give an idea of a rapidly expanding network, but also from entries in prestigious journals like the *Nova Acta Eruditorum* of Lipsia (Leipzig) or the *Journal des Sçavans* of Paris.[88] The surviving parts of Hell's correspondence demonstrate that scientific correspondence with all major international observatories was soon by and large accomplished. The *Ephemerides* seems in most cases to have functioned as a springboard. The case of Paris illustrates this. In the autumn of 1757, two Jesuit astronomers, Christianus Mayer (1719-1783) of Heidelberg and Franciscus Huberti (1715-1789) of Herbipolis (Würzburg) travelled to Paris to visit its main scientific institutions. Huberti brought with him a copy of the *Ephemerides* to show to the astronomers of Paris, and in a letter to Hell dated 3 October 1757 he describes their reaction:[89]

> Upon order from my Mæcenas, His most Honourable and Eminent *Princeps* [i.e., Prince-Bishop, "Fürstbischof"] of Würzburg, I have found myself under obligation to go to Paris, despite my wish to pay Vienna another visit. I showed Your *Ephemerides*, which I had brought with me, to the astronomers of Paris. It was pleasant so see how they at first sight raised their eyebrows, but soon praised the great industry of the calculations and immediately asked me to provide a copy for them from Germany. Only Delisle, a man who is advancing his old age, very favourable to our Society and thoroughly outspoken, added that he had great respect for Your calculations, but would have preferred that

[87] "Ernennung Maximilian Hells zum k.k. Astronomen, 1755.10.30 (Akt)" (archival reference as above): "Viertens, damit die Ehre dieser Haubt-Stadt, und *Universi*tät befördert, und dem allgemeinen Nützen gesteuret werde, solle der Kays: Königl: *Astronomus* mit allen auswärtigen berühmten *observatorijs* ein beständiges *Commercium Litterarium* unterhalten, und dahin meistens bedacht seyn, d[as]s alle zum aufnahm der *Geographie* erforderliche *Observationes Astronomicæ* dem hiesigen *observatorio* von den fremden mitgetheilet, und keine Gattung sothaner *observationum* von Jhme versaumet werde, woran and[er]e *Astronomi* einen Theil nehmen wollen."

[88] See for example *Nova Acta Eruditorum* for February 1762, pp. 49-58; *Journal des Sçavans*, Octobre 1761, pp. 672-675. As for the latter case, there is preserved a copy of a letter from Hell to the editors of the journal in Paris, dated Vienna 18 March 1761 (WUS Vienna). In this letter, Hell explicitly asks for a review of the *Ephemerides*.

[89] Huberti to Hell in Vienna, dated Paris 3rd October 1757 (WUS Vienna, secretary's copy): "Reverendissimi, ac Celsissimi Principis Wirceburgensis Mæcenatis mei jussu factum est, ut debuerim Parisios ire, qui Viennam iterato proficisci maximi præoptabam. Monstravi Tuas Ephemerides quas mecum sumpsi Parisinis astronomis, jucundum erat videre, ut primo aspectu supercilia attollerent, mox industriam maximam calculi depraedicarent. meque extemplo rogarent, ut et sibi Exemplaria ex Germania compararem. Unus del Jslius Vir senio appropinquans, et societati nostrae addictissimus, ac perquam sincerus, adjiciebat, se quidem permagni facere tuos labores, malle tamen ut tempus Observationibus potius, quam calculo impenderes, respondi Te nec ab observando feriaturum". For more on the visit of Huberti and Mayer to Paris, see Moutchnik 2006, pp. 67-69; 152-154; 447.

> You spent more of Your time on observations than on calculations. I answered that You would not avoid the task of making observations either.

Probably as a result of the high standard of the *Ephemerides,* Father Hell received the title of corresponding member ("membre correspondant") of the *Academie Royale des Sciences* of Paris shortly afterwards. This was the first time a representative of the Austrian Province of the Society of Jesus received this honour.[90] The nomination of Hell marked the start of a close and long-lived – though sometimes rather strained – scientific cooperation between the Imperial Astronomer of Vienna and his colleagues in France.[91] Hell's surviving letters bear witness of a rather frequent correspondence with the major French contemporaneous astronomers Lacaille, Delisle, Messier, Cassini de Thury, Chappe d'Auteroche, Pingré and Lalande, from the late 1750s onwards (see Unprinted Sources, 1*a* and 1*b*). The court astronomer of Vienna never visited France personally, and he never learned French well enough to speak or write it properly. This did not hamper communication, however, as the French astronomers would tend to write their letters in their own language while Hell composed his in Latin. The same kind of bilingual communication probably took place whenever he received French-speaking visitors.[92] Outside the German- and French-speaking world, Hell in the early 1760s forged contacts with colleagues at observatories in Madrid, St Petersburg, Milan, Bologna, Florence, Padua and Stockholm, using Latin in all cases.[93]

The instruction of 1755 called for international, scientific correspondence "to promote the honour of this capital and its university": it is about Vienna and the World. However, Maximilianus Hell was successful far beyond that, in collaborating with astronomers in various places even within the Habsburg Empire. This brings us to the concept of the 'nodal astronomer'. The key node in the Habsburg lands, the Viennese Imperial and Royal Observatory administered by Maximilianus Hell, was conspicuous on the international arena not only by means of the capital it represented, but also through the sheer number of smaller

[90] Weiss to Hell in Vienna, dated Tyrnavia 23 December 1758 (WUS Vienna, secr. copy).
[91] According to the *Connoissance des Temps* pour l'année 1760 (published 1759) and later editions, Hell was formally appointed a corresponding member 23 December 1758. From 1758-62 his formal contact at the Academie was Lacaille, from 1763-68, Delisle, and from 1769-92, Lalande.
[92] The first verifiable visits took place in 1761, when Chappe d'Auteroche passed by on his way to Tobolsk in Siberia, and Cassini de Thury arrived in order to observe the transit of Venus from the Jesuit Observatory and to initiate a joint project of cartography: Chappe d'Auteroche, *Voyage en Sibérie fait par ordre du Roi en 1761*, Paris 1768, entries 31 December 1760 – 8 January 1761 (ed. Mervaud 2004, vol. II, pp. 250-251); Cassini de Thury, "Observation du passage de Vénus sur le Soleil, Faite à Vienne en Autriche", in *HARS* 1761 (1763), *Mémoires*, pp. 409-412.
[93] See Unprinted Sources and Literature, 1*a* and 1*b* (Correspondence with England came much later, as we shall have occasion to discuss in Section II.3.1 below.)

and less conspicuous 'nodes', which Hell brought to the awareness of his peers through scientific correspondence and publications. This promoting was by no means all-embracive. The refutation of Schumacher has been mentioned. Hell there put his authority as a Jesuit priest and as Imperial and Royal Astronomer behind a – probably quite devastating – attack on a simple almanac editor in Dresden. Needless to say, that amateur was never bestowed the honour of having his observations published in Hell's *Ephemerides*.

A counter-example is provided by Petrus Anich (1723-1766), a farmer and turning-lathe operator from the village Oberperfuss in Tyrol. A eulogy of this man was included in Hell's *Ephemerides Astronomicae* for the year 1767. In 1751, at the age of 28, Anich had made his way from his village to the Jesuit Collegium in nearby *Oenipontum* (Innsbruck), where he presented himself to the Professor of Mathematics, Ignatius Weinhart SJ (1705-1787). The published account tells how Weinhart perceived the man's potential, and decided to teach him during Sundays and other holidays. Soon, "thanks to his own talent and industry"[94] Anich emerged as a prominent surveyor and map maker in Tyrol. Weinhart's correspondence with Hell concerning this publication is preserved. Both in these letters and in the printed version, the propaganda aspect of the story is made quite explicit.[95] In a preface to the eulogy, Hell and Weinhart explain how a recent publication on the scientific achievements of a Saxonian farmer by the name Joannes Ludewig from Cossebaude had driven them to act.[96] In that publication, Ludewig's example was used to demonstrate that "Saxony [Sachsen] owed to Martin Luther" the fact that "even Saxonian farmers engage in philosophy and produce works on mathematics and other exact sciences".[97] With great pathos, the two Jesuit professors extol Anich as an example refuting that claim. According to them, Catholic farmers had proven themselves to be at least as capable as, and probably even more capable than, Protestants to make tremendous advances in the exact sciences. Thus, the eulogy was published to

94 Hell & Weinhart *Elogium Rustici Tyrolensis Celeberrimi Petri Anich Oberperfussensis Coloni, Tornatoris, Chalcographi, Mechanicarum Artium Magistri, Geodetæ, Geographi, et Astrophili ad Prodigium Excellentis…* 1768, p. 7 footnote: "in iis, quæ præstitit Anichius longe plus debet sibimetipsi, talento suo, & industriæ propriæ, quam mihi [i.e. professori suo Weinhart]" = "in the things Anich achieved, he owed far more to himself, to his own talent and industry, than to me [that is, his teacher Weinhart]".
95 The text was reprinted with corrections and additions in Oenipontum in 1768, after a resumé had appeared in the Parisian *Journal Éncyclopedique* (Sommervogel 1893, p. 254). It is the Oenipontum version that I have had access to.
96 See Johann Ludewig, *Der gelehrte Bauer. Mit Christian Gotthold Hoffmanns Vorbericht nebst Kupffern* (Dresden, 1756), reprinted with a postface by Holger Böning, 1992.
97 Hell & Weinhart 1768, p. 3: "Saxoniam Martino Luthero libertatem sentiendi, & agendi suis sectatoribus indulgenti in acceptis habere debere suum in scientiis progressum, adeo per omnes hominum conditionibus propagatum, ut ipsi Rustici Saxones & philosopharentur, & Mathematicas, aliaque severissimas profiterentur scientias". Refutation of this statement is found on pp. 4-5 *et passim*.

demonstrate how the Roman-Catholic faith (and, one may infer, the Jesuits in particular) encouraged and favoured the spread of science even among amateurs of ignoble origins.

The Imperial and Royal Astronomer thus went beyond his instruction geographically, 'Vienna and the World' became 'the Austrian Province of the Society of Jesus and the World'. But he also went beyond it in another sense, by engaging in and promoting various sorts of science reaching beyond his core subject of astronomy. Scientific disciplines were obviously not yet as differentiated as they were to become in the nineteenth century. History and astronomy were, for example, commonly perceived as neighbouring branches of learning. Another neighbouring 'discipline' was meteorology. In various editions of the *Ephemerides*, meteorological reports as well as discussions of meteorological instruments were included. Hell's assistant during 1762/63-1772/73, Antonius Pilgram SJ (1730-1793) later published a 608-page *Untersuchungen über das Wahrscheinliche der Wetterkunde* ('Investigations on What is Probable in Meteorology', Vienna 1788). Pilgram's *Untersuchungen* were based on daily measurements made at the Imperial Observatory as well as published observations from elsewhere in Europe.[98] In 1761, Hell himself upon inspection of the meteorological journals of the Jesuit observatory in Vienna believed he could predict the weather for years in advance. He even wished to publish an "ephemeris of the weather" ahead of each year (*Ephemerides Meteorologicae* is the expression he uses).[99] When presenting this idea to Van Swieten, however, Hell was made to understand that publication of such a work would not receive any support from his part – Van Swieten would in fact make sure it was never allowed to see the light of day. Hell had by then presented the rudiments of his theory in letters to colleagues in Paris and elsewhere, and these circulated for years to come without receiving much support.[100]

[98] Pilgram 1788. On Pilgram's work, see Posch & Lackner 2008; Steinmayr 2010*d* (paper held in 1933).
[99] I guess this explains why Hell changed the name of his almanac to *Ephemerides Astronomicae* in this year; the title was expanded in order to differentiate it from the intended *Ephemerides Meteorologicae*.
[100] Hell presents his theory in letters to Weiss, dated Vienna 1 April 1761 (Vargha priv.) and to Lacaille in Paris, dated Vienna 27 April 1761 (WUS Vienna). His unpleasant negotiations with Van Swieten are described in the latter letter. The theory is exposited in an unfinished manuscript at the *Wiener Universitätssternwarte*, "Theoria Phœnomeni Ascensus, et descensus Mercurij in Barometris", addressed to the Academie Royale des Sciences but possibly never submitted to Paris. However, in a letter to Röhl in Greifswald, dated Berlin 16 September 1772 (printed in *Joh. Heinrich Lamberts ...deutscher gelehrter Briefwechsel*, Zweyter Band, 1782, pp. 397-400), Johann Heinrich Lambert ridicules Hell's meteorological theories, which he has had the opportunity to read through. As late as 1783, a 30-page *Freymüthige Gedanken über die Witterungslehre des Herrn Hells* ('Frank Reflections on the Meteorological Theory of Herr Hell') was issued by Georg Anton Däzel in Salzburg (I have not had access to this publication. It is, however, listed in the online catalogue of Bibliotheksverbund Bayern, www.gateway-bayern.de visited 1 February 2011).

Another side-branch of the court astronomer's work was the fashionable subject of electricity. Hell's former teacher Josephus Franz used to perform electrical experiments in the *Museum Mathematicum* and he had even published a *Dissertatio de natura electri* ('Treatise on the Nature of Electricity') in 1751.[101] Hell himself is known to have studied electricity during his years in Claudiopolis.[102] Although he never published the details of his experiments, they were described by others.[103] The experiences gained in the laboratory were also applied to natural phenomena, such as the *Aurora Borealis*, witness the opening of a letter from Hell to Weiss in Tyrnavia, dated Vienna 1 April 1761:[104]

> Honourable Father Colleague in Christ! Many thanks for the observation and elegant drawing of the Aurora Borealis that was observed in Tyrnavia. Your observation is in harmony with ours in most aspects, for here in Vienna, too, those tiny stripes as well as the ray that stretched out towards the north from the first pyramid were observed. However, since I personally observed the phenomenon somewhat later, I failed to see both the ray and those numerous stripes. Nor did I catch sight of those electric bundles to the left of the two northern rays because there was too much moisture in the atmosphere. I did observe, however, the three major beams. As for the cloud above the rays, I for my part could not distinguish it from here, but because this phenomenon is an electric phenomenon, I told my guests during the observation itself that there was bound to be a sort of cloud above the major rays, or at least some [accumulation of] thicker air that held a higher or lesser degree of electricity than the mountaintops of our Earth, from where it was capable of eliciting these rays. It filled me with joy that this cloud, which I had seen only in my imagination, was in fact spotted in Tyrnavia, [for] this cloud demonstrates wonderfully that this opinion of mine is true, that *the Aurora Borealis is an electric phenomenon*.

Hell was later to discard this opinion and develop another theory on the Aurora, based on his experiences in Norway (see Section I.2.3 below).

[101] See Steinmayr 2010*a*, p. 178.

[102] Hell refers to these experiments on several occasions, such as in the *Anleitung zum Nutzlichen Gebrauch …* 1762 and the "Aurorae Borealis Theoria Nova" 1776.

[103] According to Pinsker 1971, p. 104, Andreas Jaszlinsky SJ included an account of Hell's experiments in Claudiopolis in his *Institutiones physicae* ('Introduction to Physics', Tyrnavia 1756). I have not had access to Jaszlinsky's textbook.

[104] Hell to Weiss in Tyrnavia, dated Vienna 1 April 1761 (Vargha priv. In Pinzger 1927, p. 187 this letter is wrongly dated 1 April 1766): "Reverende in Xto P. Collega! // Grates maximas pro transmissa observatione, et eleganti delineatione Auroræ borealis Tyrnaviæ observatæ, hæc in plurimis convenit cum nostra, nam et his Viennæ Striæ illæ parvulæ, et radius à pyramide prima in Boream protensus observatus est, sed cum ego tardius phoenomenon hoc observaverim nec radium, nec strias illas multiplices vidi. fasciculos illos electricos ad sinistram radiorum binorum borealium etiam non discrevi ob nimios vapores horizontis, cæterum radios majores ego tres observavi. Nubem illam Supra radios ego quidem hic loci non potui discernere, attamen quia hoc phoenomenon, est phoenomenon electricitatis, durante ipsa aurora boreali dicebam hospitibus, necesse esse, ut Supra radios majores, nubes aliqua, aut certe aër densior habeatur qui majore vel minore electricitatis gradu præditus sit, quam vertices montium nostræ telluris, è quibus radios hos electricos elicere valeat. Certe multum gaudebam nubem hanc visam Tyrnaviæ, quam ego mente duntaxat videbam, quæ nubes sententiam meam: *Auroram borealem esse phoenomenon electricitatis*, mirificè demonstravit esse veram." (Hell's own emphasis).

Even though electromagnetism in the modern sense of the word had to await the nineteenth century, electricity was seen by many early-modern investigators to be in some way related to magnetism.[105] Father Hell was no exception in this respect. In 1762, he published his second booklet in the German language, entitled *Anleitung zum Nutzlichen Gebrauch der künstlichen Stahl-Magneten* ('Introduction to the Useful Application of Artificial Steel Magnets', Vienna). Again, he is careful to state that he has not used the Latin language, but the "common vernacular of our lands" in order to reach another readership than the "Gelehrten" ('erudites'): in this instance, the mechanics.[106] Despite its title, the bulk of this richly illustrated, 50-page booklet is devoted to explain how pieces of steel in various forms and sizes may be applied with the strongest magnetic force possible. Hell also discusses, although without going into details, a probable link between electricity and magnetism. For "the magnetic phenomena", the court astronomer had concluded already as a professor in Claudiopolis, were "nothing else than a certain degree of movement of the electric matter".[107] The propaganda aspect of the Jesuit professor's work, which we have witnessed already in his Claudiopolitan textbooks on mathematics and in the *Ephemerides Astronomicae*, is present in his German-language publication on steel magnets as well. "I hope", he states at the end of his introduction,[108]

> that these *Introductions* of mine, which I have undertaken during my spare time, will be adopted by the mechanics in exactly the same attitude that I have written them, that is, for the benefit of the common good, which I finally exhort my

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[105] For a survey, see Heilbron 1979.

[106] Hell 1762, p. [4]: "Die Ursachen, so mich zur Verfassung dieser Abhandlungen veranlasset haben, ware der grosse Nutzen des Gebrauches, und die noch wenig bekante Kunstgriefe diese Magneten geschickt bey ihren Kräften zu erhalten, eben jene Beweggründe waren es, die mich verbunden, daß ich selbe nicht in der gelehrten lateinischen, sondern in der unsern Ländern gemeinen Mutter-Sprache vortruge; ich schreibe auch allhie nicht für die Gelehrte, sondern nur denen geschickten Mechanikern unserer Länder, die jene Werkzeuge verfertigen […]" = "The reasons why I decided to compose these treatises [the booklet consists of four chapters, or "Abhandlungen"] were the great utility of the device and the still not widely known technique for rendering it powerful: precisely the same concerns obliged me make compose these treatises not in the learned Latin language, but in the common vernacular of our lands. For I am writing this not for the erudites, but only for the skilled mechanics of our lands, the makers of instruments like these [etc.]".

[107] Hell 1762, pp. 12-15, 39-40 & 49-50, quotation on p. 13: "[da ich zu Clausenburg] auch in der Magneten Theorie nach vielfältigen versuchen, schon so weit gekommen ware daß ich den Schluß machte, daß die magnetische Erscheinungen nichts anders, als ein gewisser Grad der Bewegung der Electrischen Materie seyen" = "[…since I, while still in Claudiopolis] on the basis of numerous experiments already had made sufficient progress even in magnetic theory to conclude that the magnetic phenomena were nothing other than a certain degree of movement of the electrical matter". As of 1 February 2011, the booklet is available on Google Books, but with the plate of illustrations missing. This is, however, reproduced in Lackner *et al.* 2006, p. 167.

[108] Hell 1762, p. [3]: "[ich] hoffe also diese meine nebenständige Arbeiten werden von denen Künstlern in eben jener Absicht angenohmen werden, mit welcher ich selbe verfasset, nemlichen dem gemeinen Besten zum Nutzen, welchen zur grösserer Ehre GOttes anzuwenden, ich letzlich meine Leser erinneren wollen."

readers to make use of for the greater glory of God ("zur grösserer Ehre GOttes").

The Jesuit motto, *ad majorem Dei gloriam*, in this German rendition is bound neatly together with the utilitarian ideology. At this stage in Hell's career, there was seemingly no conflict between the Jesuit mission and the state-promoted slogan of utility.

Finally, one more remark on the international aspect. The court astronomer's gradually expanding network of correspondents has already been mentioned, as well as the way in which the *Ephemerides Astronomicae* functioned as a platform for publication of observations. However, Maximilianus Hell also made himself visible on the international arena by issuing tables of the sun, the moon and the planets of our solar system. In supplements to the *Ephemerides Astronomicae* for the years 1763 and 1764, new editions of the solar tables of Lacaille, the lunar tables of Tobias Mayer and the planetary tables of Cassini were issued.[109] These were precious items for any skilled astronomer, but hardly any bestseller candidates. In 1768, Hell also published a separate set of observations from China, based on a manuscript of observations compiled by the Jesuit astronomer Augustinus Hallerstein. In a letter to Hell's colleague Weiss in Tyrnavia, the highly prolific science writer Lalande, editor of the *Connoissance*, the French equivalent to the *Ephemerides*, expressed his admiration of Maximilianus Hell for his being able to publish such voluminous works every single year.[110]

Theoretical works and data sets connected to the transits of Venus filled many pages of the *Ephemerides* during the 1760s, a material which will be saved for analysis in part II of this thesis. Suffice it to say that, by the mid-1760s, the court astronomer of Vienna, and his *Ephemerides Astronomicae* in particular, had certainly become conspicuous on the

[109] Sommervogel 1893, pp. 239-240 & 253.
[110] Lalande to Weiss in Tyrnavia, dated Paris 10 June 1764, comparing his own textbook, the *Astronomie* (1st edn Paris 1764) with the *Almagestum novum* of Riccioli SJ (three vols., Bologna, 1651): "Riccioli vestigiis insistens ejusdem amplitudinis opus suscepissem, sed librarium pro imprimendi sumptibus exequendis non invenissem, difficile possumus Lutetiae mathematicos libros vulgare: difficile foret credere autorem pro maximo manuscripto unum aut alterum exemplar sibi vix obtinere a typographo: miro amicum nostrum P. Hell etiamsi celeberrimum ac doctissimum ephemeridum suarum volumen satis amplum quolibet anno posse vulgare" = "I would have liked to follow in the footsteps of Riccioli and produce a work of the same length as his, but I would never have found a publisher to cover the costs of its printing. It is difficult for us in Paris to publish books on mathematical subjects; an author could hardly expect to receive a copy or two from the typographer in return for a voluminous manuscript: I admire how our friend Father Hell, however famous and erudite, is able to publish a quite lengthy volume of his *Ephemerides* every single year" (quoted from Vargha 1990, p. 57).

international arena. A new important node in the international web of astronomy had been established.

Before we move on to the third chapter in his career, it might be worthwhile to reflect on the specific locations of Hell's life so far. When reading some of the literature, one gets the impression that this was almost 'meant to be'. At least authors who are themselves Jesuits tend to paint such a picture of the time. If one reads two frequently quoted articles on Jesuit astronomy published by the astronomer Johann Schreiber SJ in 1903, it is as though Hell was 'ushered in' on top of a wave of Jesuit mathematicians specialising in astronomy.[111] Anton Pinsker SJ in a paper from 1971 explains that around the mid-eighteenth century, the Austrian Province of the Society of Jesus had almost two thousand members and ran 34 gymnasiums as well as fifteen "höhere Schulen" (*collegia*).[112] The natural sciences had traditionally not been emphasised in these institutions, Pinsker admits, but in the decades around 1750 the Jesuits of the Austrian Province were rapidly catching up with developments elsewhere.[113] Johann Steinmayr SJ (1890-1944) in a series of papers from the 1930s draws a similar story of mathematical talent blooming in Jesuit circles in Vienna and elsewhere in the Austrian province during Hell's lifetime.[114] In a more recent contribution, Agustín Udías SJ portrays Jesuit astronomy throughout the early modern period as innovative and points especially to the establishment of observatories as a key element in the emergence of modern science. The story of the Viennese observatory director Maximilianus Hell receives considerable attention in his account.[115] The question remains, however: how unique was the career of Hell – were there alternative career paths available to other talented astronomers of his generation? And how important was the Jesuit order as a vehicle for the growth in institutionalised astronomy in the Habsburg lands in the eighteenth century?

[111] The two pieces were originally published in German in *Natur und Offenbarung* Vol. 49, 1903. I have only had access to the English translations by William F. Rigge SJ (Schreiber 1904*a* and 1904*b*).
[112] Pinsker 1971, p. 101. As for priests, there were 751 in the Austrian Province of the Society in 1750 (according to Shore 2007, p. 15 footnote 62).
[113] Pinsker 1971, esp. pp. 100-102.
[114] See the papers edited by Isolde Müller and Thomas Posch: Steinmayr 2010*a-f* and 2011.
[115] Udías 2003, pp. 15-35, espec. pp. 27-29 (his account is, however, regrettably replete with errors as far as central Europe is concerned).

MAP 2 COLLEGIA IN THE AUSTRIAN PROVINCE OF THE SOCIETY OF JESUS WITH PROFESSORS OF MATHEMATICS DURING THE EIGHTEENTH CENTURY

Claudiopolis (Cluj-Napoca): collegium founded 1579, university status 1753-1784, professor of mathematics 1713-, observatory construction 1753-(unfinished)

Cassovia (Košice): collegium 1633, univ. status 1685-(?), prof. maths 1659-

Buda (Budapest): collegium 1685, prof. maths 1744- (univ. status 1777-, observatory constr. 1779)

Tyrnavia (Trnava): collegium 1561, univ. status 1635-1777, prof. maths 1636-, observatory constr. 1753-56

Jaurinum (Győr): collegium 1627, prof. maths 1761-

Vindobona/Vienna (Wien): collegium 1550, incorp. in univ. 1622-, prof. maths 1560-, Jesuit observatory constr. 1733-34, univ. observatory constr. 1755-56

Theresianum Vindobonense (Wien): collegium nobilium 1746, prof. maths 1748-

Zagrabia (Zagreb): collegium founded 1622, prof. physics 1663-, prof. maths 1770-

Graecium (Graz): collegium 1573, univ. status 1586, prof. maths 1582-, observatory constr. 1745

Labacum (Ljubljana): collegium 1597, prof. maths 1710-

Lincium (Linz): collegium 1629, prof. maths 1670-

Clagenfurtum (Klagenfurt): collegium 1604, prof. maths 1656-

Goritia (Gorizia): collegium 1621, prof. maths 1748-

Screenshot taken from Google Maps, map entitled “Provinciae Austriacae SJ collegia saeculo XVIIImo mathematica colentia”. Map data © GeoBasis-DE/BKG (© 2009), Google, Tele Atlas, Transnavicom.*

Passau
Prachatice
Andorf
Schrems
Weitra
Zwettl-Niederösterreich
Raabs an der Thaya
Laa an der Thaya
Poysdorf
Enns
Wels
Traun
Sierning
Vorchdorf
Mondsee
Micheldorf am Kienberge
Ebensee
Hallstatt
Eisenerz
Kapfenberg
Trofaiach
Obertauern
Fohnsdorf
Köflach
Graz
Gleisdorf
Pinkafeld
Ternitz
Bad Vöslau
St. Pölten
Perchtoldsdorf
Bratislava
Mosonmagyaróvár
Sopron
Hodonín
Trenčín
Piešťany
Nitra
Nové Zámky
Komárno
Győr
Kapuvár
Pápa
Szombathely
Körmend
Zalaegerszeg
Keszthely
Nagykanizsa
Feldkirchen in Kärnten
St. Andrä
Paternion
Villach
Maribor
Čakovec
Varaždin
Koprivnica
Križevci
Vrbovec
Bjelovar
Virovitica
Velika Gorica
Samobor
Novo Mesto
Celje
Velenje
Tržič
Radovljica
Domžale
Ljubljana
Postojna
Ajdovščina
Udine
Trieste
Martin
Prievidza
Banská Bystrica
Brezno
Zvolen
Levice
Lučenec
Esztergom
Vác
Gödöllő
Budapest
Pécel
Érd
Szigetszentmiklós
Székesfehérvár
Veszprém
Ajka
Dunaújváros
Kaposvár
Komló
Pécs
Paks
Kalocsa
Szekszárd
Baja
Kiskunhalas
Kiskunfélegyháza
Kecskemét
Cegléd
Jászberény
Szolnok
Gyöngyös
Eger
Salgótarján
Ózd
Kazincbarcika
Miskolc
Rožňava
Spišská Nová Ves
Levoča
Humenné
Michalovce
Trebišov
Uzhgorod
(Ужгород)
Sátoraljaújhely
Kisvárda
Nyíregyháza
Mukachevo
(Мукачеве)
Khust
(Хуст)
Vynohradiv
(Виноградів)
Újfehértó
Hajdúböszörmény
Debrecen
Hajdúszoboszló
Karcag
Mezőtúr
Békés
Békéscsaba
Gyula
Szentes
Hódmezővásárhely
Szeged
Makó
Subotica
(Суботица)
Sombor
(Сомбор)
Kikinda
(Кикинда)
Bečej
(Бечеј)
Arad
Timișoara
Mátészalka
Satu Mare
Carei
Baia Mare
Sighetu Marmației
Negrești-Oaș
Marghita
Șimleu Silvaniei
Jibou
Zalău
Dej
Botean
Aleșd
Oradea
Salonta
Beiuș
Ștei
Ineu
Cluj-Napoca
Gherla
Turda
Aiud
Brad
Deva
Hunedoara
Alba Iulia
Sebeș
Cugir
E75
E58
E60
E56
E57
E59
E55
E71
E79
E-75

I.2.2.1 PARALLEL LIVES: ALTERNATIVE CAREER PATHS IN THE AUSTRIAN PROVINCE OF THE SOCIETY OF JESUS

Map 2 shows all collegia of the Austrian Province of the Society of Jesus that in the eighteenth century had a *professor matheseos*, or chair in mathematics (most, besides professors in mathematics, also had professorships in physics, some even in geography, mechanics, architecture or the like).[116] It should be noted, however, that a couple of these institutions did not employ a single professor of mathematics until quite late – namely *Jaurinum*[117] (from 1761) and *Zagrabia*[118] (from 1770). This means that there were eleven collegia with at least one professor of mathematics in their ranks at the time when Maximilianus Hell embarked upon his scientific career. Five of these institutions might be characterised as universities in the strict sense, namely Vienna and Graecium in Austria, Tyrnavia and *Cassovia*[119] in Hungary (now Slovakia) and Claudiopolis in Transylvania (now Romania).[120] As for institutionalised, practical astronomy, there were only three or four Jesuit-run observatories in the entire Austrian province of the Old Society. These were located in the university cities Vienna (constructed 1733-34), Graecium (1745), Tyrnavia (1753-55) and Claudiopolis (construction begun 1753).

One way of contextualising the early career of Maximilianus Hell might be to present a series of 'parallel lives'. Using the observatories as focal points, the next pages will be devoted to the careers of a few selected individuals holding key positions in astronomy and related sciences within the Austrian Province of the Society of Jesus around 1750. Starting in Vienna, the focus will shift to Graecium and then to Tyrnavia and Cassovia, before returning to the Austrian capital. Tailing this 'round trip' some astronomers who were not Jesuits will be introduced, as well as the plight of a Jesuit astronomer who left the Austrian Province to receive a chair in mathematics elsewhere.

The Jesuit observatory in Vienna has already been mentioned. Its first director, Hell's former teacher Josephus Franz was not in need of a replacement until about 1754, from which time

[116] Cf. Hellyer 2005, pp. 245-247.
[117] Jaurinum or Gaurinum (L) = Raab (G), Győr (H).
[118] Zagrabia (L) = Agram (G), Zágráb (H), Zagreb (Croatian).
[119] Cassovia (L) = Kassau (G), Kassa (H), Košice (Sl).
[120] It is not always easy to define what constitutes a university in contrast to a collegium (Hochschule, university college) during the eighteenth century. For a well-informed discussion, see Frijhoff 1996. However, Frijhoff omits Claudiopolis but includes Cassovia in his list of European Universities in the early modern period on pp. 80-94. Battlori 1985 delivers a clarification of the various meanings of the word *collegium* in the case of the Jesuits. Based on his typology, I here treat Claudiopolis as a university alongside Cassovia.

Franz appears to have devoted most of his time to other activities than natural sciences. The next director of the Jesuit observatory became ***Josephus Liesganig SJ***[121] (1719-1799). His career forms the first in this series of parallel lives.

Born in the university town Graecium in 1719, Josephus Liesganig entered the Society of Jesus in 1734. He thereupon studied philosophy in Vienna. During 1742-44, at the time when Hell started as an assistant of Franz', Liesganig taught gymnasium-level mathematics in Graecium, thereafter rhetoric briefly in *Lincium* (Linz), before he returned to Vienna to finish his theology studies. In the late 1740s, when Hell was preoccupied in Leuchovia, Liesganig served as a preacher and the inspector at a German school in *Camarum*[122] in Hungary (roughly mid-way between Esztergom and Győr, this town now lies on the Slovakian side of the border with Hungary). He thereafter passed his third year of probation in Neosolium (probably in 1749/50, that is two years earlier than Hell). In the university year 1750/51 we find him serving as a *professor matheseos* in Cassovia. Already in the year after, however, Liesganig is back in the capital, now serving at the university of Vienna as a professor of mathematics and assistant at the Jesuit observatory (Hell, it will be remembered, left Vienna for Neosolium in the same year). For more than two decades, Liesganig was to have his base in Vienna. This means he was close at hand when the *astronomus caesareo-regius* was to be appointed, but for some reason the post was given to the one year younger Hell, professor in remote Transylvania. In any case, Liesganig was soon to become[123] appointed *praefectus* (director) of the Jesuit observatory, a position he was to retain until the suppression of the Society in 1773. As observatory director, Liesganig was above all given prestigious tasks in geodesy; in present-day Austria, in the entire stretch between *Brunna*[124] in the north via Vienna and Graecium to *Varasdinum*[125] in the south, and later in life in Galicia (on both sides of the present border between Poland and Ukraine). His main work, *Dimensio graduum Viennensis et Hungarici* was issued in 1770 and counts among the most important – albeit certainly not the most historiographically highlighted – eighteenth-century contributions to the determination of the figure of the Earth.[126]

[121] Also spelled Liesganigg.
[122] Camarum (L) = Komorn (G), Komárom (H), Komarnó (Sl).
[123] Or had just been – various pieces of secondary literature are not in agreement with each other here.
[124] Brunna, Brunnia or Bruna (L) = Brünn (G), Brno (Czech).
[125] Varasdinum (L) = Warasdin (G), Varasd (H), Varaždin (Croatian).
[126] See the review in *Journal des Sçavans* Aout 1770, pp. 573-574; cf. Liesganig's letter to Bevis, dated Vienna 4 August 1767 (printed in *Phil.Tr.* Vol. LVIII. For the Year 1768 [printed 1769], pp. 15-16).

During the nearly twenty years that Hell and Liesganig were directors of observatories that lay within a couple hundred meters from each other, the two seem to have been collegial collaborators, although perhaps not close friends or confidants.[127] It is not clear whether they knew each other prior to 1755, the year when Hell reinstalled himself in Vienna as *astronomus caesareo-regius*.[128]

Astronomy also had an institutional foothold in Graecium. Kepler had stayed here in the final years of the sixteenth century, and Paulus Guldinus SJ (or Paul Gulden, 1577-1643) had presented his influential theory of gravity at the same institution in the 1630s and 40s. A hundred years later, in the year 1745, the Jesuits erected an observatory in Graecium. The construction reached some 11,5 meters above the roof of the Collegium buildings. Like its Viennese predecessor, the lower floors of the *Specula Graecensis* ('Graecium Observatory') were reserved for laboratories or cabinets, known as the *Museum Mathematicum* and the *Museum Physicum*.[129] This institution had in all eight directors during its less than three decades of existence as a Jesuit observatory.[130] Petrus Halloy[131] (1707-1789); Leopoldus Mözburg (or Metzburg, 1711-1768); Carolus Scherffer (1716-1783); Josephus Pevere (1717-?); Josephus Mayr[132] (1720-after 1773); Nicolaus Boda[133] (1723-1798); Carolus Tirnberger[134] (1732-1780); and Antonius Mayr[135] (1738-?). Their periods in office were as follows:

Petrus Halloy: 1745/46; 1748/49; 1750-52; and 1753-55
Leopoldus Mözburg: 1746-48
Carolus Scherffer: 1749/50
Josephus Pevere: 1752/53
Josephus Mayr: 1755-57
Nicolaus Boda: 1757-65
Carolus Tirnberger: 1765-71
Antonius Mayr: 1771-73

[127] Thus, among the numerous letters preserved from the expedition to Denmark-Norway, none are addressed to Liesganig. In fact, he is not even mentioned in any letter to Hell's Viennese friends during this period (see the letters listed in Unprinted Sources, below). See also Section II.3.1 below.
[128] The account of Liesganig's life in this section is based on Steinmayr 2010*a* (paper held in 1932), pp. 178-181; Walther Fischer, "Liesganig, Joseph", in *Neue Deutsche Biographie* 14 (1985); Fischer 1978; Pärr 2001, pp. 29-30; Brosche 2009*a*, pp. 20-25.
[129] Steinmayr 2011 (paper held in 1935), pp. 239-242.
[130] Information taken from Fischer 1978.
[131] Also spelled Pierre d'Halloy.
[132] Also spelled Mayer.
[133] Also known as Nikolaus Poda von Neuhaus.
[134] Also spelled Tiernberger or Tirenberger.
[135] Also known as Anton Mayer, or even Alois Mayr.

Apart from Halloy, who was born in the vicinity of Namur in present-day (then Habsburg-ruled) Belgium and who had been a professor of mathematics in Tyrnavia (1738/39), Vienna (1739/40) and Graecium (1743-45) before he was put in charge of the observatory, the rest were recruited from professorships west of Vienna. Thus, Mözburg had previously been a professor of mathematics in both Graecium and Lincium, Scherffer in Graecium only, Pevere in *Goritia*[136] by the Adriatic and Boda in Clagenfurtum and Lincium. One director was even recruited without having had a previous chair in mathematical sciences at all (Mayr). It is also noteworthy that apart from the first and last (Halloy and Boda), they all served for a short period. Nor was there, apart from some meteorological reports, ever initiated any publication series for astronomical data sets from this institution.[137]

In a paper of 1935, Johann Steinmayr characterises the Graecium observatory as "all but a stillborn child".[138] His paper is almost exclusively based on a German translation of the annual reports (*litterae annuae*) of the *Collegium Graecense* and has many shortcomings that are remedied by the introduction and comments of the editors Isolde Müller and Thomas Posch, who recently published it in the journal *Acta Historica Astronomiae*. When comparing this paper with the catalogue of "Jesuiten-Mathematiker" by Karl Fischer (1978), which is based on contemporaneous catalogues of the Society, many discrepancies emerge. The provocative conclusion of Steinmayr, however, remains noteworthy, and one may well ask: how successful was this institution during its first decades of existence?

Both the appendices of Hell's *Ephemerides* and surviving parts of his correspondence bear witness of contact between Graecium and Vienna. This brings us to the second parallel life, that of ***Josephus Mayr SJ***. Fischer in his catalogue explains that Mayr was born in Passau (in southeastern Bavaria) in the same year as Hell and that he entered the Society of Jesus in 1736. Unfortunately, however, I have been unable to find information on his early career except for some piecemeal information that can be extracted from a single letter (presented below). In 1755, at the same time as Hell's appointment in Vienna, Mayr was appointed *professor matheseos* and *praefectus speculae astronomicae* ('director of the astronomical

[136] Goritia or Goricia (L) = Görz (G), Gorizia (Italian).
[137] If the manuscripts preserved at the Grazer Universitätsbibliothek are anything to go by, regular astronomical observations were made in Graz in 1758-60, 1762 and 1764-1773. In addition, some astronomical observations from the years 1746-47 are extant, as well as meteorological observations from the years 1754-56 and 1760-73 (information taken from Müller & Posch in Steinmayr 2011 and from email correspondence with Mag. Michaela Scheibl at the Universitätsbibliothek Graz. I profit from this occasion to express my gratitude to them all).
[138] Steinmayr 2011, p. 245: "das Institut […] blieb beinahe ein tot geborenes Kind".

observatory') in Graecium. Mayr still retained this position when Hell issued the first volume of his *Ephemerides*, which he personally distributed to colleagues all over the Austrian Province and beyond, including the director of the observatory in Graecium. Josephus Mayr's answer, for all its self-effacing humility, gives a quite vivid impression of the early years of the Graecium Observatory:[139]

> Honourable Father in Christ! A late response ought not to be reproached, when various obstacles were in the way, and there was no harm in the delay. I am grateful for the *Ephemerides* that you sent me. I have used them faithfully in this my worn and all but dilapidated observatory, in so far as it was possible, given my [limited] experience in astronomical matters. If only the fellow who, after the death of pious Vanossius, got the task of delivering two practical lessons every week assigned for himself, back in those days when we as colleagues[140] learned the basics of mathematics, had given us at least some instruction [in astronomy]! If only I had been given access to the observatory, either when I followed lectures in Theology here in Graecium or when I taught Poetry and Rhetoric in Vienna! Liesganig, whom I asked quite often [for permission to visit the observatory], always found various pretexts to elude my effort, and in this he followed the example of his patron [i.e., Franz?]. I was preparing to send you the occultation of Palilicium [a star in Aldebaran], but as my observation was inept, I was waiting for a second occultation of the Moon, after observation of the first had already been spoiled by stormy weather. I would have liked to

[139] Josephus May(e)r to Hell in Vienna, dated Graecium 17 October 1757 (WUS Vienna, copy in the hand of Hell's secretary): "R[everendissime] in Xto P[ater]! // Serum responsum reprehændi non debet, ubi varia illud obstacula retardarunt, nec periculum in mora fuit. Gra[ti]as habeo pro transmissis Ephemeridibus, quibus in lacera, et vix non ruitura specula quantum quidem in astronomicis experientia mea admisit fideliter usus Sum. utinam ille qui ordina[ti]onem sibi ad facienda quot hebdomadibus bina Collegia practica a pie defuncto Vanossio procuravit (dum elementa matheseos Collegæ hauriremus) Viam saltem aliquam ostendisset, vel dum hic loci prælectiones Theologicas exciperem, aut dum Viennæ Poesim, Rhetoricamque Docerem Speculæ Copia facta esset. Rogatus frequentissimè à me Liesganiggius, varijs semper excusationibus Conatum meum elusit, patronum suum egregie secutus. Occultationem Palilicij parabam mittere, at cum manca fuerit observatio, exspectabam [*scripsi;* exspectam *MS*] Lunæ defectionem secundam, primam enim tempestas scytica impedivit. Observationes alias complures adjunxissem verum cum Organa astronomica (si tamen nomen hoc merentur) examinare satis, per labores alteri officio annexos non potuerim, ijsque non sine gravi fundamento diffiderem R^{æ} V^{æ} aliunde multis distentæ laboribus vel in aliquot folijs perlustrandis molestiam adferre nolui. Paucis: Specula mole Sua laborans, et ad speciem t[an]tum astronomicam ædificata, hoc et priori anno magnis Collegij impensis a ruina integra conservata, instrumenta ex mente artificum, Sine ullo examine posita. verbo, ad observationes publico comittendas inepta, revocantem post tot annos theoricas species, et nova moliri conantem prorsus impediverunt. Author ipse Machinæ hujus Halloixius, qui consilio Saltem suo adesse debuerat, laborem omnem, toties demisse rogatus subterfugiens insuper non modicas molestias fecit. mitto tamen duas observationes, quæ si accuratæ minus Sunt, horologio per altitudines ʘ instrumento non satis acurato captas, correcto, nec in firmo satis loco constituto pro humanitate sua R^{a} V^{a} adscribet. aut si etiam velit Observatoris non sufficienti dexteritati, nec enim unq[ua]m mihi hæc tractandi sat idonea fuit Suppeditata occasio. // Non odi Mathesim, quam primas inter Scientias tenere probe novi. astronomia in delicijs esset, sed eos cuperem Socios, qui Comunicatis Consilijs publico servire vellent, discerem à quocunque libenter dumodo opportunitas esset. // Jnterim sorte mea contentissimus Vivo, et in eandem abeo cum singulis antecessoribus meis Sententiam, qui Græcensi Speculæ adeo addicti non erant, ut se ab ea liberari aut non instanter peterent, aut saltem ab ea se liberatos non gratularentur. Collegæ nomen q[uo]d R^{a} V^{a} imerito dedit acceptassem lubentissime, nisi ea quæ attuli eodem indignum me reddidissent. his me demisissime Commendo Græcij stirorum 13 Octob[ri]s 1757. Josephus Mayer." A set of observations accompany the letter.

[140] "as colleagues" (*Collegæ*) seems to imply that Hell and Mayr were students in the same classes for a while.

> attach numerous other observations to this letter, but since I was unable to sufficiently investigate the astronomical instruments (if they indeed merit such a name) due to obligations relating to my other task [i.e., as a professor of mathematics?], and since I also had further and well founded reasons to distrust their reliability, I decided not to infer upon His Reverend Father [i.e., Hell], who is already absorbed in so many labours, the burden of going through several pages [of that kind]. In brief, the observatory is labouring under its own weight, it was constructed to display the looks of an astronomical tower only (in this and the preceding year it was saved from total ruin to great expense for the Collegium), and its instruments were constructed according to the ideas of the instrument makers without ever being subjected to professional scrutiny. In one word, they are inadequate for making publishable observations, and have rendered completely fruitless my efforts to recall after so many years the theoretical disciplines[?][141] and start working on new subjects [i.e., the practical task of observing]. The very builder of this device, Halloy, who at least on his own accord should have been interested to help, I have asked humbly for assistance many times, but each time he has run off and even caused serious trouble. I am, however, sending you two observations, which, if they are not entirely accurate, His Honourable Father in his humanity will ascribe to the horologe, which rested on a not very firm floor and which moreover had been corrected by means of altitudes of the Sun that had been recorded with an insufficiently accurate instrument. Or, if he should like, he may attribute it to the insufficient dexterity of the observer, for I have never had a real opportunity to handle them properly. I do not hate Mathematics, as I am fully aware that this discipline ranks highest among the sciences. Astronomy ought to have been a pleasure to me, but I would have liked to have such helpers that were willing to serve the public good by sharing their advice. Indeed, I would be happy to learn from whomsoever, if only I had the chance. In the meanwhile I accept my destiny, and I take resort to the same attitude as my predecessors, none of whom were so attached to the Observatory in Graecium as to prevent them from either seeking immediately to be freed from this burden, or at least congratulating themselves when they were freed from it. I would have loved to accept the name of a “colleague” that His Reverence gave me so undeservedly, if not my contributions had rendered me totally unworthy of such an honour. With this, I most humbly recommend myself [to your prayers]. // Graecium in Styria, 13 October 1757. *Josephus Mayer*

Later in the same year, Josephus Mayr moved on to the chair in mathematics in Lincium, where he taught until 1760, before moving to Clagenfurtum (1760/61) and then Buda (1761/62). He did not return to teach mathematics at any of the universities proper, and seems not to have pursued astronomy any further. The letter above is the only one from Mayr that is preserved among Hell’s manuscripts in Vienna.

[141] I am not certain whether my translation is correct. As for *theorica*, this a frequent expression for theoretical astronomy (cf. e.g. Kirsch 1774 s.v.). However, the plural form used in this phrase, *[instrumenta inepta] … revocantem post tot annos theoricas species … impediverunt* is difficult to interpret.

After Mayr, ***Nicolaus Boda SJ*** (or Nikolaus Poda von Neuhaus) became the observatory director in Graecium. He was born in Vienna in 1723 and entered the Jesuit order in 1739. Having studied at the Vienna University, he held his first post as a *professor matheseos* in Clagenfurtum (1754-56). After a one-year intermezzo in Lincium (1756/57), he crossed over to Graecium for the university year 1757/58, where he took over Mayr's double role as professor of mathematics and director of the observatory. In the autumn of 1758, he spent a month at Hell's observatory in Vienna, apparently to receive training.[142] However, Boda's only preserved letters to Hell display an interest in mineralogy and entomology as much as astronomy.[143] Indeed, the Boda of Graecium is remembered primarily as an entomologist and as a correspondent with and proponent of the binomial system of Linnaeus (Carl von Linné). One would have expected to see his observations included in the *Ephemerides Astronomicae* of Vienna, but this never happened. Thus, when a lunar eclipse took place 17 March 1764, it was not Boda, but Carolus Tirnberger, *praefectus* of the Graecium observatory from 1765 to 1771, whose observation was published in the *Ephemerides.*[144] Interestingly, Father Boda later became a teacher at the Praktische Lehrschule (since 1770 known as the Bergbau-akademie) in Hell's hometown Schemnicium. The same institution even employed Tirnberger as a teacher from 1772 onwards. Boda, now under the name Poda von Neuhaus, became a close friend and collaborator of Ignatius a Born (more on him in Section I.2.4), already before the suppression of the Society of Jesus.[145] When the international meeting for miners, metallurgists and naturalists in Glashütte was organised in 1786, Boda was among the participants. He is also said to have been the confessor of Leopold II (ruler 1790-92) before he passed away in 1798.[146]

[142] Hell to Weiss in Tyrnavia, dated Vienna November 1758 (WUS Vienna, secretary's copy): "binæ erant causæ Silentij mei. Prima: adventus astronomi Græcensis P. Boda, qui integro mense hic apud me comoratus, totum fere tempus Sibi Vindicavit [*scripsi;* Vendicavit *MS*]" = "there were two causes for my silence. First, the arrival of the Graecium astronomer Father Boda, who stayed here for a whole month and kept me preoccupied with him almost all the time".
[143] Boda to Hell in Vienna, dated Graecium 11 November 1759 and 2 April 1761 (WUS Vienna, secretary's copies). In the first letter, Boda asks for forgiveness that he has been busy with other things than astronomy lately: "I have been so preoccupied with the Museum that I became negligent of astronomy. I have put together a collection of minerals and insects, following Linnaeus in the latter and Wallerius in the former. Work on these collections has absorbed almost all my time" = "adeo distractus eram rebus Musæi ut negligentior fuerim in astronomia. adornavi collectionem Mineralium, et insectorum, in his secutus Linnæum in illis Wallerium, quæ fere omne tempus mihi eripiebant".
[144] *Eph.Astr.* Anni 1765 (1764), pp. 363-364.
[145] Thus, Born published Poda's *Kurzgefaßte Beschreibung der, bey dem Bergbau zu Schemnitz in Nieder-Hungarn, errichteten Maschinen* in 1771.
[146] Many dates are uncertain, such as when exactly Boda left Graecium for Schemnicium or when he returned to Vienna. Apart from Wurzbach, Zweiundzwanzigster Theil (1870) I have had to rely upon Fischer 1978; Kafka 2003, pp. 48-51; http://de.wikipedia.org/, entry on "Nicolaus Poda von Neuhaus" (accessed 27 December 2010).

The examples of Josephus Mayr and Nicolaus Boda in Graecium demonstrate that it was not sufficient to have the infrastructure in place (official observatory, equipped with instruments, run by a professor of mathematics), you also needed key personnel with proper training and dedication, and with the right attitude towards interaction with peers in other places. Another feature, illustrated through the careers of Boda and Tirenberger as well as Hell himself, is that Jesuit astronomers could move between ecclesiastical and secular institutions – between 'pure science' and mechanics.

The observatory in Tyrnavia has already been mentioned.[147] Given the mobility of Jesuit scholars, who at least early in their careers tended to move around between various gymnasia and collegia (in keeping with the motto *docendo discimus*, 'we are learning by teaching'), it is no great surprise that there were personal links between the observatory established in Graecium in 1745 and the one constructed in Tyrnavia less than ten years later. Incidentally, the rector of the University of Tyrnavia at the time when the observatory was built, Franciscus Borgias Keri SJ (1702-1768) had previously studied and taught in Graecium. Keri published various works on languages, history, physics and astronomy. He even acquired a reputation for being the first – self-taught – producer of Dollond telescopes in Hungary. Keri may well have been the initiator of the observatory in Tyrnavia.[148]

The first director of the Tyrnavian observatory became ***Franciscus Weiss SJ*** (1717-1785). Thanks to a set of primary sources edited by Magda Vargha in the 1990s his career is well documented.[149] Born in Tyrnavia in 1717, Weiss entered the Society of Jesus in 1733 and studied at the universities of Tyrnavia and Graecium. In the mid-1740s, he taught "humaniora" at the University of Cassovia, and according to some secondary literature, even at Jesuit gymnasia in Jaurinum and *Scalis*[150] (nearly 60 kilometres west of Trenchinium, on the border with the present-day Czech Republic). It seems likely that he spent time at the observatory during his student years in Graecium. By 1750, Father Weiss had in any case

[147] The observatory was 110 Paris feet high (35,7 meters). On the ground floor there was a *Musæum Chemicum*, on the first floor, a *Musæum Physicum*, on the second, a *Musæum Astronomicum* and finally, on the third floor were the living rooms of the astronomical staff. Above the living rooms was the observatory itself, 18 feet high and rectangular in shape, with a length of 56 feet and a width of 40 feet (see Weiss, "Observationes Astronomicæ ad latitudinem, & longitudinem Tyrnaviensem inquirendam institutæ", facsimile in Vargha 1992, appendix).
[148] Steinmayr 2011, p. 247; Szerdahely 1785, p. 11 (facsimile in Vargha 1992, appendix).
[149] The *Correspondance de Ferenc Weiss. Astronome Hongrois du XVIII^{e} siècle* (two vols, 1990-92) contains transcripts of numerous letters as well as some facsimiles, most notably the *laudatio funebris* by Georgius Aloysius Szerdahely (*Memoria admodum Reverendi ac Clarissimi Domini Francisci Weiss* …Buda 1785).
[150] Wurzbach, Vierundfünfzigster Theil (1886). Scalis (L) = Skalitz (G), Szakolcz (H), Szakolca (Sl).

acquired a strong interest in astronomy. Letters to Weiss from Carolus Scherffer, at that time director of the observatory in Graecium, concern the pole height (latitude) of Graecium, observations of an aurora borealis and details of various astronomical instruments. One letter shows that in the summer of 1750, Weiss spent time in Judenburgum, a historical town approximately 70 kilometres northwest of Graecium, where the Jesuits had a strong presence.[151] It is not unlikely that Weiss was here to finish his third year of probation, just as Scherffer had done in 1747/48 (see below). Another letter demonstrates that the 33-year old Weiss contemplated to make an expedition to Brazil during this time. From Scherffer's advice on how to proceed it emerges that this was meant to be an expedition in the style of the geodetic surveys by Maupertuis in the Tornedal Valley and La Condamine in the territory of Quito in the 1730s.[152] Other sources show that in 1750 King John V of Portugal, in the aftermath of a treaty signed with Spain concerning their Latin American territories, had asked the General of the Jesuit order for ten Jesuits to be sent to map his dominions in Brazil. It is intriguing to notice that Roger Joseph Boscovich SJ – soon to acquire fame for his survey of the papal lands, which included a measure of the meridian between Rome and Rimini in collaboration with Christophorus Maire SJ – also hoped initially to go to Brazil for the same purpose.[153] Nothing came of the plans for a Brazilian expedition, however. In the university year 1752/53, at the time when Hell was present as a consultant for the planning of the observatory, Weiss was appointed *professor matheseos* at the Tyrnavian university. From 1754/55 to 1776/77 he was the *professor astronomiae* and *director speculae astronomicae* at this institution. Then it was decided to move the Hungarian University to present-day Budapest, and Weiss followed to became the director of the new university observatory in this city, in which capacity he died in January 1785.

Weiss and Hell no doubt met in Tyrnavia in 1752, and they corresponded frequently and collaborated in many ways throughout their careers. Observations of Weiss were published in the *Ephemerides* of Hell, in Bode's *Astronomisches Jahrbuch* (issued in Berlin since 1776), in the *Journal Étranger* and *Journal des Sçavans* in Paris as well as in a series of reports that Weiss issued during his years in Tyrnavia (*Observationes astronomicae ... in observatorio*

[151] Scherffer to Weiss, dated Graecium 29 August 1750 (Vargha 1990, pp. 12-14, here p. 13): "Haec V[est]rae R[e]v[erenti]ae, antequam Judenburgo abeat, prescribere volui: Si quid simile (ut non dubito, si tempestas serena favit) observatum ibi fuit, id quaeso prescribat" = "I wished to describe this to His Reverence [i.e., Weiss] before he leaves Judenburg: If something similar (which I doubt not, as long as the skies were clear) was seen there, please describe it". The preceeding part of the letter describes an aurora borealis seen in Graecium 26 August.
[152] Scherffer to Weiss, dated 2 August 1750 (Vargha 1990, pp. 10-11).
[153] See for example Hill 1961, pp. 25-27.

Collegii Academici Societatis Jesu Tyrnaviae in Hungaria habitae, Tyrnavia 1759-72, covering the years 1756-1771). Like Hell, Weiss initiated a direct correspondence with several leading astronomers abroad, among them Lalande and Wargentin. However, he appears not to have become a formal member of any of the foreign academies, and his works were limited to the field of practical astronomy.

Whereas the careers of Hell and Weiss established them as leading astronomers in Vienna and Hungary respectively, it is noteworthy that there were other ways in which to pursue a career in astronomy and related branches of "mathematics". Absence of observatories did not imply that astronomy was not studied at other collegia. In Cassovia, for instance, barely sixty kilometres southeast of Trenchinium where Hell taught in 1745-47, a 291-page *Hungaria coelestis astronomiam et chronologiam in synopsi complectens* ('Heavenly Hungary, Providing a Synopsis of Astronomy and Chronology') was issued in 1741. The author of this "Baroque synthesis of science and triumphalist history",[154] the university professor of mathematics ***Michael Lipsicz SJ***[155] merits some consideration. Lipsicz was born in 1703 in *Ovaria*,[156] barely 20 kilometres south of *Posonium*,[157] which was then the capital of Hungary. Before his arrival in Cassovia, Lipsicz had taught mathematics in Claudiopolis (1736/37), that is almost twenty years earlier than Hell. After his short period in Claudiopolis, Lipsicz stayed at the Cassovian university during 1737-42, before he moved on to become a professor of mathematics and physics in Tyrnavia (1742-45). Franciscus Weiss may have been among his pupils. Lipsicz appears not to have engaged in practical astronomy, however, and most of his works listed in an online bibliography compiled by the National Library in Zagreb treat juridical or historical subjects.[158] He did not take part in the flourishing of Jesuit astronomy in the Austrian Province around 1750, but instead taught non-mathematical curricula or held administrative posts at various Jesuit institutions within the Kingdom of Hungary (Tyrnavia, *Agria*,[159] Buda, Zagrabia, Jaurinum and *Sopronium*[160] from 1745 until his death in Jaurinum in 1766.[161]

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[154] Shore 2007, p. 164.
[155] Also spelled Lipsics, Lipšić or Lipsits.
[156] Ovaria, Ovarinum or Ad Flexum (L) = Ungarish-Altenburg (G), Magyaróvár (H), since 1939 merged with neighbouring Wieselburg (G) / Moson (H) and known as Mosonmagyaróvár.
[157] Posonium (L) = Preßburg (G), Poczony (H), Bratislava (Sl).
[158] http://161.53.3.18/cgi-bin/unicat.cgi?form=010000000199990&id=0200705097 (accessed 7 January 2011).
[159] Agria (L) = Erlau (G), Eger (H).
[160] Sopronium, Sempronium, Oedenburgum or Scarabantia (L) = Ödenburg (G), Šopron (Croatian), Sopron (H).
[161] Unless stated otherwise, biographical information on Lipsicz has been taken from Wurzbach, Fünfzehnter Theil (1866) and Fischer 1978.

A more prolific science writer was ***Carolus Scherffer SJ***, whose name has been mentioned several times already. Scherffer was born in Gmunden (nearly 60 kilometres southwest of Lincium, in Upper Austria) in 1716 and spent his school years in nearby Steyr. He entered the Society of Jesus in Vienna in 1732, six years earlier than Hell's *ingressus* in Trenchinium. After his novitiate, Scherffer received education in classical languages in Leoben (approximately 40 kilometres north of Graecium) before studying philosophy in Graecium. Having taught for a year at the gymnasium in Krems, roughly 70 kilometres west of Vienna (1738/39), he studied mathematics in Vienna in 1739-41, only a few years earlier than Hell. Then followed another year of teaching in Judenburgum, before he returned to Graecium to embark upon his studies of theology and canon law (1742-47). This means Scherffer was present when the university built its observatory in 1745, at a time when Hell was receiving his training at the observatory of Josephus Franz in Vienna. After his third year of probation in nearby Judenburgum (1747/48), Scherffer emerged as the *professor matheseos* in Graecium for the university year 1748/49. The year after, he served as the *praefectus* of the observatory as well as the laboratory. It is from this period that his first letters to Weiss are extant. Already in 1750/51, however, Scherffer moved to Vienna, allegedly because he failed to obtain the money needed for modernising the stock of instruments in Graecium.[162] For the rest of his life (he died in 1783), Scherffer taught mathematics and physics at the University of Vienna. Although his titles changed, he remained a highly esteemed professor and prolific author of scientific writings in Latin and German. Despite never becoming its formal director, he also made observations at the Jesuit observatory on several occasions; he was for example one of the observers of the transit of Venus in 1761 from that site (See Section II.1.3). Like Liesganig, Scherffer befriended the grand polymath Boscovich SJ during his visits to Vienna in the 1750s and 60s and collaborated with him in various ways (See Section II.3.1). He is also credited with being the first to introduce Newtonianism in a textbook of physics in the Habsburg lands, in the two-volume *Institutionum Physicae Pars Prima, seu Physica Generalis* and *Pars Secunda, seu Physica Particularis* (Vienna 1752-53). Scherffer's literary output was immense, in both physics, mathematics and theoretical astronomy. Like Hell and Weiss, he corresponded with leading astronomers abroad.

[162] H. Platzgummer, entry on "Scherffer, Karl" in *Diccionario histórico de la Compañía de Jesús* edited by O'Neill & Domínguez (2001). It is not correct, however, as Wurzbach writes in the Neundzwanzigster Theil (1875) of his *Biographisches Lexikon*, that no observations at all could be made, cf. the letters edited by Vargha 1990.

In terms of publicising, there seems to have existed a sort of division of work between the major figures in astronomy and related sciences in Vienna at the time – Liesganig the surveyor based at the Jesuit observatory, Hell the astronomer and almanac editor at the Imperial observatory and Scherffer the disseminator of cutting-edge scientific theory at the University.

The careers of these contemporaries of Maximilianus Hell illustrate the high degree of mobility that was normal amongst Jesuits at the time. Indeed, the order seems to have deliberately resisted specialisation and encouraged mobility. The mobility was not merely geographical, but also scientific (between different branches of science) and institutional (between various sorts of institutions). Josephus Mayr was born at the westernmost end of the Austrian Province, taught in Graecium and other places in present-day Austria before he left a last trace as a "mathematician" in Buda, in the middle of Hungary. Liesganig, despite being born and educated in the university town Graecium, spent the early part of his career both to the west and east of the capital before he settled definitely in Vienna, although in a position which involved a lot of travel. Lipsicz taught around nearly all the Hungarian realm, but never for more than a few years at each place. As a teacher and author, he even switched between Law, Philosophy, Poetry and Mathematics. Scherffer was also moving around in his younger years, but never (it seems) outside of present-day Austria. As soon as he was established in Vienna as a professor in the mathematical sciences, he stayed there for the rest of his life. Father Weiss, for his part, moved around between Jesuit institutions in present-day Slovakia, Styria (Steiermark) and Hungary before he took root at the best university on Hungarian soil. Thus, something Hell, Liesganig, Weiss and Scherffer had in common, was that they settled permanently as soon as they acquired a position at an institution where they could pursue their special interests.

The picture of astronomy in Austria around 1750 is not complete without a mention of the Benedictine Order. Its wealthiest monastery was at *Cremifanum* (Kremsmünster) in Upper Austria, roughly midway between Vienna and Munich (München). This abbey ran a renowned gymnasium as well as a more recently established Hochschule ("Akademie") in theology and law for noblemen. In 1748, plans were laid for erecting an observatory at Cremifanum. The resulting construction, which was to be seven storeys and 47 meters high, was completed in 1758.[163] Fully intact to this day, this "mathematical tower" has been used for scientific purposes without interruption ever since. In the words of the historian of astronomy Gudrun Wolfschmidt, it provides "an outstanding example of Baroque science", in which "all kinds of natural science, astronomy as well as geo science, seismology and meteorology" were included.[164]

The *specula Cremifanense* was for the first couple of years directed by an Eugenius Dobner OSB (1734-1799). From 1762 to 1791, however, its director was ***Placidus Fixlmillner OSB***[165] (1721-1791). He had been born a few kilometres from the monastery and was a nephew of the influential abbot Alexander Fixlmillner OSB (1686-1759), who appears to have been a driving force behind the construction of the observatory.[166] Having received preparatory schooling at the monastery's school, Placidus Fixlmillner studied at the Benedictine University in *Salisburgum* (Salzburg), about 85 kilometres west of Cremifanum in the 1730 and 40s. From 1745, however, he was to stay in Cremifanum as an abbot for the rest of his life. Although he published a fair amount of works in theology, law and music, it was as an astronomer that Fixlmillner acquired world-wide reputation. According to the historically oriented astronomer Konradin Ferrari d'Occhieppo, he counts along with Maximilianus Hell as one of the two "founders of modern astronomy in Austria".[167] Fixlmillner appears to have been largely self-taught in practical astronomy, making this achievement quite impressive. His collaboration with Father Hell has been studied by Ansgar Rabenalt OSB, who published an excellent edition of their correspondence in 1986. At least by 1771, Hell and Fixlmillner had initiated a scientific correspondence that was to last throughout their careers. Fixlmillner published his astronomical observations partly through publishers in *Styria* (Steyr), partly in the *Ephemerides Astronomicae* of Hell.[168]

This sole Benedictine observatory along with the four Jesuit observatories and the public observatory that was opened in Vienna in 1756, remained the only official ones in Austria and

[163] However, according to Rabenalt 1986, p. 97 it was not ready for observations until 1760. For a contemporaneous account, see Fixlmillner's "Kurze Geschichte und Beschreibung der Sternwarte zu Kremsmünster (nebst drey Kupferplatten)" in Bernoulli, *Sammlung kurzer Reisebeschreibungen …* Vierter Band (1784), pp. 373-381.
[164] Wolfschmidt 2009, p. 7.
[165] Baptised Josephus Fixlmillner, as an abbot he was renamed Placidus. OSB = *ex Ordine Sancti Benedicti* ('of the Order of Saint Benedict').
[166] Wurzbach, Vierter Theil (1858).
[167] Witness the title of Ferrari d'Occhieppo's article of 1957, "Maximilian Hell und Placidus Fixlmillner: Die Begründer der neueren Astronomie in Österreich".
[168] Information on Fixlmillner's career has been taken from Wurzbach, Vierter Theil (1858) and Rabenalt 1986. See also the useful overview of Fixlmillner's life and writings in Anonymous 1881, pp. 95-98.

the Kingdom of Hungary until the latter half of the 1770s. A promising growth in the number of observatories around 1750 was thus followed by more than two decades of standstill.

Benedictines mentioned, one should not forget the Protestants. There still existed, as already explained, parts of the Habsburg Empire where the creeds of Luther were officially tolerated, notably Transylvania and eastern parts of Hungary. Most prominent scholars from these parts travelled abroad for their studies, since they in any case were banned from studying at the Jesuit-run universities elsewhere in the Habsburg Empire. However, Protestants also ran their own schools. A prestigious institution in this respect was the Reformed College of *Debrecinum*,[169] not far from Transylvania, in function since 1538.

To the best of my knowledge, no observatory was ever established at the Reformed College in Debrecinum in the early-modern period, but one of its teachers, the medical doctor and polymath ***Stephanus Hatvani*** (1718-1786) made a name for himself in experimental physics. Among other things, after trips to western Europe in the 1740s he became a pioneer in electrical experiments on Hungarian soil.[170] Despite not having an observatory, Hatvani in 1757 was able to publish a 304-page *Introductio ad Principia Philosophiae Solidioris cui accedit Observatio Elevationis Poli Debrecinensis* ('Introduction to the principles of a more solid philosophy, with a supplement concerning the geographical latitude of Debrecinum'). Two years later, on 29 May 1759, the professor at the Reformed College contacted the Imperial Astronomer in Vienna. He had read in the Latin-language newspaper *Diarium Viennense* that Hell and Liesganig had recently observed Halley's comet together with the Emperor. He now wrote to inform the court astronomer that,[171]

> on the very same day that You observed it [i.e., the comet] in the company of His Highness the Emperor, the 3rd of May I too caught sight of it with my naked eye. 9 o'clock of the same evening I showed it to our students, and at about the same time on the following evening I demonstrated it to the highly illustrious Judge of this city.

[169] Debrecinum or Debreczinum (L) = Debretzin (G), Debrecen (H).
[170] Morovics & Šperka 2006; see also Wurzbach, Achter Theil (1862).
[171] Hatvani to Hell in Vienna, dated Debrecinum 29 May 1759 (WUS Vienna, secretary's copy): "Die eodem 3a Maij quo Vos eum cum Augustissimo Jmperatore Spectabatis, ego quoque nudis oculis conspexi, ac hora 9na Vespertina hic studiosis nostris ostendi. Seq[ue]nti die Perillustri Civitatis nostræ Judici circa idem tempus Vespertinum monstravi".

Hatvani then proceeds to give the details of his observations, for which he used an eleven-foot telescope that Weidler (an astronomer based at the Protestant University in Wittenberg) had once provided for him. He adds that[172]

> I am writing this to You, elevated Gentleman, for no other reason than that You shall become aware that we who live in the flatlands are not idle observers of Urania either [i.e., the muse of astronomy]. I beg You to forgive me, a person whom You do not know even by name, for my daring to intrude in Your arduous affairs. However, it is that common bond that unites all disciplines in a sort of blood relationship, which has brought me, a man occupying the lowlands of a teacher, to dare in this letter to address You, who thanks to your great merits sits in such an illustrious chair.

This may be carefully timed tactics or sincere flattery. Anyhow, Hatvani did not miss this opportunity to incidentally attach to his letter a copy of his printed determination of the geographical latitude of Debrecinum. The Imperial and Royal Astronomer's answer was no less swift and enthusiastic than elaborate and respectful. Hell congratulates Hatvani with being the first to have attempted to determine the geographical coordinates of Debrecinum. What is more, he finds his observations sound and his calculations accurate. "You, whose name, industry and experience in mathematical sciences have been known to me for quite a while, ever since I lived in Transylvania",[173] he adds. Moreover, Father Hell furnishes Hatvani with a calculation of coming occultations of the moons of Jupiter and encourages him to make diligent observations of these phenomena so that even the longitude of Debrecinum can be accurately determined. In all, he promises close collaboration and ends his letter by urging Hatvani to[174]

> please continue to bestow the same benevolence upon me in the future, and give more honour to the learned world as well as our homeland (*Patria nostra*) through publication of Your illustrious works.

[172] Ibid.: "Hæc non alio fine ad Te Vir Summe scribo, quam ut ex his intelligas, nec nos, qui æquor ca[m]pestre incolimus otiosos spectatores esse Uraniæ. Dabit autem mihi Veniam, quod ipse ego Tibi, ne nomine quid[em] notus, Tua tamen ardua negotio interpellare audeam. Fecit nihilominus Comune illud Vinculum quod omnes disciplinis cognatione quadam junxit, ut is, qui in [planio]re *(vox vix legibilis;* planiore *coniecit Kraggerud)* scholastico versor, Te qui magno Tuo merito illustri loco sedes hac Epistola alloqui auderem".
[173] Hell to Hatvani in Debrecinum, dated Vienna 14 June 1759 (WUS Vienna, Hell's draft): "Latitudinem Urbis vestræ à Te, cujus nomen, industria, atque in mathematicis insignis peritia jam ante hæc mihi in Transylvania versanti nota erant dudum, determinatam esse, multum Tibi gratulor, qui Primus, quod sciam, Urbi vestræ certum in orbe locum designare aggressus sis".
[174] Ibid.: "Tu vero, et me, qua coepisti benevolentia prosequere, et orbem eruditum, Patriamque nostram præclaris Tuis operibus ornare perge".

Hatvani responds a few weeks later by assuring that he will indeed attempt to make the observations expected of him, but that his lack of instrumentation poses serious problems. Although he is in possession of a couple of telescopes and a decent pendulum clock, he has no proper place to mount them and even misses a quadrant. By issuing his work of astronomy, Hatvani says, "I wanted to state an example, so that others might discover that the Hungarians (*Ungari*) would not be wanting in intellectual capacity, if only they had the patrons to provide for them".[175]

No further exchange of letters between Hell and Hatvani has been preserved in the manuscript collections of the Vienna University Observatory. The example is nonetheless interesting since it illustrates how two persons from competing religious denominations and of very different status in society (court astronomer in the capital *versus* teacher in the countryside) are able to communicate in mutual respect by appealing to patriotism (*Ungaria, Patria nostra*) and the ideals of the *Respublica litteraria* ("a sort of blood relationship that unites all disciplines"). If it did not work for Schumacher and Hell in 1759-60, it was not merely because the former was a Protestant and the latter a Jesuit, as the Hatvani-Hell connection demonstrates.

The example of Hatvani also brings the issue of amateurs to the forefront. It is often claimed that as a result of the monopoly that religious orders – primarily Jesuits – enjoyed in the teaching of natural sciences in the Habsburg lands, cultural interest in science inevitably lagged behind as compared to the Protestant parts of the German-speaking world. Why pursue an interest in astronomy, when there was nowhere to go to obtain funds for instruments and other facilities, far less a salary as a professor?

However, in Austria as elsewhere there was the possibility of noblemen engaging in astronomy or related sciences "for joy's sake". I have found only one example of such noble "Dilettantismus" in the context of Maximilianus Hell. At the Castle Wetzlas near Pölla in Lower Austria, more than 80 kilometres northwest of Vienna as the crow flies, a ***Johann Felix von Ehrmans zum Schlug*** had built an observatory already in 1729. It was used by him and his son to observe the Venus transit of 1761. A single letter from Ehrmans to

[175] Hatvani to Hell in Vienna, dated Debrecinum 7 July 1759 (WUS Vienna, secretary's copy): "specimen aliquod dare Volui, ut illinc et[ia]m alij videant, nec Ungaris defutura ingenia, si modo Mæcenates haberent, quorum opera invitarentur".

Maximilianus Hell is preserved, dated Wetzlas 8 May 1761. Here, Ehrmans characterises himself as a "Liebhaber der Astronomie" ('amateur of astronomy'), and asks for advice on where he can obtain solar filters for his two telescopes, a one foot and nine inches long Gregorian, and a four-foot long Newtonian that he has ordered at the instrument maker Schulz' in Vienna.[176] In the subsequently published report of the Venus transit of 1761, Hell lends several pages to the observations of this nobleman, explaining that he had once been a pupil of the court mathematician Marinoni, from whom he had bought a quadrant. Hell had, for his part, helped him with the acquisition of the Newtonian telescope.[177]

Further investigation is needed to see how unique the example of the amateur von Ehrmans is in the history of astronomy in the Habsburg lands.[178] Amateurs of more modest means are, however, also possible to find. The farmer-turned-surveyor Petrus Anich from Tyrol was presented in the previous section. A Viennese example of an amateur of astronomy is the painter ***Kaspar Franz Sambach*** (1715-1795), who from 1762 onwards had a career as a professor and later director of the Academy of Fine Arts in Vienna. Sambach was also known as an able observer. He used instruments that he himself had constructed to make observations at various locations in Vienna, and received at least verbal support by Hell.[179] The 1761 Venus transit report of Hell includes an account of Sambach and his observation, which regrettably had failed because of clouds. Hell also mentions the observations of a 'highly illustrious Mister Müller' (*Perillustris D[ominus] Müller*) in the St. Leopold district, as well as those of an anonymous merchant (*Mercator quidam*) in a suburb of Vienna.[180] It may also be mentioned that Sambach in 1769 provided Hell with data from a solar eclipse, which helped him determine the longitude of his observatory in Vardø.[181]

The Venus transit report of 1761, along with the preserved correspondence of Maximilianus Hell from the years 1758-61, to some extent disproves the claim that amateur astronomy did

[176] Felix Freyherr Ehrmans zum Schlug to Hell in Vienna, dated Wetzlas 8 May 1761 (WUS Vienna, secretary's copy).
[177] Hell 1761*a*, pp. 62-67. Von Ehrmans' modest observatory tower still stands today, and the old castle is currently used as a hotel (official webpage of the "Ferienschloss Wetzlas", http://www.ferienschloss.at/, particularly the "Geschichte" part, accessed 18 January 2011).
[178] A prominent noble astronomer in the generation after Hell was Elisabeth von Matt (1762-1814). She built a private observatory in the centre of Vienna and engaged in many geodetical operations in Austria and Bohemia in the early 1800s in collaboration with Johann Tobias Bürg, adjunct at the Vienna University Observatory (on her activities see now Brosche & Ma-Kircher 2010).
[179] Steinmayr 2010*e*, p. 282.
[180] Hell 1761*a*, pp. 20-21.
[181] Hell 1770*a*1, pp. 33 & 41.

not flourish in Austria. On the contrary, Hell at least tried to portray Vienna as a city where several able *amantes astronomiae* ('amateurs of astronomy') were to be found. Nor did he resist giving assistance to such amateurs, be they in the capital or in the province, as the examples of Hatvani, Ehrmans and Sambach demonstrate. It may be true, however, that in order to embark upon a career as a professional astronomer, you needed to enrol in the Jesuit or Benedictine systems of education. You would then have to spend years of training in humanistic disciplines and in spiritual exercises before you might become a student of mathematics and perhaps even be allowed into an observatory.

On the other hand, it is hard to see that career opportunities were essentially more open at Protestant universities. In Sweden, a major scientific country in the eighteenth century, the few professorships that existed in astronomy and related sciences were certainly not offered exclusively as a result of academic merits and actual skills. Nepotism and politics usually decided who was offered a post and who was not.[182] The same is true of Copenhagen, where – as we shall see in later sections – the Horrebow clan was able to stay in office for an incredibly long period. As William Clark demonstrates in his *Academic Charisma and the Origins of the Research University*, the ability to manoeuvre in a landscape of nepotism, political wrangling and downright corruption was probably as good a 'qualification' as any in order to obtain a chair at most early-modern universities in Protestant Germany as well.[183]

Finally, a remark on the career opportunities for Jesuits on a more international level. The Jesuit order formed a truly international society. While it is true that the Society of Jesus was divided into numerous *provinciae,* which in turn belonged to larger *assistentiae,* these divisions by no means produced waterproof barriers, hindering communication and collaboration. Thus, the ethnically and linguistically diverse Austrian Province formally belonged to the "German Assistancy", together with an even more diverse set of provinces, namely the provinces of England, Flandro- and Gallo-Belgium, Lower and Upper Rhine, Upper Germany, Bohemia and Poland. In the years 1754-56, Bohemia was split into the provinces Silesia and Bohemia, and the province of Poland received status as a separate assistancy consisting of the provinces Greater and Little Poland, Masovia and Lithuania. This provincial division was maintained until the suppression of the Society in 1773.[184] As court

[182] See for example Lindroth 1978, *passim*.
[183] See Clark 2006, espec. pp. 239-296.
[184] See Harris 1999, espec. pp. 218-224; cf. Fischer 1978 and 1984.

astronomer, Father Hell was to collaborate with Jesuit astronomers in neighbouring provinces, such as Josephus Stepling SJ (1716-1778), director of the observatory at the Jesuit university (known as the *Clementinum*) in Prague and Christianus Mayer SJ (1719-1783), court astronomer of the Elector in Mannheim and director of the observatory in Schwetzingen. In his correspondence, he also moved beyond the German Assistancy and contacted his peers in the Italian and French Assistancies, among them Leonardus Ximenes SJ (or Ximenez, 1716-1786), director of the observatory in Florence and Esprit Pézenas SJ (1692-1776), director of the observatory in Marseille. As we have seen, the Rome-based Jesuit Boscovich contemplated to participate in an expedition to Brazil in 1750, as part of a group that was supposed to consist of ten Jesuit surveyors. In Austrian Judenburgum, the young Weiss had plans of becoming a member of the same team. In the end, neither Boscovich nor Weiss went to Brazil, and both Weiss and Hell were to be employed within the Austrian Province throughout their careers (with the notable exception of Hell's expedition in Protestant Denmark-Norway and Boscovich's lengthy travels across Europe). However, career opportunities sometimes offered themselves to aspiring Jesuits who failed to find a chair as an astronomer in their home province.

A single example must suffice. ***Christianus Rieger SJ*** (1714-1780) was born in Vienna and entered the Jesuit order in 1731. Having taught for a while in Goritia (probably at gymnasium level), he received his first chair as a professor of architecture at the *Theresianum* in 1748, before he switched to experimental physics in the period from 1753 to 1756. Around the time when Hell and Liesganig were appointed directors of their respective observatories, Rieger was employed briefly as the *praefectus* of the *Museum Mathematicum* in Vienna (1756/57), probably an extension of his teachings in experimental physics. For the university years 1757 to 1760, however, he is entered in the catalogue of Fischer as a *professor matheseos* in Vienna. Whether he was called upon or sought himself to go elsewhere is unclear, but in 1760 he made a giant leap to Madrid, where he taught mechanics, mathematics, physics and astronomy at the *Colegio Imperial* until the year 1765.[185] After that year, he returned to the Austrian Province, to become a rector of the Jesuit collegium in Passau (on the German side of the present border with Austria) and then Labacum (in present-day Slovenia). Finally, after the suppression of the Society, he resumed his teaching at the *Theresianum Vindobonense*, though not anymore in astronomical subjects. In the 1750s and 1760s, Rieger published

185 On Rieger's period in Madrid, see Udías 2005; Brotóns 2006.

textbooks in architecture in Latin and Spanish, as well as a handful of works on astronomy and experimental physics, including electricity. In the surviving parts of the correspondence of Maximilianus Hell, we find three letters exchanged between the two colleagues, all dating from the spring of 1761, when Rieger was in Madrid.[186] Together with Spanish colleagues, Rieger observed the 1761 transit of Venus, on which he published a report (in Spanish) that was also summarised in Hell's *Ephemerides*.[187] It is not clear whether Rieger continued his activities as an astronomer after his return to the Austrian Province. There were certainly no empty chairs for astronomers to be found and no expansion of professional astronomy in sight as far as the Austrian Province was concerned.[188]

The historian Winfried Müller, in a paper on the Jesuit order in southern Germany and Austria during the Enlightenment period, characterises the examples of Jesuits of Hell's generation who became conspicuous in the sciences, as "isolated phenomena" – or, in the words of his colleague Peter Hersche, as "white ravens" among the Jesuits.[189] However, while it may be true that the number of persons who gained prominence in the exact sciences in the Habsburg lands was not high, it remains a fact that the majority of those who did, were members of the Jesuit order. If we narrow the focus to astronomy alone, the few facilities for professional astronomical research that were established in the 'Austrian Province' prior to 1773, were mostly put in place by the Jesuit order. The only exceptions were the observatory of the Benedictine order in Cremifanum and the "public" observatory in Vienna, the latter of which was initiated by the state but instantly handed over to a Jesuit director. It is not only as *Jesuits* the few prominent astronomers of Hell's generation were "white ravens".

We leave the Central-European context for a while, to make a giant leap to the expedition of the years 1768-70 and its sequel, the unfinished *Expeditio litteraria ad Polum arcticum*. Although this chapter of his career may be said to have continued until the very year of his death in 1792, the impact of the suppression of the Society of Jesus in 1773 constitutes such a turning point that it merits consideration in a separate section.

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[186] See Unprinted sources, 1*a* and 1*b*.
[187] Hell 1761*a*, pp. 47-49.
[188] Information on Rieger, unless stated otherwise, has been taken from Fischer 1978 and Würzbach, Sechsundzwanzigster Theil (1874).
[189] Müller 1993, p. 237: "So bedeutend der wissenshaftliche Rang jesuitischer Gelehrter der Aufklärungsepoche auch gewesen ist, und ungeachtet der Tatsache, daß sich die Liste prominenter Namen noch erweitern ließe, so kann, faßt man den Orden als Ganzes ins Auge, nicht verkannt werden, daß es sich eher um Einzelerscheinungen handelte; Peter Hersche sprach in diesem Zusammenhang einmal etwas maliziös von den 'weißen Raben' unter den Jesuiten". The series of "prominenter Namen" preceeding the quotation includes the name of Hell.

I.2.3 THE GLORIOUSLY INFAMOUS EXPLORER, 1768-1773

In September 1767, Maximilianus Hell was invited to make an expedition to Vardøhus, the site of a fortress and a small garrison in the remote northeastern corner of the Danish-Norwegian realm. In April 1768 he set forth, along with his assistant Sajnovics, the servant Sebastianus Kohl and a dog – not to speak of a massive array of scientific equipment that was to be substantially supplemented in Copenhagen, Christiania (Oslo) and Trondheim as the group progressed northwards. The resources offered Hell for his expedition indicate how much prestige was invested in the project: he was given the best wagons and ships available; he got all the personell and material he needed to construct his observatory in Vardø; he was provided with his own cook and supplies enough for a whole year for his period north of Trondheim; and he got the natural historian Jens Finne Borchgrevink (1736-1819) attached to the expedition as a scientific assistant, translator and 'tour guide' in northernmost Norway.[190] A hibernation in Vardø, 1768/69, was followed by another long rest in Copenhagen, 1769/70. Not until August 1770 did the group return to Vienna. In the meantime, Hell and Sajnovics had successfully observed the transit of Venus from Vardøhus and been elected full members of the Royal Societies of Sciences in both Copenhagen and Trondheim. They had interacted with leading characters in Danish-Norwegian civil, ecclesiastical and military administration alike, and with professionals as well as amateurs of science. All travel costs had been covered by the King's treasury and several scientific treatises pertaining to the expedition had been published by the Royal Society of Sciences in Copenhagen.

Analysis of the various activities of the two Jesuits on Danish-Norwegian soil and their political, scientific and social-historical implications is beyond the scope of this essay. In subsequent chapters, we shall have occasion to look into the details of Nordic participation in the international quest to establish the size of the solar system and the political implications of that enterprise. In the meanwhile, however, the *raison d'être* of the journey will be kept out of the picture as the focus stays fixed on the various scientific activities of the two Jesuit Fathers that reached beyond the core field of astronomy. I shall limit myself to a brief summary of the invitation, of the travel route and of the main scientific activities as exposited in Hell's call for subscriptions for a three-volume *Expeditio litteraria ad Polum arcticum*. Particular attention will be given to the discovery of the Hungarian language's affinity with "Lappish" (Sámi) and

[190] See for example Kragemo 1960; Voje Johansen 2004; Aspaas 2008*c*.

to Hell's role in this context, whilst the other branches of their research will be treated in less detail.

It may seem odd that the court in Copenhagen, a comparatively minor power in the north, should cast its eyes on Vienna in search of an astronomer of international reputation to observe the transit of Venus. In the lack of sources specifying the reasons behind the choice, we can only conjecture why. From a strictly internalist, scientific point of view, his candidacy is not that strange: as the Venus transit of 1769 drew closer, Maximilianus Hell had already become a well known figure in European astronomy. What is more, he had established himself as an expert on the transits of Venus, who had even dared debate with the best astronomers of France (see Section II.1.4). Other Habsburg candidates might have been just as capable of doing the job, witness the skills of a Weiss, a Liesganig, a Scherffer, a Fixlmillner… However, as I hope to have demonstrated by now, Maximilianus Hell had an official status that set him apart from his peers: as court astronomer and editor of the official almanac, he was clearly the most internationally profiled representative of Austrian astronomy. His adherence to the Jesuit order might have been seen as a hindrance, but at the eve of the dissolution of the order the anti-Jesuit sentiment was generally a far more live issue in Catholic than in Protestant countries. While it may be true that the Letter of the Law forbade the presence of Jesuits in the Danish realm, this was seen by many in the cosmopolitan elite as a remnant from past centuries rather than a bulwark against any imminent threat. The reformation had come out victorious ages ago in Scandinavia, and although various measures were still in place to prevent Catholicism to take root,[191] the Viennese Jesuit was in any case going to stay in the realm for a limited period only. The prestige involved in the international quest to determine the size of the solar system obviously mattered more than religious concerns. Economy may have been an issue as well; after all, monks were known to subsist on modest means.

Nils Voje Johansen at the University of Oslo, who has collected archival sources on Maximilian Hell's expedition for many years, has been able to verify that the decision to contact Hell was taken in the foreign ministry on 18 August 1767, with the first meeting

[191] For an analysis of the religious aspect of Danish-Norwegian state politics in the early-modern period, see Sogner 2003 (in Norwegian; also summarised in English in Grete Brochmann & Knut Kjeldstadli, *A History of Immigration: The Case of Norway 900-2000*, Oslo: Universitetsforlaget, 2008).

between Hell and the Danish ambassador taking place in Vienna on 5 September.[192] In the subsequent correspondence between ambassador Johann Friedrich Bachoff von Echt (1710-1781) and the Danish foreign minister Johan Hartvig Ernst Bernstorff (1712-1772, minister 1751-1770), the ambassador stresses the point that "just as little as any religious person is mindful to acquire riches for himself, neither will Father Hell demand any payment, except coverage of all the costs of the voyage itself". Furthermore, "as far as the costs of the voyage are concerned," the ambassador had reason to believe that, "considering the frugality in which the Jesuits are accustomed to live" no huge expenses would be incurred.[193] With backing from the government in Copenhagen, Bachoff then took direct contact with the mighty Viennese state chancellor Wenzel Anton von Kaunitz (1711-1794, chancellor from 1753), whose position covered the office of a foreign minister in modern terms.[194] The purpose was to obtain for Hell a temporary leave from his post as court astronomer. In other words, the invitation was a question of diplomacy on the highest level. But Father Hell was not only a servant of the court in Vienna. He also needed to obtain permission from the Society of Jesus. By 10 December 1767, three months after the first meeting between Hell and the ambassador, permission from both the General of Jesuit order in Rome and from Prince Kaunitz had been secured.[195] Regrettably, the correspondence between Hell and the Jesuit General, apart from the drafts for a couple of letters written in Vardø, has not been found. On the whole, the number of letters from Hell's correspondence that have been available for the present study dating from the period 1763 to 1767 is very limited.[196]

[192] Tyske Cancelli, kopibogen, entry under 18 August 1767 (RA Copenhagen): "Wird ihm [i.e. Bachoff] aufgetragen, den Pater Hell unter der Hand sondieren zu lassen, ob und unter welchen Bedingungen, derselbe auf Königl. Kosten, in Wardehuus den Durchgang der Venus durch die Sonne zu beobachten geneigt sey" = "[Bachoff, the Danish ambassador in Vienna] will be ordered to make confidential, preliminary talks with Father Hell to see if, and under what conditions, he could be willing, on His Majesty's costs, to observe the transit of Venus in front of the Sun from Vardøhus"; Tyske Cancelli, Udenrigske Afdeling, Kejseren, Gesandtskabs-relationer 1767, letter from Bachoff to Bernstorff in Copenhagen, dated Vienna 7 September 1767 (RA Copenhagen): "j'ai parlé avant hier en personne au Pere Hell, qui n'a point fait difficulté de se rendre chez moi" = "I talked the day before yesterday to Father Hell, who made no difficulty whatsoever about visiting me". Further comments on the invitation of Hell is made in letter from Bachoff to Bernstorff, dated Vienna 3 September, 29 October and 10 December 1767 (RA Copenhagen). I am indebted to Voje Johansen for generously sharing this and other archival documents with me.

[193] Bachoff to Bernstorff (RA Copenhagen), dated Vienna 7 September 1767: "Jl me reste d'ajouter, que comme aussi bien nul religieux ne scauroit acquerir pour soi, le Pere Hell ne demande aucune recompense, sauf l'affran-chissement des fraix du voyage" and Vienna 10 December 1767: "Quant aux fraix de voyage, j'ai lieu de croire qu'attendu la frugalité dont les Jesuites ont coutume de vivre, [etc.]". I am indebted to my colleague Magnhild Svenheim for helping me decipher certain difficult passages in the ambassador's correspondence.

[194] Bachoff to Bernstorff (RA Copenhagen), dated Vienna 10 December 1767.

[195] Ibid.

[196] See Unprinted Sources, 1*a* and 1*b*. A visit to the Archivum Historicum Societatis Iesu in Rome in October 2005 yielded no results.

The Nordic context of Hell's invitation will be reserved for further analysis in Chapter II.2. Returning to the Imperial Astronomer himself, one may ask what made him accept the invitation. The few autograph sources that are extant all originate from a later date. However, if we trust his own words in an unfinished introductory chapter to the *Expeditio litteraria*, edited in Chapter III.3 below, the invitation from Denmark-Norway came as a total surprise. Not only had he – allegedly – cultivated no scientific correspondence with anyone in Copenhagen, he would in any case have thought that his adherence to the Society of Jesus excluded him from invitation to a Protestant country of the North, "and especially in a time when the Society went through the heaviest of persecutions in Catholic countries".[197] The invitation presented by the Danish ambassador could be nothing other than the work of divine providence, he concluded. Thus, placing his fate in the hands of God, Father Hell expressed willingness to go to Vardø already during his first ever meeting with the ambassador of Denmark.

The Viennese Jesuit may have had several reasons for accepting the invitation, besides an instinctive inclination to 'place his fate in the hands of God'. First, there was the religious issue. The main reason why the Counter-Reformation was no longer a live issue in Scandinavia, was the restriction that the Nordic countries laid on Catholics, especially Jesuits, who normally were not allowed to enter these parts at all.[198] With an invitation in the name of the Danish King himself, this was a rare opportunity not only for Father Hell, but so also for his entire Order, to visit Scandinavia. Another likely reason is that, to the Continental-European Republic of Letters, the region in question was virtually a *terra incognita*. The Lapland expeditions of Carolus Linnaeus (Carl von Linné, 1707-1778) and Pierre Louis Moreau de Maupertuis (1698-1759) in the 1730s were already classical, but there still remained many scientific puzzles to be solved. In this situation, scientific publications as well as travellers' reports from Arctic Europe were held in high esteem.[199] A third aspect is the

[197] See below, Chapter III.3.
[198] Apart from Sogner 2003, Scandinavian-language contributions on this aspect of Hell's expedition include Duin 1984 (orig. published 1978) and Holzapfel 1979 and in part Kragemo 1960 and Kragemo 1968.
[199] On the reception of voyages in northernmost Europe by French, Italian and British natural philosophers in the seventeenh century, see for example Ruiu 2007 or Grillo in press; on the status of Lapland as a *terra incognita* in the first half of the eighteenth century, see Wagner 2004, espec. pp. 22-30; for the Swedish/Finnish relationship with the *Académie des Sciences* in particular, see Pihlaja 2005 and 2009. That this region remained exotic and mystical to savants on the Continent also in the second half of the eighteenth century is evident from Widmalm's discussion of the situation around 1800, see Widmalm 1990, espec. pp. 183-185. As regards the exotism surrounding the expedition of Hell, an article in *Nordske Jntelligenz-Sedler* No. 1, Onsdagen den 3. Januari 1770 is illuminating; see also Lalande 1803, p. 721: "Dans ces regions boréales, si peu fréquentées et si peu connues,

'purely scientific': as an expert on the transits of Venus, Hell no doubt knew of the advantages offered by the high-northern latitude of Vardø. This aspect will be highlighted in parts II and III of this thesis.

The expedition was originally envisaged to last no longer than a few months. The Viennese astronomer could reach Vardø in the spring of 1769 and return to the Habsburg capital before the end of the same year, ambassador Bachoff suggested. However, it soon became clear that Maximilianus Hell had more ambitious plans. In March 1768, just weeks before he set out from Vienna, he sent the following letter to the Pope:[200]

> Most humble prayers to His Holiness Pope Clement XIII for obtaining permission for dispensations because of a journey to be undertaken through non-Catholic lands upon call from the King of Denmark.
>
> Since upon invitation from His most Serene King of Denmark, communicated through His Ambassador to the Imperial Court in Vienna Count von Bachoff, and upon permissions from Her Highness the Empress Maria Theresa and from the General of the Society of Jesus His most Reverend Father Laurentius Ricci, a long journey is to be undertaken, funded by the King of Denmark, beginning this spring and lasting for several years, going through Saxony, Brandenburg, Denmark and Sweden to the farthest island of Norway by the Arctic Sea, called Vardøhus, a place where I will have to stay for rather a

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tout est intéressant, et le P. Hell avait tout étudié […]" = "In these northern regions, so rarely visited and so little explored, eveything is of interest, and Father Hell studied everything".

200 Hell to Pope Clement XIII, dated Vienna 5 March 1768 (Vatican See, Archivio Segreto Vaticano, "Archivio della Nunziatura Apostolica in Vienna", vol. 136, fol. 45recto [secretary's copy]): "Preces humillimae 5[ta] Martii Romam missae 1768 // Ad sanctissimum Papam Clementem XIII. pro impetrandis dispensationibus, et facultatibus causa itineris per Regiones Acatholicorum ad evocationem Regis Daniæ faciend[i]. // Cum ad serenissimi Regis Daniae per suum ad Aulam Caesaream Viennensem Legatum Comitem de Bachoff factam evocationem, et obtentam ab Augustissima Jmperatrice Maria Theresia, atque a Praeposito Generali Societatis Jesu Adm. R. Patre Laurentio Ricci licentiam sumptibus Regis daniae grande, et per aliquot annos duraturum iter proximo Vere mihi cum Socio Sacerdote é mea Societate, atque famulo Catholico incohandum sit per Saxoniam, Brandeburgum, Daniam, Sueciam, ad supremam usque Norwegiae Jnsulam in Mari glaciali sitam, Wardhus dictam, ibique per longius tempus causa observationum Astronomicarum a Rege Daniae mihi imperatarum commorandum sit, iterumque peragrata tota Suecia, et Dania, fortassis per Hollandiam, Belgiam, Angliam, Gallias, et totum Jmperium redeundum erit Viennam; hocque iter, hęcque mea cum socio meo commoratio in Regionibus hujusmodi Acatholicorum futura sit, in quibus neque Templa publica neque Sacella Catholicorum habentur, neque ullum Catholicae Religionis exercitium toleretur, et pręterea veste Religiosa in secularem mutata, nos in publico ita gerere oporteat, ut non modo non sacerdotes, sed subinde in certis Circumstantijs neque Catholicos suspicari debeant; His de causis ad evitanda mala, ad solatium spirituale, ad sedandos scrupulous conscientiae, infra scripti supplices sumus sanctissimo Pontifici pro clementissime indulgendis sequentibus mihi, meoque socio, et famulo summe necessarijs dispensationibus, et facultatibus. // *Primo:* quamdiu inter acatholicos sub veste sęculari, aut vero, quamdiu in ipso itinere etiam inter Catholicos versabimur, propter nimios labores diurnos nocturnosque tum propter itinerum gravia incommoda, tum ne per iter inter Acatholicos, sacerdotes esse noscant, humillime supplicamus pro absolvenda obligatione recitandi Breviarij. // *Secundo:* demissime supplicamus pro facultate sacrum faciendi in sacellis domesticis Legatorum Catholicorum, ubi has repererimus, item pro facultate Missam celebrandi supra portatili nobiscum occulte ferendi, in Cubiculis privatis, aut sub tentorijs saltem diebus festis, et dominicis. // *Tertio:* Pro casu necessitatis, dum alio inter Acatholicos versantes esum carnium diebus ab Ecclesia prohibitis evitare non poterimus, dispensationem, facultatemque cibis carnium vescendi humillime petimus. // P. Maximilianus Hell S.J. Astronomus Caesareo-Regius, cum socio sacerdote ex eadem Societate Jesu, et famulo Catholico."

long time because of astronomical observations that I have been ordered by the King of Denmark to undertake, followed by a return journey to Vienna, going through entire Sweden and Denmark and then perhaps through Holland, Belgium, England, France and the entire [Holy Roman] Empire, and since this journey and sojourn will befall me and my assistant in non-Catholic lands of this kind, in which neither official churches nor other places of Catholic worship are found and no worship of the Catholic religion is tolerated, and where our religious dress will need to be exchanged for secular clothing and we on the whole will have to behave in public in such a way that we not only avoid incurring the suspicion of being priests, but on certain occasions even must avoid being recognised as Catholics, we hereby beg, on behalf of myself, my assistant and my servant, in order to avoid danger, receive spiritual solace and sedate scruples, to be bestowed by His Most Holy Pontiff the most gracious permission for the utterly necessary dispensations that are stated below.

> *First*, for as long as we stay among non-Catholics, and even when travelling amongst Catholics, because of the strenuous labours both day and night as well as the incommodities caused by the conditions of travelling, and not least in order to avoid being recognised as priests while amongst non-Catholics, we beg most humbly to be freed from the obligation of reciting the Breviary.

> *Second*, we beg most humbly to be allowed to minister at domestic altars of Catholic ambassadors, whenever we find such persons, and to be allowed to celebrate mass upon a portable table which we will bring with us in secret, either in private rooms or at least in tents, during holidays and Sundays.

> *Third*, in the event of necessity, for as long as we stay in non-Catholic lands we beg most humbly to be allowed to eat meat even on days prohibited by the Church when this cannot be avoided.

In other words, the Jesuit Priest prepared himself for an existence as a 'crypto-Catholic'. It is also noteworthy how vaguely he describes the duration and expanse of his expedition: "for several years" (*per aliquot annos*) and "perhaps through Holland, Belgium, England, France and the entire [Holy Roman] Empire". Answer from the Holy See reached Father Hell in Danish-ruled Traventhal (not far from Lübeck) on 31 May 1768. The answer as such is not known to have survived. However, Hell's assistant noted the following sarcasm in the travel diary:[201]

> Herr Temler delivered to us letters, which he had brought with him from Vienna to Denmark, from Denmark to Holstein, and then hither [to Traventhal]. One

[201] Sajnovics' diary, proofread version (WUS Vienna), entry on 31 May 1768: "D[omi]nus Temler litteras reddidit, Vienna Haffniam, Haffnia in Holsatiam, inde huc a se allatas. quarum aliæ erant à P. Anto: Pilgram, aliæ ex Aula Romana, quibus Facultatem Sanctissimus Noster Clemens XIII impertitur sacrum in portatili Celebrandi, modo in Cubili nemo noctu dormiat. Dispensatio ab Horis Cannonicis, et Abstinentia a carnibus emansit, sine dubio ob malam informationem Pontifici datam. qui si Circumstantias itineris, Viarumque, et Victus rationem, atque fatigiorum magnitudinem vidisset persæpe, non commiseratione solum, sed etiam horrore perfusus, ampliores etiam Dispensationes ultro certe obtulisset. sed nempe Procursionem hanc Recreandi sese et exhilarandi causa Susceptam, et inter amoenos Jtaliæ hortos terminandam autumabat, ita referentibus ijs, quibus referendi negotium erat comissum…" (The "…" are from the original).

> letter was from Father Antonius Pilgram, another from the Roman court. Our Holiness Clement XIII bestowed upon us the right to minister at a portable table, provided that no one sleeps in the room at night. Dispensation from canonical hours and abstinence from meat was not granted, no doubt because the Pontiff was not well informed. If he [i.e., the Pope] had perceived the circumstances of the journey, the nature of the roads, the way of life and the sheer amount of fatigue involved, he would definitely have been affected often enough not only by compassion, but even horror, and on his own initiate granted even more dispensations than those he had been asked for. However, he obviously thought this excursion of ours was undertaken as any other holiday for pleasure's sake, with the aim of reaching the idyllic Italian gardens, having been told so by those whose job it was to inform him about the application.

It is easy to agree with Sajnovics' comment that neither the destination nor the travel route resembled "the idyllic Italian gardens". The two Jesuits had rolled out of Vienna on 28 April 1768, more than a year ahead of the transit of Venus. The trip overland took them through Prague, Dresden, Leipzig, Hamburg and Lübeck. In Traventhal they had an audience with King Christian VII, whom they describe in favourable terms. From the port in Travemünde outside Lübeck, Hell and Sajnovics proceeded by ship to Copenhagen, where they stayed for three weeks. From there, they set forth via Helsingør and Helsingborg along the coast of southwestern Sweden to Fredrikshald (now Halden) and Christiania (Oslo). They thereafter travelled on the far from comfortable cart roads across the mountains of southern Norway to Trondheim, where they had another three-week rest. From Trondheim, the northernmost town of Norway at the time, they proceeded by ship along the coast to their final destination of Vardø, which they reached in the midst of a storm on 11 October 1768.[202] An eyewitness from Skjervøy in northern Norway characterised the very idea of travelling to Vardø by boat at that time of year as "a desperate voyage by desperate persons".[203]

Hell and Sajnovics stayed in Vardø from 11 October 1768 to 27 June 1769. Their return journey from Vardø to Copenhagen was more or less identical, with the notable exception that it took place in the summer.[204] They now stayed in Copenhagen for more than seven months, from 17 October 1769 to 22 May 1770. They also took a slightly different route back to Vienna from Copenhagen, passing through Fyn, southern Jutland, Schleswig and Holstein to

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[202] Sajnovics, travel diary 1768-1770 (WUS Vienna).

[203] Pastor Cornelius Duns in Skjervøy to bishop Johann Ernst Gunnerus in Trondheim, dated 13 September 1768 (quoted from Dahl vol. IV, 1899, p. 109): "Pat. Hell er i Moursund med de andre, vil paa denne aarets tiid til Wardøe, Een desperat reise af desperate Personer!" = "Father Hell is in Maursund with the rest of the company, he intends to go to Vardø in this time of year: a desperate voyage by desperate persons!"

[204] For a map of the northbound journey, see Hadobás 2008, p. 115. The southbound part of the journey from Vardø to Copenhagen is depicted in Hansen & Aspaas 2005, p. 36 (both publications available online as of 17 February 2011).

Hamburg. From Hamburg, they again chose a more westerly route, this time visiting Göttingen and Kassel before turning straight westward to Düsseldorf and then south through Cologne to Mannheim and Schwetzingen, before they turned east via Würzburg, Ingolstadt and Passau to reach Lincium, Cremifanum, Graecium and finally Vienna. A wish to visit as many observatories and other research institutions as possible appears to have been one reason behind this winding track; to visit the residences of Jesuit missionaries, another.

Not until 12 August 1770 were Hell and Sajnovics back in the Austrian capital. The court astronomer had now been absent from his post for two years and three and a half months. During this time, he had visited areas where the religious controversies were far more acute and the balance of strength between the various denominations less clearly marked than in Maria Theresa's Vienna. Although the travel diary of Hell's assistant is crammed with details of ecclesiastical persons and buildings, with Jesuit missionaries and professors invariably described as *nostri* ('ours'), there is also ample information on scientific activities in his diary and other documents preserved from the expedition. Individual savants and the few institution for learning that were in place are generally described with enthusiasm. Within Copenhagen-ruled territory, there were only two universities, one in Kiel (not visited by Hell) and one in Copenhagen. Far more important to Hell and his assistant, however, were the scientific societies in Copenhagen (established 1742) and Trondheim (established 1760, Royal Society from 1767).[205] Interaction with numerous persons either closely or loosely related to these institutions was of fundamental importance to Father Hell in his pursuit of the broad scientific ambitions for the expedition. This brings us to the planned publication of a three-volume work *in folio*, covering the history of the expedition as such as well as the various branches of research undertaken in its course.

Encyclopædic ambitions of scientific travel were typical of the eighteenth century. In the context of the transits of Venus, one may point to the much-quoted reports from Captain Cook's first circumnavigation of the globe in conjunction with the 1769 transit. Equally encyclopædic in nature are the two-volume travel diary by Chappe d'Auteroche from his Siberian expedition in 1761 and the extensive travel diaries of Jacques-André Mallet and

[205] For an English account of the Royal Society of Sciences in Copenhagen see Pedersen 1992. On the history of the Trondheim Society of Sciences, see now Andersen *et al.* 2009.

Jean-Louis Pictet from their expedition to the Kola Peninsula in 1769.[206] The Parisian astronomer Cassini de Thury, who paid a visit to Hell in Vienna in 1761, put it thus in a paper on the Venus transits in the proceedings of the Académie Royale des Sciences:[207]

> When such long voyages are undertaken, one must have more than one object, so that in case the essential goal cannot be accomplished, it will be possible in some measure to remedy the damage. Otherwise, one may be forced to take comfort in having travelled more than a thousand leagues only to gaze at the Sun for six hours and find it eclipsed, not by the planet, but by a cloud.

Similar expressions are found in a letter from Scherffer to Weiss, dated 2 August 1750. There, Scherffer offers Weiss advice concerning the aims and scope of a planned expedition to survey the Portuguese dominions in Brazil. Scherffer emphasises that his colleague should prepare to undertake not only geodetic work, but also to make delicate barometrical observations, investigate the running of pendulum clocks, undertake numerous geophysical observations, and so on – in short, "to describe the Brazilian lands" in all their diversity:[208]

> I confess that, if merely one of these aspects are left out [scil. of the expedition's research programme], there will be no one in Europe who will explain that defect by pointing to the expedition's mandate, the hardships endured, the wants of the instrumentation, the limited staff or the [King's] parsimony in the expenses: surely, every person will blame it on the ignorance of Jesuits abusing the treasuries of Kings.

In other words, as Scherffer saw it, making sure to have a broad expedition programme was especially important when Jesuits were concerned, in order to ward off attacks from anti-Jesuit intellectuals abroad. Judging from the correspondence of Hell from the period 1768-70, which is to a large extent intact, the idea of making a grand encyclopædic work on the High North was present in Hell's mind from the outset of his journey. The first reference to the title as such is in a letter to his substitute in Vienna, Antonius Pilgram, dated Vardø 30 April 1769:

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[206] See the editions of Michel Mervaud & Madeleine Pinault Sørensen (Chappe 2004) and Jean-Daniel Candaux *et al.* (Mallet & Pictet 2005).

[207] Cassini de Thury, "Remarques sur la conjonction de Vénus avec le Soleil, Qui doit arriver le 6 Juin de l'année prochaine 1761." 1762 (paper read 12 November 1760), p. 334: "Lorsqu'on entreprend d'aussi longs voyages, il faut avoir plus d'un objet, pour que si l'essentiel ne peut être rempli, on puisse en être dédommagé en quelque manière; autrement pourroit-on se consoler d'avoir fait plus de mille lieues pour voir le Soleil pendant six heures & de le trouver éclipsé, non par la planète, mais par un nuage."

[208] Scherffer to Weiss, dated [Graecium] 2 August 1750 (printed in Vargha 1990, pp. 10-11, here p. 11): "Quantae molis erit Brasilas describere terras? Fateor, si horum aliquid desideraretur, vix aliquem fore in Europa, qui defectum seu in operis ordinitatem [*Vargha; anne* ordinationem *scribendum Kraggerud*], seu in temporum angustias [*scripsi;* augustias *Vargha*], seu in instrumentorum defectum, seu in Sociorum paucitatem, seu in sumptuum parsimoniam referret: quin omnes vel ignorantiam Regia liberalitate abutentium Jesuitorum accusarent." The classical scholar will notice the hexameter at the beginning of the quotation, probably an allusion to Vergil's Aeneid I.33: "Tantae molis erat Romanam condere gentem".

"my observations, which I have either made or am going to make here in Vardø, will be reserved for the *Expeditio litteraria ad Polum Arcticum*".[209] In the subsequently published report on the Venus transit, he outlined the main contents of the work, although he there refers to it as the *Expeditio litteraria* only.[210] A more elaborate description of the work (this time with its full title) was issued later in year 1770, in the form of a call for subscriptions that was included in the journal *Nova Acta Eruditorum* and also issued as a separate leaflet in both Latin and German. The entire call for subscriptions is edited in Chapter III.2 below. For now, we shall look briefly into its various parts and their contexts. First, however, a brief discussion of the title of the work appears necessary.

It is tempting to translate the title *Expeditio litteraria ad Polum arcticum* as 'Literary Expedition to the North Pole', as has been done for example by George Sarton and Helge Kragemo.[211] However, upon close inspection it turns out that the only word that is unproblematic in that translation is *Expeditio*. This simply represents 'expedition', in the modern sense of the word. The adjective *litterarius* in its early modern version means something else than belles-lettres, or literature. It here conveys the same sense as the *Respublica litteraria* (*République des Lettres, Republic of Letters, Gelehrtenrepublik*). The nearest modern equivalent would be 'scientific', allowing for a broad sense of the concept that would encompass both book-based erudition and empirical natural sciences, as in the German expression "Wissenschaften".

A couple of contemporary examples might help corroborate this interpretation of *litterarius*. The astronomer Nevil Maskelyne, in a letter to the President of the Royal Society of London sums up the historical significance of British participation in the 1761 Venus transit project in the following manner (the italics are mine):[212]

> Nor can the learned world but look upon themselves as highly indebted to your Lordship, for that noble zeal, which you have manifested for the improvement of astronomy, in setting forward, and promoting, these *literary expeditions*, which tend to the benefit of mankind, and the honour of our native country.

[209] Printed in Pinzger 1927, pp. 93-95, here p. 94: "meas [scil. observationes] hic loci factas faciendasque Expeditioni Litterariae ad Polum Arcticum reservo".
[210] Hell 1770*a*1, pp. 2-6, 17, 61, etc.
[211] Sarton 1944, p. 104; Kragemo 1960, p. 122.
[212] Maskelyne "An Account of the Observations made on the Transit of *Venus*, *June 6*, *1761,* in the Island of *St. Helena*: In a Letter to […] *George* Earl of *Macclesfield*, President of the Royal Society, from the Rev. *Nevil Maskelyne* […]. Read Nov. 5, 1761" 1762, p. 200.

There was nothing belletristic about the expeditions referred to in that statement; Maskelyne obviously implies 'scientific'. Lalande, in one of his letters to Father Weiss, asks him to address his letters to the *Académie Royale des Sciences*, so that that institution will cover the postage. This will be quite legitimate, he proceeds, for what they were dealing with was "above all observations and literary correspondence (*correspondance litteraire*)", that is subjects worthy of being paid for by the academy.[213] Again, 'scientific' is what is meant. Finally, when Hell's planned work was referred to in contemporaneous translations into Danish, the title was regularly rendered "det lærde Tog".[214] The epithet "lærd" is associated with the noun "Videnskab" (or "Wissenschaft"), implying both erudition and empirical science, but not *belles-lettres*.[215]

The next part, *ad Polum arcticum*, could easily be interpreted as 'towards' – not 'to' – 'the North Pole'. The preposition *ad*, when connected with verbs or nouns implying movement, usually means a movement towards a destination. This stands in contrast to *in* with the accusative, which implies that the destination is reached. However, another frequent meaning of *ad* is 'by, near, in the vicinity of' a place or area. Are we then dealing with a scientific expedition *towards* the North Pole, or *by* the North Pole? The call for subscriptions was translated in its entirety into German. We there find "Reisebeschreibung *nach* dem Nordpol" (my emphasis).[216] This would seem to suggest that Sarton's translation is correct: Hell was considered have travelled "to" (or at least, "towards") the *Polus arcticus*. In that case, "North

[213] Lalande to Weiss in Tyrnavia, dated Paris 7 August 1768 (quoted from Vargha 1990, p. 68): "cela est juste quand il s'agit surtout d'observations et de *correspondance litteraire*" (my emphasis).
[214] E.g. Hell 1770*a*3, pp. 538-539; Sajnovics 1770*a*2, p. 737. See also *Pars I Tomi I Caput IV* in Chapter III.3 below, where "Expeditionis hujus litterariæ" has become "dieser gelehrten Reise" in the German version.
[215] It might be mentioned that a likely model for Hell's work is the *De Litteraria Expeditione per Pontificiam Ditionem ad dimetiendos duos meridiani gradus et corrigendam mappam geographicam*, written by the two Jesuits Christopher Maire and Roger Joseph Boscovich and published in 1755. As Boscovich explains in the preface, it consists of five parts. *1)* a historical and physical account of the two Jesuits' *expeditio litteraria* through the Papal States, written by Boscovich himself; *2)* a determination of one degree of meridian on the basis of observations made by the two Jesuits, written by Maire; *3)* a correction of the geographical map of the Papal States, by Maire; *4)* descriptions of the instruments used during the expedition, by Boscovich; and *5)* a discussion of the shape of the Earth on the basis of [Newton's theory of] gravity and the measurement of degrees, by Boscovich: "Primum Opusculum a me conscriptum continet Commentarium Historicum, ac Pysicum expeditionis litterariæ per ditionem Pontificiam. // Secundum conscriptum a P. Maire continet determinationem gradus meridiani ex communibus observationibus definiti ipsius labore, & calculis. // Tertium, ipsius itidem, agit de correctione Mappæ Geographicæ, quam ex communibus pariter observationibus restitutam summo labore, ac diligentia delineavit. // Quartum, quod est meum, agit de apparatu, & usu instrumentorum in eadem expeditione adhibitorum. // Quintum itidem meum de Telluris figura determinanda ex æquilibrio, & ex graduum mensura" (Maire & Boscovich 1755, pp. xiv-xix, here p. xiv). In 1770, this classic of geodesy appeared in a French edition, bearing the title *Voyage Astronomique et Géographique, dans l'Etat de l'Eglise* (Maire & Boscovich 1770). *Litterarius* had now become "astronomical and geographical".
[216] Hell 1771*a*2, p. [1].

Pole" must designate something else than it does today, possibly just 'the region of the High North; the Arctic'.[217] However, I shall argue that the translation 'by' is probably better.

The phrase *ad Polum arcticum* is used several times in the introductory chapter of the *Expeditio litteraria,* edited below. It is hard to draw any definite conclusions from those examples, however.[218] The main piece of evidence in favour of 'by', instead of 'towards the North Pole', is a manuscript covering magnetic observations made during the southbound part of the journey, that is, from Vardø towards Copenhagen. This manuscript bears the title 'The method used for observing the magnetic needle's declinations during the *iter litterarium ad Polum boreum*'.[219] *Iter*, journey, is here a synonym for *expeditio*; *boreus* for *arcticus*. Given the southbound travel route described in this manuscript, *ad* is clearly meant on this occasion to imply 'by the North Pole', not 'towards'.

In conclusion to this discussion of the title, I suggest that the sense of the expression *Expeditio litteraria ad Polum arcticum* is probably best conveyed to modern readers by the translation ***'Scientific Expedition by the North Pole'***.

The first volume of the *Expeditio litteraria* was meant to start with an account on how the expedition came about and the international context in which it was inscribed. Hell's introductory chapter, which has remained unpublished until now, is edited in Chapter III.3 below. As for the rest of volume one, it would certainly have relied heavily on contributions from Hell's assistant, Sajnovics. Its contents may be summarised thus:

Volume I. Historicus

Part I: The history of the expedition, including a diary of the entire journey; Part II: An ethnographical descripton of the Lapps; Part III: On the "Lappish

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[217] Such a translation is given by the editors in Hviid 2005, p. 589 endote 368: "En litterær ekspedisjon til de nordlige polaregne". In that interpretation, *Polus arcticus* would be a synonym for *Zona frigida arctica* (used by Hell in the call for subscriptions, *Tomi II. Pars IV. Sectio I* in Chapter III.2 below).

[218] To quote just four examples (all taken from Chapter III.3 below, some words italicised for this occasion): 1) "Non minore Zelo, et conatu celeberrimi Sueciæ Astronomi Jllustrium Academiarum Stokholmiensis et Upsalensis præclara Academiæ Petropolitanæ studia æmulati ternas *ad septentrionem* totius Transitus peroportunas observandi *stationes fixerunt* "; 2) "*Expeditio* hæc Anglorum *ad Polum arcticum in Finnmarchiam facta est* ipso observationis anno 1769 Mense Aprili, quum ego jam à die 11 octobris 1768 cum socio meo P. Sajnovics in Jnsula Finnmarchiæ, Wardœhus dicta, versarer"; 3) "Dania ergo erat, cujus solius Dispositioni Divina Providentia *inter decem ad Polum arcticum stationes*, quam maxime completam dare decreverat observationem hujus Transitus Veneris, sola et una maris glacialis Jnsula, solum nempe Wardœhusium ea erat *in extremo septentrione statio*, quam [etc.]"; 4) "Consilio inito Expeditionem quoque litterariam *ad Polum arcticum in Jnsulam Wardœhus* Regi Clementissimo proponendam, impetrandamque decrevêre [scil. Ministri Danici]".

[219] Hell's MS "Methodus observandi Declinationes acus magneticæ per iter litterarium ad Polum boreum" (1769-1770).

Language", on its unity with the Hungarian language, and on the "Asian Language" in general.

The author of the "diary of the entire journey", ***Joannes Nepomucenus Sajnovics SJ***[220] (1733-1785) had grown up in the village Tordas in the *Alba Regalis*[221] region, just southwest of present-day Budapest. His family was of Croat origin, but had in the seventeenth century settled in Alba Regalis, where it became magyarised. With reference to the vernacular, Joannes Sajnovics explains that he had been "born and raised in Hungary by Hungarian parents", thereby implying that his mother tongue was Hungarian.[222] Already at the age of 15, in 1748, he entered the Society of Jesus. He had by then lost both his parents. As he entered the Society, Joannes relinquished the Sajnovics estate to his older brother Matthias as sole heir. He received his undergraduate schooling in Jaurinum and Buda and stayed in Trenchinium as a novice, before moving to Tyrnavia to study at the philosophical faculty in 1751. One of his university teachers was Georgius Pray SJ (1723-1801), who was later to become a leading historian in Hungary. Franciscus Weiss probably taught him as well. Sajnovics himself taught in Posonium in the mid 1750s before moving to the University of Vienna, where he studied theology and served as Hell's assistant (*bidellus*) in 1758/59 and 1759/60. One of his tasks appears to have been to serve as the secretary of the Imperial Astronomer. Comparison with the handwriting of the travel diary from 1768-70 has convinced me that all extant transcripts of Hell's correspondence from the period 1757-59 have been made by Sajnovics.[223] His service as a secretary is further corroborated in a letter from Franciscus Weiss, dated Tyrnavia 23 December 1758, in which Weiss asks Hell to "make sure that the parts that I asked for from his *Ephemerides* are copied by the Honourable Magister Sajnovics".[224] In 1764, Sajnovics figures on a list of *Theologi 4. Anni* ('theology students in the fourth year') at the University of Vienna in a Jesuit catalogue. In the same year, he also took part in observations at Hell's observatory.[225] In 1765, Sajnovics served in Posonium again, before he was appointed the assistant (*socius*) of Franciscus Weiss in his

[220] Also spelled Sainovics, Sajnovits, Sajnovich, etc.
[221] Alba Regalis (L) = Fejér (H), Weißenburg (G).
[222] Sajnovics, *Demonstratio. Idioma Ungarorum et Lapponum idem esse* 1770*a*1, p. [x] = [1771], p. [x]: "Ast ego, quem in Ungaria ab Ungaris Progenitoribus nasci, atque educari contigit, quique Sermone Patrio publica compluribus annis munia pertractavi," etc.
[223] WUS Vienna. Transcripts of correspondence from the year 1760 are missing, whereas the transcripts from 1761 have been made by another hand.
[224] Weiss to Hell in Vienna, dated Tyrnavia 23 December 1758 (WUS Vienna, secr. copy): "[…] q[uo]d R^a V^a pro singulari sua in me benevolentia Per R. M. Sajnovics, petita ex Suis Ephemeridibus describi Curet". *Ephemerides* might here refer to a diary, or journal of observations, not necessarily the printed *Ephemerides*.
[225] Hell, "Observationes Astronomicæ Anni 1763, et 1764. Viennæ et aliis locis factæ" 1764*b*, pp. 322-323.

observatory in Tyrnavia the year after.[226] It was from there that Sajnovics arrived in Vienna shortly before the outset of the expedition to resume his role as an assistant of the Imperial Astronomer, this time during his expedition to the Far North.[227]

Why Sajnovics was chosen as an assistant for the expedition is something of a puzzle. Two explanations surface in the literature, each of which have their basis in primary sources. In the introductory chapter to the *Expeditio litteraria* (edited below), Maximilianus Hell states the obvious, that Sajnovics was chosen because of his likable personality, his good health and his astronomical skills. Elsewhere, however, a contradictory explanation is given, which calls for some consideration. In contrast to Father Hell himself, Sajnovics' mother tongue was Hungarian. During his stay in Finnmark County of Norway, Sajnovics undertook a thorough examination of the "Lappish" (Sámi) language, which he published in Copenhagen as a *Demonstratio Idioma Ungarorum et Lapponum idem esse* ('Demonstration that the Language of the Hungarians and the Lapps is the Same', 1770*a*1). This investigation, usually referred to simply as the *Demonstratio*, has became a veritable classic of comparative linguistics. Already in the 1770s and 1780s, it received considerable attention. In the text of the *Demonstratio*, we find the explanation that Sajnovics was chosen as Hell's travel companion because he was to investigate a possible linguistic link between the Sámi language and his native Hungarian.

In the first, Copenhagen edition of the *Demonstratio*, Father Hell is acknowledged for having asked Sajnovics to undertake this research, for pointing out certain methodological guidelines for his interviews with native Sámi speakers and for never allowing him to give up even though the task proved difficult. The second, enlarged edition of the *Demonstratio*, published in Tyrnavia upon Sajnovics' return from his expedition, goes even further. Hell is now credited with having been present during interviews with local Sámi in Vardø. And amongst several other additions, we find a long letter from Hell to Sajnovics arguing for a probable heritage of the "Hungarian dialects" (one would now say Finno-Ugrian languages) from

[226] In the *Ephemerides* of Hell, Sajnovics is mentioned among the observers in Tyrnavia from January 1767 onwards (Hell, "Observationes Astronomicæ Anni 1766. Viennæ & aliis locis ab exercitatis Observatoribus factæ" 1767*b*, pp. 272-276).

[227] Key dates from Sajnovics' early career are taken from Kisbán 1943 and Erdődi 1970 and supplemented by the *Ephemerides* of Hell and the Jesuit catalogues *Austria. Catalogi Breves 1763-1765* and *1766-1769*.

Chinese. As to the cause for electing Sajnovics as travel companion, the following statement is found in the slightly rephrased introduction to the second edition:[228]

> For he [scil. Hell], with the same benevolence that he had bestowed upon me already some time ago, during that two-year period when he wanted me to assist him in his astronomical tasks in Vienna, had chosen me also for this expedition to the Far North, and *brought me along to Finnmark as a travel companion and an assistant in his activities, in particular in his endeavours to investigate the Lappish language* [my italics]. This was an occasion for Hungarians to visit the Lapps, this was an occasion to test the conjecture of a correlation between the Hungarian and Lappish language, which Honourable Father Hell had formed in his mind already beforehand, from reading the *Lapponia* of Schefferus and the *Erdbeschreibung* of Büsching, a conjecture he had mentioned to me every so often during the journey.

This first part of this quotation is entirely missing in the first edition of the *Demonstratio.* From this addition to the second, Tyrnavian edition, we get the impression that Sajnovics' potentials for linguistic research were quite as important as his skills as an astronomer, when Hell chose him as travel companion. The puzzling inconsistence between the two statements has led to some discussion: was Sajnovics chosen as a travel companion in order to investigate the Lappish language, or was he chosen because he was a likeable person and an able astronomer?

A Hungarian author who has produced numerous articles on the expedition of Hell and Sajnovics, Lajos Bartha, in a paper of 1983 (in Hungarian) conjectures that Hell's real agenda was to make Sajnovics the director of a new observatory that he wished to see constructed at the Jesuit collegium in Hungarian Buda. By bringing him along on his glorious expedition, Hell wished to qualify his promising pupil for such a post. The investigation of the Sámi language and its affinity with Hungarian must have been something that came up by chance while they were in Norway, Bartha argues. Only after the event did Sajnovics decide to credit

[228] Sajnovics *Demonstratio ...* [1771], pp. [xi-xii]: "Ipse enim me, eadem benevolentia, qua olim jam biennio integro Viennæ in Astronomicis sibi ad manus esse voluit, Expeditionis quoque hujus ad Arctos delegit comitem, & laborum suorum, ac potissimum (disquisitionis Idiomatis Lapponici causa suscipiendorum) futurum socium, secum in Finmarchiam detulit. // Hic enimvero inter Lappones versari licuit Ungaris, hic conjecturam, quam R. P. HELL de convenientia Idiomatis Ungarici cum Lapponico, pridem antea e Lapponia SCHEFFERI, & Geographia BÜSCHINGII mente præconceperat, mihique per iter sæpius commemoraverat, periclitari […]". The parentheses around *disquisitionis ... suscipiendorum* are difficult to explain. In my translation, I have interpreted *ac potissimum* to belong within the parentheses. Monika Ehlers seems to have made the same correction as well (cf. Sajnovics 1972, p. 9). The second part of the quotation, *Hic enimvero* etc., is present in both editions, with the notable exception that the original *Ungaro* ('a Hungarian') has been changed into *Ungaris* ('Hungarians') in the Tyrnavian edition (cf. Sajnovics 1770*a*1, p. [xi] *versus* Sajnovics [1771], p. [xii]). Thus, by implication it was not only 'Sajnovics the Hungarian' who had occasion to spend some time among the Lapps, but 'Hell and Sajnovics the *Hungarians*'.

his mentor with having been so “thoroughly foreseeing while planning the expedition, thereby enhancing the reputation of his confrère”.[229] Gyula Décsy and Wolfgang Veenker, in their afterword to a modern translation of the Tyrnavian *Demonstratio* (published in 1972), state that Sajnovics included the long letter of Hell’s along with other additions in the Tyrnavian edition “probably only out of politeness”.[230]

Both Bartha and the editors of the modern edition of the *Demonstratio* are on the right track. However, the real explanation to the additions and alterations in the Tyrnavian edition can be proven to exceed mere politeness. It turned out during my investigation of Hell’s manuscripts in Vienna that several significant additions to the *Demonstratio* had not been made by Sajnovics at all – they were in fact dictated by Hell, word by word (See Fig. 1 and 2 below). What was going on here, was that Maximilianus Hell wanted to be credited with the honour of having discovered the ‘Lappish-Hungarian’ linguistic link, and what is more, of having discovered it not by chance, but as a result of careful planning. In a letter to the above-mentioned Jesuit Georgius Pray, who precisely in this period was establishing himself as a prominent historian of Hungarian history, Hell exclaims that:[231]

> Nothing, therefore, of all this has to do with Father Sajnovics, neither does any of the other research made during the expedition pertain to him; except that [he] assisted me in some tasks according to my instructions and my ideas; thus, whatever has been revealed, elaborated, discovered and so on, has to do with me only, and the Demonstration of the identity of the Lappish and Hungarian language, as regards the structure of the work, the arguments, its elaboration and so on […] has itself been accomplished according to my ideas and instructions.

This statement stands in stark contrast to statements that were made on the spot. In a letter to the confessor of Maria Theresa, Father Höller SJ, Hell exclaims (Vardø, 6 April 1769):[232]

[229] Bartha 1983, p. 300: “Ezért azt a gyanút keltik, hogy Sajnovics utólag szerette volna bemutatni, mennyire előrelátóan járt el Hell az expedíció szervezésénel, ezzel is öregbítve rendtársa hírnevét”.
[230] Décsy & Veenker 1972, p. 159: “wahrscheinlich nur aus Höflichkeitsgrunden”.
[231] Hell in a letter to Georgius Pray, quoted by Anna Jászó 1983, p. 259: “Nihil ergo horum omnium ad Patrem Sajnovics pertinent; nihil etiam de laboribus in Expeditione susceptis ad eum spectat, nisi quantum is [*scripsi;* in *Jászó*] sub mea directione, et juxta mentem meam mihi in quibusdam ad manum fuit; quidquid igitur detectum, elaboratum, repertum et cetera est, id solum ad me pertinet, ipsaque demonstratio identitatis idiomatis Lapponici et Ungarici, quoad oeconomiam operis, argumenta, dispositionem et cetera … mea confecta est mente, et directione …”. The letter is not dated by Jászó, but she refers to “les ms. de la Bibliothèque de l’Université de Budapest, Collection Prayana, T. XVIII, pièce n^{o} 24, feuillet 2”. In November 2007, through my scientific assistant Ágnes Kunszenti, I ordered scannings of all letters from Hell to Pray from the Eötvös Lorand University Library of Budapest. We received a DVD containing a considerable number of letters addressed to Pray by Hell (See Unprinted Sources, 1*a*), but none containing this particular sentence.
[232] “Mira dei dispositio, quod socium linguae nostrae gnarum P. Sajnovics meae hujus expeditionis elegerim. Laudemus Deum in inventione fratrum nostrorum” (quoted from Pinzger 1927, p. 93).

> Mysterious the work of God, that made me choose Father Sajnovics, who knows our language, as the travel companion of this expedition of mine. Let us praise God for the discovery of our brothers [i.e., the Sámi]!

Another letter from Vardø, addressed to Antonius Pilgram, the substitute at the Imperial and Royal Observatory, contains an even more bewildering statement (Vardø, 5 April 1769):[233]

> [You] must have had a prophetic spirit, when You in Your letter to Sajnovics wrote: "I salute the dark pastorella a thousand times", and "I expect Lappish eclogues from him"; in fact, You, and the entire European world of learning may expect concerning the Lappish race a new discovery, which will be received with bewilderment by entire Europe. I, who formed this conjecture about the Lapps from the very beginning, gave him some rules and criteria, according to which he was to do this research, and now we have reached such clarity, that no human being will doubt this. Indeed, indeed, Sajnovics is in fact able to make "Lappish eclogues"; I am quite satisfied to have chosen him as my travel companion, he who so readily and in such a brief span of time was able to learn the Lappish language. I have asked him to extract some memorable stories from our diary and send them to [You], so that You may share them with our friends in Vienna. [...] I beg you, however, to please make sure this discovery arrives to the ears of *Herr Van Swieten*; he will find pleasure therein, *since he was the one who bade me do this investigation* [my italics]; but please give him only the general information that they [scil. the Sámi] are no Americans, but real Orientals, as we will have the honour to inform him in detail upon our return.

The very idea of investigating the origin of the Sámi population is here attributed to (the anti-Jesuit!) Van Swieten, a detail which was never to re-emerge in Hell's or Sajnovics' texts. In search for an explanation of Hell's jealous claim to the honour of the discovery, one should look into the local contexts in which the *Demonstratio* was promoted.

While they stayed in Denmark-Norway, Hell and Sajnovics enjoyed the patronage of the mighty Interior Minister, patron of the University of Copenhagen, *praeses* ('president') of the Royal Society of Sciences in Copenhagen and head of the 'missionary collegium' that was

[233] Hell to Pilgram, Vardø 5th April 1769 (quoted after Pinzger 1927, pp. 67-68): "Euer Erhw. müssen einen prophetischen geist gehabt haben, da Sie an Hh. Saj. in Ihrem brieffe geschrieben: *Nigram Pastorellam ... millies saluto*, et *Lapponicas ab eo Eclogas exspecto*: in wahrheit, Sie, und die gantze europäische gelehrte welt haben eine neue entdekung der Lappländischen nation zu erwarten, die gantz Europa mit erstaunen vernehmen wird; ich der ich gleich anfangs von denen Lappländern diese muthmassung gefasset, gab Ihm einige Regeln und criteria, nach welchen er diese untersuchung machen solte, und nun sind wir so im klaren, dass kein mensch daran zweiflen wird. ja ja in wahrheit, er ist in stande Lappländische Eclogen zu machen; ich bin recht vergnügt, dass ich ihme zum Reise gefährten gewählet, der so fertig und in so kurtzer Zeit die Lappländische sprache hat erlehrnen können. ich habe ihme gebetten, auß unserm diario einige merkwürdigkeiten auß zu ziehen und an Euer Ehrw. zu schreiben, die sie mit unsern Wienner-freunden communiciren könen [...]. Machen Sie doch, ich bitte Sie, dass diese entdekung zu ohren des Hh. von Swietten komme; sie würden ihm ein Vergnügen machen, als welcher mich ersuchet, diese untersuchung zu machen; melden Sie Ihm aber nur en general, dass Sie keine amerikaner, sondern wahrhaftig orientaler sind, wie wir die Ehre haben werden, ihm außführlich zu berichten".

responsible for church services in the Sámi regions (the *Collegium de cursu evangelii promovendo*), ***Otto Thott*** (1703–1785). Thott acknowledged Hell's and Sajnovics' status as experts and supported their efforts to promote an understanding of Sámi as what we might coin the 'Ur-Hungarian of the High North'. One significant decision of his was that the official Danish dictionary of the Lappish language, which was just then being published, was to be revised and reissued according to the Hungarian orthography, in keeping with recommendations from the Hungarian visitors. In doing so, Thott overruled protests from Norwegian priests and missionaries who had formed a divergent understanding of the Sámi language and its origins.[234] The 'Royal stamp' that protected Hell and Sajnovics while in Denmark-Norway, also secured them collaboration from virtually every core member of the Royal Society of Copenhagen. This is evident from the concluding chapter of Sajnovics' *Demonstratio,* where numerous savants who had contributed to the studies of Sajnovics by lending him books and offering other sorts of assistance, are singled out and thanked. Not surprisingly, Thott was the dedicatee of both editions of the *Demonstratio*. In December 1770, however, in the aftermath of a coup staged by Christian VII's personal physician Johann Friedrich Struensee (1737-1772), Thott was forced to resign all his offices. Hell and Sajnovics lost their chief patron in Copenhagen and the 'magyarisation' of Danish-Norwegian language politics vis-à-vis the Sámi was discontinued. In the meanwhile, however, the two Jesuits had returned to their homes and the *Demonstratio* had become an issue on the Central-European agenda.

Upon their return to the centres of the intellectual culture of the Hungarian Enlightenment, which included the Habsburg capital Vienna, the Hungarian capital Posonium and the Hungarian university town Tyrnavia, Hell and Sajnovics had to fight for their authority as experts on Hungarian language and history. The second edition of the *Demonstratio,* which was issued in Tyrnavia sometime between February and April 1771,[235] contains several

[234] This story is recounted in detail by Martinussen 1992 (in Norwegian; for a brief English summary of her conclusions see Hovdhaugen *et al.* 2000). See also Aspaas in press (in Finnish) and Sammalahti 1996.
[235] It is often overlooked that the year of printing is missing on the title page of both the first and the second editions of the *Demonstratio*. The Copenhagen edition states: *Regiae Scientiarum Societati Danicae praelecta Hafniae mense Januario Anno MDCCLXX* ('Read before the Royal Danish Society of Sciences in Copenhagen, in the month of January of the year 1770'). The Tyrnavian edition reads: *Regiae Scientiarum Societati Danicae praelecta, et Typis excusa Hafniae Anno MDCCLXX. Recusa Tyrnaviae* ('Read before the Royal Danish Society of Sciences, and printed in Copenhagen in the year 1770. Reprinted in Tyrnavia'). The date of publication is well documented in the case of the first edition: On 4 March, the proofs were still being read, but on 10 April 1770, Sajnovics received a copy fresh from the press (Sajnovics, travel diary, entries 4 March and 10 April 1770 [WUS Vienna]). The second edition is not that easy. Correspondence confirms, however, that it was published later than January 1771, for in a letter to Georgius Pray in Posonium Hell writes: "Pater Sajnovics vix mense Januario

references to Hell as a 'Hungarus'. The first edition refers only to Sajnovics as 'Hungarus'. In the interval between the Copenhagen and the Tyrnavian edition, the work of one Hungarian, Sajnovics, had become the work of two Hungarians, Hell and Sajnovics (in that order).[236] What had happened?

Maximilianus Hell, it will be remembered, was recorded as fluent in Latin, German and "Slavic" – *not* Hungarian – when he entered the Society of Jesus at the age of eighteen. His parents were both German speakers. Nevertheless, in 1756 he is recorded in a Jesuit document as an *Ungarus Schemniczіensis* ('Hungarus from Schemnicium').[237] His status as a 'non Hungarian-speaking Hungarian' was unproblematic, but only up to a point. The early-modern identity of the *Hungarus*, which could legitimately be claimed by any person born and raised in the composite Kingdom of Hungary regardless of his native language, came under increased pressure during the Central-European Enlightenment. By 1770, a competitive, haughty *Magyar* identity was on the rise, nurtured by an influential group of intellectuals. Several of these intellectuals belonged to the so-called "Hungarian Guards" of Maria Theresa. The Hungarian Guards did not simply build their identity on their mastery of the Hungarian language, but even more so on "a prestigious pedigree and social exclusiveness".[238] Fair to say, like Hell and Sajnovics, the Hungarian Guards promoted the Hungarian language, but they were not eager to see their status being challenged by theories of linguistic affinity – and thereby historical kinship – to less noble peoples at the outskirts of, or even beyond, European

Viennam excurrere poterit, neque enim opus ejus mense Januario typis absolvendum arbitror, gaudebo, si vel cum fine februarij me inviserit" = "Father Sajnovics will hardly be able to go to Vienna in the month of January, and I doubt that his work will be ready from the press in this month either: if he can manage to come around the end of February, I shall be happy" (Hell to Pray, dated Vienna 4 January 1771 [EL Budapest]). In a letter dated 10 January 1771, Hell asks the same man to pass on some papers to Tyrnavia "pro opusculo Patris Sajnovics reprimendo" = "for the new edition of Father Sajnovics' work". It is crucial that Pray takes care of this task as soon as possible, he adds, "hujus enim defectu dissertatio Patris Sajnovics nondum inchoari potuit" = "for without this, Father Sajnovics has so far been unable to begin his work" (Hell to Pray, dated Vienna 10 January 1771 [EL Budapest]). From a letter dated 29 March 1771, it emerges that Sajnovics has by then arrived in Vienna, probably to promote the new edition of the *Demonstratio* (Hell to Pray, dated 29 March 1771 [EL Budapest]) By May of the same year, Sajnovics had returned to Tyrnavia and could boast about the favourable reception that his work had received in Vienna (Sajnovics to Joannes Nagy, dated Tyrnavia 12 May 1771 [transcript in Holovics 1972]). See also Gheno 1975 (in Italian) for a good discussion of the internal evidence in the printed text of the Tyrnavian edition.

236 It might also be mentioned that, in an early manuscript draft to the call for subscriptions to the *Expeditio litteraria*, Hell points to Sajnovics as the author of a chapter of the first volume: "the treatise of Father Sajnovics on the identity of the Hungarian and Lappish language". In all printed versions, however, the name of Sajnovics had been erased, and Hell promises only a chapter on "[t]he origin and occasion of this investigation of the Lappish language" (See below, Chapter III.2, *Tomi I. Pars III. Caput I*).

237 Pinzger 1920, p. 30. The document in question is the *Liber votorum domus Professae Viennensis*; a list of Jesuits having sworn the four vows of loyalty, the fourth of which was to the Pope. This solemn ceremony took place in Hell's case in 1756, in that of Sajnovics, in 1766.

238 Kontler 2011, p. 139; repeated in Kontler in press.

civilisation. In this situation, Hell and Sajnovics filled the second edition of the *Demonstratio* with references to several Hungarian-speaking erudites, most of whom were Jesuits, who had read the first edition and embraced its main thesis: that there existed a close kinship between Hungarian and Sámi. What is more, the concluding chapter contains explicit reference to the support of Maria Theresa, and (more vaguely) to "each and every one of the highest men" in the Hungarian capital Posonium.[239] However, by 1770 it was not sufficient to appeal to the patronage of Maria Theresa and her protégés, for the Empress had become increasingly estranged from her Hungarian Guards after a bitter confrontation with the Hungarian Diet in 1764-65. Nevertheless, in the local context of Vienna and Hungary, the discovery of a Hungarian-Lappish relationship, and the speculations concerning the historical heritage of the Hungarian nation that it entailed, was the main 'scientific capital' that the two Jesuits had assembled in the High North. Father Hell was not willing to let all that honour remain with his assistant. Nor was he willing to let his legitimacy as an authoritative investigator of Hungarian history, which he planned to develop further in his grand *Expeditio litteraria*, be challenged on the grounds that he did not master the Hungarian language. This explains why Maximilianus Hell insisted on being ascribed the honour of the Lappish-Hungarian discovery, and to be characterised as a native Hungarian alongside Sajnovics.

A "third edition" of the *Demonstratio* was to be published within the framework of the *Expeditio litteraria* – or to be precise, it was to fill the third part of volume one. The correspondence of Hell from 1771-72, along with several unfinished treatises and notes preserved among his papers at the Vienna University Observatory, bear witness of an acute interest in the 'Hungarian question'.[240] Major sources for the early history of the Magyars were examined by Father Hell in this period, including 'The Deeds of the Hungarians' (*Gesta Hungarorum*) written around the year 1200 by the so-called Anonymus, or Notary of King Bela, and the *De Administrando Imperio* ('On How to Govern the Empire') of Constantinus Porphyrogenitus, a Byzantine Emperor and writer of the tenth century.[241]

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[239] Sajnovics [1771], p. 127: "quemquam ex summis in Republica nostra Viris, […] prout mihi experiri licuit, quando superiore Autumno plerosque Eorum præsens veneratus sum".
[240] See Unprinted Sources 1*c* and 2*c*.
[241] Two chapters of the *Expeditio litteraria* were supposed to be devoted to the *Anonymus* and to Constantinus VII Porphyrogenitus respectively (See Chapter III.2, *Tomi I. Pars III. Caput VI-VII*). On the *Anonymus*, see now the edition of Martyn Rady and László Veszprémy in the outstanding series *Central European Medieval Texts* (Anonymus 2010). On Porphyrogenitus, see the edition by Moravcsik, Jenkins and Dvornik (Constantine VII Porphygenitus 1962-67).

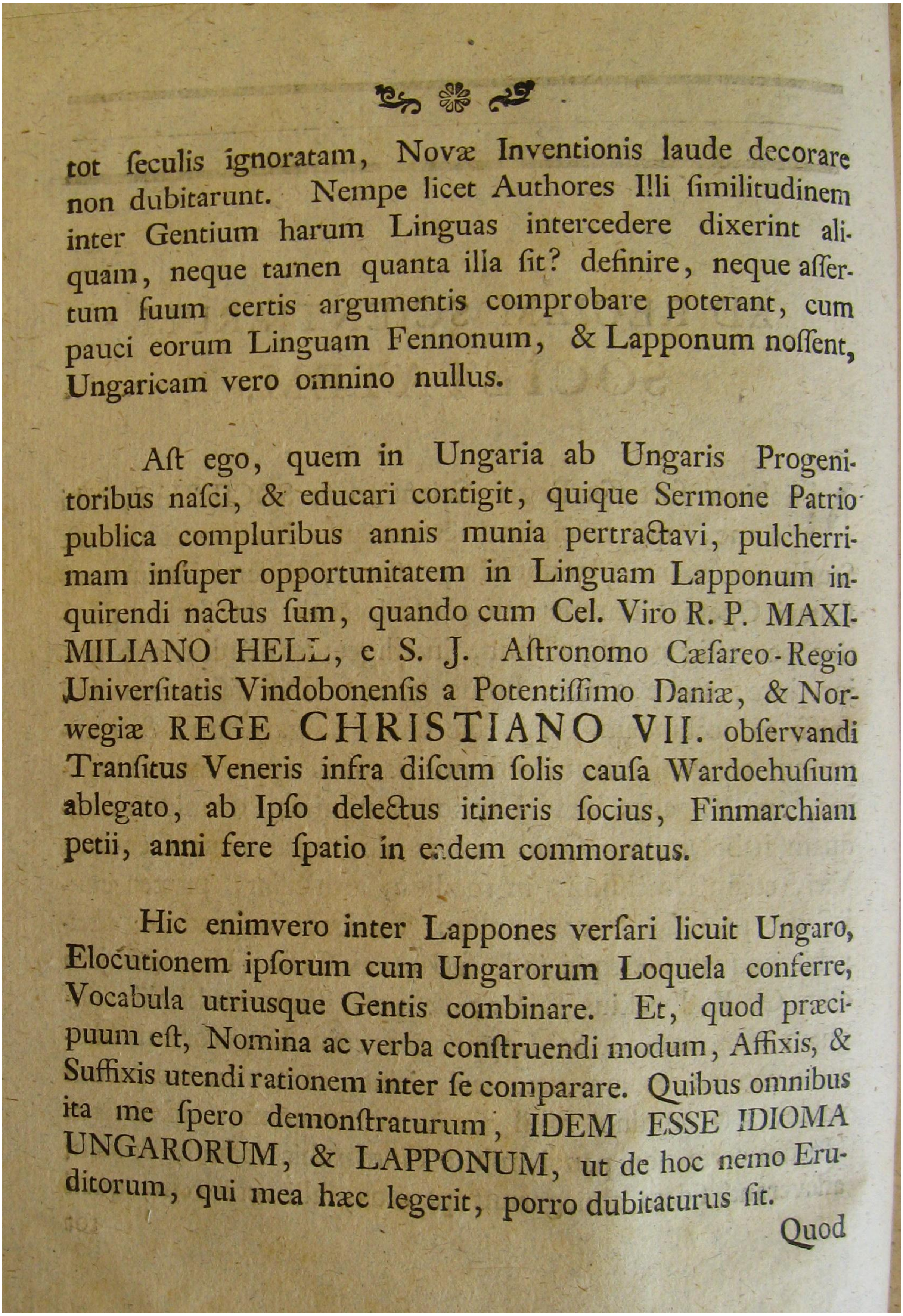
FIGURES 1a, 1b, 1c, 1d MAXIMILIANUS HELL’S INFLUENCE ON THE SECOND EDITION OF SAJNOVICS’ *DEMONSTRATIO*

Fig. 1a

From the introduction to the first edition of Sajnovics’ *Demonstratio* (Sajnovics 1770*a*1, introduction, no page). One notes that there is no mention of Maximilianus Hell’s Hungarian origin in the first paragraph. The second paragraph begins with the words: “Hic enimvero inter Lappones versari licuit *Ungaro* …” (“For on this occasion, it was possible for *a Hungarian* to spend time among the Lapps …” [my emphasis]).

*Digitised by the author.

FIG. 1a



tot ſeculis ignoratam, Novæ Inventionis laude decorare non dubitarunt. Nempe licet Authores Illi ſimilitudinem inter Gentium harum Linguas intercedere dixerint aliquam, neque tamen quanta illa ſit? definire, neque aſſertum ſuum certis argumentis comprobare poterant, cum pauci eorum Linguam Fennonum, & Lapponum noſſent, Ungaricam vero omnino nullus.

Aſt ego, quem in Ungaria ab Ungaris Progenitoribus naſci, & educari contigit, quique Sermone Patrio publica compluribus annis munia pertractavi, pulcherrimam inſuper opportunitatem in Linguam Lapponum inquirendi nactus ſum, quando cum Cel. Viro R. P. MAXIMILIANO HELL, e S. J. Aſtronomo Cæſareo-Regio Univerſitatis Vindobonenſis a Potentiſſimo Daniæ, & Norwegiæ REGE CHRISTIANO VII. obſervandi Tranſitus Veneris infra diſcum ſolis cauſa Wardoehuſium ablegato, ab Ipſo delectus itineris ſocius, Finmarchiam petii, anni fere ſpatio in eadem commoratus.

Hic enimvero inter Lappones verſari licuit Ungaro, Elocutionem ipſorum cum Ungarorum Loquela conferre, Vocabula utriusque Gentis combinare. Et, quod præcipuum eſt, Nomina ac verba conſtruendi modum, Affixis, & Suffixis utendi rationem inter ſe comparare. Quibus omnibus ita me ſpero demonſtraturum, IDEM ESSE IDIOMA UNGARORUM, & LAPPONUM, ut de hoc nemo Eruditorum, qui mea hæc legerit, porro dubitaturus ſit.

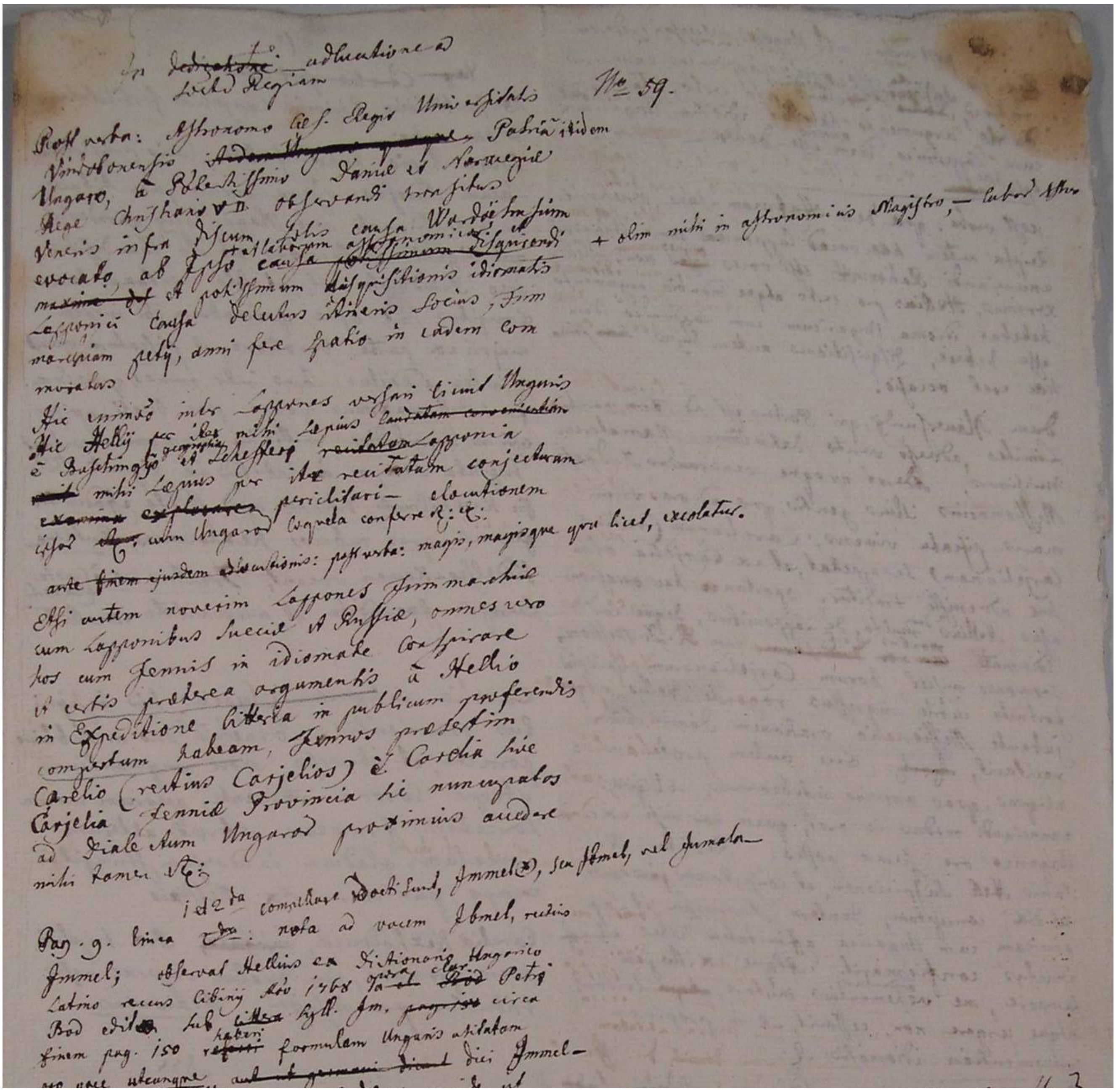
Quod

Fig. 1b

Detail from Hell's manuscript "Jn adlocutione ad Societatem Regiam" (WUS Vienna), a draft for instructions to be sent to Sajnovics in Tyrnavia during the winter 1770/71. Hell's autograph. Translation: "In the preface to the Royal Society [of Copenhagen] // After the words: 'Imperial and Royal Astronomer from the University of Vienna', [add the following:] '*also a Hungarian by nation*, invited to Vardøhus by the redoubtable Majesty King Christian VII of Denmark and Norway in order to observe the transit of Venus in front of the disc of the Sun. Since the same Hell, formerly my teacher in astronomical subjects, had chosen me as his travel companion in order to assist him in his astronomical tasks and in particular the examination of the Lappish language, I set off for Finnmark, where I spent about a year. // For on this occasion, it was possible for *Hungarians* to spend time among the Lapps; on this occasion, it was possible to put to the test Father Hell's conjecture, which he based upon the *Geographia* ["Erdbeschreibung"] of Büsching and the *Lapponia* of Schefferus and which he had frequently mentioned to me during the journey; [on this occasion, it was possible] to test their pronunciation with the language of the Hungarians etc. etc.' […]".

*Digitised by the author.

FIG.1b



In ~~dedicatione~~ adlocutione ad
Sedem Regiam No 59.

Post verba: Astronomo C. R. Regiae Universitatis Vindobonensis ~~[illegible]~~ Patria itidem Ungaro, a Potentissimo Daniae et Norvegiae Rege Christiano VII observandi transitus Veneris infra discum Solis causa Wardoëhusium evocato, ab Ipso [illegible] causa ~~[illegible]~~ designandi + olim mihi in astronomicis Magistro, — [illegible]
~~maxime [illegible]~~ et potissimum disquisitionis idiomatis Lapponici causa delectus itineris Socius, sum [illegible] anni fere spatio in eadem commoratus

Hic enim inter Lappones versari licuit Ungaris [illegible] mihi saepius ~~laudatam [illegible]~~ ~~[illegible]~~ Lapponia [illegible] saepius per [illegible] conjecturam ~~[illegible]~~ ~~[illegible]~~ periclitari — elocutionem ipsos ~~[illegible]~~ cum Ungarorum loquela conferre &c. &c. magis, magisque quo licet, excolatur.

ante ~~finem~~ ejusdem dissertationis: post verba:

Etsi autem novenim Lappones [illegible] omnes vero cum Lapponibus Sueciae et Russiae, omnes vero hos cum Fennis in idiomate conspirare et certis praeterea argumentis a Hellio in Expeditione litteraria in publicum proferendis compertum habeam, Fennos praesertim Carelio (rectius Carjelios) et Carelia sive Carjelia Fenniae Provincia hic nuncupatos ad Dialectum Ungarorum proximius accedere mihi tamen [illegible]

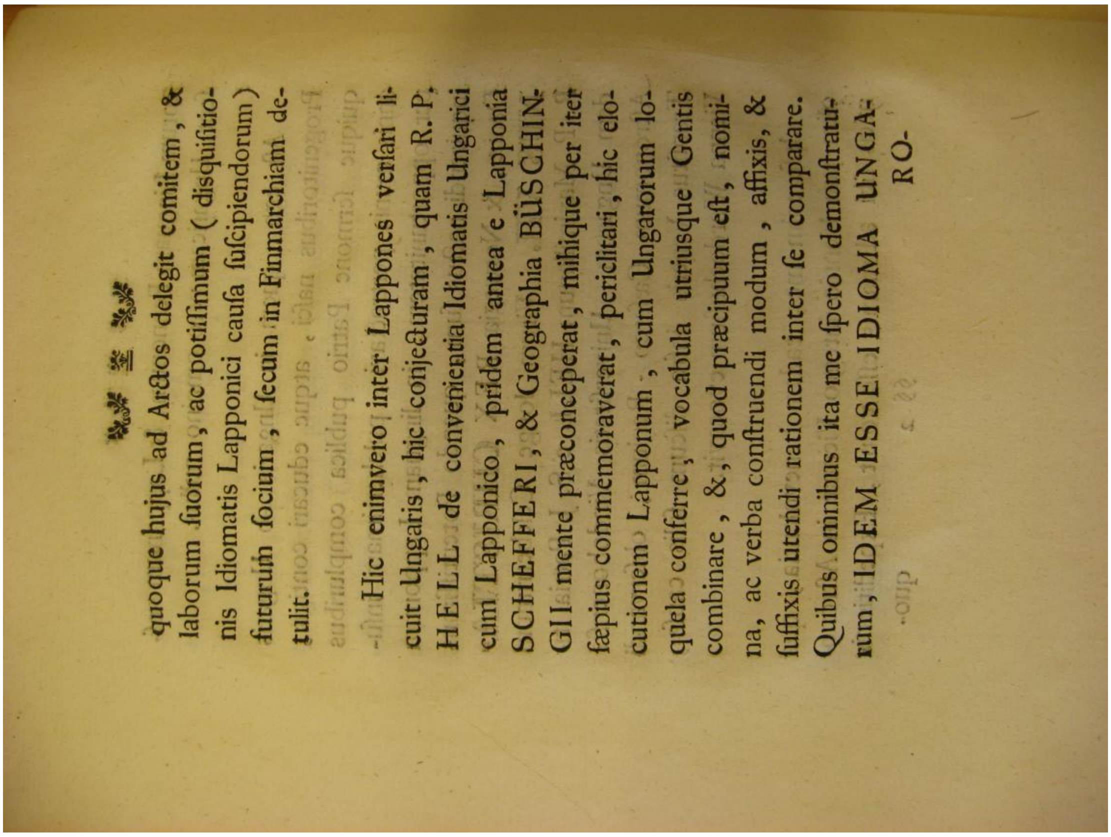
Pag. 9. linea [illegible]: nota ad vocem Ibmel, rectius Immel; observat Hellius ex Dictionario Ungarico Latino recens Cibinii Ao 1768 opera clar. ~~[illegible]~~ Petri Bod edito sub littera Syll. Im. ~~[illegible]~~ circa finem pag. 150 haberi formulam Ungaris [illegible] dici Immel- [illegible]

Fig. 1c and 1d

The corresponding pages from the second edition of Sajnovics' *Demonstratio* (1771, unpaginated introduction). One notes that Hell's instructions in Fig. 1b have been followed closely. Among the most significant alterations is the consistent designation of Hell as a Hungarian. For example, whereas the first edition had "Hic enimvero inter Lappones versari licuit *Ungaro* …" (Fig. 1a), the second edition has "His enimvero inter Lappones versari licuit *Ungaris* ... (Fig. 1d; "For on this occasion, it was possible for *Hungarians* to spend time among the Lapps …" [my emphasis]).

*Digitised by the author.

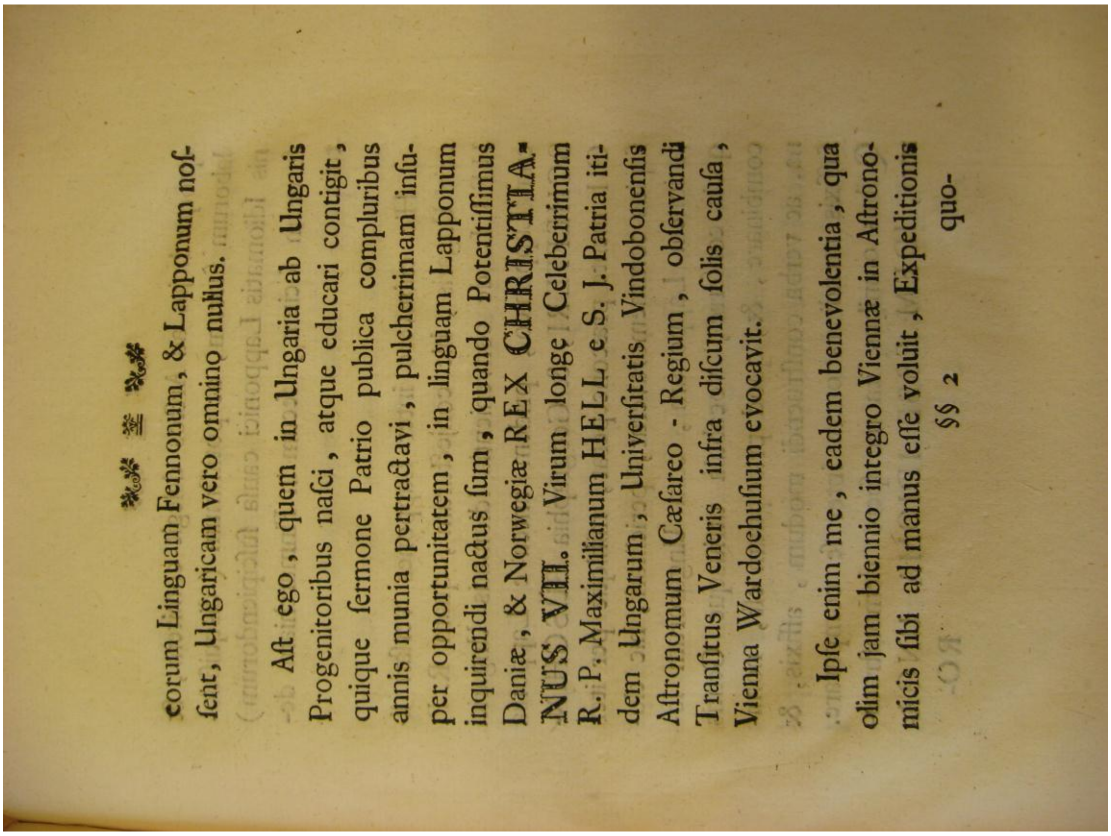
FIG. 1d



quoque hujus ad Arctos delegit comitem , &
laborum suorum , ac potissimum (disquisitio-
nis Idiomatis Lapponici causa suscipiendorum)
futurum socium , secum in Finmarchiam de-
tulit.

Hic enimvero inter Lappones versari li-
cuit Ungaris , hic conjecturam , quam R. P.
HELL de convenientia Idiomatis Ungarici
cum Lapponico , pridem antea e Lapponia
SCHEFFERI , & Geographia BÜSCHIN-
GII mente præconceperat , mihique per iter
sæpius commemoraverat , periclitari , hic elo-
cutionem Lapponum , cum Ungarorum lo-
quela conferre , vocabula utriusque Gentis
combinare , & , quod præcipuum est , nomi-
na, ac verba construendi modum , affixis , &
suffixis utendi rationem inter se comparare.
Quibus omnibus ita me spero demonstratu-
rum , IDEM ESSE IDIOMA UNGA-
RO-

FIG. 1c



corum Linguam Fennonum , & Lapponum nos-
sent , Ungaricam vero omnino nullus.

Ast ego , quem in Ungaria ab Ungaris
Progenitoribus nasci , atque educari contigit ,
quique sermone Patrio publica compluribus
annis munia pertractavi , pulcherrimam insu-
per opportunitatem , in linguam Lapponum
inquirendi nactus sum , quando Potentissimus
Daniæ , & Norwegiæ REX CHRISTIA-
NUS VII. Virum longe Celeberrimum
R. P. Maximilianum HELL e S. J. Patria iti-
dem Ungarum , Universitatis Vindobonensis
Astronomum Cæsareo - Regium , observandi
Transitus Veneris infra discum solis causa ,
Vienna Wardochusium evocavit.

Ipse enim me , eadem benevolentia , qua
olim jam biennio integro Viennæ in Astrono-
micis sibi ad manus esse voluit , Expeditionis
§§ 2 quo-

FIGURES 2a and 2b MAXIMILIANUS HELL’S INFLUENCE ON THE SECOND EDITION OF SAJNOVICS’ *DEMONSTRATIO*, PART II

Fig. 2a

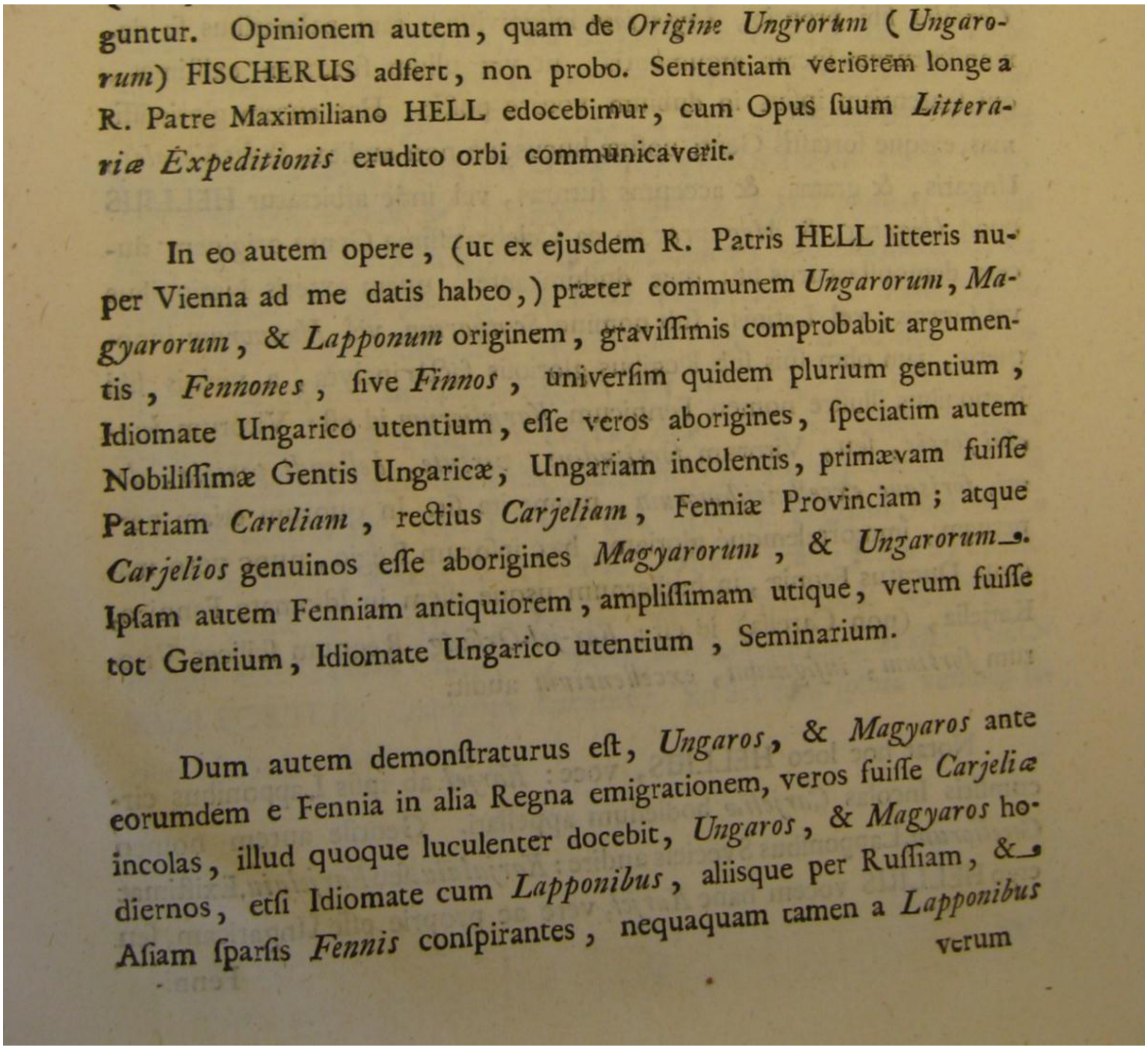
Detail from the second edition of the *Demonstratio* (Sajnovics 1771, p. 119), ostensibly giving a summary of a genuine letter from Hell in Vienna to Sajnovics.

Fig. 2b

Hell’s manuscript beginning with the words “Jn eo autem opere ...”, a draft for instructions to be sent to Sajnovics in Tyrnavia during the winter 1770/71. The first couple of lines translates as “Moreover, in the same work (as I learned from the same letter of Father Hell’s, recently sent to me from Vienna), he will not only demonstrate the common origin of each of the two peoples, that is the Hungarians and the Lapps, he will also, by means of weighty evidence, show that the Fenni, or Finns, are the ancestors of all the various tribes that use the Hungarian language, and especially that the ancient fatherland of that most noble Hungarian tribe, which inhabits Hungary, was Carjelia, and that the Carjelians are the genuine ancestors of the Magyars and Hungarians […]”. Hell’s autograph.

*Digitised by the author.

FIG 2a



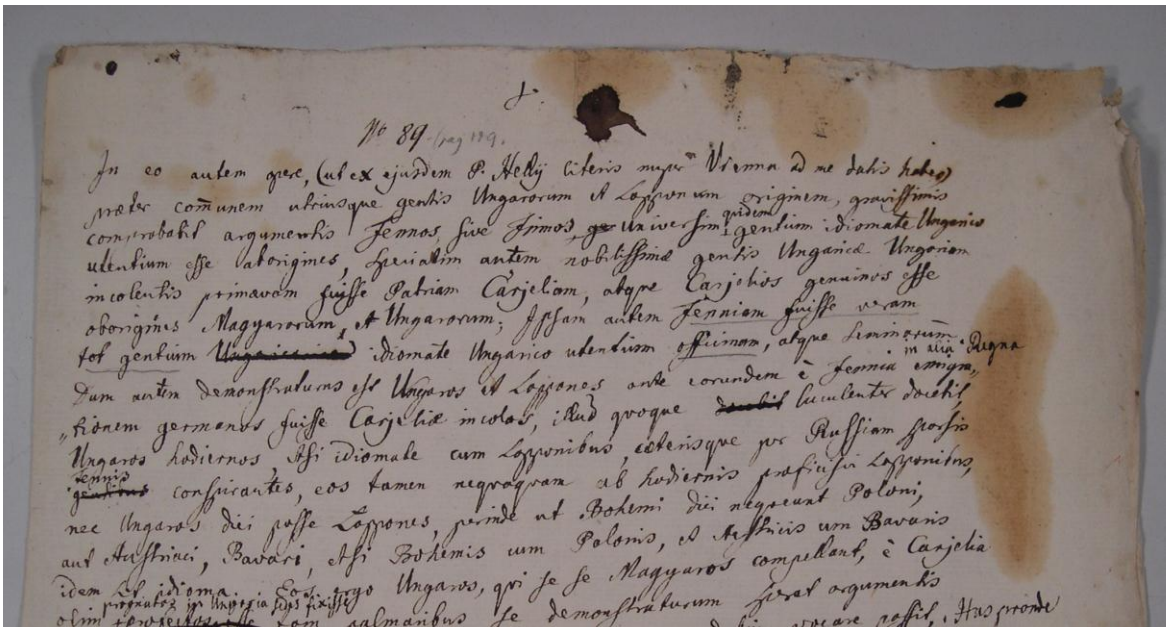
guntur. Opinionem autem, quam de *Origine Ungrorum* (*Ungarorum*) FISCHERUS adfert, non probo. Sententiam veriorem longe a R. Patre Maximiliano HELL edocebimur, cum Opus suum *Litterariæ Expeditionis* erudito orbi communicaverit.

In eo autem opere, (ut ex ejusdem R. Patris HELL litteris nuper Vienna ad me datis habeo,) præter communem *Ungarorum*, *Magyarorum*, & *Lapponum* originem, gravissimis comprobabit argumentis, *Fennones*, sive *Finnos*, universim quidem plurium gentium, Idiomate Ungarico utentium, esse veros aborigines, speciatim autem Nobilissimæ Gentis Ungaricæ, Ungariam incolentis, primævam fuisse Patriam *Careliam*, rectius *Carjeliam*, Fenniæ Provinciam; atque *Carjelios* genuinos esse aborigines *Magyarorum*, & *Ungarorum*. Ipsam autem Fenniam antiquiorem, amplissimam utique, verum fuisse tot Gentium, Idiomate Ungarico utentium, Seminarium.

Dum autem demonstraturus est, *Ungaros*, & *Magyaros* ante eorumdem e Fennia in alia Regna emigrationem, veros fuisse *Carjeliæ* incolas, illud quoque luculenter docebit, *Ungaros*, & *Magyaros* hodiernos, etsi Idiomate cum *Lapponibus*, aliisque per Russiam, & Asiam sparsis *Fennis* conspirantes, nequaquam tamen a *Lapponibus*

verum

FIG. 2b



We return now to the call for subscriptions to the *Expeditio litteraria*. Unlike Sajnovics' work on the Sámi language, the second part of volume one (which was to contain ethnographical descriptions of the Lapps) was never published. The preserved manuscripts are few and insignificant as compared to the texts on Hungarian history and language. However, when investigating the chapter headings of this part of the *Expeditio litteraria*, one suspects that it would have consisted mainly in a summary of an original work by the Norwegian priest and Lappish-language professor Knud Leem (1697-1774). The chapter headings in the bilingual, richly illustrated 'Description of the Lapps of Finnmark' (*Beskrivelse over Finmarkens Lapper / De Lapponibus Finnmarchiae ... Descriptio*, Copenhagen 1767) incidentally match the chapters planned by Hell quite well.[242] A few comments would probably have been added by Hell, based on his Lapland experiences, but one may assume that this part of the *Expeditio litteraria* would have relied mostly on Leem's work.

Most parts of the second volume, the *Tomus Physicus*, were never published. From references in letters and other sources we do know, however, approximately what it would have looked like. It was meant to be divided into the following parts:

> *Volume II. Physicus*
> Part I: On plants, animals, fish, etc. in northern Norway; Part II: On the decrease of the sea level in the far north; Part III: On the luminescence of the sea in the far north ("morild" in Norwegian); Part IV: A new theory of the Aurora Borealis; Part V: Meteorological observations, including investigation of the ebb and flow of the tides, etc. Part VI: Economical remarks.

Neither Hell nor Sajnovics could boast of a background as natural historians. In research relating to part one of this volume, they were aided by a theology student who had been educated by Linnaeus at Uppsala, Jens Finne Borchgrevink (1736-1819). On the part of the journey spent north of Trondheim, Borchgrevink had filled the triple role of a scientific assistant, translator and 'tour guide' to the company.[243] A letter from Hell to the professor of botany in Copenhagen, Georg Christoph Oeder (1728-1791), dated Vardø 6 April 1769, is preserved. Here, Hell promises to collect "algae, mosses and other aquatic plants" for Oeder to make use of for his purposes.[244] Collecting plants of the Danish-Norwegian kingdom was now a priority, in conjunction with the richly illustrated *Flora Danica*, which was being

[242] Compare Leem 1975 (facsimile edition) *versus* Hell's call for subscriptions. For a more elaborate discussion of the Leem-Hell relationship, see Aspaas in press.
[243] See Voje Johansen 2004.
[244] Hell to Oëder, dated Vardø 6 April 1769 (WUS Vienna, draft): "algas fucosque, cæterasque Plantas aquaticas".

edited during these years. What came of Hell's promised contribution to this prestigious project merits a study in its own right.[245] In any case, for this part of the *Expeditio litteraria* Maximilianus Hell is likely to have drawn heavily upon a pioneering work by the bishop and amateur natural historian Erik Pontoppidan (1698-1764), *Norges Naturlige Historie* (two vols., published Copenhagen 1752-53, also in English as 'The Natural History of Norway').[246] This richly illustrated work was also available in a German translation, which Hell had read.[247] Apart from enumerations of species of plants, animals and so on, this volume would contain observations concerning the decrease of the sea level along the northernmost coasts of Norway[248] and an explanation of the luminescence of the sea at night, the so-called *morild*.[249] A new theory on the northern lights was also announced. The first and fundamental part of his very interesting, albeit mistaken *Aurorae Borealis Theoria Nova* ('New Theory on the Aurora Borealis'), was presented as a lecture to the Royal Society of Copenhagen in March 1770 and published in Vienna in 1776. Here, Hell dismisses a possible correlation between the northern lights and magnetism as well as electricity. Instead, the Aurora Borealis was a "purely optical phenomenon". Despite Hell's explicit comparison of his theory with the discoveries of Copernicus, it hardly received unanimous support from the research community.[250]

Finally, as late as 1792, the year in which he died, Father Hell published his meteorological report from Vardøhus, which was also meant to be a part of volume II.[251] Other minor parts of this volume are either lost or were never written.

[245] The incursions into the subject in Aspaas & Voje Johansen 2004*b* and Jørgensen 2007 are mere beginnings.
[246] Pontoppidan 1977 (facsimile of the original, published in Copenhagen 1752-1753). The English edition was first published in 1755 (London: A. Linde).
[247] Pontoppidan 1753-1754.
[248] For this branch of Hell's research, see Kragemo 1960 or Aspaas 2008*c* (supplemented by sources not used by Kragemo).
[249] Hell rightly found that this phenomenon was caused by small shrimps (Hansen & Aspaas 2005, p. 9). He mentions this discovery in several letters. Particularly elaborate are his descriptions in letters to Bishop Gunnerus, founding father of the Society of Sciences in Trondheim, dated Vardø 15 January 1769 and 6 April 1769 (printed in Pinzger 1927, pp. 59-62 & 83-86). Hell promised in these letters to submit an article on his findings to the Proceedings (*Skrifter*) of the Royal Society of Trondheim, edited by Gunnerus, but such a work was never issued.
[250] Hell 1776*b*. On the auroral theories of Hell and other central-European contemporaries, see Réthly & Berkes 1963, pp. 18-27. A paper in English on this branch of Hell's research is available on the internet (Aspaas 2008*e*). In a future work, I hope to investigate the northern lights studies of Maximilianus Hell in more detail.
[251] Hell 1792. This early series of meteorological observations seems to have escaped the notice of historians of meteorology in Norway. In his survey of "Early Meteorological Obervations in Vardø" (in German), Birkeland mentions a brief series of data from 1829-31 as the earliest from Finnmark (Birkeland 1835). Nor does Kragemo mention Hell's meteorological report in his articles on the Vardøhus expedition (Kragemo 1933, 1960, 1968). For a recent account in Hungarian, see Bartha 2004*b*.

The third volume was where Hell and Sajnovics were on more solid ground. Their status as astronomers and 'mathematicians' in the eighteenth-century sense of the word was hardly contested. In brief, the third volume was to consist of the following works:

> *Volume III. Mathematicus, & Astronomicus*
> Part I: The latitude and longitude of Vardø, description of the observatory and instruments used in Vardø during 1768-69, the refraction of the atmosphere in the far north, the observation of the transit of Venus itself, and an accurate determination of the solar parallax; Part II: Geographical latitudes determined *en route* between Copenhagen and Vardø; Part III: Observations Pertaining to the Declination of the Magnetic Needle; Part IV: A new Method to Determine the Figure of the Earth, by means of Barometric Observations

The first printed result of the expedition was the *Observatio Transitus Veneris ... Wardoëhusii ... facta* ('Observation of the Transit of Venus Made in Vardøhus', Copenhagen 1770*a*1). This text not only contains the data sets of the observation of the transit: Hell also gives a brief presentation of the *Expeditio litteraria*, a discussion of the refraction of the atmosphere on such high latitudes, as well as a thorough determination of the latitude and longitude of Vardø (See Chapter II.3). After the first edition in Copenhagen in February 1770, three further Latin editions as well as a Danish translation of the *Observatio* were issued later in the same year.[252] One particular part of the *Observatio*, on how to determine the latitude by means of stars culminating in the same zenith distance, was the subject for a more elaborate account in the *Ephemerides Astronomicae* for the year 1775 (Vienna 1774).[253] As for the "accurate determination of the solar parallax" that was meant to be included in the *Expeditio litteraria*, this instead took the form of two intricate and polemical pamphlets, issued as appendices to the *Ephemerides Astronomicae* for the years 1773 and 1774 (published 1772 and 1773). The contents of these works and their reception will be analysed in subsequent parts of this thesis.

The second part of volume three would consist of contributions to the geography of western Scandinavia. Hell presented a report on his latitude determinations made *en route* between Copenhagen and Vardø at a session of the Copenhagen Society of Sciences in May 1770. It was translated into Danish and printed in the proceedings (*Skrifter*) of the Copenhagen

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[252] See Table 5 in Chapter II.3.
[253] Hell, "Methodus astronomica Sine usu Quadrantis, vel Sectoris, aut alterius cujusvis instrumenti, in gradus Circuli divisi, item sine notitia refractionis, ope solius tubi instructi micrometro filari, singula secunda indicante, et in apto ad hunc usum fulcro mobili applicati, elevationem Poli cujusvis loci, in continente siti, accuratissimam definire" 1774. This has been described as the Horrebow-Talcott method.

Society of Sciences in the same year.[254] Not until 1790 was an (enlarged) edition of the Latin original issued in Vienna, as a supplement to the *Ephemerides Astronomicae* for the year 1791. Maps were also made, among them a frequently reprinted map of the island Vardø, and maps on "Norway, Nordland and Finnmark". The latter three should in modern terms represent southern Norway, present-day Nordland and Troms counties and Finnmark county. According to Hell, he sent test-prints of these maps to the Copenhagen Society of Sciences around 1778, but these have yet to be found.[255]

The third part of the third volume, on the declination of the magnetic needle, has survived in manuscript. However, the observations were not published until 236 years after they had been made, in a report by Truls Lynne Hansen and the author of this thesis.[256] The fourth part is not extant, either in manuscript or in any printed version, but can be reconstructed through Hell's correspondence and other sources. By means of barometrical observations, Hell argued, it should be possible to determine the curvature of the Earth's surface far more accurately than Maupertuis had done some decades earlier.[257] Fortunately for Hell, he never published this part, for this marvellous idea was surely a dead end.

To sum up, Maximilianus Hell had planned to make a grand work on the High North of Europe. In retrospect, one may characterise his work as one of the gloriously announced but never accomplished masterpieces of the history of science. Moreover, what was conceived on Danish-Norwegian soil as a work focusing on the High North, soon had its emphasis

[254] Hell "Nogle Steders Geographiske Breder i Finmarken, Nordlandene, Norge og Sverrige bestemmede ved astronomiske Observationer" 1770*b*. The Latin original is today preserved at the National Library in Oslo.
[255] Hell 1790, p. 310: "Hæ chartæ, Æri insculptæ, jam ante Annos duodecim Illustrissimæ Societati Scientiarum Hafniensi transmissæ sunt" = "These maps, engraved on copper, were sent to the highly illustrious Society of Sciences in Copenhagen already twelve years ago". These maps were for a time in the hands of the prominent Norwegian historian Gerhard Schøning (1722-1780), who has left a brief report on the names of places they included. It is not known whether these maps exist today (cf. Kristian Nissen's manuscript "Pater Hells Norgeskarter fra tiden omkring 1770", intended as a chapter in the unpublished *Bidrag til Norges karthistorie, III* [Nasjonalbiblioteket, Oslo. MS 4o. 3051:c7]).
[256] Hansen & Aspaas 2005. Lajos Bartha published a study based on part of these manuscripts in 2004 (Bartha 2004*a*), cf. Aspaas & Hansen 2007, endnote 1.
[257] A particularly valuable source, which I have never seen quoted in this context, is Christianus Mayer SJ's lengthy treatise *Ad Augustissimam Russiarum omnium Catharinam II. Alexiewnam Imperatricem Expositio de transitu Veneris …*1769*b*. On pages 304-323 Mayer elaborates on the potentials of using barometric observations from various places as a means to settle several questions, among them the figure of the Earth: "for this reason, Honourable Father Hell, that famous astronomer of Vienna, has distributed more than twenty diligently calibrated barometers, which he had brought with him from Vienna, to curious and able observers at various places along his journey, so that he thereafter, upon his return from Vardøhus may receive their observations" = "qua de causa R. P. HELL, Cel. Ille *Viennensis* Astronomus 20, et plura, quae secum *Vienna* attulerat, barometra optime rectificata per iter diversis in locis Obseruatoribus curiosis et gnaris distribuit, vt dein eorum obseruationes post suum *Wardhusio* reditum reciperet" (Mayer 1769*b*, p. 317).

‘relocated’ to Central Europe. In this process, glory turned to infamy, as we shall have occasion to witness in coming sections of this thesis. However, if Hell and Sajnovics had lingered on Danish-Norwegian soil for another year, their working climate would surely have become complicated there as well. Their main patron in Copenhagen, Otto Thott was among the victims of Struensee’s coup in the autumn of 1770 and he never regained the influence on Danish-Norwegian politics that he enjoyed for as long as Hell’s visit on Danish-Norwegian soil lasted. The same happened to another supporter of the two Jesuits, the foreign minister Bernstorff.[258] However, how Hell and Sajnovics might have manoeuvred in the new political landscape of the Danish capital is a piece of contrafactual historiography that I resist the temptation to venture into.

I.2.4 THE EX-JESUIT, 1773-1792

The fourth phase in the life of our main protagonist, from July 1773 to April 1792, is marked by the suppression of the Society of Jesus that had fostered him, and by steps taken by the Viennese rulers towards religious tolerance, freedom of press and ‘Germanisation’ in the period known as the Josephine Enlightenment, or the era of “Josephismus”. Each of these developments caused great distress to the ex-Jesuit Hell. On the other hand, Hell retained his position as court astronomer until his death and never ceased to issue his *Ephemerides*. In this sense, he remained a loyal servant of the Viennese court. However, although the Society of Jesus as such had ceased to exist and his superiors had turned their backs on the Counter-Reformation, Hell remained a faithful champion of nearly all the Jesuit order stood for. For example, he favoured Latin as opposed to the German language, and strongly disliked the educational reforms that were implemented by his rulers. On the positive side, as Imperial Astronomer he was given the task of drawing up a plan for a Viennese Academy of Sciences soon after the Society of Jesus was abolished.

By far the most important turning point in Maximilianus Hell’s life occurred in the year 1773. Prior to that year, the court astronomer had been able to publish works of science in which he took a clear counter-reforming stance. He did so as a Jesuit and the representative of a state whose Empress supported a distinctly pro-Catholic policy. Moreover, he was able to cultivate an identity as a *Hungarus* by supporting the study of Magyar history and language; even that

[258] It seems Struensee’s coup even brought an end to Danish participation in projects involving international scientific collaboration, cf. Sortkær 2008, pp. 21-23.

in keeping with the pro-Hungarian 'PR profile' of Maria Theresa. His loyalties lay with the Empress, with the Catholic church, with the Kingdom of Hungary – and with the Latin language. For the first eighteen years of his service as Imperial and Royal Astronomer, there seemingly existed no serious conflict between these loyalties. But with the fall of the Society of Jesus, the Imperial and Royal Astronomer of Vienna became a servant of the state only. The Pope no longer supported the Jesuits as a bulwark against heresy; it was in fact he who had ordered the Society to cease to exist. What is more, the court in Vienna increasingly sought to ameliorate the conditions of the Protestants and other religious minorities, thereby distancing itself from the counter-reforming cause. In university life, a new era was in the making. In 1778, Lutherans were formally allowed to enrol at the Vienna University, and in 1782 even Jews were admitted, if only to the faculties of Medicine and Law. Prominent professors of theology, such as Ignatius Wurz SJ (1731-1784) and Nicolaus Muszka SJ (1713-1783) were sacked and had to serve in pastoral care instead.[259] German was introduced as a language of teaching and textbooks were produced in that language even at university level, alongside Latin at first, but soon exclusively.

Since the year 1773, now an ex-Jesuit in the service of an increasingly tolerant court, Maximilianus Hell could either choose to 'go with the flow' and make the most out of the new cultural-political climate, or try to remain in contact with a network of loyal ex-Jesuits and other conservative forces. I will try to demonstrate in this section that he did a bit of both. First, however, a few remarks on the general intellectual development that led to the abolition of the Jesuit order are necessary.

The suppression of the Jesuit order is linked with the ideas of the Enlightenment. In its most radical form, Enlightenment philosophy preached division between state and church, consistent neutrality in confessional matters and freedom of press. Anticlericalism was ubiquitous among the radical *philosophes* from the start. The Society of Jesus was particularly open to attack, given its widespread influence in teaching and its support of a tight bond between state and church. However, decapitation of monarchs and their supporters in the name of *liberté, fraternité et égalité* is a later development: up until 1789 it was still possible to claim that Enlightenment ideals lent themselves to be combined with the very epitome of the *Ancien Régime*, a Supreme Ruler. Enlightened despotism, as this ideology is often called,

[259] Kröll 1971, pp. 567-568.

was precisely the form of state governance that was advocated by the co-ruler Joseph II from the mid-1760s onwards. In its Central-European form, Enlightened despotism was therefore very much underway long before Joseph II took over the throne upon the death of his mother in November 1780. According to most historians, the reforms following Joseph's accession should not be interpreted as a radical break with the policies of his mother. Rather, they were the culmination of an on-going development. For the next nine years however, until his own death in February 1790, the sole ruler of the Habsburg lands was to put into place a multitude of reforms, among them a highly controversial "German language edict" imposing a common official language in the Kingdom of Hungary. So marked was the imprint of this Enlightened ruler on the 1780s as a whole that this decade is frequently referred to in Central-European historiography simply as the era of "Joseph(in)ismus" (Josephism, or Josephinism).[260] The brief rule of Joseph's younger brother Leopold II (1747-1792, ruler from February 1790 to March 1792) brought an end to Josephism and eased the strains that had arisen between reformists and their opponents. Among Leopold's moderate steps was annulment of the German language edict.[261] The periodisation used in this essay, however, is motivated by Hell's biography rather than by the succession of Emperors.

The suppression of the Society of Jesus in Austria was by no means a sudden disaster. In 1759 and 1767 respectively, Portugal and Spain had banned the order from the Iberian Peninsula as well as all their colonies.[262] In 1762, France had started a similar process, culminating in 1764.[263] The Jesuits were also expelled from the Kingdom of Naples and the Dutchy of Parma in the winter of 1767/68. As has been pointed out by Winfried Müller and other historians, ever since the late 1740s various measures – some symbolical, some more solid – had been taken by Viennese authorities to stifle Jesuit dominance in university life, censorship and at court. In January 1768 even the mighty state chancellor Kaunitz is known to have expressed his support to the idea that the Society of Jesus be abolished. Moreover, the anti-Jesuit bias of another influential political player, Maria Theresa's personal physician Gerhard Van Swieten, has already been mentioned.[264]

[260] For good accounts of the Enlightenment in the Austrian lands in English, see Balázs 1997 or Evans 2006.
[261] See for example Király 1969.
[262] See for example Aldea 1970; Schneider 1970.
[263] See for example Schneider 1970; Cognet 1970, p. 442.
[264] Müller 1993, pp. 238-240; see also Kröll 1973, especially p. 550.

In Hell's letters written during his expedition in Denmark-Norway – to the General of the Jesuit Order in Rome, to Bishop Gondola in northern Germany and to Jesuit friends in Vienna – gossip concerning an imminent suppression of the Society is a recurring theme.[265] Hell is doing what he can, he assures his correspondents, to make a good impression of the Society of Jesus in Denmark-Norway. And when rumours tell that the young King Christian of Denmark and Norway during his 'grand tour' (1768/69) will perhaps visit Rome in addition to London and Paris, Hell is full of hope that this will bring good news concerning future politics towards Catholics (and Jesuits) in the lands ruled by the Copenhagen court. As late as 5 April 1773, Hell in a letter to Father Weiss in Tyrnavia ensures his confrère that[266]

> [t]hings are going quite well with our Society, we are expecting more hilarious news from Rome any day soon. One thing is certain: a declaration that is most favourable towards the Society has long since been sent from our court to Rome, not directly to the Pope, as a false rumour has it, but to the kind of men from whom the Pope is likely to be told about it, and by now he has been told. They say they have learnt from a French letter something I think is highly likely to be true, namely that an instruction has been sent from the King of the French to his ambassador in Rome Cardinal de Bernis that he shall from now on refrain from all negative actions against the Society vis-à-vis the Pope; […] after a week or two we will learn from official news exactly what impression the declaration of our court has made in Rome.

Fifteen weeks later, Pope Clement XIV issued the infamous *Dominus ac Redemptor noster* that brought an end to the Society of Jesus in all Catholic countries. A draft of this papal bull had in fact been ready since December in the preceding year. Empress Maria Theresa, known as a supporter of the Jesuits but too devout a Catholic to combat the jurisdiction of the Church, could do nothing but consent to the orders of the Roman Pontiff. On 10 September 1773, the suppression of the Society of Jesus in the entire Habsburg Empire was officially announced and all its estates taken over by the state.

It should be stressed that the suppression of the Jesuit order in the Habsburg lands was not as devastating to individual Jesuits as it had been in the realms of the House of Bourbon in the

[265] See the letters edited by Pinzger 1927.
[266] Hell to Weiss in Tyrnavia, dated Vienna 6 April 1773: "Res nostræ Societatis optimè procedunt, Romà indies lætitiora præstolamur, illud certum, Declarationem nostræ Aulæ societati faventissimam, jam dudum esse perscriptam Romam, non ad Pontificem directè, ut falso rumore sparsum est, sed ad eos, à quibus Pontifex hanc audire debet, et hucusque jam audivit. Narrant ex litteris gallicis haberi, id [*scripsi;* ei *MS*] quod mihi valde credibile est, à Rege Galliarum ad Suum Legatum Romæ Cardinalem de Bernis missum mandatum, ne ipse porro quidquam contra Societatem ageret apud Pontificem; […] post unam, alteramve hebdomadam ex publicis novis audiemus, quamnam impressionem fecerit Romæ Declaratio Aulæ nostræ."

1750s and 60s. Whereas in western Europe large numbers of Jesuits had been either imprisoned or expatriated and deported to the Papal States, in Austria and its hereditary lands the former Jesuits were allowed to stay. As "Weltpriester" (*presbyteri saeculares*, 'secular priests') they were given pensions from the state. In Latin texts from this period, an ex-Jesuit like Hell would no longer be referred to as a *Pater Reverend(issim)us* ('[Most] Honourable Father'), but usually as a *Dominus Reverend(issim)us* ('[Most] Honourable Mister'). In the field of learning, although former Jesuit professors of theology and philosophy proper were in most cases replaced, quite a few professors in other branches of science found themselves in a position where they could continue their careers; some even ended up as bishops or senior officials in the state bureaucracy.[267]

It is sometimes forgotten that the Society of Jesus was never completely extinct. The order managed to survive in certain parts where the *Dominus ac Redemptor noster* had little or no effect. In North American Maryland and Pennsylvania, the just over twenty Jesuit missionaries of 1773 signed their obedience to the Papal bull. This was almost a mere formality, however, for at the same time, they retained their posts and kept the former Jesuit properties, now as private individuals.[268] Closer to Hell's Austria, in the Prussia of Frederick the Great, all former Jesuit gymnasia as well as the Jesuit University in *Vratislavia*[269] were taken over by the state. On the other hand, the former Jesuit staff was allowed to continue, meaning that the education system remained effectively unchanged, to the dismay of Voltaire amongst others. However, despite being protected by a tolerant ruler because of their skills as teachers, the Jesuits of Prussian Silesia were secularised in 1776 and those of Varmia (now northeastern Poland) in 1780.[270] By contrast, in the parts of the old Polish Assistancy of the Society of Jesus that Catherine the Great possessed since the partition of Poland in 1772, the couple hundred Jesuits who were around were never secularised. Instead, they reorganised themselves around a new General 'in diaspora'. Catherine II protected them for the same

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[267] The doctoral thesis of Hermann Haberzettl 1973 (defended at the University of Vienna in 1970) appears to be the most comprehensive survey available on the history of Austrian ex-Jesuits. See also Müller 1993 and Robertson 2009, with references.

[268] Schlafly 2006, p. 774.

[269] Vratislavia or Wratislavia (L) = Breslau (G), Boroszló (H), Vratislav (Czech), Wrocław (Polish).

[270] The attitude of Frederic II of Prussia towards the Jesuits displays a marked difference between norm and practise. As an anti-Macchiavellian Enlightenment philosopher and a friend and long-term correspondent of leading representatives of the French Enlightenment, he shared the opinions of his time against the Jesuits and was especially suspicious of their subversive political and economic power. On the other hand, he attended theatrical and musical performances of Jesuits in Silesia and respected the Jesuit system of education. In 1772 he was even asked to be the protector of the Society of Jesus. Even though he rejected this role, Jesuits were allowed to stay and teach in the Prussian as well as former Polish parts of his realm after the Society was suppressed in 1773. See the balanced study of Hoffmann 1969; cf. e.g. Van Horn Melton 1988, pp. 171-199.

reason as her Prussian counterpart, seeing that they were essential to the school system in areas now known as eastern Belarus and Latvia. Here, Jesuit centres were found in the form of four collegia, in Polack, Viciebsk, Orsha and Daugavpils, and two principal residences, in Mstislav and Mogilev.[271] In the first half of the 1780s, a novitiate as well as a tertianship (house for the third year of probation) were set in function in Polack, meaning that a complete program of Jesuit formation was in place. This new situation elicited a certain degree of immigration of former Jesuits from European states where the Society was still suppressed.[272] But even for those who stayed in Central and Western Europe, the survival of the Society in the East was of symbolic importance. Thus, if the Society of Jesus could no longer support the former Jesuits of the Austrian Province, some devout ex-Jesuits – Hell among them – looked to Prussia and especially Russia for comfort. At the same time, new career opportunities for ex-Jesuits also opened in eastern parts of the Habsburg lands, as a result of reforms of the education system and foundation of new institutions for higher education in Hungary, Galicia and Silesia during the 1770s and 1780s. That said, few of those who dreamed of a universal restitution of the Jesuit order lived to see their dream come true. Not until August 1814 arrived the Papal bull *Sollicitudo omnium Ecclesiarum*, which restored the Society of Jesus in all Catholic lands.

In a subsection called “Parallel Lives, Part II” we shall have the occasion to look at the career paths of some selected ex-Jesuit astronomers from the Austrian Province. In the meanwhile, the rest of this section will be devoted to a sketch of Hell’s activities in the 1770s and 1780s.

As of 1773, Hell was at the height of his fame in the Republic of Letters. His chief ‘scientific capital’ had been assembled during his expedition in Scandinavia. The Viennese court astronomer had delivered substantial contributions to the on-going efforts to calculate the scale of the solar system, and had even been elected a member of prestigious scientific bodies in Copenhagen, Trondheim, Stockholm – and above all Göttingen. Apart from that, he was also a full member of the *Accademia delle Scienze* in Bologna and a corresponding member of

[271] *Polack* (Belarusian) = Polacia or Polocia (Latin), Polock (French), Polotsk (Russian). *Viciebsk* (B) = Vitebscum (L), Witebsk (F), Vitebsk (R). *Orsha* or Borsha (B) = ? (L), Orsza (F), Orsha (R). *Daugavpils* (Latvian) = Duneburgum (L), Dunebourg (F), Dünaburg (German), Dźvinsk (B), Dvinsk (R), Daugpilis (Lithuanian). *Mogilev* (B) = ? (L), Mogilew (R), Mohylów (F), and multiple other tranliterations. *Mstislav* (B) = ? (L), Mstislaw (R), Mśtislaw (F), Mścisław (P), etc.
[272] This account is based chiefly on Beauvois 1976; Schafly 2006; and Ludwik Grzebień, “II. Provincia de la Rusia Blanca (1773-1820)” in the entry on “Rusia” in O’Neill & Domínguez (eds, 2001). I have not had access to the comprehensive study of Marek Inglot, *La Compagnia di Gesù nell’Imperio Russo (1772-1820) e la sua parte nella restaurazione generale della Compagnia*, Rome: Editrice Pontifica Università Gregoriana 1997.

the main scientific academy in the Catholic world, the *Académie Royale des Sciences* in Paris. But he was not only an astronomer of international fame, he was also an encyclopædist in the sense that his research interests encompassed historical research, language studies, geophysics, meteorology, magnetism, electricity and so forth. Viewed from an internal-scientific angle, then, it is not surprising that when the Viennese court decided to form an Imperial Academy of Sciences, the ex-Jesuit Maximilianus Hell was entrusted with the task of drawing up a plan of this academy.

Decision to review the possibility of establishing an Academy of Sciences in Vienna was taken in January 1774. The suppression of the Society of Jesus was probably what triggered this decision: scientific life in Austria would have to be reorganised anyway. In the spring of 1774 Maximilianus Hell, along with a recently appointed professor of universal and literary history at the Vienna University, Ignaz Mathes Von Hess (1746-1776) were given orders to draw up their plans for such an academy. Von Hess opted for an academy consisting of two branches, a "physikalisch-mathematische Classe" and a "historisch-philosophische Classe". The academy, Hess argued, ought to be financed either by issuing calendars, or by imposing a nation-wide tax on the book trade.[273] Hell's proposal was more modest in scientific terms, but seemingly more detailed with regard to financial planning. The ex-Jesuit argued that the Viennese academy, like its older sisters in London and Paris, ought to focus on "physikalisch-mathematische" disciplines only.[274] Proposed salaried members were, besides Hell himself, the ex-Jesuits Carolus Scherffer and Paulus Makó de Kéreg-Gede (1723-1793) from the *Theresianum* as well as three non-Jesuits, among them the prominent chemist and botanist Nicolaus Josephus Jacquin (1727-1819). According to Hell's plan, income for the Academy was to be secured from three sources. First, the Academy was to be granted a certain amount of money from a special fund that had been created as the Jesuit estates were confiscated; second, an ambitious reform of the calendar system was to be implemented and the resulting income be earmarked for the Academy; and third, a certain percentage of the income from the semi-official newspaper *Wiener Diarium* was to be bestowed upon the same institution. Additional money was promised by the Kingdom of Hungary, on condition that one third of the members of the Academy were to be Hungarians and half of that part Protestants. The first and the third source at first seemed rather unproblematic, whereas the Hungarian proposal

[273] The present account, unless otherwise indicated, is based primarily upon Joseph Feil 1861, supplemented by Haberzettl 1973, pp. 182-185; Steinmayr 2010*e*, pp. 267-270 and relevant parts of Hell's correspondence.
[274] To be more precise, the Viennese academy of Hell's proposal was intended to cover "astronomy, geometry, mechanics, physics, botany, anatomy and chemistry" (according to Haberzettl 1973, p. 184).

was in any case insufficient to finance the entire Academy. It was the second and probably most substantial source of income, the calendars, that in the end toppled the entire project.

Throughout the early modern period, calendars (almanacs) were 'big business'. You needed a *privilegium* to be allowed to publish them. In Vienna, these privilegia were bought from the state and issued at ten-year intervals. But from now on, the court astronomer proposed, no new privilegia should be issued without the consent of the Calendar Commision, whose director was to remain none other than Maximilianus Hell. Better control with the contents of the calendars was to be one positive outcome of this arrangement – considerable income for the Academy, another. This deal would not be unique in eighteenth-century Europe. In Sweden, Hell's colleagues had secured income for the Academy of Sciences in Stockholm in exactly the same manner.[275] However, given the large sums involved in the trade of calendars, Hell was soon up against mighty forces. The publisher of the *Ephemerides Astronomicae* of Hell, Joannes Thomas de Trattner (1719-1798), was also the publisher of several other calendars throughout the Habsburg lands. Arguably, he was the most successful book dealer in this period of Austrian history.[276] His intervention in Hell's academy plans is described in various sources. In a letter to Weiss in Tyrnavia, dated Vienna 27 January 1775, Hell apologises that the *Ephemerides* for that year had been delayed. The cause for the delay, however, was not his responsibility:[277]

> The Ephemerides, which were finished at the end of the year, I have not yet been able to acquire from Trattner despite repeated requests. I suspect that he has deliberately chosen to cause me this bother because he has learnt of the Imperial decree, by which all the calendars that used to be printed throughout the hereditary lands have now been earmarked to finance the Academy of Sciences that is to be established here in Vienna. In this way, he has been bereaved of an income of thousands of florints. As soon as I receive these Ephemerides, I will send a copy to my Highly Honourable Mister Colleague [i.e., Weiss] in Tyrnavia.

[275] Lindroth 1967, vol. I:1, pp. 102-110.
[276] See for example Frank & Frimmel 2008, pp. 198-200.
[277] Hell to Weiss in Tyrnavia, dated Vienna 27 January 1775 (Vargha priv.): "Ephemerides, quæ in fine anni paratæ erant, ipse à Trattnero ad iteratas petitiones nondum obtinere potui; suspicor hanc mihi molestiam creare velle, cum intellexerit Decreto Cæsareo calendaria per omnes Ditiones hæreditarias imprimi solita, Academiæ scientiarum hic Viennæ erigendæ pro fundo assignata esse, atque hac de Causa aliquot millium florenorum proventum, sibi ademptum esse; ut primum autem Ephemerides has obtinuero, Exemplar pro more Adm. R. D. Collegæ Tyrnaviam mittam."

Unfortunately for Hell, Trattner did not limit himself to cause this sort of bother. Referring to the "poor book dealers", Maria Theresa on 25 November 1775 signed the following statement in her own hand:[278]

> I couldn't possibly decide to set up an *accademie des scienses* [*sic*] with three ex-Jesuits and one professor of chemistry, however worthy; we should be a laughing-stock in the world […]. I find the Abbé Hell not strong enough; an *accademie* that is worse than the already existing ones would be worth neither the costs nor the effort.

The story did not end there. In April 1776, after more than two years of lobbying, Hell received the final blow: there was to be no Austrian Academy of Sciences. The Empress renewed the privilegia of the principal book dealers, among them the highly prosperous Trattner. Hell was at the same time allowed to publish his own calendars. Already in 1774 he had issued his first German-language almanac: soon he produced an almanac for the knightly order, a "Physikalischer Almanach", a chronological almanac, an almanac for children and an almanac with riddles.[279] Sales were slow, however, and faced up with the competition of the likes of Trattner he had no chance of acquiring the income needed to facilitate an Academy.

In his pioneering study of the failure to establish a Viennese Academy of Sciences during the realm of Maria Theresa, Joseph Feil explains that it was Trattner who, during an audience, had moved the Empress to reject the idea of an Academy. Trattner claimed that bankruptcy threatened not only himself and his business, but even all his creditors, in case the calendar privilegia were not renewed. In short, he "wailed and cried" and managed to persuade the Empress to "sacrifice to this man the promising prospect of an Academy and the benefits for the common good that were likely to result thereof".[280] This story is confirmed by a Danish theology student who visited Vienna a couple of years later, Andreas Christian Hviid (1749-1788).

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[278] The original according to Feil 1861, p. 382: "ohnmöglich kunte mich resolvirn eine accademie des scienses anzufangen mit 3 exjesuiten und ein zwar wackerm professor der chemie wir wurden lächerlich in der welt […]. abbée hell finde nicht stark genug was schlechters als andere schonn existirende accademieen lohnte weder deren kosten noch mühe". The first part of the translation is quoted from Evans 2006, p. 50, the second part is by the author of this thesis.

[279] Sommervogel 1893, p. 256, quoting "Berisch, p. 96-98". Probably *Die Wiener Autoren: Ein Beitrag zum gelehrten Deutschland*, by Heinrich Wolfgang Behrisch, Preßburg: Löwe, 1784, 272 pp. I have not had access to that work, nor to any of the popular almanacs in question.

[280] Feil 1861, p. 383: "Er [i.e., Trattner] drang vor die Kaiserin, gab seinen und seiner Gläubiger Ruin vor, wenn er seinen Kalenderverlag verlöre […], lärmte und flehte: und die Kaiserin […] liess sich gewinnen und opferte diesem Manne die glücklichen Aussichten einer Akademie und das daraus zu fliessende Beste auf".

Hviid visited Vienna from 27 October 1778 to 20 January 1779, with the aim of transcribing ancient manuscripts. His travel diary, which he later edited for publishing, is crammed with detailed information not only on archives and libraries, but also on the intellectual élite of the Habsburg capital. Hviid met Father Hell on several occasions, both in the home of the highly sociable Papal *nuntius* (or nuncio, 'ambassador') Guiseppe Garampi (1725-1792) and in the public observatory itself. Despite their diverging views on religion and politics – Hviid was a Protestant and highly supportive of Enlightenment ideas – Hviid describes Hell in positive terms. Hviid was allowed to look through Hell's works in progress on the *Expeditio litteraria* and heard him praise Danish science. An entry in the diary also includes a rumour on the failed efforts to establish an Academy of Sciences in Vienna:[281]

> Professor…..tells me that Hell a few years ago was given orders to draw up a plan for the establishment of an Academy of Sciences in Vienna. In it, physics, astronomy and mathematics were to be included, just like in the English and French academies. He did draw up this plan, and suggested for the funds of the Society [i.e., the Academy] the income from the almanacs, which in the first year probably had run to some 40,000 *Reichstaler* [florints], but which would possibly increase to an annual 88,000 in the future. A publisher named Trattner was publishing the almanacs of the entire Monarchy. He had access to the Empress, and having heard rumours of the Society, he demanded an audience at her place. Upon entering the chamber, he fell to his knees before the portrait of Emperor Francis [Maria Theresa's late husband], which was hanging there on the wall, wailed to it as if to the living Emperor, telling him that he was going to lose his monopoly and all his income be diverted for physics and heresy. The Empress thereupon rejected Hell's plan.

Hviid also tells us something that Feil mentions only in passing, that Maximilianus Hell "ten years earlier" (about the year 1764 according to Feil) had argued that an Academy of Sciences ought to be established in Vienna. That plan had been rejected by an unnamed minister on the very same day that the Empress was to sign it. The reason for that refusal had been that the minister had insisted that the government should appoint the members of the Academy,

[281] Hviid 2005, p. 370 (entry on 21 November 1778): "Professor….fortæller mig, at Hell for faa Aar siden havde faaet Befaling at giøre en Plan til et Videnskabers Akademie for Wien, hvori man skulde arbeide i Physiken, Astronomien og Mathematiken, ligesom i det Engelske og Franske. Han havde og udarbeidet denne Plan, og foreslaaet til Selskabets Fond Indkomsterne af alle Almanakkerne, som i det første Aar nok havde beløbet sig til 40,000 Rdlr., og siden maaske vilde naae til 88,000. En Boghandler Trattner, havde hele Monarkiets Almanakker at trykke. Denne havde Adgang til Keiserinden, og da han hørte Rygter om Selskabet, forlangde han Audients hos hende. Ved Indtrædelsen i Gemakket, falder han paa Knæ for Keiser Frantses Portrait, som hængde paa Væggen, klager for det, som for den levende Keiser, at nu skulde han miste sit Monopolium, og Indkomsterne deraf anvendes til Physik og Irreligion, hvorpaa Keiserinden forkastede Hells Plan." The manuscript version of Hviid's diary has not survived. Several names of persons are deliberately left out in the published version of 1787, as here. See the introduction of Michael Harbsmeier and Morten Petersen to their annotated edition of Hviid's text (Harbsmeier & Petersen 2005).

something Hell wisely refused.[282] "On the other hand", Hviid presumes, "there may have been a hint of Jesuitism involved. For if the first members of the Academy came from that Company [i.e., the Society of Jesus], then the rest were likely to be selected from the same regiment as well".[283] Following Hviid, one may interpret Hell's plan of 1774/75 as, at least in part, an attempt to retain the Jesuit heritage. In his letters to Jean Bernoulli III in Berlin[284] and to Weiss in Tyrnavia from this period, Hell emphasises that parts of the funds of the Academy were to be used to preserve the Jesuit observatories in Graecium, Vienna and Prague, whose directors were going to be members of the Academy as well. In her verdict of November 1775, Maria Theresa at least hinted to the presence of too many Jesuits in the Academy as problematic. The political climate had changed. It did not work any longer, to appeal to the alleged strengths of Jesuit science. Other networks had emerged and new alliances were being forged with the political leaders.

Freemasonry represents one such network overtly opposing the Jesuit order. The freemasons, or *muratori libri*, despite repeated condemnations from the Pope (in 1738 and 1751) gained a foothold in Catholic Vienna in the early 1740s. From there freemasonry spread through other urban centres of Central Europe. The Masonic lodges were partly military, partly civil. Their creeds were strongly influenced by Protestantism and Enlightenment ideals, but as laws of tolerance started to come in effect in the 1770s and 1780s, they also proved to have a wide appeal among Catholics. As Hermann Haberzettl, historian of the ex-Jesuits of Austria in the last quarter of the eighteenth century puts it, freemasonry in essence had three aims: "enhancing the general level of education, religious tolerance, appeasement of misery".[285] All three aims were in harmony with the Enlightenment ideals as promoted by Joseph II. In 1781, now fully acknowledged by the court, a group of Freemasons established a high-profiled lodge "Zur wahren Eintracht" ('For true Unity') in Vienna. To this group, even a small group of ex-Jesuits joined in. It was soon to become the dominant civil lodge in the Austrian capital,

[282] Hviid 2005, p. 370; Feil 1861, pp. 372-373 ("ums Jahr 1764").
[283] Hviid 2005, p. 370: "Men paa den anden Side stak der maaskee ogsaa lidt Jesuitisme derunder; thi vare de første Medlemmer af dette Compagnie, bleve nok ogsaa de øvrige valgte af samme Regiment".
[284] Jean (Johann) Bernoulli III (1744-1807), Astronomer Royal and director of the Berlin observatory since 1764, had travelled across western Europe and England in the years 1768-69, and his *Lettres Astronomiques* (1771*a*) were – and still are – used as a standard work of reference for the state of astronomy in France, Britain, and German-speaking countries anno 1769. In the 1770s, he published the series *Recueil pour les Astronomes* and *Nouvelles Litteraires des divers pays*, a kind of annotated bibliography with surveys of ongoing activities of relevance to astronomy in every part of the world; his *Lettres sur differens sujets* (1777*c*) on a journey through central and southern Europe are equally useful. He was obviously an important contact for Maximilianus Hell in his attempts to win recognition in this period. They seem never to have met personally, however.
[285] Haberzettl 1973, pp. 48-56, here p. 48: "Hebung der allgemeinen Bildung, religiöse Toleranz, Linderung der Not".

in no small measure thanks to the charismatic leadership of ***Ignatius a Born***, or Ignaz Edler von Born (1742-1791). His career merits some consideration.

The son of a "Stadthauptmann" (appointed major) in *Alba Julia*[286] in Transylvania that had been known as a promoter of gold mining in that region, Ignatius a Born was to pursue a career in mineralogy, chemistry and mining. After an initial post in Prague, where he became the founding father of a private Society of Sciences in 1770, Born came to Vienna in 1776 for the task of rearranging the "Naturaliencabinett" of the Empress.[287] Three years later, he became a senior official of the bureaucracy overseeing the mining industry.[288] In 1782, Born joined the lodge Zur wahren Eintracht with his wide circle of friends. He soon became a leader of the lodge and ultimately (1784) even the "Großsekretär" (main secretary) of the Austrian lodges. Seeing itself as a sort of "substitute academy", Zur wahren Eintracht founded a scientific journal (*Physikalische Arbeiten der einträchtigen Freunde*, Vienna 1784-85) and promoted a wide range of other scientific, political and belletristic activities. In science, Born is primarily remembered for his invention of an improved method for amalgating silver (1784) and as the initiator of the above-mentioned international gathering for metallurgists, miners and natural historians in Glashütte, not far from Hell's hometown Schemnicium (1786). In matters of religion and culture, however, Ignatius a Born is known as a satirist and a champion of anti-clerical views. He is claimed by many to be the model for the character Sarastro in Schickaneder's and Mozart's *Zauberflöte* ('Magic Flute', 1791).

Born had in fact been a member of the Jesuit order for sixteen months, in 1759/60, but left the Society before he finished his novitiate. His main work as an anticlerical satirist was issued in 1783 under the pseudonym Joannes Physiophilus, with the title *Specimen Monachologiae, methodo Linnaeano, tabulis tribus aeneis illustratum* (also published in German and French, and in English as 'John Physiophilus's Specimen of the Natural History of the Various Orders of Monks, after the Manner of the Linnæan System').[289] The book is jokingly cast as an academic treatise of natural history, in which the various monks are distributed in their *species* and described according to Linnæan terminology as though they were specimens of natural history. Thus, the *genus* of the monk is in general terms defined as an "animal" that is

[286] Alba Julia (L) = Weissenburg or Karlsburg (G), Gyulafehérvár or Károlyfehérvar (H), Alba Iulia (R).
[287] The Naturaliencabinett was a predecessor of the present Naturhistorisches Museum.
[288] In German: "Hofrat(h) bei der Hofkammer im Münz- und Bergwesen".
[289] The Latin original is available on Google Books, see [Born] 1783. Most researchers identify the pseudonym Joannes Physiophilus with Ignatius a Born. See however, Evans 2006, p. 46 footnote 35.

"anthropomorph, hooded, wailing at night, thirsty." Moreover, the body of the monk is "two-footed, erect, with a back which is curved inwards, a head which is flattened from above, always hooded and clothed on all sides, except for certain species whose head, feet, ass and hands are nude."[290] Luckily for the Society of Jesus, this order had ceased to exist and was spared description in Born's merciless satire. The first German edition of the work, this time jokingly attributed to an "Ignaz Loyola Kuttenpeitscher", sold two thousand copies in three weeks only.[291]

Ignatius a Born is also known to have published a satire aimed directly at Father Hell, the so-called *Telescopium Christiano-Hellianum*. Cast as a call for subscriptions modelled upon Hell's advertisement for the *Expeditio litteraria*, this satire bears the false signature of Maximilianus Hell.[292] Printed leaflets were circulating in Vienna at least by the autumn of 1784. In 1786, the entire call for subscriptions was even included in the *Staats-Anzeigen*, a serious journal edited by the Göttingen historian August Ludwig Schlözer. In this spurious call for subscriptions, Hell is portrayed as a sworn enemy of the freemasons, and the full title of his work is given as[293]

> The Christian-Hellian Telescope, or Macro- and Microscopic Observations on the Heresy and Goal of the Freemasons by Honourable Father Maximilianus Hell of the Society of Jesus [*sic*], Made Upon His Return and Repentance from Speculations Concerning Matters Relating to Venus.

The work was supposed to be published by the publisher "of our Society, in three volumes, although not in *folio*, but, as befits Christian modesty, in *octavo*".[294] Furthermore, the volumes were to be published on the day of Saint Xavier in the year 1784, on the day of Saint Aloysius in the year after and on the day of Saint Ignatius in 1786. Subscriptions were open "in all

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[290] [Born] 1783, p. [17]: "MONACHUS. // **Definitio**. Animal antropomorphum; cucullatum, noctu ejulans; sitiens. // **Descriptio**. Corpus Monachi bipes, erectum, dorso incurvato, capite depresso, semper cucullatum & undequaque vestitum, si in speciebus quibusdam caput, pedes, anum, manusque nudas excipias."
[291] Robertson 2009, p. 139.
[292] Numerous authors have taken this signature on face value, and discussed the contents of the call for subscriptions as though the text had been written by Father Hell (see for example Pinzger 1920).
[293] [Born] 1786, p. 230: "Inscribitur hoc opus *Telescopium* christiano-*Hellianum*, seu R. P. *Maxim.* HELL, E. S. J. a *Speculatione* rerum *circa Venerem* reducis & resipiscentis, OBSERVATIONES *Macro- & Microscopicae*, de Haeresi & Fine *Franco-Muratoriorum.*" One notes the use of the designations *R. P. … e S. J.* ("Honourable Father … of the Society of Jesus"), a man clinging to his old titles despite the decree of the Pope!
[294] Ibid.: "Scriptum hoc e Bibliopolio *Augustano Societatis nostrae* prodibit in Tomis III, at non in *folio*, sed, ut *christianae* conueniat *modestiae*, in 8vo."

Catholic cities and provinces, at the Honourable Father Preachers' and ex-Jesuit Missionaries'".[295]

The reference to Hell as "Honourable Father … of the Society of Jesus", the naming of canonised representatives of the same Society (Xavier, Aloysius and Ignatius Loyola), the supposed existence of a Jesuit press and even of ex-Jesuit missionaries – all was neatly phrased in order to nail the Viennese court astronomer as a spearhead of anti-tolerant schemes against the freemasons. Other attacks on Hell's reputation came in newspapers and other ephemeral publications such as the *Oesterreichische Biedermanns-Chronik*, *Wienerische Kirchenzeitung*, *Briefe aus dem Himmel* and *Phantasten- und Prediger-Almanach* in the mid-1780s. In one of these series, he was even listed as having died – morally speaking – in the year 1773, in the midst of his "struggle for the good cause".[296] Freedom of press took its toll on the ex-Jesuit.

A visitor to Vienna in the autumn of 1784, the German-speaking Danish citizen Friedrich Münter (1761-1830) has left a detailed diary that can be compared to the testimony of Hviid from six years earlier. Like Hviid, Münter was on a study trip, transcribing old manuscripts and visiting libraries and archives. Unlike Hviid, however, Münter was a freemason, and on the very day of his arrival in Vienna, he visited Ignatius a Born. In fact, during his seven weeks in the Austrian capital (from 30 August to 20 October 1784), Münter paid visits to the Born family virtually every day. He also visited the papal nuntius, Garampi, whom he appears to have sympathised with despite his papal allegiance. It was through Garampi that Münter was introduced to Father Hell, "a thin, deteriorated little man, in whom the sly Jesuit is at the same time before one's eyes".[297] Münter paid only three visits to him, but heard from various sources enough sensational rumours about this famous ex-Jesuits to fill several pages of his diary.

According to Münter, the Society of Jesus was never really suppressed. It still prospered not only in Russia, but even in the Austrian lands, where there were supposed to exist four large prelatures – in Oenipontum, Leopolis, Vienna and a fourth (unnamed) place. The Jesuits were

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[295] [Born] 1786, p. 231: "Acceptabuntur autem Subscriptiones in omnibus catholicis urbibus & provinciis, apud RR. PP. Concionatores & *Missionarios Exjesuitas*."
[296] See Steinmayr 2010*e*, esp. pp. 271-273, here p. 272.
[297] Münter, *Tagebuch* 1937, p. 62 (entry 7 September 1784): "einen magern verfallenen kleinen Mann, dem man aber den pfiffigen Jesuiten gleich ansieht".

said to hold secret nocturnal meetings in Vienna, over which Hell presided as the Superior, or "Grosmeister".[298] Moreover, the court astronomer allegedly cultivated close contacts with the Jesuit order in Russia and profited from support from a network of Jesuit-friendly bishops like the one in Agria in Hungary (see below). Throughout, Münter characterises Hell as an extremely dishonest man, who complained about "die unglaubigen Zeiten" ('this age of no faith') and saw little value in the freedom of the press, which he preferred to call "Zügellosigkeit" ('recklessness').[299] In sum, Hell was one of those[300]

> elected munitions of God, fighting to prevent the creed of the Jesuits to become extinct, and he really devotes himself with all his might in this struggle. A substantial part of the pamphlets directed against the Emperor passes through his hands. He either writes them himself, or orders others to write them, and thereafter passes them on to his beastly-horned [i.e., Satanic] colleague, who immediately submits them to be printed in the press of the Order.

Both Münter and Born were not only Freemasons, they were even members of the so-called *illuminati* ("Illuminaten"), a secretive order of brothers who were driving forces of what some scholars describe as the "*counter*-counter-Reformation" in German-speaking parts of Europe.[301] In the face of adversaries like these, it is little wonder that Maximilianus Hell was searching for new alliances. Not all was broken, though, and while many of the rumours entered in Münter's diary are no doubt exaggerations, they are in part confirmed by Hell himself in his preserved correspondence with the historian and fellow ex-Jesuit Georgius Pray from the years 1781-82.[302] Moreover, Hell's contacts with several conservative bishops are well documented. One particular contact merits special consideration.

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[298] Münter 1937, pp. 83-85 (entries on 26 and 27 September 1784), here p. 85.
[299] Münter 1937, p. 77 (entry on 23 September 1784).
[300] Münter 1937, pp. 65-66 (entry on 11 September 1784): "[…] die Auserwälten Rüstzeuge Gottes, die Lehre der Jesuiten nicht aussterben zu lassen, u. er strebt auch pro viribus darnach. ein grosser Theil der gegen den Kaiser gerichteten Schriften geht durch seine Hände. er schreibt sie entweder selbst, oder lässt sie schreiben, und dann schickt er sie zu seinem theuererkohrnen Collegen, der sie gleich der Presse in der Ordensdrukerey giebt."
[301] Amongst the output of literature of a more or less academic nature on the *illuminati*, those who read Norwegian are advised to consult Sørensen 2007.
[302] Particularly intriguing is a letter from Hell to Pray in Buda, dated Vienna 27 June 1782 (EL Budap). Hell here explains that he has been kept busy by a "a lot of negotiations" with the Pope when he visited Vienna earlier in that year, and since then by partly writing, partly advicing others to write, partly facilitating the publication and distribution of numerous pamphlets in answer to the "deluge of writings directed against the Pope, the Church, the Ecclesiasts, the faithful, the good morale etc. that flood our city and its surroundings, even the very Empire" = "Præsentia Pontificis, quocum mihi plurima agenda erant, tum colluvies libellorum contra Papam, Ecclesiam, Ecclesiasticos, Religiosos, bonos mores etc: urbem nostram Viciniamque, imò ipsum Jmperium inundans". Moreover, Hell adds that "I say nothing about the things I am secretely doing here in Vienna for the sake of protecting the Religion, things I do all the more safely because no one will suspect that it is an astronomer who is treating theological and ecclesiastic subjects" = "taceo illa, quæ hic Viennæ pro servanda Religione secretissime ago, id quod securius facio, cum nemini suspicio oriri possit, Astronomum esse, qui Theologica, et Ecclesiastica tractet."

Numerous letters from Hell to the bishop of Agria, the nobleman Carolus Eszterházy de Galantha (1725-1799) are preserved. This bishop had in 1762 sent a student, Matthaeus Balajthij (1731-*post* 1779),[303] to Hell in Vienna to receive some rudimentary training in astronomy. Balajthij soon after became a professor of mathematics in the gymnasium of Agria. After the suppression of the Society of Jesus, Eszterházy attempted to raise this institution to university level. To this end he began sumptuous construction works, including the construction of an observatory. Late in the year 1774, he sent another student, Joannes Madarassy (1743-1814) to Hell to receive a full formation as an astronomer. Madarassy was to stay at Hell's place for several years to come. Eszterházy also asked the Imperial Astronomer to provide for him the best available instruments from England, and to come and inspect the construction site in Agria in order to give instructions face-to-face.[304] In his correspondence with the bishop, Hell expresses joy for this occasion to serve his "Fatherland" (*Patria*), promises to make the name of Eszterházy known throughout the world of learning and to spare no effort in ordering the instruments the bishop asks for.

In the spring of 1776, Hell set forth to Agria along with Madarassy. Their journey lasted just over five weeks, but was given ample space in the *Ephemerides Astronomicae* for the year 1777. Here, Hell presents a detailed travel account, which is conspicuous for the nature of the extra-scientific material it includes. Not surprisingly, the Bishop of Agria is praised as a patron of the sciences. But there is more to the travel account than that. While travelling back and forth, Hell describes a series of villages and urban centres and depicts a country replete with distinguished scholars. In Tyrnavia, he meets his colleague Weiss; in the village Szered, he spends some time at an inn built by Franciscus Eszterházy de Galantha, brother of the bishop of Agria, and draws a meridian line on the floor in the presence of the keeper of the inn, "a distinguished man, who is interested in mathematics"; in Buda, he visits his former travel companion Joannes Sajnovics, now a professor of mathematics in this *Metropolis*

[303] Also spelled Balajthi, Balaithi, etc. See Katona 1809, pp. 935-936.
[304] Hell to Bishop Eszterhazy in Agria, dated Vienna 25 November 1755; 22 August 1755; 23 April 1776 (Vargha priv.). Madarassy to Bishop Eszterhazy in Agria, dated Vienna 27 January 1776; 3 March 1776; 6 April 1776 (Vargha priv.). While Balajthij was in Vienna in 1762, some "mathematical and physical" instruments were also ordered, but these were hardly as costly as the astronomical instruments Bishop Eszterházy asked for in 1776 (Hell to Bishop Eszterházy in Agria, dated Vienna 21 September 1762; 24 October 1762. Balajthij to Bishop Eszterházy in Agria, dated Vienna 21 [September] 1762 – all letters from Vargha's private archive).

Ungariae; and so forth.[305] Agria is portrayed as a virtual 'centre of advanced science', the bishop himself as a devout Christian with a Jesuit-like mode of thinking, and the journey as a whole as having been undertaken "for the greater glory of God".[306] In Hell's travel account, Hungary is a landscape peopled exclusively by Jesuit-friendly Catholics, where one particularly eminent patron is building an observatory that, when fully equipped, "I venture to declare, will no doubt become the most splendid observatory in entire Europe" (*sic*).[307]

Bishop Eszterházy got his splendid observatory, which survives intact to this day.[308] Madarassy finished his training at Hell's observatory in Vienna in 1778 and thereafter served as the astronomer of Agria, but Eszterházy's plans of establishing a university were toppled by a *Ratio Educationis*, or 'General Law of Hungarian Education', that was issued by the court of Vienna shortly after Hell undertook his Hungarian tour. Already in 1776 it was decreed that in the entire Kingdom of Hungary there was to be only one university, in addition to five *academiae* ("Hochschulen"), in Jaurinum, *Varadinum*,[309] Cassovia, Zagrabia and a fifth place in the Cisdanubian region. Cassovia thereby lost its university status, while the status of Tyrnavia was for a while uncertain. The year after, however, it was decided that the Tyrnavian university was to move to Buda, and the compounds of Tyrnavia host a "Hochschule" only. Agria was to remain a gymnasium, or *lycée*, of the same status as numerous others across Hungary.[310] Hell remained in close contact with Bishop Eszterházy, however, and after their personal meeting in Agria in 1776, their correspondence turned more and more towards religious matters. Among the subjects discussed in their letters was the status of the German language.

[305] Hell, "Observationes Astronomicæ Latitudinum Geographicarum, sive Elevationum Poli, Locorum quorumdam Ungariæ, factæ 1776" 1776*a*, quotation from p. 167: "Caupo, Vir egregius, & rerum mathematicarum curiosus".
[306] Hell 1776*a*, espec. p. 289: "Atque hoc modo iter meum […] ad *Dei gloriam majorem* perfectum est" and pp. 279-280, where the Bishop looks on as Hell and the rest of his team draws the meridian line of his observatory, and while doing so "contemplates, no doubt, in his pious mind those words of David, *the Heavens will tell of the glory of God, and the firmament announce the works of His hands* as well as that holy dictum of *Divine Ignatius Loyola*, who having observed the stars at night said, *O how the dirty the Earth appears, as I look at the sky*." = "illud, haud dubie, Davidis pia mente revolvens: *Cæli enarrant Gloriam Dei, & opera manuum ejus annunciat firmamentum;* atque etiam illud *Divi Ignatii Loyolæ*, cœlum stellatum sæpius suspicientis sancte dictum: *Quam sordet mihi tellus, dum Cœlum aspicio*". Ignatius Loyola was a founding father of the Society of Jesus, 'For the Greater Glory of God' its motto.
[307] Hell 1776*a*, p. 273: "hanc [scil. speculam] præcipuam totius Europæ futuram absque dubio pronunciare audeo".
[308] See for example the articles by Norbert Weyss 1986*a*, 1986*b* and 1987.
[309] Varadinum (L) = Grosswardein (G), Nagyvárad (H), Oradea (R).
[310] See for example Katona 1809, pp. 865-868 & 886-880.

In preceding sections, it has been explained that Maximilianus Hell came from a German-speaking family. He nonetheless reckoned himself as a *Hungarus*, and supported the pro-Magyar (albeit not pro-Hungarian Guard) sentiments that Sajnovics gave voice to in the *Demonstratio*. Latin remained, however, his most cherished language. It represented not only the language of the Catholic church, it was also a universal language of the sciences and a *lingua franca* of his *patria*, Hungary. When Balajthij came to Vienna in the early 1760s, Hell explains to the bishop that he is making sure his student learns French, "which is of utmost importance for a mathematician".[311] In the mid 1770s, Hell reports that Madarassy learns French with ease, but struggles to learn German. In the end, Madarassy asked the bishop for money to move out of Hell's apartment and hire a room in a private home so that he could speak the language on a daily basis.[312] However, it was not science that necessitated his acquisition of German, it was politics.

The likes of chancellor Kaunitz and the co-ruler Joseph II found Latin inadequate for the administration of a modern country, and argued in favour of imposing German as the official language of the Kingdom of Hungary. Decrees issued in 1774, and especially the *Ratio educationis* of 1777, contain paragraphs on the desirability of increased teaching of the German language in the schools of Hungary.[313] But German was not only favoured in lower-level schools, it was ultimately to replace Latin as the compulsory language of teaching at the University of Vienna in 1783. The year after, in April 1784 to be quite specific, Joseph issued his infamous German language edict, making German the official language of the Kingdom of Hungary as well. The argument was utilitarian, for the administrative language of Hungary – Latin – had by then become "one that the nation does not even understand".[314] Whereas Romanian and Slavic languages were spoken alongside, or instead of, Magyar in certain parts of the Kingdom, knowledge of German was widespread throughout. Thus, the only feasible alternative for a common administrative language was German, the Emperor argued. Joseph had already issued several decrees on Hungarian matters, and some of these, for example his efforts to stifle the rights of the nobility, had found support in at least some camps. The German language edict, however, caused a universal outcry.

[311] Hell to Bishop Eszterházy in Agria, dated Vienna 24 October 1762 (Vargha priv.): "sedulo mathesi, Physicæ, et linguæ gallicæ, quæ mathematico summe necessaria est, Studebat [scil. Balajthij]" (no mention of German!).
[312] Hell to Eszterházy in Agria, dated Vienna 22 August 1775 and 1 July 1776; Madarassy to Eszterházy, dated Vienna 2 April 1776 (Vargha priv.).
[313] See for example Katona 1809, pp. 831-837.
[314] Joseph in the German language edict, quoted after Balázs 1997, p. 206.

It would be far beyond the scope of this thesis to investigate the various twists and turns of Habsburg politics in the Josephine decade. Suffice to say that bishop Eszterházy proved to be a stout opponent against the reforms of Vienna.[315] Hell for his part did not welcome the increased use of the German language. Despite his own fluency in German, he found it inadequate for the advancement of 'universal science'. To Hviid in 1778, he expressed regrets that the "Danes always wrote in Danish; this was an impediment to our scientific image abroad […]. We [i.e., the Danes] should write more in Latin, he argued, or at least in French, which is also a universal language."[316] Hell's knowledge of French was passive, Hviid tells us, for during dinners at Garampi's, he spoke "kitchen Latin" only, and that "in an unusual rapidity", since "this erudite does not speak French".[317] Even so, it was French, not German, that he advocated in case Latin should be dropped.

But Hell's support of Latin (and to some extent French) against German was not only related to his concerns for a *lingua franca* of the Republic of Letters and of his homeland, Hungary. When he wished to repress the use of German and bring back Latin at university level, he did so also for religious reasons.

After the accession of Leopold II early in the year 1790, Hell saw new opportunities for Agria. In letters to bishop Eszterházy, he expresses hopes that the university of Hungary, which has "been on the move for so long" (having moved from Tyrnavia to Buda in 1777 it was again moved, across the Danube to Pest in 1784), should now – at last – find a "safe and permanent haven" in Agria.[318] The ex-Jesuit also involved himself in a new edition of the old University Statutes of Vienna, in order to convince the policy makers of the need for a purely Catholic university system.[319] In brief, he hopes to[320]

[315] For the bigger picture of Hungarian resistance towards the policies of Vienna, and the role of Hungarian bishops in particular, see Bahlcke 2005.
[316] Hviid 2005, p. 369: "Han [i.e., Hell] klagede over at de Danske stedse skreve Dansk; det var en stor Hinder for vor litterære Renome blant Fremmede […]. Vi burde skrive mer paa Latin, meente han, eller i det mindste paa Fransk, hvilket ogsaa er et Universal-Sprog."
[317] Hviid 2005, pp. 401-402 (entry 6 December 1778): "Denne Lærde talede idelig Latin, thi Fransk taler han ikke." And: "alt dette skede paa Kykken-Latin, som han taler med en ualmindelig Hurtighed."
[318] Hell to Bishop Eszterházy in Agria, dated Vienna 30 October 1790 (Vargha priv.).
[319] According to Sommevogel 1893, p. 257 the full title of the edition was *Diplomata, Bullae, Privilegia, Libertates, Immunitates, Constitutiones, et Statuta celeberrimae Universitatis Vindobonensis ab an. 1634. primae suae institutionis ad an. 1689. quo studio theologico aucta, et completa florebat: excerpta ex lib. II. Commentariorum viri cl. Petri Lambecii. Editio tertia, idiomate latino et teutonico, cum notis praesertim Lambeccianis* (Vienna 1791). In a copy that Paul Shore has had access to, an autograph letter was pasted between pages 167 and 168, in which Hell "reveals his contempt for Protestant education, calling Protestant universities 'pseudo-Universities' that 'corrupt students' minds'" (Shore 2007, p. 105). This resembles the contents of Hell's letters to Eszterházy from 1790/91.

> restore the studies at the universities of our hereditary realms, which now lie with their backs broken, to their ancient status and spirit in the same manner as the university studies were restored during the reign of the pious Emperor Ferdinand II, at first in Vienna in the year 1623, and thereafter in all the cities of the Austrian hereditary realms.

Finally, in a particularly long and bitter letter to the bishop, Hell laments over the dissolution of the Society of Jesus, and what he calls the *seminaria Antichristi* ('seminars of Antichrist') that had replaced the theology studies at the university since the Jesuit professors were removed from their posts. As a result of the implementation of compulsory teaching in German, knowledge of Latin had seen such a rapid decline among university students that even mass at the University Church was now held in the vernacular. As a result, young women attended, and flirted overtly with the (male) students. The fair sex would not have been present, Hell argues, if only the masses had been celebrated in Latin as they used to be in the 'good old days' before the suppression of the Society of Jesus.[321]

In the elderly Hell's arguments for the preservation (or restoration) of Latin, his old loyalties ran together. As a *Hungarus*, he wished to see Latin prevail as the *lingua franca* of his multiethnic fatherland. As a partisan of the conservative forces of the Catholic church, he savoured a glorious past in which there existed a single, universal language for the servants of God. As a representative of the Republic of Letters, he saw the benefits of the Latin language for communication across linguistic and political boundaries. In this sense, he was indeed facing backwards. But he was also a pragmatic.

Hell's promotion of the Magyar language has been discussed in Section I.2.3 above. Given his position as a mentor, and almost even a 'censor', of Sajnovics' *Demonstratio*, certain formulations are worth pointing to. The Sámi dialect, with its rich and to a large extent protected vocabulary thanks to its isolation in the High North, ought to be used to enrich the Hungarian language, it is argued.[322] Furthermore, the *Demonstratio* claims that Hungarian (and Lappish) is a language that is inferior to no other language, even superior to many others

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[320] Hell to Bishop Eszterházy in Agria, dated Vienna 1 November 1790 (Vargha priv.): "[…] si inquam fructum tulerit speratum, ut studia Universitatum in Regnis nostris hæreditariis penitus prostrata, ad statum, et spiritum primævum restaurentur eo modo, quo sub pio Jmperatore Ferdinando II anno 1623 restaurata fuere Viennæ, et subinde in aliis Urbibus Regnorum hæreditariorum Austriæ."
[321] Hell to Bishop Eszterházy in Agria, dated Vienna 11 November 1791 (Vargha priv.).
[322] Aspaas in press (in Finnish).

as regards its suitability for literature.[323] These patriotic remarks, although formulated in Latin, resemble the ideology of a text in the Hungarian language that was published two years later, by the Hungarian-guard member Georgius (György) Bessenyei. With his pamphlet, the *littérateur* Bessenyei wanted to "prove that the Hungarian language was suitable for the very highest literary genre".[324] As interpreted by Benedict Anderson and other historians of nationalism, this event marked the "birth of Hungarian nationalism".[325] The role of the *Demonstratio* in this process is ambiguous. One may conclude, however, that it was not only the Latin language that Father Hell promoted, he also tried – at least during the early years of the 1770s – to benefit from a current of pro-Magyar sentiment by supporting the patriotic study of Hungarian. This strategy did not work out well. The *Demonstratio* was ridiculed and held against Hell by Born and his circle in the 1780s, and even the leading intellectuals of the Hungarian Guard – Bessenyei among them – spoke against its main thesis.[326]

It is said in the catalogues of the Society of Jesus that Hell mastered "Slavic" (probably Slovak) and that he used this language during mass in Claudiopolis. One may infer that he also used it in Leuchovia. However, there is nothing in the primary sources that I have had access to that suggests that Hell played a role in the codification of Slavic languages of the Kingdom of Hungary, which was taking place during eighteenth century, a process in which several Jesuits of his generation took part.[327] Far more marked is his use of that highly ambiguous language, German.

After the suppression of the Society of Jesus, Hell published far more works in German than he had done before this watershed. His issuing of German-language almanacs around 1775 has been mentioned above. In the same period, he also published numerous articles in German-language newspapers, journals and books. These publications of Hell's treated in part astronomy, in part other subjects such as medicine.

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[323] For example Sajnovics 1771, p. [xiv]: "per tot secula egregie exculta, seu ubertate vocabulorum, seu concinna brevitate, seu intimos animi sensus explicandi dexteritate, nulli Orientalium, aut Occidentalium Linguarum inferior, multis autem certe superior evasit [scil. lingua Ungarorum]" = "[the language of the Hungarians,] splendidly cultivated through so many hundreds of years, has emerged as inferior to no other language, be it eastern or western, as regards its richness of vocabulary, its elegant succinctness or its suitedness to express the inner emotions of the human soul. Indeed, in these respects it is superior to many other languages".
[324] Paul Ignotus, in the work *Hungary* from 1972, as quoted by Anderson 2006, p. 73.
[325] Ibid.
[326] See Kontler 2011 & in press.
[327] See Kamusella 2009, pp. 99-139.

When in 1775 a collection of essays by ex-Jesuit professors was issued in Vienna, called *Beyträge zu verschiedenen Wissenschaften von einigen Oesterreichischen Gelehrten* ('Contributions to Various Sciences by a Few Austrian Erudites'),[328] Hell apparently made no protests, but on the contrary welcomed the German rendition of some selected astronomical works of his. After all, his two pieces in this set of Contributions had already been published in Latin in the appendices of the *Ephemerides Astronomicae*. Towards the end of his life, at the very same time that he sighed over the widespread decline in Latin competence to Eszterházy, he allowed a colleague in Vratislavia, Antonius L. Jungnitz, to translate nearly all the appendices of his *Ephemerides Astronomicae* into German and publish them in quick succession, as *Beyträge zur Praktischen Astronomie, in verschiedenen Beobachtungen, Abhandlungen, Methoden aus den astronomischen Ephemeriden der Herrn Abbe' Maximilian Hell* ('Contributions to Practical Astronomy, in the Form of Various Observations, Treatises and Methods taken from the Astronomical Ephemeris of Mister Abbed Maximilianus Hell', four vols., Breslau & Hirschberg 1790-93).[329]

Hell also discussed astronomy in popular newspapers. One particularly verbose series of articles were published in the newspapers *Mannheimer Zeitung* and *Wiener Diarium* in 1777. Here, two ex-Jesuit astronomers, Christianus Mayer and Maximilianus Hell, engaged in a heated discussion of the phenomenon that is nowadays known as double stars. Hell claimed to have discovered the phenomenon far earlier than Mayer, and what is more, he disagreed with Mayer in his interpretation of the phenomena as a sort of 'satellites', or "Fixsterntrabanten". The debate went on throughout the autumn of 1777, after which year Mayer continued publishing (and debating) on the phenomenon in German and Latin, whereas Hell appears to have withdrawn from the public debate.[330] Furthermore, Hell even used German for public lectures in astronomy, which he announced in newspapers in the latter half of the 1770s.[331]

In German-language periodicals he also tried to gain a reputation as a medical doctor. As far as I have been able to ascertain, Hell essentially made two attempts to establish himself as an

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328 Scherffer *et al.* 1775.
329 Jungnitz' edition of the *Beyträge* was antedated by a German version of Hell's proposal of new constellations in honour of King George III and William Herschel (Vienna: Trattner, 1789). That too had been translated into German by Jungnitz.
330 For an excellent analysis of the polemics surrounding Chr. Mayer's work on double stars, see Moutchnik 2006, pp. 273-314 (see however my review, Aspaas 2008*b*, for correction of some minor errors).
331 Haberzettl 1973, p. 197.

authority on medicine. The first was relating to 'magnetic healing', or Mesmerism. The second attempt had to do with scurvy.

Magnetic healing in the Enlightenment is primarily associated with Franz Anton Mesmer (1734-1815), who after initial experimentation in Vienna moved to Paris, where he became something of a 'star'.[332] Hell's 1762 treatise on the application of magnets of steel contains no mention of medical use. In a letter to Weiss in Tyrnavia, dated Vienna 7 May 1765, Hell is expressly skeptical about the possible healing power of his steel magnets:[333]

> I am happy that my Father Colleague [i.e., Weiss] has become a colleague of mine even in medical subjects. For even I have here turned magnetic doctor and experienced the effect [of magnets] on various persons. However, the effect of this artificial magnet in easing the pain of toothache, I ascribe not to magnetism (which can have no influence on the teeth unless these were made of iron or steel), but to the coldness of the steel. Next time I will test this with a piece of steel which is not magnetised, and I think the effect will be the same; my Honourable Father Colleague can make the same experiment, pretending that the metal that is applied is magnetic, so that the pain of the patient is not disturbed by persuasion.

This was one year before Mesmer published his first in a series of works on magnetic healing, inspired by amongst others Father Hell, who for his part was to claim publicly after his return from Vardø that he – not Mesmer – was the one who had discovered the potentials of artificial magnets as healing devices. His polemics against Mesmer were published in German.[334] A side-effect of this publicity was that Hell received heaps of mail and had numerous visitors at his door, begging for his help with all kinds of ailments.[335] Popular science could make you too popular.

A second medical issue in which Hell tried to be credited with having made an important discovery, was use of sugar as prophylactic medicine against scurvy. While in Vardø, Hell had experienced that several local inhabitants suffered from this disease. He himself, his

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[332] The classic study is by Darnton 1968. See now also Schaffer 2010 or Krefting 2010 (in Norwegian), with their references.
[333] Hell to Weiss in Tyrnavia, dated Vienna 7 May 1765 (quoted from Pinzger 1927, p. 198): "Gaudeo Patrem Collegam, et in materia medica mihi collegam factum, nam et ego hic medicus magneticus evasi, effectumque in pluribus expertus sum; effectum hunc magnetis artificialis sistendi dolores dentium, ego non magnetismo (qui nullam cum dentibus connexionem nisi hi e ferro vel calybe essent habet) sed frigori calybis adscribo. Proxime tentabo cum lamella calybea non magnetica, puto eundem me effectum obtenturum; idem R. P. Collega pertentare poterit, simulando applicatam lamellam esse magneticam ne persvasio dolores patientis perturbetur."
[334] See Hadobás 2008.
[335] Hell to Weiss in Tyrnavia, dated Vienna 27 January 1775 (Vargha priv.).

assistants and all the sailors of the ship, who spent the winter in Vardø as well, were not affected at all. The cause of the disease, Hell argued, was the presence of too much salt in the air. By eating sugar on a regular basis, the balance of salt versus sweet in the body was kept constant. Hell's theory was published in the *Wiener Realzeitung* in 1777, but was refuted and forgotten.[336]

It is noteworthy, then, that Hell in fact promoted his own reputation as an expert on medicine in the German vernacular. As regards the *Wiener Realzeitung*, he even was a member of the editorial team of this journal in 1777, which aimed to disseminate scientific news to a German-reading audience. Although he broke with the journal after less than one year,[337] this circumstance reveals that Hell also 'went with the flow' and used German for scientific texts.

In other words, Maximilianus Hell did not only protest stubbornly against the spread of German and decline of Latin. He also tried to adapt to the new politics, partly by lecturing and composing scientific works in German, partly by allowing others translate his Latin treatises and disseminate them to German readers. However, he did also cling to Latin whenever possible. In this, his strategies differ from the paths followed by many other ex-Jesuits of his own generation. One example is the *littérateur* Michael Denis SJ (also known as Sined the Bard, 1729-1800), who was steeped in Latin, but favoured the German language by producing numerous acclaimed works of poetry and prose in a refined German style. Denis was, however, part of the circle around Ignatius a Born and as such a likely supporter of progressive ideas and practices.[338] A more conservative voice resembling that of Hell, was the ex-Jesuit Ignatius Wurz (1731-1784). This theologian had been sacked from the University of Vienna in the aftermath of 1773. After this, he emerged as a leading figure in the rhetoric of the conservative forces of the Catholic church. His numerous polemical works were, however, issued exclusively in German.[339] Conservatism did not necessarily imply use of Latin.

The same ambiguity could be said to characterise Maximilianus Hell's regrets against the policies of toleration promoted by Joseph II. While he hated the decrees of Vienna that

[336] Hell's short article, first printed in the *Wiener Realzeitung* 1777, 8ten Stück, p. 122-126, was reissued in 1779 along with a devastating refutation by Doctor Von Albertiz (Anonymous [ed.], 1779). See also Aspaas 2008, p. 65.
[337] Haberzettl 1973, pp. 31-32. The reason for the break was evidently that the profile of the *Realzeitung* turned increasingly towards Enlightenment politics in the late 1770s, *op.cit.*, pp. 32-26.
[338] Haberzettl 1973, *passim*.
[339] Haberzettl 1973, pp. 200-201.

protected the rights of Protestants and brought them into university life under the banner of tolerance, he applauded the policies of Frederick II of Prussia. In a letter to Jean Bernoulli in Berlin, dated Vienna 1 March 1775, Hell expresses joy for the way in which the King of Prussia protected the Jesuits in Silesia.[340] He fails to recognise, however, that Frederic did so in the same ideological spirit in which his counterpart in Vienna protected the Protestants.

Finally, some remarks on the international aspect of Hell's career. Since his appointment as Imperial and Royal Astronomer in 1755, Father Hell had deliberately sought to acquire international fame as an astronomer. After the suppression of the Society, however, we have seen how he became increasingly absorbed in local issues. In his satire of 1784, Born put into Hell's mouth an account of how "after sweating over this work [i.e., the *Expeditio litteraria*] for ten years", he decided to "say goodbye to all mundane issues" and to "ascend from astronomical matters even higher into the heavens, and henceforth treat nothing but spiritual and divine subjects".[341] In a comment to this sentence the editor Schlözer adds that "Herr Hell was nevertheless elected a fellow of the Royal Society of Sciences in London in the preceding year".[342] A similar claim is made in some of the historiography, for example in Ferrari d'Occhieppo's article in the *Dictionary of Scientific Biography* (1972):[343] "Christian VII of Denmark and George III of England offered Hell honorary pensions much higher than his salary, but he refused them". Furthermore, Schreiber claims that a "call to England with a considerable salary, which [Hell] received at the time of the Suppression of the Society, he declined".[344] Without source reference, it is hard to establish the facts in these cases. Suffice to say that Hell is missing on the official lists of fellows of the Royal Society of London. The only Jesuits who were elected fellows during the eighteenth-century appear to have been Roger Joseph Boscovich, Christianus Mayer and Martinus Poczobut, head of the observatory in Vilnius.[345] Moreover, Hell appears to have had no personal contact in erudite circles in England until 1776, when he finally received an answer from the Astronomer Royal,

[340] Hell to Bernoulli in Berlin, dated Vienna 1 March 1775 (UB Basel).
[341] [Born] 1786, p. 229: "Desudaui per annos X in edendo hoc opere", and below on the same page: "Dicto ergo mundanis omnibus vale, ab astronomicis altius ad aetherea ascendi, & abinde nil nisi spiritualia & divina tractaui".
[342] Schlözer in [Born] 1786, p. 229 footnote: "Gleichwol ist Hr. *Hell* erst im vorigen Jar, von der königl. Societät der Wissenschaften in London, zum Mitglied aufgenommen worden."
[343] Ferrari d'Occhieppo in Gillispie (ed.), vol. VI, p. 234.
[344] Schreiber 1904*b*, p. 111.
[345] Aspaas 2008*b*.

Maskelyne, upon repeated requests for help in furnishing the Agria observatory with instruments.[346]

Until solid evidence emerges, the alleged 'English trace' in Hell's career ought to be treated as dubious. The 'Danish trace', however, has a more solid fundament in the sources. In a petition delivered to the Kaiserlich-Königliche Hofkammer (virtually, the 'ministry of finance') in July 1781, Hell asks for a higher salary. In doing so, he argues that one reason why he deserves a rise in payment is[347]

> because I, in consideration of the honour of the Imperial and Royal Court, rejected an offer of a yearly personal pension of a thousand *Gülden* from the Danish Court as a token of gratitude for my highly strenuous and dangerous journey to the island Wardoehus in the Arctic Ocean, where I observed the transit of Venus in front of the Sun. I refused to receive this pension because I, as Imperial and Royal Court Astronomer, deemed that it would be negative for the honour of the Imperial and Royal Court if I benefited from a pension from a foreign court in conducting my work.

There is no mention here of any similar offer from England, nor have I found it mentioned in any other document that has been available for this study.

On the whole, the scientific ambitions of Maximilianus Hell appear to have been scaled down after about 1780. The major astronomical contributions to the supplements of the *Ephemerides Astronomicae* in the 1780s were either authored by Hell's serving assistant Franciscus Triesnecker or by his former assistant, Antonius Pilgram.[348] His own contributions in the appendices of the *Ephemerides Astronomicae* gradually shifted away from the core subjects of practical and theoretical astronomy towards more externally oriented works. Thus, in the volumes for 1787 and 1788 Hell published poems and other texts celebrating the discovery of the planet now known as Uranus, which, he argued, should be named *Urania* after the muse of astronomy; in the 1789 volume, he published a curious elegy arguing that

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[346] See Section II.3.1 below.

[347] Hell to the Kaiserl: Königl: Hofkammer in Vienna, no date, but according to an administrative note received 25 July 1781 (Akademie der Wissenschaften in Vienna): "weil ich in Betrachtung der Ehre des K: K: Hofes die mir von Dänischen Hof angetragene jährliche *Pension ad Personam* von tausend Gülden als eine *Remuneration* wegen der sehr beschwerlichen und gefährlichen Reise nach der Jnsul Wardohuβ im Eiβmeere, wo ich den Durchgang der *Venus* vor der Sonne beobachtet hatte, ausgeschlagen, und nicht angenommen hatte, aus Ursach, weil ich als K: K: Hof*Astronom* der Ehre des K: K: Hofes nachtheilig erachtete, von einem fremden auswärtigen Hofe eine *Pension* meines Amts wegen zu ziehen."

[348] Cf. Sommervogel 1893, pp. 244-246. Beginning in the late 1780s, the highly talented, but far less renowned astronomer Johann Tobias Bürg (1766-1834) also took part in observations at the Vienna University Observatory. After Hell's death in 1792, he served as Triesnecker's adjunct and co-editor of the *Ephemerides* (for a popular account of Bürg's career, see Firneis 1993).

Adam was ‘the first and greatest astronomer in history’; in the volume for 1790, he published a star map with new constellations named after George III and William Herschel, accompanied by an eulogy of the two characters; and so forth.[349] Tailing this series of artistic works, Hell issued two fragments of the *Expeditio litteraria* in the volumes for 1791 and 1793.

No biography is complete without an end. Hell met his on 14 April 1792, shortly before his 72nd birthday. A few weeks earlier, the Viennese court astronomer had caught a lung fever, which quickly deteriorated and in the end proved fateful. His scientific heritage was preserved by the new court astronomer Franciscus de Paula Triesnecker, who ran the Imperial Observatory and issued the *Ephemerides* as before. However, Hell’s manuscripts and correspondence were for a long time on private hands, as has been explained in Section I.1.2.2 above. Although a substantial collection of manuscripts made its way to the Imperial Observatory some fifty years after the death of Hell, crucial parts were either lost or are still awaiting their discovery.

It is to be hoped that missing parts of the manuscripts, maps and other illustrations that Hell made for the *Expeditio litteraria* will one day emerge. If some of the conclusions of this biographical essay will be proven wrong thanks to such a stroke of luck, its author will be the first to applaud. The etymology of the word ‘essay’ after all implies that it is an ‘attempt’, no more.

I.2.4.1 PARALLEL LIVES, PART II: CAREER PATHS OF OTHER EX-JESUITS FROM THE AUSTRIAN PROVINCE OF THE SOCIETY OF JESUS

This subsection will follow the same pattern as subsection I.2.2.1 above. This time, however, the focus will be on the impact of the transition from Jesuit-run observatories to institutions administered by the state in the aftermath of 1773. Hell remained at his workplace after the suppression, but his case was special since his institution had been founded (and funded) by the state in the first place. Other observatories (and observers) mentioned in the previous set of parallel lives experienced a different plight. Above, we saw how the Jesuits were not unique in establishing observatories and making observations: even Benedictines and various private individuals contributed to the growth of interest in astronomy in the Habsburg lands

[349] Sommervogel 1893, pp. 245-246.

around the mid-eighteenth century. The overall aim of this subsection, then, will be to investigate the new conditions for astronomical activity in the former Austrian Province of the Society of Jesus from 1773 to 1792.

The observatories will again be used as starting points. Apart from the university observatory, or Imperial and Royal Observatory of Vienna that was run by Maximilianus Hell, we shall investigate the plight of Jesuit observatories that had either been constructed, or were planned to be constructed, in Vienna, Claudiopolis, Buda, Graecium and Tyrnavia. Included in the story are developments in institutionalised astronomy at other places, namely in Leopolis, Mellicum, Lambachum and Agria. In all these places, ex-Jesuits had a role to play. The career of Franz Xaver von Zach is finally introduced, as an example of a Central-European astronomer without a Jesuit background. First of all, however, a historiographical remark is necessary.

Horst Kastner-Masilko, in his biography of Hell's successor Triesnecker (published 2005) concludes that "the dissolution of the Jesuit order had almost no impact on the work at the Vienna Observatory".[350] The expert on the ex-Jesuits of Austria in the period in question, Hermann Haberzettl, concludes on a similar note:[351]

> a quite special 'favourite pet' in the scientific activity of the Jesuit order was astronomy. In this discipline, no change took place in the wake of the suppression. The status of the ex-Jesuits remained unchallenged.

In contrast to these statements stands Hell's frequent laments on the Society's suppression, such as this one from 1790:[352]

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[350] Kastner-Masilko 2005, p. 47: "Die Auflösung des Jesuitenordens hatte fast keine Auswirkung auf die Arbeit der Wiener Sternwarte".
[351] Haberzettl 1973, p. 196: "Ein ganz besonderes Lieblingskind der wissenschaftlichen Betätigung des Jesuitenordens war die Astronomie. In diesem Fach änderte sich durch die Aufhebung nichts. Die Stellung der Exjesuiten blieb unangefochten".
[352] Hell 1790, pp. 301-302: "Hac enim Dissolutione SOCIETATIS JESU effectum est, ut officii mei Astronomici, & laborum meorum Astronomicorum *Sociis* & *Adjunctis,* quos SOCIETAS JESU suis Sumptibus aluerat, omnibus prorsus destitutus, & penitus privatus fuerim, mihique *uni* & *soli* tam annuæ Ephemerides Astron[omicæ] calculandæ, & typis edendæ, quam observationes Astron[omicæ] instituendæ, peragendæ, & continuandæ, quam etiam Commercium litterarium cum Astronomis *totius Europæ* (imo & cum Pekinensibus in Sinis) habendum, omnesque reliqui labores Astronomici, sine *Sociis*, & *Adjunctis*, *soli* & *unico* perficiendi fuerint. // His in temporum angustiis, nihil mihi aliud deliberandum superfuit, quam aut officio Astronomi Cæs. Regii valedicere, si nempe *promissum* EXPEDITIONI MEÆ LITTERARIÆ vastum, in tribus Tomis conscribendum Opus absolvendum vellem: aut, Opus hoc supprimendum, si scilicet, officium Astronomi (quo stante SOCIETATE JESU, adjutus laborum Sociis, fungebar) porro continuandum decernerem".

as a result of this dissolution of the Society of Jesus, I was utterly deprived of all those assistants and adjuncts, paid by the Society of Jesus, who used to aid me in my astronomical duties and activities. Thus, by my own efforts solely and uniquely I must both do the calculations for the annual *Ephemerides Astronomicae* and preside their publication, as well as take care of the planning, conducting, and continuation of astronomical observations, and even take care of my scientific correspondence with astronomers all over Europe (in addition to Beijing in China); and whatever other astronomical tasks that called for my attention, must be done without any assistants or adjuncts, solely and uniquely by myself. In this time of hardship, I was left only with two choices: either to bid farewell to my chair as Imperial and Royal Astronomer, if I wished to finish my vast, three-volume work *Expeditio Litteraria* as promised, or to suppress this work, if I decided to continue in my chair as an astronomer, a chair in which I, for as long as the Society of Jesus existed, was helped by assistants in my work.

Hell's view, that the suppression of the Society of Jesus was detrimental to science, has been adopted by most authors with pro-Jesuit leanings. On the other hand, Kastner-Masilko and Haberzettl are by no means unique in their claim that astronomical activity was never seriously affected by the sudden change of status from *è Societate Jesu* to *exJesuita* (from 'of the Society of Jesus' to 'ex-Jesuit') that befell Maximilianus Hell and his colleagues. Given the discrepancy between the two views, it appears necessary to give the issue a brief inquiry.

A lexical remark may be worthwile. As explained by Haberzettl, the term ex-Jesuit has at least two meanings. It may include persons who:[353]

1) either through voluntary exit or as the result of expulsion, left the Society after having delivered their vows, usually after having spent a relatively long part of their life as its member; *2)* usually also those who, through the suppression of the order that was sanctioned by the church in 1773, were freed from their vows and forced to take another direction in their life.

Haberzettl has in his study chosen to employ the widest possible definition, so that even Ignatius a Born, who left the order already as a novice, figures as "ex-Jesuit". This subsection sticks to the second definition and explores only the careers of members that were secularised as a result of the Pope's decree in 1773.

[353] Haberzettl 1973, p. 9, quoting Ludwig Koch, *Jesuitenlexikon* , Paderborn 1934, p. 535: "[…] 1.) nach Ablegung der Gelübde, meist nach verhältnismäßig langem Leben im Orden, diesen wider verlassen haben, sei es durch freiwilligen Austritt oder durch Entlassung; 2.) gewöhnlich auch jene, die 1773 durch die kirchliche Aufhebung der Gesellschaft Jesu von ihren Gelübden entbunden und zu einer anderen Laufbahn gezwungen wurden."

Despite radical changes in the institutional organisation of science in the Habsburg lands in the wake of the year 1773, the ***Imperial and Royal Observatory of Vienna*** remained intact. The number of assistants may have been reduced, but the court astronomer himself sat safe in his chair. Whilst his colleagues abroad feared that the *Ephemerides* might be discontinued or the Imperial Observatory shut down,[354] nothing of the sort happened. Instead, the annual volumes of the Viennese ephemeris were churned out of the press as before, with supplements presenting long lists of observations as well as theoretically ambitious treatises.

Two hundred meters away, however, the ***Jesuit Observatory of Vienna*** was closed shortly after the suppression of the Society. The director Liesganig, whom we met in Subsection I.2.2.1 above, was appointed professor at the former Jesuit collegium of Galician *Leopolis,*[355] which had come under Austrian rule in the aftermath of the first partition of Poland in 1772.[356] From his base in Leopolis, Liesganig conducted extensive surveys of the new Habsburg province of Galicia and served as the director of an observatory that had been founded by the Jesuits around 1769.[357] As Liesganig passed away in 1799, he left a large collection of manuscripts from his surveys in Galicia. He did not, however, publish any observations from Leopolis in the *Ephemerides Astrononomicae* edited by Hell and Triesnecker. Back in Vienna, the Jesuit observatory seems not to have been manned at all after Liesganig's departure for Leopolis in 1774. In a letter to Weiss, dated Vienna 12 November 1783, Hell explains that[358]

> I have managed to save the observatory of the Viennese academic collegium, which surely, in case I had been absent from Vienna at that time, would have

[354] See for example Bernoulli 1776*b*, pp. 9-10.

[355] Leopolis (L) = Lemberg (G), Lwów (Polish), L'vov (Russian), L'viv (Ukrainian). Udías mistakedly locates "Lemberg" to Alsace in France (*sic!* Udías 2003, p. 31).

[356] The Jesuit collegium of Leopolis was founded in 1661, received papal approbation as a university as late as the year 1759, a status it lost in 1773. For the next decade, it was known as the *Theresianum*, or academy for noblemen, until Joseph II renewed its university status in 1784.

[357] The observatory is missing entirely in Howse 1986. Udías conjectures that this observatory was founded by Liesganig (Udías 2003, p. 31). However, Brosche 2009*a*, p. 25 includes an engraving of "das Observatorium des Jesuiten-Collegs 1771" ("the observatory of the Jesuit collegium, 1771") and an official webpage of the Ministry of Education and Science of Ukraine gives the year of founding as 1769 http://www.lnu.edu.ua/Subdivisions/PROPERTY/astro/astro_eng_bg.htm (accessed 30 May 2011). According to Fischer 1984, pp. 139 & 147, a Ludowicus Hoszowski SJ (1732-*post* 1773) served as professor of mathematics at the Jesuit collegium in Leopolis from 1769 to 1773. During 1771-73, Hoszowski was also entered in the Jesuit catalogues as *Professor astronomiae* and *Praefectus musei mathematici* at the same collegium, but he left for an ecclesiastical post in Przemyslia after the suppression and seems never to have become part of the team around Liesganig (ibid.).

[358] Hell to Weiss, dated Vienna 12 November 1783 (Vargha priv.): "Speculam Colegij Academici Viennensis a Cæsare conservatam obtinui, quæ certissime, si Viennâ id temporis abfuissem, sublata, et deposita fuisset, eo, quod Architectus verba Cæsaris male interpretatus fuerit".

been removed and demolished, because the architect had misunderstood the words of the Emperor.

The Jesuit observatory is described as still in existence in the work on *Wetterkunde* that was published by Antonius Pilgram in 1788. Exactly when it was demolished is not known.[359] As to Hell's action to preserve it, this may be interpreted as a sign of his hopes that the Society of Jesus would one day be restored and activities resumed at the former observatories.[360]

Before the suppression, the Society of Jesus had been in a position where it by its own means could construct observatories and equip them with instruments and personnel. Although the growth around 1750 was followed by a period of standstill, it remains a fact that between 1745 and 1756 the number of Jesuit observatories had tripled, from one (Vienna) to three (Graecium and Tyrnavia added). In the course of the 1750s, the Benedictines constructed their sole observatory in Cremifanum, led by Fixlmillner, and the state funded the Imperial and Royal Observatory in Vienna, headed by the Jesuit Hell. No major expansions appear to have taken place during the 1760s. As the 1770s begun, however, the Jesuits found that the time was ripe for new establishments. Enlightened interest in astronomy certainly peaked around the transit of Venus in 1769, and when Maximilianus Hell returned as an explorer of world-wide reputation in the year after, the conditions for a revitalisation of institutional astronomy were probably as good as they could ever become. What few pieces of evidence I have come across in the primary sources, are detailed below.

The observatory founded by Hell in ***Claudiopolis*** in 1753 has left only few traces in the historiography. In a letter to Bugge in Copenhagen, dated Vienna 24 July 1789, Hell states that this observatory was never finished. In fact, he had only been able to lay the foundations (*fundamenta*), which[361]

> still to this day lie hidden underground, since in the year 1755 I was called away from that city once and for all, in order to take upon myself the duties of an Imperial and Royal Astronomer in Vienna, a chair I still retain.

[359] Steinmayr 2010*a*, p. 178.
[360] Cf. Hell's letter to Jean Bernoulli III in Berlin, dated Vienna 15 February 1777 (UB Basel).
[361] "In Transylvania fundamenta speculae a me anno 1753. *Claudiopoli* (Clausenburg) jacta sub tellure adhuc latent, ea de caussa, quod anno 1755. ex hac Urbe peremtorie Viennam ad officium Astronomi Caes. Regii, quod hucusque gero, evocatus, speculam hanc Claudiopolitanam educere et perficere non potuerim" (quoted after Pinzger 1927, pp. 154-155).

The catalogue of "Jesuiten-Mathematiker" compiled by Karl Fischer appears to contradict this statement. Here, two of Hell's successors as professors of mathematics in Claudiopolis, Matthias Geiger and Paulus Benkő, are described as *prof[essor] mathes[eos], praef[ectus] Mus[aei] Mathem[athici] et Spec[ulae] astron[omicae]* ('professor of mathematics, director of the mathematical museum [i.e., laboratory] and the astronomical observatory') in the periods 1755-57 and 1758-62 respectively.[362] Perhaps they, like Hell before them, were only directors of a planned observatory (*specula*)? Further confusion is added in a recent article (in Hungarian) on the history of the Claudiopolis observatory by Ferenc Szenkovits.[363] Szenkovits here reproduces an engraving of the centre of Claudiopolis dating from 1759, in which a small tower on top of a two-storey building is visible. This has been interpreted as proof that the observatory building was already finished by then. However, Szenkovits concludes that the observatory, either in terms of instrumentation or observatorial achievements, could hardly be compared to other observatories of a European standard.[364] That may be characterised as an understatement. The Claudiopolitan observatory is not even mentioned in the numerous works of Jérôme Lalande or Jean Bernoulli that provide Europe-wide surveys of contemporaneous astronomy, let alone in Hell's *Ephemerides*. A letter from Hell to Jean Bernoulli III in Berlin, dated Vienna 15 Febuary 1777, clarifies the puzzle:[365]

> A fourth observatory, the construction of which was begun by me in Claudiopolis in Transylvania in the year 1753 – I had laid down its very stable foundations by the year 1755, when was called to Vienna – has remained unfinished until now. As of the year 1773, work on this building was about to be continued and brought to an end, if it were not for that fatal dissolution of my order, which brought this task in disarray. I had in fact an astronomer there, a Father of our Society by the name Hart[mann], professor of physics, whom I had furnished with a mobile, three-foot quadrant, a pendulum clock and a five-foot Newtonian telescope. [At the time when the suppression of the Society arrived,] I had already received from him several observations aimed at establishing the longitude and latitude of this observatory.

[362] Fischer 1978, p. 170.
[363] Szenkovits 2006.
[364] Szenkovits 2006, pp. 106-111.
[365] "quartum [scil. observatorium Astronomicum] à me An[no] 1753 Claudiopoli in Transylvania cœptum, cujus Solidissima jecer[am] fundamenta, sed per meam Anno 1755 evocationem Viennam, hucusq[ue] ædificari intermissum, jam quoque Anno 1773 labor ædificij continuan[dus] et perficiendus erat, nisi fatalis illa ordinis mei dispersio, opus hoc interturbasset; [Astro]nomum ibidem jam habebam Patrem è Societate nostra nomine Hart[mann] Physices Professorem, à me interea Quadrante mobili trium pedum, horolo[gio] pendulo, et tubo Newtoniano 5 pedum instructum, à quo etiam observa[tio]nes nonnullas, ad longitudinem, latitudinemque observatorij definiend[um] factas obtinueram" (UB Basel, some letters at the end of each line are missing on my copy, due to their nearness to the binding. These are supplied [in brackets]).

This Hart[mann] (the final letters of his name are in fact illegible on the copy I have had access to) should be ***Ferdinandus Hartmann SJ***, who according to Fischer was born in *Cibinium*,[366] a town in far southeastern Transylvania with a large German-speaking population. He entered the Society in 1753. Neither his year of birth nor death is stated in Fischer's catalogue, except that he served as a *Prof[essor] geometriae et geographiae practicae* (that is, geodesy) in Tyrnavia in 1768/69, as a professor of mathematics in Claudiopolis in 1770/71 and last but not least, as a *Professor physices experimentalis* in the same town in 1772/73. His whereabouts after the suppression of the Society are not known. The observatory of Claudiopolis appears never to have become fully operative.

In the important Hungarian town ***Buda*** (later merged with neighbouring Pest into Budapest) the Jesuits ran a collegium. As the legend to Map 2 shows, this institution had a professor of mathematics since 1744. Soon after Hell and Sajnovics returned from their expedition, Sajnovics was given this post. At the same time, plans were being laid to make this former assistant of both Hell (Vienna, Vardø) and Weiss (Tyrnavia) the director of a new Jesuit observatory in conjunction with this collegium.[367] With scarcely concealed pride Sajnovics in a letter of 12 May 1771 exclaims:[368]

> I am destined to become a professor in Buda, where I am supposed to lay the foundations for practical astronomy. I this way, I hope to become the Royal Astronomer of Hungary, which is the most illustrious title I can ever imagine.

In the above-mentioned letter to Jean Bernoulli, dated 15 February 1777, Hell explains that as the suppression of the Society arrived in 1773, everything was ready, the funds had been secured and Sajnovics appointed for the job of supervising the construction.[369] Evidently, the suppression of the Society of Jesus brought these plans to a halt.

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366 Cibinium or Hermannopolis (L) = Hermannstadt (G), Nagyszeben (H), Sibiu (R).

367 In a letter to Weiss, dated Vienna 24 May 1771, Hell says (Vargha priv.; also found in Pinzger 1927, p. 106): "De Specula Budensi nondum cum R. P. Provinciali conferre potui; optarem sanè, ut hoc in loco, quem ego mihimet, qua Repetens Matheseos jam olim designaveram, astronomia excoleretur" = "I haven't yet been able to discuss the Buda observatory with the honourable *Pater Provincialis* [i.e., the head of the Austrian Society of Jesus]. I would really hope that astronomy may be cultivated in the very same place that I, as a teacher of mathematics so long ago, had planned to become my workplace."

368 Sajnovics to Joannes Nagy, dated Tyrnavia 12 May 1771 (facsimile in Kisbán 1943, between pp. 40 & 41): "Ego destinor pro Professore Budano, ut ibidem initia ponam astronomiæ practicæ, atque sic spero me futurum Regni Ungariæ Astronomum! quo Titulo nihil unquam illustrius duxi".

369 Hell to Jean Bernoulli III in Berlin, dated Vienna 15 February 1777 (UB Basel): "Eodem anno fatali 1773 Budæ […] à Patre Sajnovics Socio mei itineris danici Specula exstruen[da] jam decreta erat, sumptusque parati."

At the dawn of the 1770s, the Jesuits did not limit themselves to their plans for expansions in Claudiopolis and Buda. They also lobbied for developments outside their own ranks. As explained in Subsection I.2.2.1, the Benedictines had proven themselves capable of funding a high-standard observatory in Cremifanum. The historiography on the Benedictine order's role in the history of central-European astronomy is meagre. It is clear, however, that also that order felt the pressure of the anticlerical sentiment that had gained currency in the country.

A recent contribution by Gottfried Glaβner and Christine Preiner presents an account of an attempt to establish an observatory in at the Benedictine monastery in ***Mellicum*** (Melk), some 30 kilometres west of Vienna.[370] In the late 1760s and early 1770s, the abbot of this monastery tried to set in place various innovations in order to give his institution a more 'modern' profile, in response to the utilitarian ideology of this age. One of the plans he nurtured was remaking the monastery's powder tower into an astronomical observatory. The abbot of Mellicum was encouraged in this project by amongst others the Jesuit astronomers Paolo Frisi from Milan and Josephus Liesganig from Vienna, who both paid visits to Mellicum to offer support and advice. In the end, however, the project was dropped because of internal strife within the monastery.

Somewhat later, a modest Benedictine observatory was in fact funded at the monastery in ***Lambachum*** (Lambach). Fixlmillner in a letter to Jean Bernoulli III in Berlin from the summer of 1777, explained that an observatory was being established at this place, and that a monk from the abbey had been sent to Vienna to receive instructions.[371] The name of this monk was ***Julianus Ricci OSB*** (1745-1812).[372] Ricci stayed at Hell's place in Vienna for several months, until the autumn of 1777, when he travelled to Lambachum along with the Imperial Astronomer, who was to assist in the practical arrangements for this observatory.[373]

[370] Glaβner & Preiner, "'…Physics would be a dry and barren subject without any experiments': or why, in 1771, the plan of constructing an observatory in Mellicum – despite good arguments – was not accomplished " (in German), 2009.
[371] Fixmillner to Bernoulli in Berlin, dated Cremifanum 23 June 1777 (printed in Bode's *Astronomisches Jahrbuch* and summarised in *Journal des Sçavans*, Décembre 1778, p. 814): "Il dit, à la fin de sa Lettre, qu'on va établir à l'Abbaye de Lambach, près de Cremsmunster, un Observatoire; & qu'un Religieux de cette Abbaye est à Vienne pour prendre les instructions nécessaires".
[372] Rabenalt 1986, p. 129 footnote 2.
[373] In a letter to bishop Eszterházy in Agria, dated Vienna 8 September 1777 (Vargha priv.), Hell writes: "Crastina die, quæ est 9 Septembris, in Austriam Superiorem cum alio Astronomo Monasterij Lambachensis Ordinis S. Benedicti, quem per menses quatuor hic Viennæ in Astronomia exercui, ad invitationem Reverendissimi D. Abbatis excurro causa ordinandi novi observatorij ibidem exstructi" = "Tomorrow, that is the 9th of September, I will go to Upper Austria along with another astronomer of the Benedictine Monastery of

Whatever its position internally in the Benedictine system, the observatory in Lambachum certainly never gained anything near the prominence of the Cremifanum observatory. In the latter place, Fixlmillner continued his observations as before, unaffected by the downfall of the Jesuit order. His observatory became a 'node' of European astronomy in its own right, but Fixlmillner seems not to have promoted his colleague in Lambachum or his observations to any great extent. That remained a more local affair.

I know of no further attempts to establish astronomical observatories either by religious orders or private individuals in the geographical area covered by the former Austrian province of the Society of Jesus. However, the plight of the Jesuit observatories that were operative as the suppression arrived remain to be described.

The Jesuit observatory of Vienna has already been mentioned. The younger sister observatory in ***Graecium***, whose less-than-glorious history has already been described in Subsection I.2.2.1 above, was closed not long after the suppression of the Society in 1773. As of 1774, however, an "Alois Mayr" was appointed professor of astronomy in Graecium. He is probably identical with the Antonius Mayr who moved from Graecium to Vienna a couple years later.[374] In any case, this Mayr did not remain in his chair for long. According to Johann Schreiber, it was soon "judged proper to do away with the chair of astronomy [and] to lock the observatory" of Graecium. It remained locked until it was finally demolished in 1787.[375]

The last director of the Graecium observatory was almost certainly ***Antonius Mayr SJ*** (or Mayer). His career merits some consideration. Born in Vienna in 1738, Mayr entered the Society around 1756, held a chair as 'professor of higher mathematics' (*prof[essor] math[eseos] repet[itae]*) in Graecium in 1765-72, before he was appointed director of the astronomical observatory in Graecium for the university year 1772/73.[376] At least by 1776, however, Mayr's days in Graecium were over. He returned to Vienna, where he had a short career as the adjunct of Maximilianus Hell. On the title pages of the *Ephemerides Astronomicae* for the years 1777 and 1778, he is presented as a calculator of the almanac as

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Lambachum. I have trained him in astronomy for four months, and upon invitation from the Most Honourable Abbed I will go there to arrange a new observatory that has been constructed at that place".

374 According to Michaela Scheibl at the Universitätsbibliothek Graz his real name was not Anton, but "Alois Mayr". Under this name, on 9 April 1774 the ex-Jesuit Mayr was granted a salary of 500 Gulden to serve as professor of astronomy in Graecium (Email from Michaela Scheibl, 17 January 2011).

375 Schreiber 1904*a*, p. 16.

376 Fischer 1978.

well as Hell's *adjunctus*. In November 1776, Hell explains to his colleague Jean Bernoulli in Berlin that to replace his two former assistants (see below) "I have received only one, the adjunct Antonius Mayr. He is an ex-Jesuit, but will need to be instructed in astronomical calculations first".[377] It appears these instructions were no success, for after 1777 he no longer served as Hell's assistant according to the title pages of the *Ephemerides*.[378] His whereabouts after 1777 are not known, except that he published a book on poisonous frogs in 1783 (Vienna). Wurzbach says he died in Vienna, but that his year of death is unknown.[379]

The career of another representative of the Graecium university, ***Franciscus de Paula Triesnecker*** (or Franz von Paula Triesnecker, 1745-1817) is far better known. Born in Mallon close to Kirchberg am Wagram in Lower Austria, he entered the Society of Jesus in 1761 and studied philosophy in Vienna and mathematics and languages in Tyrnavia. In 1770/71 he taught *humaniora* in Lincium before he enrolled as a student of theology in Graecium. Despite the suppression of the order, Triesnecker continued his studies to become a doctor of philosophy in Graecium in 1775. Triesnecker's biographer Horst Kastner-Masilko has not been able to establish his whereabouts in the interval from 1775 to 1780, in which year (or early in the next at the latest) he emerged as the adjunct of Maximilianus Hell in Vienna. Triesnecker was to stay in this role throughout the 1780s and early 1790s. After Hell's death in 1792, he inherited the position as Imperial Astronomer, and kept this chair until his own passing in 1817. As an editor of the *Ephemerides* and its appendices, Triesnecker followed loyally the principles that had been laid out by his predecessor until the series eventually had to be discontinued in 1806 as a result of financial problems resulting from the Napoleonic Wars.[380] Unlike Mayr, Triesnecker appears to have been a success as an adjunct. Exactly who taught him astronomy is not known, but it is tempting to conjecture that he learned the rudiments of astronomy in Graecium before he was called to Vienna at the age of 35.[381] Like

[377] Hell to Jean Bernoulli in Berlin, dated 30 November 1776 (UB Basel): "horum amborum loco unic[us] mihi datus est Andjunctus D. Antonius Maÿr exJesuita quidem, se[d] in calculis astronomicis primum instruendus" (letters in brackets are my conjectures; they are missing on my copy because of their nearness to the binding).
[378] It is probably this adjunct Father Hell refers to in a letter to Wargentin in Stockholm, dated Vienna 29 July 1778 (CVH Stockholm): "[…] adjumento Adjuncti mei perpetuo infirmi destitutus, tempus Dissertationum conscribendarum necessarium omnino mihi defuerit" = "lacking assistance from my adjunct, who is constantly ill, I have not had the time needed to write scientific works".
[379] Information on Antonius Mayr, unless otherwise stated, has been found in Schörg 2009, p. 100; Fischer 1978 (Schörg has not used Fischer); Wurzbach, Achtzehnter Theil (1868; note that Wurzbach has listed all "Mayer's" alphabetically as *Meyer*, regardless of the various spellings of this name).
[380] On Triesnecker's career, see Schörg 2009, pp. 83-86; Kastner-Masilko 2005 (Kastner-Masilko's biography should, however, be used with caution – see my review in *Acta Historica Astronomiae*, Aspaas 2008*a*); Pärr 2001, pp. 41-43; Wurzbach, Siebenundvierzigster Theil (1883).
[381] See my review of Kastner-Masilko's biography (Aspaas 2008*a*).

Liesganig, Triesnecker was to become an active surveyor in the service of the state; in the 1790s and 1800s, he took part in field works in both Galicia and Lower Austria.[382]

In the Kingdom of Hungary, developments were not as negative as in Austria proper. The leading astronomer on Hungarian soil, Franciscus Weiss remained the director of the Tyrnavian observatory until 1777, when it was decided that there should be only one university in the Kingdom of Hungary and that this university was to lie in Buda. A new observatory was then constructed at the new Royal Palace in ***Buda***, with the Imperial Astronomer taking part in the construction process.[383] By 1779, construction works were finished. Observations began in 1780, with Weiss the undisputed director. Sajnovics was to remain in the background, and although he did publish a textbook of astronomy in 1778,[384] he never received a chair as a professor of astronomy, far less the title 'Royal Astronomer', which he had dreamed of a few years earlier. (Whether Sajnovics formally took over as director in the interval between Weiss' passing in January 1785 and his own death in May of the same year is unclear.)

After Weiss' departure for Buda in 1777, a former assistant of his at the ***Observatory in Tyrnavia***, took of over his chair as director. This ex-Jesuit, ***Franciscus Taucher*** (1738-1820) had been born in Claudiopolis, but was educated in Tyrnavia during the flourishing period of the Austrian Province. When Sajnovics left for Vardø in 1768/69, Taucher rose to the rank of adjunctus and finally director. After Weiss and the rest of the university staff and students had left, Taucher carried on a dreary existence at the former university compounds until the year 1785, when Weiss passed away.[385] He then brought with him the remaining instruments from the Tyrnavian observatory to Buda, where he took over Weiss' post as *praefectus* of the university observatory, a position he retained until his retirement in 1806.[386] Fischer says he

[382] Kastner-Masilko 2005, pp. 116-123.
[383] In the spring of 1777, the year after he had been in Agria to make arrangements for Madarassy's observatory there (See Section I.2.4 above), Hell travelled to Buda to give advice on the construction of the new observatory (Hell to Bernoulli in Berlin, dated Vienna 20 June 1777 [UB Basel]).
[384] Sajnovics, *Idea Astronomiae* 1778 (reprint 1993).
[385] Taucher's letters to Weiss from this period, as edited by Magda Vargha, offer dark reading. Witness for example his constant fear of a decree ordering the closing down of his observatory; his sentimental account of the celebrations of Saint Loyola, patron saint of the Jesuit Order; or how he stubbornly refuses to give Emperor Joseph II, sworn enemy of the Jesuits, access to the observatory during his visit to Tyrnavia in 1784 (letters to Weiss in Buda, e.g. those dated Tyrnavia 29 August 1776, 5 May and 4 December 1784, edited by Vargha 1990, pp. 127-128 and 1992, pp. 210-213).
[386] Vargha 1992, pp. 226-227.

died in *Quinque Ecclesiae*.[387] After 1785, the observatory of Tyrnavia was neither equipped nor manned. The team at Buda included an assistant (*adjunctus*), he too an ex-Jesuit, by the name Franciscus Bruna (1745-1817), from Zagrabia. He first served as the assistant of Weiss, then of Taucher.

The downfall of the Jesuit order thus brought an end to what was likely to have become a ‘second wave’ of observatory establishments in Habsburg-ruled lands after the ‘first wave’ in the period from the mid 1730s to the mid 1750s. With the Society of Jesus bereaved of its resources, it was up to the state or the still surviving orders to fund new institutions.

When Haberzettl writes that “the status of the ex-Jesuits [in astronomy] remained unchallenged”, this is true in the sense that there were no obvious inheritors. The statement is, however, correct only from a strictly internal-scientific point of view. Seen from another angle, the Jesuits had now lost their ability to decide for themselves, since all former collegia, including their observatories, had been taken over by the state. The Imperial Astronomer himself was never removed, although the dissolution of the Society was a serious blow to him in spiritual terms. For all other Jesuit astronomers, however, the impact of the suppression was far more concrete. At the end of this subsection, a few more career paths will be taken into account.

The title page of the *Anni 1776* volume (published 1775) of the *Ephemerides Astronomicae* states that this particular issue had been “determined through calculations made under the direction of Maximilianus Hell, by the Honourable Freiherr Ignatius Baron von Rain and Franciscus Güsman, Astronomers of the University” (*dirigente Maximiliano Hell … calculis definitæ a RR. DD. Ignatio Lib. Barone de Rain et Francisco Güsman Astronomis Universitatis*).

Ignatius Lib. Baro de Rain was born in *Vitopolis*[388] in present-day Croatia in 1737 and entered the Society of Jesus in 1753.[389] Of noble birth, he was educated at the Theresianum in Vienna, presumably with Scherffer as his foremost teacher in astronomical subjects. He is

[387] Quinque Ecclesiae or Sopianae (L) = Fünfkirchen (G), Pécs (H).
[388] Vitopolis, St. Viti ad flumen or Flumen (L) = Fiume (Italian, also G, H), Sankt Veit am Pfaum (G), Reka or Szentvit (H), Rijeka (Cr).
[389] Dates according to Steinmayr 2010*a*, pp. 199-200. In Fischer’s catalogue an Ignatius Rain is said to have been born in Vienna in 1757, which is surely a misprint, for he entered the Societas Jesu in 1753 (Fischer 1978).

probably identical with a certain *M. Rain S.J. Repetens Matheseos* ("M[agister?] Rain of the Society of Jesus, teacher of mathematics") that observed the Venus transit from the Imperial Observatory in 1761;[390] at least Ferencová in her biography states that Hell received assistance from an "Ignáca Raina" in 1760/61.[391] According to Steinmayr, the same Rain also served, this time as "zweiter Assistent" ('second assistant'), at Hell's observatory in the year 1770, during Hell's absence in Denmark-Norway.[392] In the university years 1771-73, however, Rain held the chair as *professor matheseos* at the collegium in Lincium. There is no mention of Rain in the two recent "Diplomarbeiten" on the history of Viennese astronomy by Nora Pärr and Cornelia Schörg.[393] His collaboration for the *Ephemerides* was in any case limited to the *Anni 1776* volume only, and Steinmayr states that his year of death is unknown. However, a letter from Hell to Jean Bernoulli III in Berlin, dated 30 November 1776, reveals that Rain had by then already departed for a post as a professor of mathematics in Leopolis. Rain here served as an assistant of Liesganig in his survey of Galicia. It may be he ended his days in Galicia.[394]

The career of ***Franciscus Güsman*** (or Güssmann, Gueßmann, Guessmann, 1741-1806) is briefly sketched in Cornelia Schörg's Diplomarbeit.[395] He was born in Wolkersdorf (roughly 15 kilometres north of Vienna) in 1741, entered the Society of Jesus in 1757 and was preparing for departure for the Jesuit missions in China as the suppression arrived in 1773.[396] His participation in the calculations of the *Ephemerides* appears to have been limited to one year only (*Anni 1776*). By November 1776, Güsmann had left Vienna – along with Rain – to receive a chair in physics in Galician Leopolis.[397] Like Rain, he took part in Liesganig's survey of Galicia from the late 1770s onwards. In 1787 he returned to Vienna, allegedly because of health problems, and was appointed professor of experimental physics at the Theresianum.[398] He taught partly at the Theresianum, partly at the Wiener Technisches Hochshule until he retired and eventually died in Seitenstetten in 1806.[399]

[390] Hell 1761*a*, p. 17. In a letter to Taufferer in Labacum (now Ljubljana), dated Vienna 6 April 1761, Hell speaks of a *bidellus* (assistant, servant) by the name "Rain".
[391] Ferencová 1995, p. 29, sadly without source quotation.
[392] Steinmayr 2010*a*, p. 200, likewise without source quotation.
[393] Pärr 2001, Schörg 2009.
[394] Information on Ignatius Rain, unless otherwise noted, has been culled from Fischer 1978.
[395] Schörg 2009, p. 99.
[396] Steinmayr 2010*a*, p. 181.
[397] Letter from Hell to Jean Bernoulli, dated 30 November 1776 (UB Basel). Note that the content of this letter is reiterated (in French) in the Second Cahier of Bernoulli's *Nouvelles Littéraires* (Bernoulli 1777*a*, pp. 8-9).
[398] Haberzettl 1973, p. 168. See also Brosche 2009*a*, pp. 22-23.
[399] Information on Güsmann, unless otherwise noted, has been taken from Wurzbach, Sechster Theil (1860).

However limited evidence we have on some of these characters, it is striking that Hell was able to continue to recruit his collaborators from former Jesuit circles. As an ex-Jesuit, he was at least not entirely isolated from his former Jesuit network. He had problems keeping these assistants, however: when the state called them to imperial purposes outside Hell's sphere of influence, they disappeared from sight.

One may ask again, then, how much difference the dissolution of the Society made to the career of Hell as a professional astronomer. For one thing, his work pace was definitely affected negatively. However, a major cause for his distractions appear to have been his involvement in political intrigues. The infrastructure for practical astronomy was still in place, there were assistants to hand and the very continuation of the *Ephemerides* is strong testimony that theoretical work was being done at Hell's observatory in Vienna. However, as a 'nodal astronomer' Hell had lost most of his impact. Decisions concerning the fate of observatories across the Habsburg lands were being taken by other decision makers. The Jesuit observatory of Graecium was quickly closed; the Jesuit observatories of Tyrnavia and Vienna followed in its wake. Instead of growth in the number of observatories there came a period of demise. New university observatories in Buda and Leopolis, both run by ex-Jesuit staff, were not sufficient to foster a new generation of astronomers. The Benedictine order made no considerable expansion in astronomy, either. It stuck to its observatory in Cremifanum, to which only a minor 'satellite' was added in nearby Lambachum.

Secular talent hardly found more opportunities in the Vienna-ruled territories after 1773 than before that year. An example is the highly talented astronomer ***Franz Xaver von Zach*** (1754-1832), who was born in Pest (now part of Budapest) as the son of a German-speaking military officer. Not much is known about his education, except that Zach was inscribed as a pupil of the piarists, a 'secular' and liberal Catholic order that was to take over many of the teaching facilities of the Jesuits after the suppression.[400] Be that as it may, having been taught in *Vesprimia*[401] (roughly 100 km west of Budapest) and Pest in the 1760s and early 1770s, Zach knew enough astronomy to be hired by Liesganig for his surveys of Galicia in the mid-1770s. His personal opinion of Liesganig and other Galician ex-Jesuits, as expressed in later writings,

[400] Brosche 2009*a*, pp. 15-16. On the piarists in Central Europe, see for example Koltai 2005.
[401] Vesprimia or Vesprim (L) = Wesprim or Weißbrunn (G), Veszprém (H).

was far from flattering.[402] Having ended his period in Leopolis, Zach travelled to Vienna in 1781/82 in search of a position and appears to have visited Hell, to no success.[403] He then embarked upon a grand tour of Italy, France and England, where he forged personal contacts with various influential characters of contemporaneous astronomy and became the protégée of the London ambassador of the important Saxonian town Dresden, Hans Moritz von Brühl. Upon Brühl's suggestion, Zach was eventually appointed court astronomer of the Duke of Saxe-Gotha-Altenburg, Ernst II (1745-1804), in 1786. He then promptly moved from London to Gotha, where he established an observatory and stayed in touch with his numerous correspondents in more westerly parts of Europe. By the turn of the century, Zach had become one of Europe's leading astronomers, a position he kept until his death in 1832. His bitterness towards the Jesuits was never weakened, and in his publications he continuously criticised and accused them of manipulation of data sets and clandestine activities designed to keep outsiders out of science.[404]

The bitterness of Franz Xaver von Zach may have been a special case. Some of his accusations towards Liesganig and Hell resonate like repetitions of the propaganda of Ignatius a Born and other freemasons (Zach was, by the way, a freemason himself). It should be stressed that it was not only the *ex-Jesuits* who made things difficult for aspiring astronomers from Central Europe in the final quarter of the eighteenth century. The utilitarian ideology as promoted by Joseph II was combined with a reluctance to direct too many resources towards science that was not 'useful'. Maximilianus Hell sighed over this situation in a letter to Jean Bernoulli, dated 15 February 1777:[405]

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[402] For various examples, see Brosche & Vargha (eds.) 1984 and Brosche 2009*a* (with references to numerous recent contributions).

[403] Brosche, in referring to a letter written by Zach from Lyon in the spring of 1783, tells that "die nicht namentlich genannten kaiserlichen Astronomen ärgern sich, daß ihnen Maskelyne nicht auf ihre Briefe antwortet" = "the unnamed Imperial Astronomers are irritated because Maskelyne does not answer their letters" (Brosche 2009*a*, p. 31). The likely informant would be Father Hell, Imperial Astronomer of Vienna.

[404] See Brosche 2009*a* (with ample references).

[405] Hell to Bernoulli in Berlin, dated Vienna 15 February 1777 (UB Basel): "Sed hæc in Astronomiam [practi]cam per destructionem ordinis mei illata damna, minora Sunt, qua[m] quæ observatoria olim jam à societate exstructa, *Pragense* in Bohemia, Græcense in Stÿria, et Viennense in Collegio Academico perpessa fuissent, nis[i spe?] resuscitandæ Societatis nostræ erectus, viribus omnibus obstitissem; jam e[nim?] Societatis, et Scientiarum Solidarum inimici, Augustissimæ Jmperatrici per[suadebant?] tria hæc observatoria Sumptibus societatis nostræ exstructa, instructaque, tanquam Superfluos, inanesque conservationis sumptus exigentia, tollenda, demoliendaque esse; satis inanium sumptuum, pro sola, ut ajebant, apud exteros conservanda fama, impendi observatorio Viennensi Cæsareo, et Tyrnaviensi; utque facilius Astronomiam unà cum Jesuitis eliminarent; observatoria astronomica non esse utilia Principibus ajebant, nisi ijs, qui classem in Mari haberent, atque navibus mercimonia exercerent, Regna autem Austriæ Subjecta, his carent, ergo Superflua esse observatoria, Superfluos astronomos, Sumptus inanes, qui in Astronomiam impenderentur, quasi verò Astronomia alium usum non haberet, nisi *nauticum*." (Letters in [brackets] are my conjectures; they are missing from the copy I have had access to because of their nearness to the binding.)

> The above-mentioned damages that have been inflicted upon [Practical?] Astronomy by the destruction of my order [i.e., the Society of Jesus], are however less grave than the fate that would have befallen the observatories that once upon a time were erected by the Society, namely the ones in Bohemian Prague, in Styrian Graecium and at the academic collegium in Vienna, in case I had not – encouraged by [a hope?] that our Society will one day be brought back to life – resisted it with all my might. For [you see?], there are enemies of the Society and of the hard sciences who have been [trying to persuade] Her Highness the Empress that these three observatories, which our Society once erected and equipped, were worthy of being destroyed and demolished because they allegedly were superfluous and thus extracting worthless funds for their conservation. Enough worthless funds, they said, were already being spent on the Imperial Observatory of Vienna and on the observatory in Tyrnavia, for "the sole purpose of retaining reputation abroad". And in order to eliminate Astronomy along with the Jesuits, they claimed that astronomical observatories were useless to rulers except for those who have a fleet at see or are engaged in maritime trade; accordingly, since the lands subjected to Austria lack these properties, the observatories were of no use, the astronomers were of no use and all funds were unworthy of being wasted on Astronomy: as if Astronomy had no use except for navigation!

The dominant ideology during Joseph II's reign had little respect for the heritage of Jesuit science. We have seen that although Maximilianus Hell lingered in Vienna, Josephus Liesganig and Franciscus Weiss moved, to Leopolis and Buda respectively, upon orders from the state. None of the three are likely to have been particularly welcoming to 'new men' in astronomy; there were enough former Jesuits around to recruit for the few vacancies and new offices that existed. However, in consideration of the fact that the former Jesuit observatories in Vienna, Graecium and finally Tyrnavia were being closed down in the aftermath of 1773, it would be harsh to subscribe to the verdict of Franz von Zach, that the nepotism of the ex-Jesuits was the main problem: the only new facility for institutional astronomy that was founded in the former Austrian Province of the Society of Jesus in the fifteen years following the year 1773, was not financed by the state, nor by a representative of the 'progressive forces' associated with the masonic lodges. Ironically, Carolus Eszterházy, the conservative bishop of Agria appears to have been the only true patron of institutionalised astronomy in the Habsburg lands during the post-suppression period.

I.2.5 ASSESSMENT OF MAXIMILIANUS HELL'S CAREER

This biographical essay has presented a sketch, no more, intended to stimulate further studies by others. The presence of this rather elaborate chapter in the thesis was necessitated by a lack of consistency in the available literature on Maximilianus Hell and his works in conjunction with the transits of Venus. Most previous works have been lacking proper source references, a circumstance that has necessitated rather extensive use of primary sources in this essay. Besides, the lack of academic publications on Maximilianus Hell and his contemporaries in the English language gave further impetus to this essay.

Father Hell's 'nationality' has been – and still remains – an important issue to many authors, understandably so, given the troubled historical experiences that Central Europe has witnessed. Another important issue to many authors is the 'innocence' of this Jesuit: was Hell in any way personally to blame for the vicissitudes he experienced? Furthermore, to state it bluntly, it appears important to many biographers to clarify whether their biographee was a genius or not. While trying to avoid 'whiggish' history writing, I do not dismiss these issues as irrelevant. Accordingly, I will address them in brief. A final issue that I will discuss has to do with our overall understanding of Jesuit science in eighteenth-century Europe and of Father Hell's place in this context.

As Map 1 showed, apart from his student years in Vienna, Hell's career prior to 1755 took place within the confines of the Kingdom of Hungary and the closely associated Principality of Transylvania. He never hesitated to call himself a "Hungarian", or *Hungarus*. The modern borders, however, tell a different story. His childhood and school years took place in the heartland of the modern Slovak Republic; his first professorship was in Romania; and, in terms of mother tongue, he belonged to a largely privileged, German-speaking minority that was widely dispersed all over the Kingdom of Hungary and Transylvania, as well as Austria proper.

Proud scholars from both Slovakia and Hungary tend to hail Hell as a representative of 'their' nation state. Slovak authors will spell his name *Maximilián Hell* and use Slovak forms of the names of places visited in his youth, even when producing texts in a foreign language. It is true that Hell was born in a part of Hungary that is now known as Slovakia. He did learn Slavic in his youth, for he was able to conduct church services in that language. However, when certain Slovak writers classify him as a "Slovak scientist" and his expedition to Vardø a "Slovak expedition", they are pushing it too far. Hell never presented himself as a Slovak, nor did he describe his birth region as a particularly Slavic region. Instead, he liked to present himself as a *Hungarus*. To be "Hungarian", however, implied something else entirely in Hell's youth than it does today.

As we have seen, Hell did not hesitate to define himself as a *Hungarus* (or *Ungarus*, as he preferred to spell it) or to refer to the Kingdom of Hungary as his *Patria* (strictly translated, "Fatherland"). Scholars from Hungary tend to refer to him by the name *Miksa Hell* (or Höll), even when writing in English or French.[406] Contrary to vulgar connotations in the twentyfirst century, however, the characterisation 'Hungarus' in the mid eighteenth century was used for at least five 'peoples' or ethnicities in the modern sense of the word. What they shared was neither a common vernacular, nor religion, culture or heritage. The thing they had in common was *geography*: every 'Hungarus' lived in an area that was then known as the Kingdom of Hungary. This explains how Maximilianus Hell was included in the bio-bibliographical encyclopædia of Alexius Horányi, *Memoria Hungarorum et provincialium scriptis editis notorum* from the year 1776 ('Dictionary of *Hungari* and people from the provinces that have made themselves known through published writings').[407] On the other hand, in precisely the same year, Ignatius de Luca included a biographical entry on Hell in his *Das gelehrte Österreich* ('learned Austria'). Wheras Horányi included Hell in his cavalcade of *Hungari*, de Luca categorised him as an Austrian and declared that Hell's parents were "both born Germans" (that is, German-speaking).[408] Perhaps this statement led Maximilianus Hell to write in a letter to Bernoulli that[409]

> My Hungary (for I am myself an *Ungarus*) has a more sane attitude towards Astronomy, which is held in high esteem among the *Ungari*. Here in Vienna, a work called *Das Gelehrte Österreich*, Part I, from the letter A to the letter O,

[406] See for example Vargha 1990 and 1992; Szabados in Hockey *et al.* (eds.) 2007.
[407] Alexius Horányi, *Memoria Hungarorum et provincialium scriptis editis notorum* Tomus II, 1776, pp. 81-90. It might be mentioned that this genre of Hungarian *Historia litteraria* saw some significant predecessors in earlier decades of the eighteenth century: see Tüskés 2010 on the works of Dávid Czvittinger, Mihály Rotarides and Márton Schmeizel and their contexts.
[408] De Luca 1776, p. 176: "beyde gebohrne Deutsche".
[409] Hell to Jean Bernoulli III in Berlin, dated Vienna 15 February 1777 (UB Basel): "Ungaria tamen mea (nam ipse Ungarus Sum) Saniorem de Astronomia Sensum habet, maximoque apud Ungaros in pretio est. Prodijt hic Viennæ, sub titulo: *das gelehrte Oesterreich*, Pars I. à littera A, ad, O, Virorum doctorum per Regna hæreditaria austriaca Scriptis clarorum, nunc inter vivos versantium; Pars II à littera O, ad Z, sub prælo est; celebriores hos inter Scriptores, Ungari maximum efficiunt numerum, centenis enim plures sunt, unde constat, Ungariam præ cæteris Regnis hæreditarijs, Scientijs omnis generis excultam maxime floruisse, actuque florere, licet apud Exteros hactenus (defectu commercij litterarij) pene ignoti fuerint Viri docti Ungariæ".

> providing a survey of learned men that are now living throughout the Austrian hereditary lands and who have acquired fame through their writings, has been published. Part II, from the letter O to the letter Z is now in press; among these prominent authors, the *Ungari* make up the largest proportion, for they count more than a hundred. This demonstrates that Hungary has flourished, and in fact still flourishes, more splendidly than the rest of the hereditary kingdoms with respect to the cultivation of all kinds of sciences. However, among foreigners Hungary's learned men have remained virtually unknown as a result of the lack of scientific correspondence.

Father Hell was apparently anxious to stress, lest his Berlin correspondent should have any doubts, that he was a *Hungarus* – and proud of it. True, the notion of nationality underwent considerable changes in the final decades of the eighteenth century, when the ideas of romanticists like Herder started to gain influence among *littérateurs* in Central Europe. As we have seen, Hell did contribute to the increased interest in Hungarian language and history in his age, but he disliked the narrow definition of the "real Hungarian" (*Magyar*, or 'Hungarian by blood') that was advocated by several other champions of Hungarian patriotism in the 1770s and 1780s. One may conclude, therefore, that Maximilianus Hell was a non-Hungarian speaking *Hungarus* from the Slovak part of the Kingdom of Hungary, parented by a German-speaking mother and father, educated by Latin-speaking Jesuits and provided for by the cosmopolitan Viennese court for most of his adult life. In other words, he was neither a typical Hungarian nor a typical Slovak in anything near the modern sense of these words.

Maximilianus Hell's working languages were Latin and German, and he recognised the importance of the French language, which he clearly read without difficulty, although he never learned to write or speak it properly himself. When discussing scientific topics with his Hungarian peers, he stuck to Latin, both in writing and orally. In the cosmopolitan milieu of eighteenth-century Vienna, where – according to contemporaneous accounts – "German, Latin, French, Italian, Greek, Hungarian, Bohemian, Polish, Flamish, Wallach, Turkish, Illyric, Croatian, Windic and Ruthenic"[410] were heard daily on the streets, Hell did fine with his German and Latin. Since 1755, two designations were the first to appear on the title pages of his publications: *astronomus caesareo-regius* ("Imperial and Royal Astronomer") and – up until the year 1773 – *è S.J.* (or *è Societate Jesu*, "of the Society of Jesus"). Both designations signalled, to the eighteenth-century reader, the author's adherence to multiethnic and plurilinguistic entities. Hell's use of scientific Latin facilitated dissemination of the

[410] Cf. Knopper 1993, p. 131: "allemand, latin, français, italien, grec, hongrois, bohémois, polonais, flamand, wallach [roumain], turc, illyrique, croatique, windique, ruthénique".

Ephemerides Astronomicae in all countries of learning, and laid the foundations for his membership in the informal, international 'Republic of Letters'. As to the Vardøhusian expedition, we shall see in a later part how Maximilianus Hell defined that as a "Danish expedition", just as the foreigners recruited by Catherine II's Imperial Academy in the same year undertook "Russian expeditions".[411] Thus, when a recent book refers to Hell's expedition as a significant event in "the history of cooperation of the Norwegian and Slovak nations",[412] this is an anachronism at best. No less misleading is a Hungarian author's recent description of it as a "Hungarian expedition".[413] As is to be expected, the former scholar has included no Hungarian publications on his list of references, and the latter quotes no Slovak publications whatsoever.

Tackling the co-existence of conflicting national appropriations in the historiography can be a challenge.[414] I do not wish to become a champion of any nationalistic cause. In order to avoid this, I have consistently used the Latin forms of all names of places and persons from the Kingdom of Hungary and Austria. Latin was, after all, the official language of the Kingdom of Hungary as well as the Society of Jesus. The best way of avoiding anachronisms in the case of the *Hungarus* and Jesuit Father Maximilianus Hell appears to be to stick with Latin.

Another sensitive issue is the distribution of blame and innocence in a history that is replete with confrontations. The fundamental study of Hell's life and scientific career that was undertaken by Ferenc Pinzger has already been described at some length in Section I.1.1.4. Later authors have in general followed in the same tradition. Pinzgerian hagiography has prevailed over Littrowian slander. But is that really progress? I hope to have shown that there were certainly blind alleys in the scientific theories promoted by Hell, and that his alleged "modesty" was more than once overshadowed by jealous promotion of personal glory. In brief, he was a human like most of us are.

What then about that concept, 'Jesuit science'? Could it be that, despite the reservations raised in Section I.1.1.2, the present treatment of Maximilianus Hell's career as an example of Jesuit science has turned out to be more helpful than previous classifications based on nationality?

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[411] See Chapter III.3.
[412] Kafka [2003], p. 4.
[413] Bartha 2004*a*, p. 50: "a várdői magyar expedíció".
[414] See Shore 2007, pp. 10-14 for a sound discussion of the challenges posed on western scholars in the study of Jesuit history in early-modern Central Europe.

Two choices have been made in the above account. First, I have deliberately tried to interpret Hell's career within the context of the Austrian Province of the Society of Jesus. It was this administrative division that was constitutive to his early career, rather than the borders of the state. By breaking down national barriers that have proven themselves virtually insurmountable to those who prefer to interpret Hell's career as part of the history of a single nation state, I hope to have contributed to an appreciation of his biography that is more in tune with the realities of eighteenth-century Central Europe. The second choice has been to interpret his activities within the framework of Habsburg politics. This has led to a second lesson, which in a sense contradicts the above interpretation. Maximilianus Hell was not only a Jesuit and an exponent of Jesuit science, as one might think when reading the series of 'parallel lives' presented above. Hell was also a representative of the Habsburg Empire. For example, his work instruction explicitly demanded international contacts. This was hardly part of the professional work instruction of the average Jesuit professor in the Austrian province of the Society of Jesus. Therefore, to interpret Father Hell as a Jesuit and little else, hardly does justice to his career. Rather, he should be seen as an official representative of the Austrian Province of the Jesuit order *and* of the Habsburg Empire. After the dissolution of the Society of Jesus, he became a man of conflicting loyalties and at times self-contradictory political statements, strategies and practices. His loyalties became increasingly alienated from the policies of his rulers, although he never resigned from his office as court astronomer. In this sense too, he was a human being – neither a monster nor a saint.

In coming chapters of this thesis, the contributions of Maximilianus Hell to the eighteenth-century efforts to calculate the solar parallax will be analysed. The two transits of Venus both fall within the part of Hell's career as a Jesuit Professor and Court Astronomer. However, the calculations based on the 1769 transit of Venus were made in an atmosphere of an imminent and finally real spiritual disaster to the main character of this thesis. Neither did the suppression of the Society of Jesus pass unnoticed for Hell's colleagues in France, Germany, Russia and Scandinavia. To what extent the rhetoric directed against the Jesuits by enlightened *philosophes* influenced the professional work of European astronomers in the 1760s and 1770s is a complex question, which will be addressed later.

Part II

THE EIGHTEENTH-CENTURY TRANSITS OF VENUS AND THE ROLE OF MAXIMILIANUS HELL: NORDIC AND CENTRAL-EUROPEAN CONTEXTS

II.1 THE 1761 TRANSIT OF VENUS AND THE ROLE OF FATHER HELL

> Neminem astronomiæ studiosum esse puto, quin ea quæ in hoc Veneris cum Sole congressu observata fuerunt, intelligere valde aveat, præsertim cum nullus sit usquam alius corporum cælestium concursus, quo incertas adhuc, aut nondum sat accurate definitas Solis & Veneris parallaxes majori subtilitate assequi valeamus
>
> - Eustachio Zanotti 1761 [1]

> Quel est l'Astronome qui ne connoisse pas les excellentes Éphémérides de Vienne?
>
> - Jean Bernoulli 1771 [2]

The transits of Venus in 1761 and 1769 are widely recognised as 'highlights' of eighteenth-century science. This recognition has resulted in a considerable number of monographs,[3] conference proceedings,[4] journal articles[5] and chapters in general histories and textbooks of astronomy[6] devoted to these events. Among this literature, contributions focusing on the historical significance of a particular expedition, region or country abound.[7]

During the eighteenth century, Maximilianus Hell's Venus transit expedition to Vardø was regarded as almost as exotic as, and certainly no less scientifically important than, that of James Cook to Tahiti or of Chappe d'Auteroche to California, both undertaken in the same

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[1] Zanotti, *De Veneris ac Solis Congressu* ... 1761, p. 1: "I reckon there is no one interested in astronomy who does not wait impatiently to learn what was observed during the recent meeting of Venus with the Sun, especially since there is no other encounter between celestial corpses from which we are able to ascertain with a greater degree of exactness the still unknown, or not yet sufficiently well defined, parallaxes of the Sun and Venus".

[2] Bernoulli, *Recueil pour les Astronomes*, vol. I, 1771*b*, p. 154: "What astronomer does not know of the excellent *Ephemerides* of Vienna?".

[3] Historical accounts of past transits of Venus, with ample explanations as to how they were predicted, how they were used for computation of the solar parallax, how they were observed, etc. are provided by amongst others Woolf 1959, Maor 2000, Sellers 2001, Sheehan & Westfall 2004, Marlot 2004, Arlot & Luminet 2004 (I have not had access to the second edition of Maor [2004]).

[4] The proceedings of the international gatherings in Gotha, Germany in 1998, Lancashire, UK in 2004 and at the Observatoire de Paris, France in 2004 (edited by Brosche *et al.* 1998, Kurtz 2005 and Aubin 2007) contain historical articles on the transits of Venus.

[5] Among the many articles on this topic, Chapman 1998 (in English), Verhas 2001 (in French) and Verdun 2004 (in German) merit particular mention.

[6] E.g. Vorontsov-Vel'yaminov 1969, pp. 106-107; Herrmann 1984, pp. 38-41; Acker & Jaschek 1985, pp. 34-36; Van Helden in Taton & Wilson (eds.) 1995, pp. 153-168.

[7] See for example House & Murray 1997 or Orchiston 2005 on James Cook's Tahiti expedition; Nunis Jr. 1982 or Engstrand 2004 on Chappe d'Auteroche's California expedition; Bedini 1997, pp. 184-188 on North America; Metz 2007 on William Wales' expedition; Bray 1980 and Lomb 2004 (according to Hughes 2005*b*) on Australia; van Gent 2005 on the Dutch West Indies; Butler 2005 on Ireland; Woolf 1962, Pecker 1998 and Débarbat 2005 on France; Aspaas 2011*a* on the Nordic countries; etc.

year. For over a hundred years, his sets of data from Vardø were prominent in debates concerning the distances of the solar system. This fact has led to a number of monographs and articles devoted to Hell's expedition and its scientific results.[8] But whereas his importance in the Venus transit project of 1769 is well known, not much has been said about his role in 1761.

In recent studies of early modern learning, considerable attention has been paid to the contributions of the Jesuits in several branches of science, including astronomy.[9] But whereas the focus of most studies on the eighteenth-century transits of Venus has been on the role played by French and British astronomers in co-ordinating expeditions and systematising data assembled from various parts of the world, the impact of representatives of the Society of Jesus has not yet received much attention. The international scope of this Catholic order, and the custom of using Latin as a means of communication among the members of the order, complicates traditional categorisations based on nationality or citizenship. Accordingly, Maximilianus Hell's adherence to the Jesuit order will receive particular attention in the present analysis of his role in 1761. Given the lack of literature concerning his impact in 1761, a variety of primary sources illuminating his activities – both as a 'networker', inspiring, facilitating and publishing the observations of others, and as a 'theoretician', assessing observations, calculating orbits and discussing various properties of the planet Venus – will be explored.

Two initial sections provide a survey of the phenomenon and its place in contemporary astronomy, with particular emphasis on the 1761 transit (Sections II.1.1 and II.1.2). There then follow sections on Maximilianus Hell's role as a participant and networker of the observations of 1761, and on his subsequent deliberations on various aspects of the theory of Venus (II.1.3 and II.1.4). A concluding section assesses the role of Hell in 1761 from the perspective of modern literature on the Venus transit project and perceived as an international enterprise (II.1.5).

[8] See the introduction to Chapter II.3 for references.
[9] See Section I.1.1.2 for references.

II.1.1 THE PHENOMENON AND ITS PLACE IN CONTEMPORARY ASTRONOMY

A *transit*, or passage of Venus in front of the Sun as seen from Earth, is a rather rare astronomical phenomenon. The first transit of Venus to be observed by means of astronomical equipment took place in 1639. Since then, transits of Venus have occurred in the years 1761, 1769, 1874, 1882 and 2004. The next transit will take place on 5-6 June 2012, but after that no transits of Venus will occur until 2117 and 2125. Thus, a passage of Venus is not for every generation to witness.

The 1639 transit of Venus made no immediate impact and (as far is known) was only observed by two amateur astronomers in the English countryside.[10] By contrast, the pre-calculated transits of 1761 and 1769 attracted massive interest from the entire world of learning. Indeed, they became major events of eighteenth-century science, attracting lavish funding and propelling scientific expeditions into remote regions. The principal reason was that the transits of Venus were seen as unique opportunities to measure the distance between Earth and the Sun, a coveted measure in the 'quantifying spirit' of the Enlightenment. Early on in the seventeenth century, Johannes Kepler's (1571–1630) ground-breaking work on the orbits of the planets had laid the foundations that enabled skywatchers to be prepared for spectacular events, such as transits of Venus.[11] The Newtonian theory of gravitation and

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[10] The observers were Jeremiah Horrocks (c. 1618–1641), observing from outside Liverpool, and his friend Simon Crabtree (1610–1640), observing from the Manchester area. Horrocks, who had foreseen the event, has recently been hailed as the "Father of British Astronomy" (Aughton 2004, title page), a rather odd suggestion, since Horrocks' manuscript *Venus in Sole Visa* was left unpublished until it was sent out of the country and eventually printed by the famous astronomer Johannes Hevelius (Jan Heweliusz, 1611–1687) in Danzig (Gdansk, modern Poland) in 1662. Only then did the Fellows of the Royal Society of London become aware of Horrocks' achievement (Hevelius 1662, pp. 111-181; cf. Aughton 2004, pp. 3-7). See also Posch & Kerschbaum 2005 and Chapman 2005 for illuminating studies of Horrocks and his place in the history of European astronomy.

[11] Kepler issued a pamphlet in 1629 asking "sailors navigating the Ocean", as well as "learned men living in America, the Mexican and neighbouring provinces", along with European Professors of Mathematics and such magnates as would "have the *otium* allowing them to take part in the pleasure of these celestial spectacles; in sum, all and every one who cares for celestial matters", to prepare for two spectacular events he foresaw for November and December of the year 1631 – a transit of Mercury and a transit of Venus in front of the Sun (Kepler, *Admonitio ad Astronomos* ... 2nd ed. 1630, pp. 12-13: "Satis hoc est caussæ, ut *adhorter omnes & singulos*, non *naucleros* tantum, qui Oceanum navigabunt, *doctósve viros*, qui Americam, qui Mexicanam & vicinas provincias habitant; sed Europæos quoque, *Professores Mathematicos* in Academiis constitutos, *Magnates* etiam, qvibus otium ad hæc spectaculorum cœlestium oblectamenta suppetit; denique universos, qvibus cœlestia curæ sunt [...]"). Kepler himself passed away before the events took place, but the French Professor of Mathematics, Pierre Gassendi (1592–1655) responded to Kepler's admonition and observed the transit of Mercury from Paris on 7 November 1631. He also tried to observe Venus passing in front of the Sun a month later, but failed to do so because that transit took place during the night and therefore (as we now know) was invisible in Paris (Gassendi, *Mercurius in Sole visus, et Venus invisa Parisiis, Anno M.DC.XXXI.* orig. 1632 = Gassendi 1658, pp. 499-510; cf. Maor 2000, p. 42 n. 2; Marlot 2004, p. 61). See also Hughes 2005*a* for an

mechanics presented later in the same century (Isaac Newton, 1642–1727) had further improved the methods of calculating the movements of the planets, but there were still considerable uncertainties about the actual *distances* from the Sun to the various planets. A transit of Venus was seen as the best way to solve the problem; observations of Venus in front of the Sun from widely separated sites on Earth would reveal tiny shifts from which the absolute distance between the Sun and Earth could be deduced. Once the Sun-Earth distance was known, the distances between all the other planets in the solar system could be deduced as well, by means of Kepler's Third Law.[12]

The astronomical unit to be obtained was based on the so-called *parallax*: an object (in this case, Venus) is seen to vary its position against a background (here, the Sun) when viewed from different angles. Holding a finger in front of you will produce a similar phenomenon: if you look at your finger with one eye at a time, you will see that its position shifts against the background (e.g. the wall of your study) as each eye is closed. Similarly, eighteenth-century astronomers wanted to use a transit of Venus to produce a parallax: the tiny disc of Venus would be viewed in different positions against the background (the Sun) as various astronomers spread themselves over the Earth. The distance between various sites of observation on Earth, combined with apparent shifts in the position of Venus in front of the Sun, as seen from each site, would provide the data necessary to determine the solar parallax.

The term *solar parallax* may be defined as "the angle, which the semidiameter [i.e., radius] of the earth subtends, being seen from the Sun".[13] Taken the other way around, this amounts to the shift of the Sun's position when moving from the centre of Earth to a position at the surface where the Sun is seen in the horizon (the distance between the centre of the Earth and its surface equals the radius of the Earth). However, as no observer could possibly enter the centre of the Earth, widely-separated observers on its surface had to suffice instead. Provided the geographical position of each observer was determined, the distance between them could be used to calculate what the difference in view would have been between the centre of the

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interesting discussion of why only Horrocks and Crabtree saw the 1639 transit, despite the fact that it would have been visible in western parts of the European continent as well.

[12] Kepler had found that "the squares of the times of revolution (periods) of the planets are proportional to the cubes of their mean distances from the sun" (quoted after Woolf 1959, p. 3). Whereas the times spent by each of the then known planets – Mercury, Venus, Earth, Mars, Jupiter, and Saturn – in encircling the Sun were known to Kepler, he could only guess at the distances between them. However, as soon as the distance between the Sun and any of the planets in the Solar system was known, the size of the whole system could be deduced by means of this Third Law. For a discussion of the mathematical principles behind the Third Law, see Davis 2005.

[13] Peter Daval, "An Account of the Sun's Distance from the Earth …" 1764, p. 1.

Earth and its surface. In sum, two sets of data were necessary: first, the geographical position of each observer and second, the exact divergence of Venus' path in front of the Sun as seen from the various stations. What was then obtained was primarily the data needed to determine the distance between Earth and Venus. However, since the *relative* distances between the planets had been known ever since the days of Kepler, the distance between Earth and Venus could easily be used as a basis for the distances between all the known planets in the solar system, including the coveted Earth-Sun distance itself (see Fig. 3).

The size of the Earth was fairly accurately known by the mid-eighteenth century. Thus, the figure of the solar parallax was really just a compressed, internationally acceptable way of expressing the distance between Earth and the Sun, without having to choose between English, French or various German miles, the Russian *verst*, the French *toise* or (later) the kilometre. The smaller the parallax, the greater the distance between Sun and Earth.

A planetary transit can only occur with either of the two planets Mercury and Venus, since the other planets in our solar system have orbits farther out, thus never passing between the Sun and the Earth. However, although transits of Mercury occur fairly frequently (between twelve and fourteen times a century) they have been of little use in calculating the solar distance. Mercury is simply too close to the background (the Sun) to offer any substantial parallax, no matter how far the terrestrial observers spread themselves apart.[14] The planet Venus, on the other hand, orbits the Sun much closer to us and should therefore be of far better use, according to the ideas of influential Enlightenment astronomers. To use the finger-analogy again: if you hold your finger only a centimetre or two from the wall, no substantial shift will be produced as you close each eye in turn (that is, the background will shift about as much as your finger). At half a metre's distance, however, the parallax will be considerable.

[14] Edmund Halley, who observed a transit of Mercury from St. Helena in the southern Atlantic on 7 November 1677, tried his best to obtain corresponding observations from Britain in order to determine the solar parallax. He was probably inspired by a short *scholium* in a work by the Scottish mathematician James Gregory (1638–1675), stating that (Gregory in Woolf 1959, p. 15): "This problem has a very beautiful application, although perhaps laborious, in observations of Venus or Mercury when they obscure a small portion of the sun; for by means of such observations the parallax of the sun may be investigated" = Gregory, *Optica Promota* 1663, p. 130: "Hoc Problema pulcherrimum habet usum, sed forsan laboriosum, in observationibus Veneris, vel Mercurii particulam Solis obscurantis: ex talibus enim solis parallaxis investigari poterit". Due to bad weather in the British Isles, however, no corresponding observations of the Mercury transit could be found. Later, Halley became convinced that a transit of Mercury would be unsuitable to measure the solar parallax, pointing instead to the coming transits of Venus. Nonetheless, efforts were made by French academicians to determine the Sun's parallax by means of a Mercury transit as late as 1753, but after that the idea seems to have been abandoned for good in favour of the transits of Venus (see *HARS* 1753 [1757], pp. 228-240, especially p. 239; cf. Woolf 1959, pp. 35-51; Marlot 2004, pp. 92 & 99).

A transit may last for several hours, depending on how close to the centre of the Sun's disc the planet makes its passage. As a result of parallax, the time spent by the planet crossing the disc of the Sun will also vary according to where on the surface of the Earth an observer is situated. The transit of Venus in 1769, for example, as observed by Maximilianus Hell in Vardø, lasted 6^h 29′ 34½″ (6 hours 29 minutes 34½ seconds). At the same time, the astronomer Charles Green (1735–1771) of James Cook's (1728–1779) crew on Tahiti saw Venus spend 6^h 5′ 37″ crossing the Sun, i.e. nearly 24 minutes less.[15] This difference in time was a key figure in the calculation of the Sun's parallax. By measuring the exact time spent by Venus in crossing the Sun, astronomers were able to determine how close to the centre of the Sun's disc the transit took place as seen from each station. Theoretically the position of Venus on the Sun's disc could be measured. In practise such observations were difficult and the displacements of Venus not large enough to yield a satisfactory result. Exact time-keeping, combined with the determination of each observer's geographical position, therefore came to constitute essential data for the computation of the solar parallax (see Fig. 4).

[15] Duration of the entire transit as reported by Hell, *Observatio Transitus Veneris ... Wardoëhusii ... facta ...* 1770*a*1, pp. 78-80 (=1770*a*2, pp. 97-100; 1770*a*3, pp. 613-616; 1770*a*4, pp. 92-94; 1793, pp. 298-303) and by Green in Cook, "Observations made … at King George's Island in the South Sea …" 1772, p. 410.

FIGURE 3   THE SOLAR PARALLAX

The solar parallax **p** is the angular displacement of the Sun when the observer moves from **C** to **A**. This is the same as the angle **p'** subtended by Earth's radius **r** as seen from the Sun. Since α>>r, we have p = p' = r/α.

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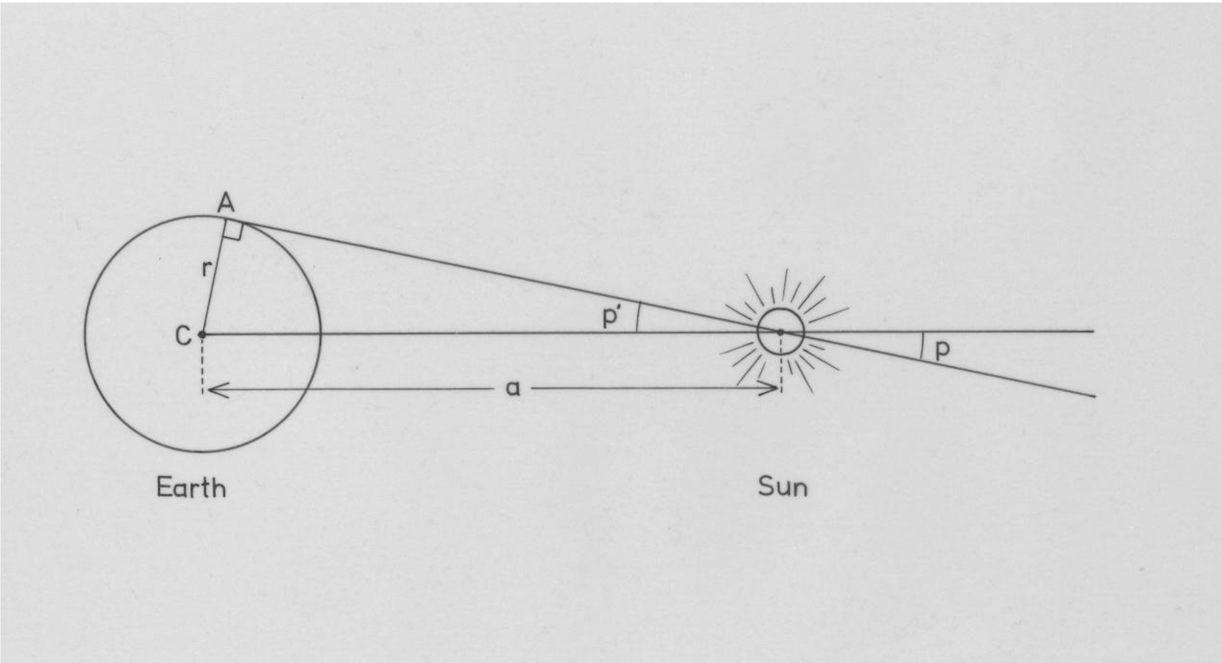

FIGURE 4   THE SHIFT OF VENUS' PATH FROM TWO SITES OF OBSERVATION

During a transit of Venus, the path of the planet on the disc of the Sun as seen from **A** and **B** would shift, altering the times of ingress and egress as well as the duration of the transit (note that the degree of shift has been exaggerated here).

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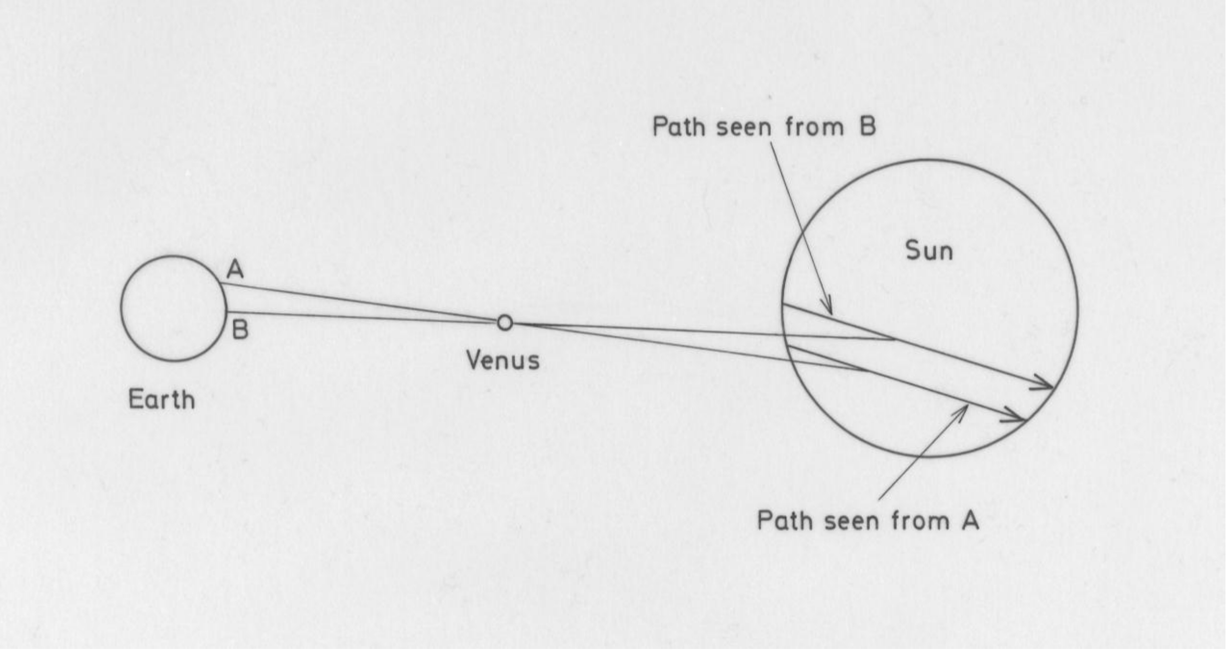

FIGURE 5   THE KEY STAGES OF A TRANSIT OF VENUS

α: exterior contact of ingress (first contact), **b**: interior contact of ingress (second contact), **c**: interior contact of egress (third contact), **d**: exterior contact of egress (fourth contact).

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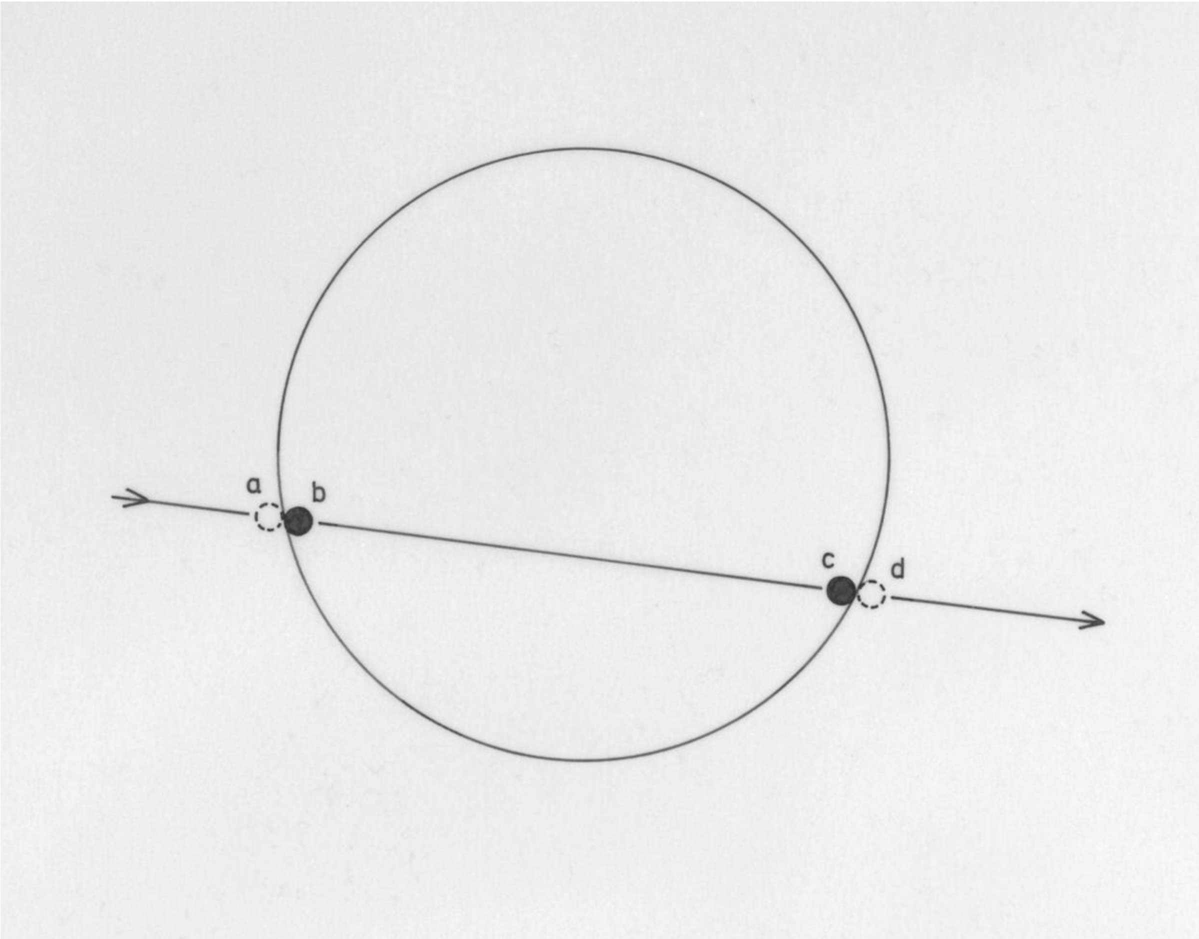

FIGURE 6 DELISLE'S METHOD

Delisle's method requires observations of the time of ingress or egress and knowledge of the observers' positions on Earth. When an observer at **A** sees the start of the ingress, an observer at **B** still has to wait a while for the event. Venus moves faster than Earth and the line from **B** therefore swings towards the Sun. The relatively slow rotation of Earth is of secondary importance in this context.

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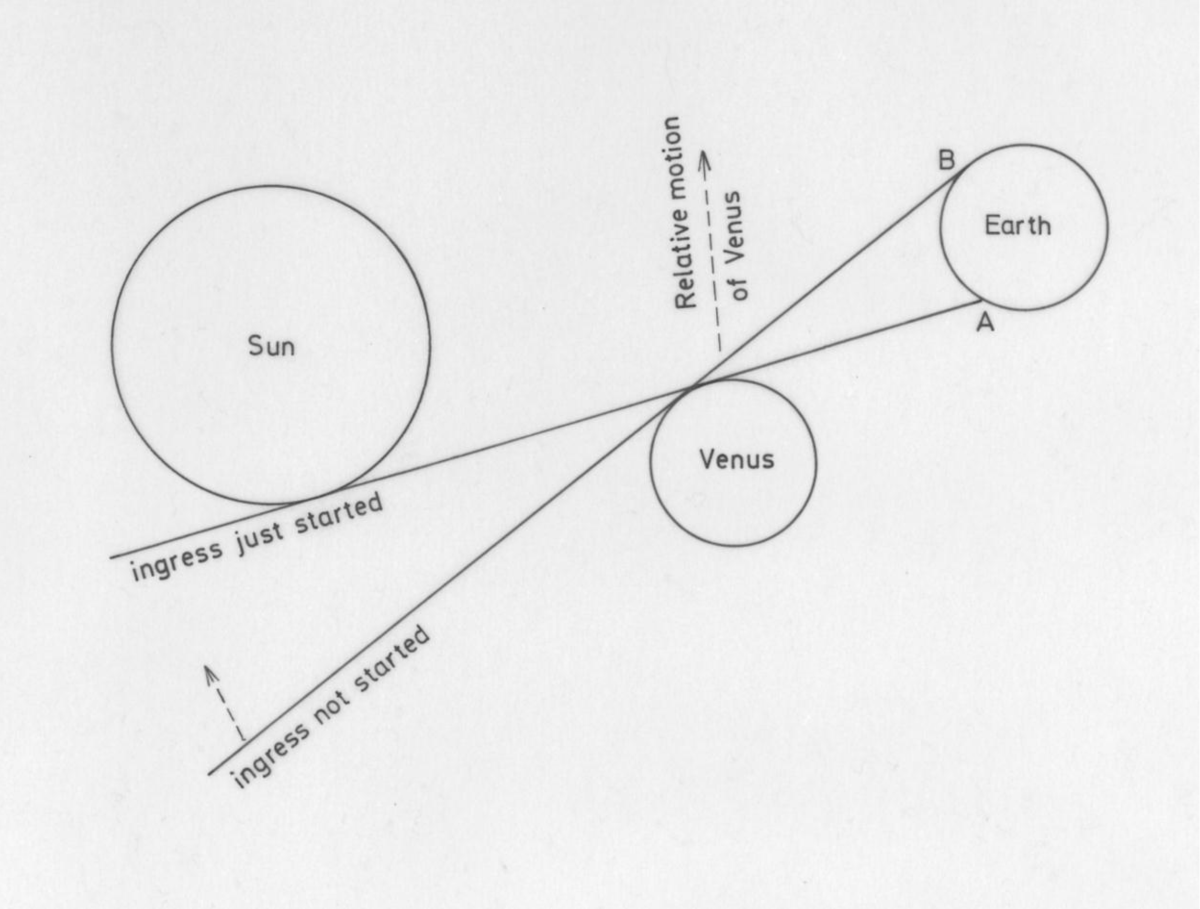

II.1.2 THE 1761 TRANSIT OF VENUS

As soon as the 1761 transit came about, however, and sets of data from the various stations were to be used in order to compute the solar parallax, problems emerged. The English astronomer Edmund Halley (1656–1742), the first to present the astronomical community with an elaborate plan of computing the solar parallax based on the coming transits of Venus, had been convinced that the position of the planet would vary considerably when viewed from stations to the far north and south of the equator. Consequently, provided the observers spread themselves sufficiently far apart, the only co-ordinates needed were a) the geographical *latitude* of two places of observation, and b) the difference in the time spent by Venus crossing the disc of the Sun, as seen from the two places. Combined, these figures would provide the basis needed to settle the parallax problem once and for all, he argued.[16] On the other hand, this meant that the entire duration of the transit would have to be observed.

The crucial stages of the transit were the moments of contact between Venus and the limb of the Sun, commonly designated as the *exterior* and *interior contact of ingress,* and the *interior* and *exterior contact of egress,* sometimes referred to in order of appearance as the *first exterior, first interior, second interior* and *second exterior contacts,* or sometimes just *first, second, third* and *fourth contacts* (see Fig. 5).[17] It was the two interior contacts, that is the second and third contacts, that were of primary concern to Halley. But what if cloudy weather deprived an observer of one of these crucial contacts, or a station's geographical position made only the beginning or the end stage of a transit observable? Following Halley's method, precious data from many stations risked having to be discarded. This concern was raised by the French astronomer Joseph-Nicolas Delisle (1688–1768), a leading figure in the planning of the transit project of 1761. In various memoirs, articles, letters and unpublished lectures he presented an alternative method for the computation of the solar parallax. If a *single contact* of Venus with the Sun's limb was observed from two stations ranging far apart, he argued that

[16] Halley in Sellers 2001, p. 206 (=Motte's translation from the Latin in *Abridgment of the Philosophical Transactions*, Vol. I. p. 243ff): "the transit of Venus over the Sun's disc […] will cause very sensible differences between the times during which Venus will seem to be passing over the Sun at different parts of the Earth. And from these differences, if they be observed as they ought, the Sun's parallax may be determined even to a small part of a second". The Latin original, Halley 1717, p. 457, reads: "*Veneris* transitus per *Solis* discum […] maxime sensibiles efficiet differentias, inter spatia temporis quibus *Venus Solem* perambulare videbitur, in diversis *Terræ* nostræ regionibus. Ex his autem differentiis debito modo observatis, dico determinari posse *Solis* parallaxin etiam intra scrupulum secundi exiguam partem".

[17] The terms *immersion* and *emersion* are also used as synonyms for *ingress* and *egress* respectively (*immersio* and *emersio* in Latin literally mean "diving in" and "diving out", *ingressus* and *egressus* "going in" and "going out"). Furthermore, *internal* and *external* are common synonyms for *interior* and *exterior*.

the difference in latitude *and* longitude between the two stations would provide the necessary basis for the computation of the parallax (see Fig. 6).[18] This suggestion no doubt came as a relief to many astronomers on the European continent. The transit of 1761 was pre-calculated to take place during the night and early morning hours as seen from the heartland of Europe, leaving hope only for the egress (i.e. the end stages of the transit) to be observed. By following Delisle's method, however, data from these observatories would be just as valuable as those from faraway places on other continents.

Halley and Delisle were both right – in theory. However, there turned out to be at least three sources of error involved in the delicate process of observing a Venus transit.

First, regardless of whether the method of Halley or that of Delisle was chosen, *exact time-keeping* was a crucial factor. Harrison's invention (John Harrison, 1693-1776) of the chronometer had just taken place as the transits of Venus came about. Only prototypes of the technology were at hand, and what is more these were still widely held to be insufficiently tested for scientific use.[19] Thus, pendulum clocks were the only aid available, both in 1761 and in 1769. It is worth noting that James Cook did not even take a chronometer with him on his first circumnavigation of the globe – instead, the moments of ingress and egress were determined by means of standard pendulum clocks.[20] A pendulum clock cannot be transported while it is running, however, and will need to be corrected astronomically over several days in order to be held to be reliable. Besides, its retardation or acceleration compared to the Sun would vary from day to day, depending on the temperature. For most purposes, George Graham's (1675-1751) temperature-compensated mercury pendulum solved this problem, but a retardation or acceleration of a few seconds every 24 hours was still common. For the delicate observations of a transit, where each moment needs to be determined to the exact second, this uncertainty was unacceptable, which is why so many of the Venus transit reports include tables of time-keeping stating the retardation or acceleration of the clock over many days. For example, Maximilianus Hell used two pendulum clocks in Vardø: one from Vienna, the other from Copenhagen. Both were constructed with temperature-compensated

[18] In one of his manuscripts, read as a memoir to the Royal Academy of Sciences in Paris, 30 April 1760, Delisle explains: "Cette methode consist à se servir des observations de l'entrée où de la sortie dans des lieux ou l'une de ces deux phases arriveroit dans des tems les plus éloignés qu il seroit possible" (quoted from *Les rendez-vous de Vénus* CD, caption *Delisle, manuscrits 1753 et 1760*, p. 10) = "this method consists of using observations of the entry or exit [of Venus] at places where one of these two stages will take place at points of time differing as much as possible between them". See also Woolf 1959, pp. 33-35.
[19] See for example Wilford 2000, pp. 152-162; Bennett 2002.
[20] Cf. Aughton 1999, p. 11.

pendulums, so as not to be affected too much by climatic factors. Nevertheless, they had to be tested against astronomical observations over several weeks leading up to the transit.[21]

Second, the moments to be observed were particularly the second, third and fourth contacts of Venus with the Sun's limb. The very first contact, that of Venus' exterior contact at ingress was generally held to be too difficult to observe. Venus being invisible in a daytime sky, the observer would simply not know where to look for it until the contact had taken place and the ingress had in fact started.[22] However, during the transit of Venus in 1761, a totally unexpected problem occurred. Instead of entering and leaving the Sun in the form of a well-defined round spot, Venus was seen to take the form of a *black drop* around the moments of second and third contact. To some observers, this phenomenon seemed to last for almost a whole minute. Whether this 'black-drop effect' was caused by disturbances in the Earth's atmosphere or that of Venus, or by some diffraction of light in the astronomical tubes of that time, or was due to astigmatism in the eye of the observer, or amounted to the same as the standard blurring of an image when two objects are very close to each other and the light is too dim for the human eye to distinguish between them, in other words "a combination of solar limb darkening and telescopic point-spread functions" has been a matter of dispute right up to the present time.[23] Whatever its cause, the phenomenon contributed to making the results of 1761 ambiguous. For the 1769 transit the astronomical community was better prepared and several reports include illustrations detailing the optical difficulties involved (see Fig. 7). This did not eradicate the ambiguity of the data, but it was helpful when the observations of various observers were compared.

Third, the path of Venus in front of the Sun as seen from widely-separated sites turned out to shift far less than anticipated by Halley. There was no way that the difference in latitude between stations could suffice. Accordingly, Delisle's idea had to be implemented – or rather, a combination of the two – meaning that a knowledge of each station's longitude was

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[21] Only a small extract of these tests was published in the Venus transit report (Hell 1770*a*1, pp. 61-69). Hell's MS "Observationes Astronomicæ et Cæteræ Jn Jtinere litterario Viennâ Wardoëhusium usque factæ" (1768-69) contains a longer series of tests, starting 26 April and ending 4 June 1769. Another description containing extracts from these tests is extant in an untitled MS of Hell, starting with the words "NB De Horologiis" (1769).
[22] Halley in fact insisted that only the interior contacts were to be used, i.e. the time span between the occurrence of the second and third contacts was the focus of his attention (cf. Halley 1717). Later astronomers extended their attention to the exterior contacts as well, particularly the fourth and last contact of Venus with the limb of the Sun.
[23] See for example Horn d'Arturo 1922; Bønes 1972; Brahde 1972; Maor 2000, pp. 95-97; Shaeffer 2001; Pasachoff *et al.* 2005. Quotation from Pasachoff & Pasachoff 2010, p. 107.

required. In theory, the difference in longitude between two places could be measured simply by transporting a running clock between them. The difference in local time, as revealed by simple observations of the Sun or stars, would then reveal the difference in longitude between the two places. However, as mentioned earlier, this is an impossible procedure when using a pendulum clock. Hence, astronomers did their best by adjusting their clocks to local mean time and then used celestial phenomena such as occultations of the moons of Jupiter or eclipses of the Moon or the Sun, compared to observations of the same event communicated by other astronomers in faraway places, to compute the longitude: a very delicate and time-consuming process indeed.[24] For the 1769 transit of Venus, however, a solar eclipse was predicted to take place on the very day after the event. Most observers therefore used observations of this eclipse as the basis for their longitude determination. Again, however, when observing the eclipse, a similar set of sources of error had to be accounted for: atmospheric disturbances during the eclipse, minute inaccuracies in time-keeping, resulting from sudden changes in temperature, the subjective discernment and skill of the observer, and so on.[25]

Despite these practical challenges – some foreseen, some unexpected – there were also good reasons to hope for the success of the Venus transit projects of the 1760s. Not only had theoretical astronomy undergone rapid development since the days of Kepler: practical astronomy had also been brought to a totally new level, with new technical equipment available to an increasingly large number of observers, the standardisation of observational routines and the founding of professional observatories in conjunction with universities, colleges, academies, societies of learning and monasteries.

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[24] As Moutchnik 2006, p. 101 points out, even at the astronomical centre of Paris astronomers spent almost the entire eighteenth century defining the exact position of the observatory. Bearing this in mind, it should come as no surprise that the meridian for temporary observatories in far-away places was liable to a certain degree of error.

[25] In the *Histoire de l'Académie Royale des Sciences pour l'année 1757*, the editors, comparing the methods of Halley and Delisle, concede that "[i]l est vrai que la méthode qu'y a substitué M. de l'Isle, suppose qu'on connoisse la différence des méridiens entre les deux observatoires. Toute l'erreur commise sur cette différence des méridiens, tombe sur le résultat que l'on tire des observations" (*HARS* 1757 [1762], p. 85) = "it is true that the method which M. Delisle has substituted [to the one of Halley], presupposes that the difference of the meridian between two observatories is known. Every error committed in the difference of meridians will affect the result that can be deduced from the observations".

FIGURE 7   THE BLACK DROP EFFECT

The black drop effect as depicted by Daniel Melander, professor of astronomy at Uppsala, in his 1769 report "Uttydning på de Phænomener, hvilka åtfölja Planeten Veneris Passage genom Solen" ('Interpretation of the phenomena that follow the transit of the planet Venus through the Sun' [Melander 1769]). Melander's **Fig. 2**, **Fig: 3** and **Fig 4** show formations of Venus (**V**) during interior contact at ingress.

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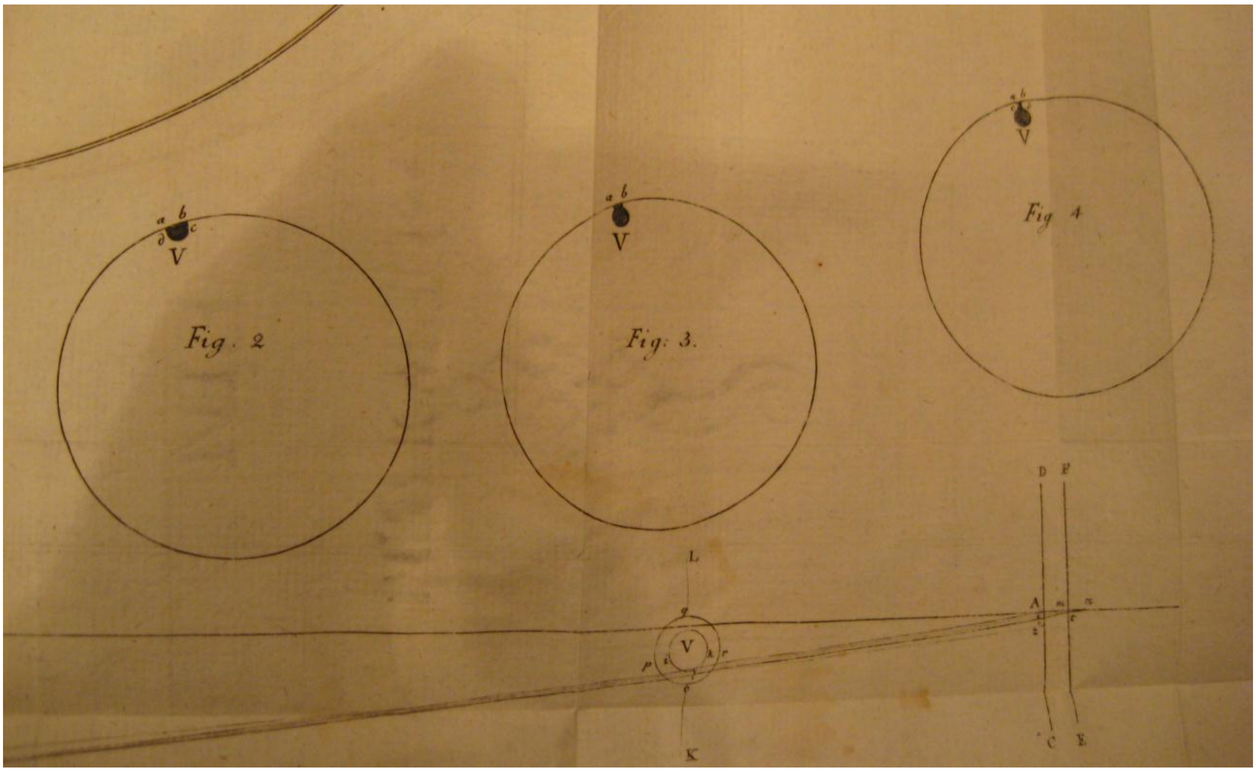

A few years after Halley wrote his admonition of 1716, the Wittenberg astronomer Johann Friedrich Weidler (1691–1755) published a ‘Dissertation on the Present State of Astronomical Observatories’.[26] In this work, published in 1727, a total of sixteen European observatories are described, in addition to a sole Jesuit observatory in China. The largely chronological arrangement of Weidler’s dissertation bears witness to the initial phases of what we might call an institutionalisation process of astronomy. Beginning with the long-since deserted Uranienborg on Hven (or Ven), established by Tycho Brahe in 1580, he continues with Rundetårn in Copenhagen (finished in 1642), Greenwich (1676), Paris (1671), Nuremberg (1678) and Leiden (1633). In fact, these observatories are the only ones established prior to 1700 that he finds worthy of mention.[27] During the first quarter of the eighteenth century, however, Berlin, Kassel, Altdorf, Utrecht, Bologna, Rome, Genoa, Padua, Lisbon and St. Petersburg followed suit.

During the second half of the eighteenth century, the French astronomer Joseph Jérôme Lefrançais de Lalande (also spelled La Lande or Delalande, 1732–1807) undertook a similar survey for his classic *Astronomie*. In the preface to the 1792 edition, a total of 138 observatories are described, the vast majority of them situated in Europe.[28] Some were no longer functioning at the time of writing; others were in the early stages of construction. Nevertheless, the sheer number of observatories described by Lalande, compared to those enumerated by Weidler, gives an idea of the rapid growth of interest in astronomy during the eighteenth century. As the year 1761 approached, therefore, the conditions for success were in fact even more promising than they had been in the days of Halley.

The 1761 transit of Venus took place in the midst of the Seven Years’ War, in which the two leading nations of astronomy, France and Britain, were opposing each other. Despite the difficulties caused by the war they managed to co-operate and the standard history of the eighteenth-century transits of Venus concludes that approximately 65 sites provided sets of

[26] Weidler, *De Praesenti Specularum Astronomicarum Statu Dissertatio*, 1727. In the preceding year, the author of the dissertation had travelled around Germany, the Netherlands, England, France and Switzerland, where he had visited several of the observatories described, cf. the biography by Wilhelm Weidler 1915, pp. 6-10.
[27] Other famous seventeenth-century observatories, like that of Hevelius in Danzig/Gdansk, are not mentioned by Weidler, probably because they were not functioning any more at the time of writing (cf. the title of Weidler’s dissertation, “De Praesenti Statu…” = “On the *Present* State…”).
[28] My count, on the basis of Lalande, *Astronomie*, 3rd edition, 1792, Préface, “Des différens observatoires de l’Europe”, pp. xxx-liv. The prefaces to the two prior editions of the *Astronomie* (published in 1764 and 1771) do not contain analogous enumerations of observatories.

data that were used for the computation of the solar parallax.[29] The vast majority of the observers who embarked upon expeditions for this occasion were French or British. A mappemonde indicating where the transit would be visible had been issued by French astronomers and given world-wide distribution ahead of the transit,[30] and astronomers took up positions in places such as Tobolsk and Selenginsk in Siberia, Rodrigues in the Indian Ocean, Pondicherry in India and St. Helena in the Southern Atlantic, as well as numerous locations in Europe. In 1716, Halley had stated that previous attempts to determine the Earth-Sun distance by well-known astronomers such as Tycho Brahe, Copernicus, Kepler and Riccioli had resulted in a distance ranging from 1,200 Earth radii up to 7,000 ("Earth radii" = semidiameters of the Earth). By contrast, he anticipated that his own method would result in a calculation of the solar distance with a margin of error of no more than 0.2 per cent.[31] However, given the sources of error listed above, it should come as no surprise that computations of the solar parallax based on all the 1761 observations varied from 8.28″ (Planman 1769),[32] 8.33″ (Rumovskii 1767),[33] 8.615″ (Röhl 1768)[34] and 8.69″ (Short 1764)[35] to 9.00″ (Hell 1763,

[29] Woolf 1959, pp. 135-141.
[30] Reprint in Woolf 1959, Fig. 8, between pp. 98-99, cf. the distribution list on pp. 209-211.
[31] Halley in Sellers 2001, p. 211: "We have now shewn, that by this method the Sun's parallax may be investigated to within its five hundredth part" = Halley 1717, p. 460: "Diximus autem hac ratione Solis Parallaxin intra quingentesimam sui partem investigari posse".
[32] Planman 1769 (paper written in 1767), p. 127: "Hinc iterum per medium habetur solis parallaxis 8″,49. Rejecta autem columna tertia, ceu maxime discrepante, dabunt reliquæ solis parallaxin 8″,30, quæ cum parum admodum abludat ab ista 8″,28, quam maximi momenti observationes præbebant […]; vi novissimi transitus Veneris, parallaxis solis horizontalis quam proxime statuenda est 8″,28" = "Thus, once again we have a solar parallax of 8.49 seconds. However, if the third column [of calculations], being the most divergent, is rejected, the rest will give a solar parallax of 8.30 seconds. Since this parallax is so little at variance with the above-stated parallax of 8.28 seconds, which the most important observations gave us […], the horizontal parallax of the Sun, on the basis of the latest transit of Venus, should be stated to be very close to 8.28 seconds".
[33] Rumovskii 1767*b*, p. 510: "Omnes itaque obseruationes a me in computum ductae, eo gradu in statuenda Solis parallaxi consentiunt, vt pleraeque non nisi in centesimis minuti secundi partibus discrepent, atque minima a maxima non nisi 0″.36 […]. Mediam itaque ex his determinationibus quantitatem 8″.33 pro vera magnitudine parallaxeos assumere iure possumus" = "Thus, all the observations that I have used for the computation, are in harmony with each other for the fixing of the Sun's parallax to such a degree that in most cases there is a discrepancy of only a hundredth part of a second between them, and the difference between the smallest and the largest is only 0.36 seconds. Hence, the mean quantity of all the determinations – 8.33 seconds – we may justly assume to be the true magnitude of the parallax".
[34] Röhl 1768, p. 110: "Jch habe aus allen diesen Beobachtungen aus dem Grade der Zuverläßigkeit, welches sie in Ansehung der Parallaxe geben, und welche ohne Zweifel dem Unterscheide der Zwischenzeit zwischen den Beobachtungen proportionirlich ist, das Mittel gesucht, und da finde ich noch 8″,615 wie vorher" = "From all these observations [i.e., of the transit of Venus] I have sought the mean value, according to the degree of reliability that they convey as regards the parallax, and which certainly is proportional to the interval of time between the observations; and again I find 8.615 seconds, just like before".
[35] Short 1764, p. 340: "Thus is the Sun's parallax, on the day of the transit, concluded to be = 8″,56 [i.e., a mean horizontal parallax of 8.69 seconds; cf. Verdun 2004, p. 12], and that from three different modes of comparing together a great number of observations variously combined" (cf. Short 1763, p. 621: "The parallax of the Sun being thus found, by the observations of the interior contact at the egress = 8″,52 on the day of the transit, the mean horizontal parallax of the Sun is = 8″,65").

Lalande 1764),[36] 9.26″ (Audiffredi 1766),[37] 9.89″ (Hornsby 1763)[38] and 10.24″ (Pingré 1768),[39] i.e. a margin of error of more than 10 per cent, a far cry from the 0.2 per cent predicted by Halley! In kilometres, the figures of Planman and Pingré equal 158,884,000 and 128,472,000 km respectively, an unacceptable degree of uncertainty to the contemporary 'quantifying spirit'.[40]

The three main sources of error mentioned above were also the 'weapons' with which astronomers attacked each other in the ensuing debates after the 1761 transit. In order to bring all the data into harmony, it was necessary to consider some features of various observations doubtful. The longitude might have been erroneously determined, the clocks wrongly adjusted or the practical skills of the observer(s) insufficient. Given the ambition, publicity and the sheer amount of money invested in the project, it may well be that such assessments aroused a certain degree of anger among those whose observations were deemed unreliable. However, judging from the tone of the main papers on the solar parallax published in the aftermath of 1761, it seems to be an exaggeration to describe this as a "quarrel between French and British astronomers".[41] Quite the contrary: astronomers involved were generally careful to use polite language when discussing the observations and/or calculations of their colleagues. With hindsight, we may conclude that this strategy was a prudent one: most astronomical data sets are useless when not compared with other observations.[42] Cutting off correspondence with a

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[36] Hell 1763, p. 225: "Ex his omnibus concludendum arbitror, interea, dum Anno 1769. iterum instituatur observatio transitus ♀ per discum ʘ, assumendam ex omnibus arithmetice mediam Parallaxim, scilicet = 9″.0." = "based on all these [i.e., observations] I think we may – while we are waiting for the year 1769, when another transit of Venus across the disc of the Sun will be observed – draw the temporary conclusion that an arithmetically deduced mean parallax should be assumed, namely, 9.00 seconds"; Lalande 1764, p. 800: "en attendant que le passage de 1769 nous ait donné à ce sujet de nouvelles lumieres, nous nous en tiendrons à faire la parallaxe moyenne du soleil de 9″" = "while waiting for the time when the passage of 1769 will have shed new light on this issue, we draw the conclusion of a mean solar parallax of 9 seconds".

[37] Audiffredi's mean value of the solar parallax as calculated in *De Solis parallaxi ad V. Cl. Grandjean de Fouchy … Commentarius*, Rome 1766, was – according to Pigatto 2005, p. 83 – 9″.26 (i.e., 9.26 seconds).

[38] Hornsby 1764, p. 494: "such different methods give a parallax of the Sun on the day of the transit equal to 9″,736". This represents a mean horizontal parallax of 9.89 seconds; cf. Verdun 2004, p. 12.

[39] Pingré 1768, p. 32: "en excluant toutes celles que j'ai marquées comme douteuses, la parallaxe est de 10″,24" = "when all those [i.e., observations] that I have marked as dubious are excluded, the parallax is 10.24 seconds", cf. p. 23: "Si je persiste à croire que la parallaxe horizontale du Soleil est d'environ 10 secondes ¼ , c'est que mon observation ne me permet de penser autrement" = "when I persist in believing that the horizontal parallax of the Sun is about 10¼ seconds, I do so because my observation does not permit me to think otherwise" (cf. Pingré 1763, p. 486, where the mean horizontal parallax is stated to be as high as 10.60″).

[40] I am indebted to Truls Lynne Hansen (pers. comm.) for calculating these figures, using the present value of Earth's equator radius (6,378 km).

[41] Chr. Mayer *Ad Augustissimam ... Expositio de transitu Veneris ...* 1769*b*, Praefatio, p. [v]: "inter *Anglos Gallos*que ex obseruationibus anni 1761 natam de parallaxi horizontali controuersiam"; cf. Hell, *De Parallaxi Solis …* 1772, pp. 113-114, where he speaks of *lites litterariae* ("scientific quarrels") between French and British astronomers after the transit of 1761.

[42] For more on this aspect of early-modern astronomy, see for example Widmalm 1991 & 1992; Brosche 2009*b*.

centre of learning abroad by offending one's colleagues there risked a loss of access to precious material for future research. Besides, the next transit was approaching: why run the risk of making a fool of oneself when the data from the 1769 transit was analysed?

Despite the discrepancies between the various attempts to determine the solar parallax, the 1761 transit project had not been a total failure. Several features of the phenomenon had been investigated and although some observers had missed ingress as well as egress, their observations were still of use for purposes other than the solution of the parallax problem. As one of the observers, the Italian Jesuit Eustachio Zanotti (1709–1782) noted, the transit was useful not only for the definition of the solar parallax, "also, if we turn to the knowledge of the planet Venus itself, this observation is no doubt to be preferred to any other method which can possibly be attempted in order to adjust the nodes of its orbit".[43] Another feature of most reports on the 1761 transit was the measurement of the size of Venus as seen on the Sun's disc, which had been a matter of dispute since the 1639 observations. Several observers also noticed a luminous ring around Venus at certain stages of the transit, which – sometimes in conjunction with the black-drop effect – inspired them to make speculations concerning a possible atmosphere surrounding Venus.[44]

The Venus transit projects of the 1760s have been described as the first ever projects of international co-operation in science.[45] The informal centre of co-ordination lay in Paris,

[43] "ac si ipsam planetæ Veneris theoriam spectamus, non est dubium quin hæc observatio ad loca nodorum stabilienda ceteris omnibus, quæ institui possunt, anteponenda sit" (Zanotti 1761, p. 1).

[44] The Russian polymath natural philosopher, historian and poet Mikhail Vasil'evitch Lomonosov (1711–1765), who observed the transit of Venus from his private home in St. Petersburg in 1761, speculated on a possible atmosphere of Venus. However, his report was only printed in limited numbers as a booklet in Russian and German. Furthermore, it was never included in the official periodical of the St. Petersburg Academy, and was poorly distributed, if at all, outside Russia. Hence, it seems to have been largely ignored until the late nineteenth century, when it was republished in conjunction with the Venus transit of 1874 (cf. Kravets & Chenakal, in Vavilov (ed.), 'Lomonosov: Collected Works', vol. IV, 1955, pp. 353-376; 767-774). This late nineteenth-century publication led Russian historians to hail Lomonosov as the discoverer of the atmosphere of Venus. In recent literature, this claim is sometimes taken as indisputable (e.g. Maor 2000, pp. 88-91; Marov 2005; Ullmaier 2005, p. 146). However, speculation on a possible atmosphere of Venus can be found in numerous reports from several countries: see for example Braun (observation in Saint Petersburg) in Hell 1761, pp. 92-94; Wargentin (Stockholm) 1761*b* & 1762; Bergman (Uppsala) 1762; Hellant (Torneå/Tornio) 1761; Chappe (Tobolsk, Siberia) 1762; Ferner (Conflans, near Paris) 1762; Dunn (Chelsea) 1762; A. Mayer & Röhl (Greifswald) 1762; cf. the very valuable discussion in Röhl 1768, pp. 114-148. Unlike Lomonosov's booklet, these reports – which were all published in the immediate aftermath of the transit – were distributed far and wide in the Republic of Letters. See also Nordenmark 1939, pp. 175-192; Oseen 1939, pp. 152-154; and the discussions of Meadows 1966 and Marlot 2004, pp. 159-163.

[45] Woolf 1959, p. 4: "the conjunction of enlightened interest and scientific practice, actually achieved in the observations of the transits, also gave rise to the first international, co-operative scientific expeditions in modern history". Moutchnik 2006, p. 18 includes a project of cartography between Vienna and Paris that started in 1761, on the initiative of Cassini de Thury, as one of three international projects of cooperation in eighteenth-century

where the senior astronomer Delisle, assisted by his colleagues Charles Messier (1730-1817), César-François Cassini de Thury (also called Cassini III, 1714-1784), Nicolas Louis de Lacaille (also called l'Abbé La Caille, 1713-1762) and the above-mentioned Lalande were pulling the strings. They were all central in the planning of the project, distributing scientific papers and letters containing practical counsel and encouragement to astronomers in the provinces and abroad, and making arrangements that enabled them to obtain the best astronomical equipment available. Consequently, in the days, weeks and months after the 1761 transit had taken place, observations came trickling in to the Royal Academy in Paris for the academicians to assess, adjust and publish. Another centre that received numerous Venus transit reports was the Royal Society in London, where a series of articles was subsequently printed in the society's *Philosophical Transactions*. A third centre that also did much for the instigation, organisation and subsequent publication of Venus transit observations all over the world, but which has received far less attention in modern research, was the Imperial and Royal Observatory of Vienna, led by Maximilianus Hell. Paying attention to the role of Father Hell in 1761 is important, not only because this may serve as a supplement, adding nuance to the story of the eighteenth-century transits of Venus seen as an international enterprise, but also because it may offer hints as to why the government in Copenhagen later came to choose Hell as a candidate for the Vardø expedition (see Section II.2.4).

II.1.3 FATHER HELL AS A 'NETWORKER', ANNO 1761

In 1755, the Empress Maria Theresa of Austria had ordered the construction of a University Observatory in the centre of Vienna, in addition to the Jesuit Observatory already established in the same district since 1734. As director of the new "public" observatory, also called the "Imperial and Royal Observatory of Vienna" (*Observatorium Caesareo-Regium Viennense*), she appointed the Jesuit Maximilianus Hell, who at the same time was given the title "Imperial and Royal Astronomer" ("kayserlich-königlicher Astronom", or *Astronomus Caesareo-Regius*).

science – the other two being the Venus-transit project of the 1760s (counted as a single project) and the *Societas Meteorologica Palatina* of Mannheim, founded in 1781. The cartographical project of Cassini, however, included far fewer participants from a limited area and cannot be compared to the universal interest invested in the Venus transit project from the entire scientific community. A similar, small-scale but international undertaking of much greater geographical distribution than Cassini's cartography project would be the lunar-parallax project of 1751-52, in which several astronomers from at least five countries participated (see Section II.2.1 below).

As explained in Section I.2.2 above, Hell was given instructions to issue a combined almanac/journal for every year, apparently in emulation of the only analogous publication in existence at the time, the *Connoissance des Tems* of Paris. The *Ephemerides (Astronomicae) ad Meridianum Vindobonensem* began to be issued as early as 1756 (covering the year 1757).[46] The choice of Latin as the language of publication made it readily accessible to the entire world of learning. The high standard of calculations and studies presented in the *Ephemerides*, combined with his prestigious position as Imperial and Royal Astronomer, rapidly established Maximilianus Hell as a prominent figure in contemporary astronomy.[47] In obtaining access to the data of fellow astronomers, both within the Habsburg territories and abroad, Hell's status as a member of the Jesuit order was another advantage. The Society of Jesus was the Catholic order that devoted itself most ardently to astronomy and the mathematical sciences. The strong sense of community between the Jesuits and the mutual exchange of letters inherent in their way of life were elements that fitted perfectly well with the demands of practical astronomy.[48] A network of Jesuit astronomers from China and India to Italy, France, Spain, Germany, Central and Eastern Europe provided observations to be assessed and published with comments by Father Hell and his assistants.

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[46] The issue for the year 1757 has no appendix, but appendices were added for every issue from the *Anni 1758* volume onwards. As to the year of printing, Hell's *Ephemerides*, like any other almanac, was routinely issued before the year it covered. However, the year of printing is missing from the title page of every issue until the *Anni 1766* volume, published "Viennæ MDCCLXV". Thus, on the title page of the first issue we find *Anni 1757*, and this year is taken for granted as the year of printing in some modern studies (e.g. Ferrari d'Occhieppo 1957, p. 28; Zdeněk 1970, p. 100; Weyss 1986*a*, p. 5; Harris 1993, p. 537 footnote 19; Lackner *et al.* 2006, pp. 17 & 23). One exception to the above rule was the *Anni 1761* volume, which was delayed due to the move of the printing house from one location to another. Several letters (compare Unprinted Sources, 1*a*) from January-February 1761 contain apologies for this delay, revealing the exceptionality of the situation (Hell to Lacaille, to Delisle and to Messier in Paris, all dated 31 January 1761; Hell to Rieger in Madrid, dated 6 February 1761; Hell to Braun in St. Petersburg and to Chappe d'Auteroche in Tobolsk, both dated 8 February 1761). Two manuscript bibliographies of Hell's published works, both written in Hell's own hand and preserved at the monastery of Pannonhalma, Hungary (compare Unprinted Sources, 1*c*), explicitly state that the first volume of the *Eph.Astr.* was in fact published in 1756 (Hell's MSS "opera à P. Hell. S.J. edita" [dated 9 June 1773] and "Elenchus operum editorum à P. Maximiliano Hell" [1791]). In Hell's correspondence, no letter from the year 1756 is known to have survived. However, a letter from the Jesuit astronomer Joseph Steppling (or Stepling, 1716–1778) in Prague to Hell in Vienna, dated 30 January 1757, contains praise for the *Eph.Astr.*, which he had had the opportunity to leaf through: "Ephemerides à R^{o} P. ad annum 1757 editas, sane præstantes non sine Voluptate vidi, et pervolvi, gratulorque R^{o} P. de initio isto, rebus astronomicis utilissimo, et Societati Nostræ perquam honorifico" = "The *Ephemerides* published by the Reverend Father for the year 1757, which are of really high quality, I have had the great pleasure of seeing and leafing through. I congratulate you, Reverend Father, with this start, so useful for Astronomy and truly honourable for Our Society [of Jesus]". All this evidence combined seems to indicate that the *Anni 1757* volume was also published ahead of the year it covered.

[47] See for example the recension of the *Eph.Astr. Anni 1761* in the *Journal des Sçavans*, Octobre 1761, pp. 672-675. This volume was sent by Hell to the editors of the journal with an explicit request for a review (letter from Hell to the editors of the journal, dated 18 March 1761). Shortly afterwards a recension of the *Eph.Astr. Anni 1762* appeared in the *Nova Acta Eruditorum*, Anno MDCCLXII, pp. 49-58.

[48] On the emphasis on correspondence in the internal structruy of the Society of Jesus, see for example Szilas 1972.

Prior to the 1761 transit, Father Hell issued a 20-page monograph with instructions as to how the transit was to be observed.[49] A lucid text, written in a language accessible even to those with little previous experience in astronomy, it appears to have been widely disseminated. This is evident not only from epistolary evidence,[50] but also from the impressive report Hell was able to compose only a few months after the transit had taken place, 'Observation of the Transit of Venus in front of the Disc of the Sun on 5 June 1761, with Observations of the same Venus Transit made by Various Skilled Observers throughout Europe, and an Appendix of Several Other Observations', published as an appendix to the *Ephemerides Astronomicae* for the year 1762.[51] Not all observers communicated directly with the astronomical giants of Paris and London. Some shared their data with Maximilianus Hell, leaving it to him to assess and publish their observations. Internal evidence in Hell's text indicates it was printed sometime during the autumn of 1761, the last reference being to August of that year[52]. By then, Hell had received letters and printed reports stating the results of observations in Central Europe as well as Russia, Sweden, Italy, France, Spain and even England, despite the war. Several of the observers referred to the twenty-page monograph when they reported their observations.[53]

Like his colleagues in Paris and London, Hell had used his position as Imperial and Royal Astronomer to place orders at the urban instrument makers on behalf of astronomers living outside Vienna, and to make sure the necessary instruments reached them before the transit took place.[54] His brief monograph with instructions should be seen in this context,

[49] Hell, *Transitus Veneris per discum Solis Anni 1761 …* [1760].
[50] Hell to Lacaille in Paris, 31 January 1761; Hell to Rieger in Madrid, 6 February 1761; Hell to Braun in St. Petersburg, 8 February 1761; Hell to Chr. Mayer in Heidelberg, 9 February 1761; Messier in Paris to Hell, [May] 1761; Poleni in Padua to Hell, 25 May 1761. In the first of these letters, to Lacaille, Hell says his work was meant for learners in astronomy only: "Adjecta transitus Veneris per discum Solis exemplaria tuo arbitrio inter tyrones Astronomiæ distribues, nam in horum usum solum hæc conscripta volui" = "The copies of the *Transitus Veneris per discum Solis* you may distribute as you will among learners of astronomy, it is for their sake only that I decided to write it". In a letter dated Paris 18 April 1761, Lacaille confirms to Hell that he has fulfilled his request. Mayer also commented on the treatise, in a letter to Hell dated Heidelberg 17 April 1761.
[51] Hell, "Observatio Transitus Veneris ante discum Solis die 5[ta] Junii 1761. …. Adjectis Observationibus ejusdem Transitus Veneris factis à variis per Europam Viris in observando exercitatis, cum Appendice aliarum nonnullarum Observationum", 1761.
[52] Hell 1761, p. 89: "Anno 1761. […] mense Augusto". Unfortunately, I have been unable to track down letters written in the autumn/winter of 1761-62 that might have shed light on the exact date of publication (cf. Unprinted sources, 1*a* and 1*b*).
[53] Cf. Hell 1761, where Hell states his sources for the data of other observers scrupulously. Many of the handwritten reports on the 1761 transit that were delivered to Hell are still preserved among his manuscripts at the Wiener Universitätssternwarte (WUS Vienna).
[54] Hell to Chr. Mayer in Heidelberg, 9 February, 12 March, and 10 April 1761; Hell to Ximenez in Florence, 18 February 1761; Freyherr Ehrmans zum Schlug to Hell in Vienna, dated Wezlas 8 May 1761. On the last-named person, see Section I.2.2.1.

whereas the memoir in the *Ephemerides Astronomicae* was addressed just as much to an international community of experts.

At the time when the 1761 transit of Venus took place, Hell received a prominent guest from Paris, the director of the *Observatoire Royal*, Cassini de Thury. Cassini's principal mission appears to have been to initiate a rare example of international co-operation in geodesy: the stretch of land between Paris and Vienna was to be accurately mapped. For this task, he needed participation from astronomically skilled individuals, and active support from the rulers of several territories.[55] In Vienna, the task of co-operating in the practical work was allotted to Hell's colleague, the highly experienced surveyor and director of the Jesuit observatory, Father Joseph Liesganig (or Liesganigg, 1719-1799).[56] Having arrived in May, Cassini stayed long enough to observe the transit of Venus from Liesganig's observatory, with members of the imperial family present.[57]

In Vienna, the 1761 transit was visible only in the early hours of the morning of 6 June. Hell's observatory was not advantageously situated for this observation because high buildings blocked part of the view to the east. Nonetheless, three Jesuit observers were present at that site. The Imperial Astronomer himself, however, took up his position in a tower of the Jesuit library nearby.[58] All these sites of observation lay within a couple hundred metres of each other and provided the astronomical community with independent data from a total of nine observers from virtually the same geographical point.[59] What is important to note, however, is the fact that – with one exception, Liesganig – none of the professional observers in Vienna managed to observe the interior contact of egress, due to clouds. All they could see were parts of the planet's path across the Sun's disc, as well as the moment of exterior contact. Hell therefore had no personal experience of the "black-drop effect" to draw upon when he was to observe the next transit of Venus in Vardø.

[55] See for example Widmalm 1990*b*; Dumont & Débarbat 1996; Moutchnik 2006, pp. 86-90.
[56] Letter from Hell to Lalande in Paris, dated Vienna 12 June 1761 (reproduced in Aspaas 2010*a*). On Liesganig, see Section I.2.2.1.
[57] Cassini de Thury, "Observation du passage de Vénus sur le Soleil, Faite à Vienne en Autriche" 1763; cf. Hell 1761, pp. 17-20 & 41. Maor's claim that Cassini de Thury observed the transit from the "from the comfortable quarters of the Vienna Observatory" in the company of "the observatory's director, Father Maximilian Hell" (Maor 2000, p. 87; repeated by Steinicke & Brüggenthies 2004, p. 78) is mistaken.
[58] Hell 1761, pp. 1-20, here p. 1.
[59] I am indebted to Prof. Maria G. Firneis of Wiener Universitätssternwarte for information concerning the positions of these historical sites (guided tour during the conference "Astronomie in Wien: 250 Jahre Eröffnung der Universitätssternwarte", 29 September – 1 October 2006).

II.1.4 FATHER HELL ON LESSONS TO BE DRAWN FROM THE 1761 TRANSIT

Maximilianus Hell's report on the 1761 transit of Venus is not only impressive for the sheer number of observations compiled. In this memoir – as well as in other writings – Hell also includes remarks concerning various lessons to be drawn from the transit.

One conspicuous element of the transits of Venus, which had already been noted by the two amateur astronomers who observed the transit of 1639, was that the planet's size appeared to be considerably larger in the night sky than it did in front of the Sun during a transit. In fact, observers of the transit reported that Venus appeared to have a diameter of less than one arc minute; most micrometer determinations gave about 58 seconds, or just short of a hundredth part of the Sun's disc. In the nights before and after the transit, however, Venus appeared in the sky as a bright star of approximately 1 arc minute and 17 seconds,[60] or almost 33% larger than when viewed against the disc of the Sun. What could be the cause of this sudden diminution? Hell discusses various hypotheses that might explain the phenomenon and concludes that it was most likely to be caused by a certain optic tendency, causing dark objects to appear smaller when viewed against a light background and light objects to appear larger in front of a dark background. This tendency, combined with other optical factors caused by the lenses of the astronomical tubes and the smoked glasses that were used for observations of the Sun, seemed to Hell to be the most likely factor explaining the change of size of Venus. Further research was needed, however, and his wording in this context is very cautious.[61]

In the autumn of 1761, Hell stated that it was impossible to determine the parallax of the Sun, since observations from other continents had not yet reached Europe. On the basis of the observations known to him, however, he presented a tentative determination of what the position of Venus on the Sun would have been, if seen from the centre of the Earth.[62] Two years later, when all the world-wide observations had reached him, he was to conclude that the solar parallax was probably somewhere around 9 seconds.[63] As to the adjustment of the nodes of the planet's orbit, Hell used various observations of the path of Venus across the Sun's disc to determine the coming transits of Venus in the years 1769 and 1874 as seen from the centre of the Earth. He also calculated the visibility of the solar eclipse that was to take

[60] Hell 1761, pp. 24-25, 99-100.
[61] Cf. Hell 1761, pp. 24-28.
[62] Hell 1761, pp. 29-32.
[63] See above, footnote 36.

place on 4 June 1769.[64] Other lessons to be drawn from the transit, such as the possibility of an atmosphere surrounding Venus, were mentioned in some of the reports compiled by Hell, who allowed the observers speak for themselves on this issue, although he concluded early on in his memoir that the planet was not at all likely to have an atmosphere.[65]

A final lesson that could be drawn from the transit was that Venus probably had no moon. From time to time, various astronomers had argued its existence, among them the *Conseiller au Grand Conseil* Armand-Henri Baudouin de Guemadeuc (1734/37-1817). In a lecture held at the *Académie Royale des Sciences* in Paris on 20 May 1761 and printed immediately afterwards, Baudouin reported observations made by his friend Jacques Montaigne (1716-?) in Limoges, who had seen a gleaming object beside Venus on four occasions earlier the same month. Montaigne – and his patron Baudouin – interpreted this as the much-sought moon of Venus.[66] The most likely appearance of such an object as a moon of Venus would be a minute spot somewhere on the disc of the Sun just before, during or after the transit. Many looked for it, but no one reported having seen such a thing.[67] Even so, Hell remained silent about the possible existence (or non-existence) of this moon in his report of 1761.[68]

In 1765, however, a refutation of all "observations" of the moon of Venus as optical illusions, nothing more, was issued in Vienna with the title 'On the Moon of Venus' (*De Satellite*

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[64] Hell 1761, pp. 110-115.

[65] Hell 1761, pp. 21, 26.

[66] The full title was *Mémoire sur la découverte du Satellite de Venus, & sur les Nouvelles Observations qui viennent d'être faites à ce sujet; Lu à l'Academie Royale des Sciences le 20 Mai 1761*. On this memoir and its reception, see now Kragh 2008, espec. pp. 44-56. To his references may be added Krünitz, "Verzeichniß der vornehmsten Schriften von der Venus und dem Merkur…" 1769, espec. p. 119 and Marlot 2004, pp. 101-104. Since Kragh's account is based almost exclusively on printed sources, it may also be worth mentioning here that Baudouin's memoir is referred to – without criticism – by Hell already in his letter to Lalande, dated Vienna 12 June 1761. It is also mentioned in his printed report on the transit (Hell 1761, p. 38), but without any negative comments.

[67] See for example Ferner's report of observations in the Paris region in a letter to the Royal Society of London, dated 20 June 1761 and published in the *Philosophical Transactions* (Ferner 1762, p. 225), and Wargentin's assessment of the results of the Swedish Venus transit observations in the proceedings of the Swedish Royal Academy of Sciences (Wargentin 1761*b*, p. 179 = 1764*b*, pp. 177-178). For further references, see Kragh 2008.

[68] In the *Transitus Veneris per discum Solis*, however, Hell asks observers to look for a small spot crossing the disc of the Sun around the same time as Venus (Hell [1760], p. [10]): "Denique […] tam pridie observationis, quam ipsa die Transitus, discus Solis sæpius contemplandus erit, an non fortassis alia quæpiam macula minor, & bene rotunda sive in eandem, sive in contrariam motui Veneris partem, attamen aut motu Veneris celeriore, aut saltem æquali (sed non tardiore) lata in disco Solis conspiciatur, quam maculam dicto motu præditam, satellitem Veneris esse oporteret, qualem nonnulli se quondam in aliis circumstantiis vidisse putabant" = "Finally, both on the day preceding the transit, as well as on the day of the transit itself, the disc of the Sun should be investigated frequently, to see whether perhaps some smaller, perfectly round spot is there to be seen on the disc of the Sun, a spot moving either in the same or the opposite direction as Venus, but at a speed either exceeding, or at least equalling – certainly not trailing behind – that of Venus. Such a spot, moving in such a way, should represent the moon of Venus, which various observers believe they have seen long ago, under other circumstances".

Veneris). The author of this rather sensational publication was Maximilianus Hell. There were two factors that had led him to publish this work, he explained. One was that he, a few years back, had presented his thoughts on the non-existence of the "Venus moon" in a letter to Lacaille, his formal contact at the *Académie Royale* in Paris. After Lacaille's death in 1762, this letter had been transferred to the hands of others and Hell felt unhappy that the preliminary thoughts he had intended to ventilate to Lacaille alone were now being discussed by several savants in France. The other factor was that, in 1764, another set of "observations" of the "Venus moon" – this time from Copenhagen – had been published. And since even Baudouin now urged Hell to publish his work, the time was ripe for an elaborate memoir on the subject.[69] Hell's argumentation was based on experiments whereby he had succeeded in creating optical illusions, where a tiny, illusory bright spot was produced beside a larger, real gleaming object, viewed through a tube in a dark chamber. Most astronomers realised that with this, the case was settled. As one reviewer remarked about Father Hell's *scharfsinnigen Bemerkungen und Versuchen* ("sagacious remarks and experiments"), "It is a shame that moon of Venus has disappeared: some of the jokers here had already decided to call it by the witty name of 'Cupid'"[70]. In 1768, Hell's memoir was reissued in the *Nova Acta Eruditorum* of Leipzig.[71] Even so, there were observers looking for traces of this moon during the 1769 transit as well, again with no success since – as we now know – Venus has no moon.[72]

The debate on the notorious "moon of Venus" was soon followed by another one, in which Father Hell was also involved. As mentioned, Hell had added as a sequel to his 1761 memoir

[69] Hell 1765, pp. 3-15. See Section II.2.3 for more on the Danish observations.
[70] Krünitz, "Verzeichniß der vornehmsten Schriften von der Venus und dem Merkur, und dem Durchgange dieser Planeten durch die Sonnenscheibe" 1769, pp. 117-118: "Es ist Schade, daß dieser Mond der Venus verschwunden ist; unsere witzigen Köpfe hatten bereits einen artigen Namen, nämlich Cupido, für ihn bestimmet."
[71] Cf. *Nova Acta Eruditorum ... Anno MDCCLXVIII*, pp. 49-126.
[72] The observers organised by the Russian Academy in 1769 were given specific orders to look for the moon of Venus, cf. Rumovskii 1771, p. 45. Thus, Chr. Mayer in his report on the Venus transit of 1769 explains that he has been on the lookout for the moon of Venus, but has seen no trace of it (Mayer 1769*a*, p. 559). In the more elaborate treatise adressed to Catherine II, however, he denies the existence of this moon (Mayer 1769*b*, p. 285; cf. p. 140). Likewise, the Uppsala astronomers Erik (Eric) Prosperin (1739-1803) and Fredrik (Fredric) Mallet (1728-1797) looked for the moon of Venus in 1769, but saw no trace of it (Prosperin 1769, pp. 158-159; Mallet 1769, pp. 222-223). Also the British observers seem to have been instructed to look for the moon of Venus in 1769, cf. Kragh 2008, p. 58. Despite the universal failure to see such a thing as a moon besides Venus on the Sun's disc, the debate arose again in the mid-1770s when an astronomer at the Berlin Academy of Sciences, Johann Heinrich Lambert (1728-1777), produced an article criticising Hell's monograph ("Essai d'une théorie du satellite de Vénus" 1775) and even went as far as announcing, in the *Berliner Astronomischen Jahrbuch* for the years 1777-78, that the moon of Venus would be visible in front of the Sun on 1 June 1777. Hell refutes this prediction in the *Eph.Astr. Anni 1777* (published 1776), p. 7. He also mentions Lambert's prediction unfavourably in some of his letters (see the letters to Fixlmillner, dated Vienna 31 August 1776, 27 November 1776, and 15 February 1777; published with comments by Rabenalt 1986, pp. 119-123). See also Kragh 2008, espec. pp. 80-84 for further sources.

some remarks concerning the visibility of Venus during the coming transits of 1769 and 1874. One of his conclusions was that the 1769 transit was not going to be visible in Vienna, because the Sun would then be below the horizon. This conclusion was not obvious to every contemporaneous astronomer, however. The French astronomer Claude-Étienne Trebuchet (1722-1784), for example, was of the opinion that the 1769 transit would be visible in Vienna. When Trebuchet in 1764 published a work in which he argued against the conclusions of Hell, this provoked a brief review by the Vienna astronomer in the appendix of his *Ephemerides.*[73] Trebuchet, for his part, defended his position in a lengthy letter that was published in the *Journal des Sçavans* for October 1766. This in turn elicited another answer from Hell, a summary of which was published in the *Journal des Sçavans* for August 1767. The debate continued at least until 1770, even though the outcome had proven Hell to be right: the 1769 transit of Venus was indeed not visible in Vienna.[74] However, although the core of the debate was a disagreement on the exact orbit of Venus, it soon also involved the existence (or non-existence) of the "moon of Venus", the feasibility of solar eclipses for longitude determination, the methods of Halley and Delisle for computing the solar parallax, the correct interpretation of a *Mappemonde* of the transit of 1769 that had been published by Lalande, and so on.[75] This Trebuchet was one of the calculatory assistants of Lalande at the *Connoissance des Temps*[76] and the whole debate might be seen to indicate a build-up of tension between Lalande and his Viennese counterpart. Was Lalande sending Trebuchet into the field to defend the reputation of the *Connoissance* versus its main rival, the *Ephemerides,* edited by Father Hell? The evidence to hand is too scanty to say for sure.

It should be evident that as the transit of 1769 approached, Father Hell was becoming an influential figure in contemporary astronomy. Not only was he known as the calculator of an almanac of a high standard, and the compiler of others' observations, he had also – as illustrated in his writings concerning the theory of Venus – discussed several of the central themes of theoretical astronomy and had dared to contest the theories of others. He was

[73] Hell, "Observatio Litteraria", in *Eph.Astr. Anni 1765*, 1764.
[74] Trebuchet, "Lettre à Messieurs les auteurs du Journal des Sçavans sur les passages du Vénus, & sur l'Eclipse de Soleil arrivée en 1764", in *Journal des Sçavans* 1766; Hell, "Extrait d'une lettre du R. P. Hell […] sur le passage de Vénus observé en 1761", in *Journal des Sçavans* 1767; Trebuchet, *Lettre à Messieurs les auteurs du Journal des Sçavans sur le passage de Vénus* [separate reprint, with additions], 1770. The second *Lettre* of Trebuchet was – according to a handwritten message in the hand of Trebuchet on the back page of Hell's copy, dated Auxerre, 16 September 1770 – written in 1768 and published in a *Recueil philosophique*. Only a brief resumé appeared in the *Journal des Sçavans,* as late as February 1771, pp. 118-119.
[75] Trebuchet 1766 & 1770; Hell 1767. See also Pingré 1769.
[76] See for example Boistel 2004.

recognised as an able observer and calculator, as well as an important network figure, helping colleagues in the provinces to obtain high-quality instruments, co-ordinating the activities of both professional and amateur observers, and exchanging data with astronomical centres abroad.

II.1.5 ASSESSMENT OF FATHER HELL'S ROLE IN 1761

A common starting-point for virtually all research on the eighteenth-century transits of Venus is the study of Harry Woolf, dating from 1959. Woolf's tables, especially those concerning all the successful observations from 1761 and 1769, are used extensively and the figures deduced from them are considered to be reliable.[77] In 1761, according to Woolf, data from a total of 120 individual observers contributed to the computation of the solar parallax. A considerable proportion of these observations were published exclusively in the *Ephemerides Astronomicae* of Vienna. It might be a fruitful task to compare Woolf's study, and in particular his tables, with the appendix of the *Ephemerides* for the year 1762, in which Hell offered a survey of observations of the transit of 1761. This may reveal new evidence for an assessment of Hell's role as a 'networker' in 1761. Furthermore, such a task might serve as a corrective to the tables of Woolf, constructed half a century ago.

In Table 1, Hell's Venus transit report from 1761 is compared to the table in Woolf's monograph. Woolf states that he has used "the published memoirs on the transit, the work of J. F. Encke, who reconsidered the importance of the eighteenth-century transits of Venus in 1822, and of S. Newcomb, who did the same in 1890" in constructing his table.[78] Furthermore, he informs the reader that his[79]

> tabulation does not, in any manner, pretend to represent all the observations that were made of the 1761 transit. Others were known to have been made in various locations; even the name of the observer is sometimes known in these cases, but somehow the results never found their way into the standard literature of contemporary astronomy. […] Indeed, the data summarized in the above table […] represents the supply available to those who set out to calculate the solar parallax after the transit.

[77] See for example Van Helden 1995, p. 163; Maor 2000, pp. 108-109; Sellers 2001, p. 133; Marlot 2004, p. 226; Verdun 2004, p. 6; or internet sources such as Jürgen Giesen, "Der Venusdurchgang vom 1761" http://www.venus-transit.de/1761/index.html (accessed 10 April 2008); [anonymous], "Tableau récapitulatif des expéditions menées pour l'observation du passage de Vénus devant le Soleil du XVII e siècle au XIX e siècle" http://www.imcce.fr/vt2004/fr/fiches/fiche_n21.html (accessed 2 August 2005).
[78] Woolf 1959, p. 135.
[79] Woolf 1969, pp. 140-141.

In Woolf's table, there is a column stating "Source", in which Hell's memoir from 1761 appears on a total of 27 occasions, in nineteen instances as the only source for this information. Had it not been for Father Hell's network, then, we may assume the sets of data from these nineteen observers would never have found their way into the astronomical literature and would have been missed by those who attempted to compute the solar parallax. However, a careful reading of Father Hell's publication reveals that the number of such cases should be even higher.

Reading through Father Hell's memoir, I detected several lacunae in Woolf's table. Observers are mentioned and data referred to by Hell that somehow did not make it into Woolf's table. At first sight, these instances might be explained away as observations in which neither the ingress nor the egress was observed, because of clouds or other practical problems. Such partial observations were nonetheless interesting to Hell and his contemporaries, since they provided precious data on the size of Venus, information concerning Venus' position on the Sun's disc at some point during the transit, etc. They were not included by Woolf, however, because he assembled only data from which the solar parallax could be deduced. However, this does not apply in every case. There are observations of ingress or egress referred to by Hell that are missing from Woolf's table. In my table I have highlighted cases where this is the case. Leaving aside an anonymous merchant (*Mercator quidam*) in a suburb of Vienna, who used the inaccurate public clock for time-keeping, and Christian Hoffmann of Dresden, whose observations are described as not entirely correct by Hell, we are nonetheless left with two sites of observation entirely missing from Woolf's table (see under Madrid in my table). Another feature of Woolf's table is that certain sites provided individual sets of data from more than one observer. These are referred to as more than one individual observation, even though the site of observation is the same. This has happened with Greenwich Observatory, for example, where Bliss, Bird and Green all observed simultaneously, but without determining the moments of contact identically. Accordingly, the same site, Greenwich, occupies three separate enumerations in Woolf's table. Again, a close reading of Hell's memoir reveals instances where Woolf has overlooked the fact that individual observers provided different data from the same site. These instances are highlighted in my table as well (see under Crembsium and Herbipolis).

This means that the actual number of individual observations that provided data for a computation of the solar parallax in 1761 should be referred to not as 120, but 125. A small adjustment, admittedly, but as we all know, “the devil is in the detail”. Of these 125 instances, there are 25 where Father Hell’s *Ephemerides Astronomicae* may well be the only source of this information in standard astronomical literature.[80] Below, this total number of individual observations will be raised even further (Section II.2.5).

Hell’s text is partitioned according to the designations *Germania* (including Austria), *Gallia* (France), *Anglia*, *Hispania*, *Italia*, *Hungaria*, *Polonia*, *Svecia* (Sweden, including Finland) and *Moschovia* (Russia). The nationality of the observer is considered insignificant, the place of observation being the defining factor in most cases. Thus we find, for example, the observations of the Austrian Jesuit Christianus Rieger (See Section I.2.2.1) referred to under *Hispania*, since his site of observation was in Madrid. In Woolf there is a column listing “National sponsor/or nationality” (=“Nationality/Sp.” in my table). This column is sometimes left blank by Woolf, and I have made no attempt to fill in the gaps. However, I have considered it to be of relevance to investigate how far the Jesuit network was involved in the 1761 project, and the extent to which Hell’s memoir might be used as a source in this respect. Indeed, data sets from 21 Jesuit observers are reported by Hell, in addition to the observational attempts of three further Jesuits who all failed to see the crucial moments of contact. In checking Woolf’s table, I can find only nine of these referred to as Jesuits, one of them (Joseph Lorand Béraud [1702-1777], observing in Lyon) even with a question mark added. Others, such as Maximilianus Hell, are referred to as “German Jesuit”, whereas Georg Kratz (or Kraz, 1714-1766), observing from Ingolstadt, figures as “Jesuit”. All in all, there are eleven instances where the designation “S.J.” (or *è Societate Jesu*, “of the Society of Jesus”) is used by Hell, whereas Woolf refers to the observer only as “German”, “Italian” or leaves a blank space. Thus, Jesuits were responsible for a higher proportion of the data provided for the computation of the parallax in 1761 than a mere glance at Woolf’s table indicates.

[80] Another point of detail that could be made here is that certain corrections have been made to the column marked by Woolf as “Type of observation”, by me as “Obs.” Here, Woolf has used the abbreviations “I,1”, “I,2”, “E,1”, and “E,2” to mark the exterior and interior contacts of ingress (“I”), and interior and exterior contacts of egress (“E”). In my table, I have followed this convention. Checking the text of Hell, I have found four instances where what were in fact entirely complete observations are referred by Woolf as incomplete (see Wargentin, Braun, Krasil’nikov and Kurganov towards the end of my table). In the case of Ellicot, observing from London, only data from the interior contact of egress exists, not E,1-2 as stated by Woolf.

Woolf discusses the contributions of various nations in the pages following his table.[81] He points to France taking the leading position, both quantitatively (31 observers) and qualitatively. There then follows Sweden as number two (21 observers) and Britain as number three (nineteen observers). Observers from German-speaking countries occupy fourth position, with fifteen observers. "Most of these were Jesuits", Woolf states, without investigating the matter further.[82] Similarly, fifth position is held by the Italians, with nine observers, "the majority" of whom were Jesuits.[83] Russians, Danes and Portuguese all have three observers in Woolf's statistics, giving them equal status statistically. However, "[a]n unclassified group of sixteen remains", Woolf concludes.[84] But what if we try to classify the observers differently, paying attention to the Jesuit aspect of the project? In addition to the 21 observers explicitly labelled as Jesuits by Hell, we find in Woolf's table three sites of observation in India and China that were also headed by Jesuits.[85] I shall make no attempt to draw conclusions concerning the qualitative side of the Jesuit contribution (such an assessment should be done by, or at least in close collaboration with, professional astronomers).[86] However, it seems fair to point out that at least statistically, there is no doubt that Jesuit science was of great importance in the Venus transit project of 1761 – in fact the Jesuits occupy second place, beaten only by France (see, however, Section II.2.5 below). And with Latin being the primary language of communication among members of the order, it is perhaps also somewhat misleading to classify Jesuit observers as "German-speaking", "Italian-speaking", etc., as Woolf attempts to do. True, the order was divided into *assistentiae* ('Assistancies'), which were were in turn divided into *provinciae* ('Provinces'), each with their own administrations.[87] Even so, examples such as the *Ephemerides Astronomicae* of Hell bear witness that these divisions did not hamper communication across administrative boundaries.

[81] Cf. Woolf 1959, pp. 140-149.
[82] Woolf 1959, p. 143.
[83] Woolf 1959, p. 144.
[84] Woolf 1959, p. 143.
[85] Data from Jesuit observers in Peking (No. 1), Madras (No. 5), and Tranquebar (No. 6) appear in Woolf's table, but these far-away observations were not mentioned by Hell (certainly because they had not yet reached Europe) and have therefore been omitted from my table.
[86] Harry Woolf, for his part, describes Maximilianus Hell's observation from Vienna as one of the two very best from German-speaking countries, and the observations of Ximenez and Zanotti (both of whom were Jesuits) as the two best from Italy (Woolf 1959, pp. 143 & 144). He does not, however, attempt to make an overall assessment of the Jesuit contribution. See my paper delivered at The First Annual Conference for the History of Science in Norway for more on my views on such assessments (Aspaas 2008*e*).
[87] See Section I.2.2.1 above.

As to the number of individual observers overlooked by Woolf, I am not sure how this came about. He seems to have had problems studying the memoir of Hell, which was written in Latin. Though still widely taught in the mid-twentieth century, fluency in the Latin language had waned considerably since the days of Father Hell.

Finally, a remark relating to the biographical essay (Chapter I.2) above. If we examine the identity of the observers whose data Hell published in his 1761 survey, we find that professional observatories were important, but not crucial to the project. True, in Vienna the Jesuit Observatory and the Imperial Observatory were both essential, and the number of skilled observers present at the two institutions considerable. However, Hell was also careful to include in the project a few Viennese amateurs who were not Jesuits and who observed from private homes. Even the observations of the amateurs Felix Ehrmans zum Schlug (father and son) from faraway Wetzlas Castle figure in his report. Nonetheless, the imprint of Jesuit science on Hell's report is far more conspicuous. As for observatories belonging to the German Assistancy of the Society of Jesus, Hell is careful to mention the contributions of his colleagues at observatories in Tyrnavia (Weiss), Ingolstadt (Kratz), Würzburg (Huberti and two anonymous assistants) and Prague (Stepling) – although in the latter case observations had failed due to clouds. Even at collegia that lacked proper observatories, Jesuits had made observations for Hell to publish in his *Ephemerides*. Thus, data from Jesuits in Dillingen (Hauser) and Labacum (Schöttl) were included in the report. A curious omission from the report is the unsung observatory of Graecium. However, several sources presented in Section I.2.2.1 indicate that relations between the Jesuit astronomers of Vienna and Graecium were not as good as they could have been. Another omission is the observation of the Benedictines at the high standard observatory of Cremifanum, where the transit was indeed observed.[88]

When moving beyond the German Assistancy, we find patterns of contact that are more complex. From Spain, the Austrian Jesuit Rieger, a former colleague of Hell's, has provided Hell with all necessary information. The neighbouring Italian Assistancy of the Society of Jesus had numerous observers involved in the project, and most of these are mentioned by name even in case where they had failed to see anything of the transit due to clouds. One may interpret this 'name-dropping' as a sign of Hell's eagerness to demonstrate the importance of Jesuit science to the project. The close political and family relations between Habsburg-ruled

[88] According to http://www.transitofvenus.nl/history.html (last accessed 6 June 2011), Fixlmillner's predecessor Eugenius Dobler observed the transit "accompanied by prelate Bertholdi and other clergymen".

Vienna and various Italian territories may also have influenced the Imperial Astronomer's account. By contrast, activities in eastern Europe are not extolled at all. Thus, the printed report by a Catholic professor at the Kraków Academy is dismissed as "highly imperfect" ("valde imperfecta").[89] In Russia, a correspondent of Hell's, Josephus Adamus Braun, provided data from his own private observation as well as observations made at the Imperial Observatory in Saint Petersburg. The French presence is highly marked, but here the Jesuit contribution is not highlighted as much as in the Italian and German Assistancies. The two non-Catholic countries Sweden and England are surprisingly well represented in Hell's report. Information concerning the English observations had been assembled by the Swedish astronomer Bengt Ferner, who was in Paris at the time.[90] He sent extracts from his correspondence with English astronomers to Hell, who included these extracts in his report. Information on the Swedish observations had taken another detour, to Hell's correspondent Lacaille in Paris. The section on observations from Stockholm was based entirely upon a letter from Lacaille and an article in the *Journal Étranger* of Paris.

One may conclude, then, that the Jesuit network was indeed helpful in establishing Father Hell as an astronomer of international reputation. His connections in the Italian and German Assistancies were generally quite good and helpful in providing him with a considerable number of observations for his Venus transit report. Abroad, his contacts were still developing as of 1761. His conspicuous status as the Imperial and Royal Astronomer of the Habsburg territories probably counted more than his adherence to the Jesuit order, when astronomers in places like Saint Petersburg and Paris took the bother of providing him with observations for his journal. It is the combination of the two roles – Jesuit *and* court astronomer – that gave Hell such a prominent position in the Venus transit project of 1761.

[89] The report in question was surely Jacobus Niegowiecki's *Transitus Veneris per discum Solis post peractas revolutiones tam synodicas quàm periodicas intrà annos circiter 122. iterum anno domini 1761. die 6. Junii. celebratus et per mathematicos universitatis Cracoviensis sub elevatione poli gr. 50. min. 12. observatus*, Cracoviae 1761 (title taken from the online catalogue of the BibliotheksVerbund Bayern). An interesting survey in English of the history of astronomy in early-modern Poland has been provided by Bieńkowska 1972 (see pp. 88-89 on Niegowiecki).

[90] Ferner was later nobled Ferrner. In the *Ephemerides*, his name is misspelled "Fermer". At least by May 1761, he was a correspondent of Hell's (cf. Ferrner 1956, pp. 388-390).

TABLE 1 HELL 1761*a* COMPARED TO WOOLF 1959, pp. 135-140

HELL 1761					WOOLF 1959		
"Country"	*Location* (observation site)	Observer(s)	page(s)	Observation	No. in Tab.	Obs.	Nationality/Sp.
Germania	*Vienna* (tower in Jesuit library)	Max. Hell S.J. & Anonymi	pp. 1-17	E,2	No. 36	E,2	German Jesuit
	ibid. (University observatory)	Herberth S.J.	p. 17	E,2	No. 37	E,2	German [sic]
		M. [Ignatius] Rain S.J.	p. 17	E,2	No. 38	E,2	--- [sic]
		l'Abbé Lysogorski	pp.17,88-89	E,2	No. 39	E,2	---
	ibid. (Jesuit observatory)	Cassini de Thury w/Archduke Joseph	pp. 17, 41	E,2	No. 40	E,2	French
		Josephus Liesganig(g) S.J.	pp. 17-18	E,1-2	No. 41	E,1-2	German Jesuit
		Carolus Scherffer S.J.	p. 18	E,2	No. 42	E,2	German [sic]
		Antonius Steinkellner S.J.	p. 18-19	E,2	No. 43	E,2	German [sic]
		Carolus Mastalier S.J.	p. 19	E,2	No. 44	E,2	--- [sic]
	ibid. (suburban garden)	Sambach	pp. 20-21	failed, clouds	---	---	---
	ibid. (St. Leopold suburb)	Müller	p. 21	E,2	No. 45	E,2	German
	ibid. (suburban garden)	**Anonymus** ("Mercator quidam")	p. 21	**E,1-2** (inaccurate clock)	---	---	---
	Crembsium (Wetzlas Castle)	Baron Felix Ehrmans zum Schlug	pp. 62-67	E,1-2	No. 48	E,1-2	German
		Son of Felix Ehrmans zum Schlug	p. 66	**E,2**	---	---	---
	Ingolstadium (Ingolstadt)	Georgius Kratz S.J.	pp. 68-75	E,1-2	No. 53	E,1-2	Jesuit
		Anonymus 1	p. 74	E,1-2	No. 54	E,1-2	---
		Anonymus 2	p. 74	E,1-2	No. 55	E,1-2	---
	Monachium (München)	Anonymus/-i	pp. 75-77	E,1-2	No. 52	E,1-2	---
	Herbipolis sive Wirceburgum (Würzburg)	Franciscus Huberti S.J.	pp. 77-79	E,1-2	No. 66	E,1-2	--- [sic]
		Anonymus 1	pp. 77-79	**E,1-2**	---	---	---
		Anonymus 2	pp. 77-79	**E,2**	---	---	---
	Schwezinga (Schwetzingen)	Christianus Mayer S.J.	pp. 79-81	E,1	No. 67	E,1	German [sic]
		Elector Palatine [Karl Theodor]	pp. 79-81	not stated	---	---	---
	Dillinga (Dillingen)	[Bertholdus] Hauser S.J.	pp. 81-82	E,1-2	No. 64	E,1-2	Jesuit
	Göttinga (Göttingen)	Tobias Mayer	p. 82	E,1-2	No. 65	E,1-2	German
	Dresda (Dresden)	**Doctor Christianus Hoffmann**	pp. 82-83	**E,1** (not entirely exact)	---	---	---
	Labacum (Ljubljana)	Joannes Schöttl S.J.	p. 83	E,1-2	No. 47	E,1-2	German [sic]
	Praga (Prague)	[Josephus] Stepling S.J.	p. 84	failed, clouds	---	---	---
Gallia	*Seno (Sens)*	Cardinal de Luynes	pp. 36-37	not stated	(cf. p. 141)	---	(French)
	Parisii (Paris) (Inn de Clugny)	de Baudouin	pp. 37-38	E,1-2	No. 86	E,1-2	French
		Messier	p. 41	E,1-2	No. 84	E,1-2	French
	ibid. (Chateau de St. Hubert)	de la Condamine	p. 38	as yet unknown	No. 80	E,1-2	French
		le Monier [=Monnier]	p. 38	as yet unknown	No. 79	E,1-2	French
	ibid. (Observatoire Royal)	Maraldi	p. 38	E,1-2	No. 81	E,1-2	French
		Rizzi Zannoni	p. 41	E,1-2	No. 83	E,1-2	Italian
	ibid. (Conflans)	l'Abbé de la Caille [=Lacaille]	pp. 38-39	E,1-2	No. 95	E,1-2	French
	ibid. (Luxemburg)	de la Lande [=Lalande]	pp. 39-40	E,1-2	No. 87	E,1-2	French
	ibid. (Collège Louis le Grand)	Cluët S.J.	p. 41	E,1-2	No. 89	E,1-2	French Jesuit
		Merville S.J.	p. 41	E,1-2	No. 88	E,1-2	French Jesuit
	ibid. (exact locations not specified)	Chabert w/Duke de Chaulnes	p. 41	as yet unknown	---	---	---
		de Fouchi	p. 41	as yet unknown	No. 94	E,2	French
		de Fermer[=Ferner]	p. 41	as yet unknown	No. 92	E,1-2	Swedish
		Jeaurat	p. 41	as yet unknown	No. 90	E,2	French
		Libour	p. 41	as yet unknown	No. 85	E,1-2	French
		Saron	p. 41	as yet unknown	---	---	---
		Joly	p. 41	as yet unknown	---	---	---
		de Barros	p. 41	as yet unknown	No. 91	E,1	Portuguese
		de Bellery [=Belléri]	p. 41	as yet unknown	No. 82	E,1-2	French
	Lugdunum (Lyon)	de Lorenzi	p. 42	as yet unknown	---	---	---
	ibid.	Beraud S.J. [=Béraud]	p. 42	E,1-2	No. 73	E,1-2	French Jesuit(?)
	Bajocae (Bayeux)	Outhier	p. 42	as yet unknown	No. 101	E,1-2	French
	Beterae (Béziers)	Bovillet	p. 42	as yet unknown	---	---	---
	Rotomagum (Rouen)	Domin	p. 42	as yet unknown	---	---	---
	ibid.	Bovin[=Bouin]	p. 42	as yet unknown	No. 99	E,2	French
	ibid.	du Laque [=Dulague]	p. 42	as yet unknown	No. 100	E,2	French
	Aurelia (Orleans)	Jousse	p. 42	as yet unknown	---	---	---
	Bordegala (Bordeaux)	Desmarets	p. 42	as yet unknown	---	---	---
	Rodriquez (Rodrigues, Indian Ocean*)*	Pingré	pp. 40, 98	as yet unknown	No. 9	E,1	French
	Pondicheri (Pondicherry in India*)*	le Gentil	pp. 40-41	failed to reach station	(cf. pp. 126-128)		(French)
	Tobolsk in Russia	l'Abbé Chappe	pp. 41, 98	as yet unknown	No. 8	I,2;E,1-2	French

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"Country"	*Location* (observation site)	Observer(s)	page(s)	Observation	No. in Tab. Obs.		Nationality/Sp.
Anglia	*Greenvichium (Greenwich)*	Bliss	p. 44	E,1-2	No. 102	E,1-2	British
		Birch [=Bird?]	p. 44	E,1-2	No. 104[?]	E,1-2	British
		Green	p. 44	E,1-2	No. 103	E,1-2	British
	Londimum (London) (Savile House)	Short w/Duke of York	pp. 42-45	E,1-2	No. 107	E,1-2	British
	ibid. (Spithal Square)	Cantons [=Canton]	pp. 44-45	E,1-2	No. 109	E,1-2	British
	ibid. (Sherburn Castle)	Housby	p. 44	E,1-2	No. 111	E,1-2	British
	ibid. (Hackney)	Dollond [=Dolland]	p. 44	E,1-2	No. 105	E,1-2	British
		Ellicot	p. 44	**E,1**	No. 105	E,1-2	British
	ibid. ("Platea Scholar."[=Clerkenwell])	Heberden	pp. 44-45	E,1	No. 106	E,1	British
	Leskardium (Liskeard, Cornwall)	Anonymus [=Haydon]	p. 45	E,1-2	No. 113	E,1-2	British
	in faraway places ("maxima...itinera fecerunt")	Anonymi	p. 98	as yet unknown	(Cf. No.18,19,119,120)		(British)
Hispania	*Madritum (Madrid)*	Christianus Rieger S.J.	pp. 47-49	E,1-2	No. 114	E,1-2	German Jesuit
	(Collegium Imperiale)	Michael Beneventus S.J.	pp. 47-49	E,1-2	No. 116	E,1-2	--- [sic]
		Antonius Eximen(i)us S.J.	pp. 47-49	E,1-2	No. 115	E,1-2	--- [sic]
	ibid. (Collegium Nobilium)	**Father Zacagnini**	p. 48	E,1-2	---	---	---
Italia	*Bononia (Bologna)*	Eustachius Zanotti S.J.	pp. 49-54	E,1-2	No. 57	E,1-2	Italian [sic]
	(Institute observatory)	Matheucius [=Mateucci]	pp. 49-54	E,1-2	No. 59	E,1-2	Italian
		Marinus[=Marini]	pp. 49-54	E,1-2	No. 58	E,1-2	Italian
	ibid. (lower floor, same building)	Gregorius Cassalius [=Cassali]	pp. 49, 54-56	E,1-2	No. 61	E,1-2	Italian
		Sebastianus Canterzanus [=-zani]	pp. 49, 54-56	E,1-2	No. 62	E,1-2	Italian
		Father Frisi	pp. 49, 54-56	E,1-2	No. 60	E,1-2	Italian
	Mediolamum (Milan)	Bovius & Gerra S.J.	p. 49	as yet unknown	---	---	---
	Patavium sive Padua	Marchio Joannes Poleni	pp. 49, 57-59	failed, clouds	---	---	---
		Joannes Albertus Columbus	pp. 57-59	failed, clouds	---	---	---
		Joannes Antonius a (della) Be(l)la	pp. 49, 58	failed, clouds	---	---	---
		Ab. Antonius Franciscus Poleni	p. 58	failed, clouds	---	---	---
		Ab. Antonius Rocchius	p. 58	failed, clouds	---	---	---
		Doctor Jacobus Durerius	p. 58	failed, clouds	---	---	---
		Doctor Josephus a Libera	p. 58	failed, clouds	---	---	---
		Doctor Antonius a Libera	p. 58	failed, clouds	---	---	---
	Roma (Rome) (Convent. Dominic. S. Mariae ad Minervam)	Anonymus	p. 57	E,1-2	No. 56[?]	E,1-2	Italian
	ibid. (Seminarium Romanum)	Anonymi	p. 57	as yet unknown	---	---	---
	Florentia (Florence) (Observ. St. John Evangelist)	Leonardus Ximenius S.J.	pp. 49, 59-61	E,1-2	No. 63	E,1-2	Italian Jesuit
	Venetum (Venice)	Rogerius Boscovich S.J.	pp. 49, 61	failed, clouds	---	---	---
Hungaria	*Tyrnavia (Trnava)*	Franciscus Weiss S.J.	pp. 84-88	E,1-2	No. 46	E,1-2	German [sic]
Polania	*Cracovia (Kraków)*	Anonymus/-i	pp. 88-89	not stated ("valde imperfecta")	---	---	---
Svecia	*Holmia sive Stockholmia (Stockholm)*	**Wargentin** w/Queen, Prince et al.	pp. 40, 89-92	**I,1-2;E,1-2**	No. 20	I,2;E,1-2	Swedish
		Klingenstierna	pp. 40, 89-92	I,2;E,1-2	No. 21	I,2;E,1-2	Swedish
		Wilke [=**Wilcke**]	pp. 89-92	I,2;E,2	No. 20 [sic]	I,2;E,1-2	Swedish
Moscovia	*Petropolis (St. Petersburg)* (private home)	Braun	pp. 92-94	**I,1-2;E,1-2**	No. 11	I,2;E,1-2	---
	ibid. (Imperial Observatory)	Krasilnicow	pp. 92-93	**I,1-2;E,1-2**	No. 12	I,2;E,1-2	Russian
		Kurganow	pp. 92-93	**I,1-2;E,1-2**	No. 13	I,2;E,1-2	Russian

II.2 THE NORDIC REGIONS AND THE TRANSITS OF VENUS, 1761 AND 1769

> ingen ort, hvarken i Europa, Asia eller Africa, är bättre där til [i.e., til observationer af Veneris passage] belägen, än Svenska Lappmarken
>
> - Pehr Wilhem Wargentin 1767 [1]

> tanti res momenti AVGVSTAE videbatur, vt Ipsa, pro Suo incredibili in scientias omnes amore, obseruare dignaretur, Dux expeditionum omnium, et particeps operis […] memorando posteris exemplo, scientias et artes nuspiam melius efflorescere, quam vbi Monarchae philosopharentur
>
> - Christianus Mayer 1769 [2]

> eventus attamen docuit, omnes hasce etsi sapientissimè cogitatas, quas jam recensui Regum, Principum, Astronomorumque dispositiones, divina ita ordinante Providentia haud sufficientes omnino futuras fuisse ad decidendam sine dubio, et cum certitudine, aut saltem maxima cum probabilitate Quæstionem *præcisæ Quantitatis* Parallaxeos solis si suasu et consilio sapientissimorum Daniæ Ministrorum Augustissimus Rex *CHRISTIANUS VII* in societatem summi hujus negotij, præter opinionem omnium aliarum Academiarum non venisset sumptibus quam maximis ad finem hunc consequendum liberalissimè profusis, ideoque omnium hucusque recensitarum à summis Principibus factarum Expeditionum veluti Coronidem impositurus
>
> - Maximilianus Hell c. 1773 [3]

In this chapter, the broader picture of activities in the Nordic regions in conjunction with the eighteenth-century transits of Venus will be analysed. As has already been explained (Sections II.1.1 and II.1.2), it was desirable – from an astronomical point of view – to obtain

[1] Wargentin in a letter to the Swedish King, dated 14 January 1767 (quoted from Nordenmark 1939, p. 374): "no place in the whole of Europe, Asia or Africa is better suited [for observations of the transit] than Swedish Lapland".

[2] Chr. Mayer 1769*b*, pp. 91-92: "The EMPRESS deemed that [the transit of Venus] was of such importance that she Herself, in accordance with Her incredible love of all the sciences, deigned to observe it, as the Head of all the expeditions and a participant in the project […], a memorable example for Posterity, that the sciences and the arts have never flourished more than when Monarchs themselves have been philosophers".

[3] See Hell's unfinished introduction to the work *Expeditio litteraria ad Polum arcticum* (edited below, Chapter III.3, here §. IV): "It turned out that, notwithstanding all the wise and careful planning of kings, princes and astronomers recounted so far, divine providence would have rendered all their efforts entirely insufficient for the attainment of their goal. A precise definition of the Sun's parallax, that is, a definition beyond any doubt, associated with all certitude or at least with the highest possible degree of probability, would not have been possible if it were not for the Supreme King CHRISTIAN the SEVENTH, who followed the advice of Denmark's highest ministers and entered among the participants in this extremely important entreprise. To the surprise of all other academies, His Highness donated the highest possible sums for the attainment of this goal as if to snatch the crown of all the expeditions launched by the mightiest princes so far reviewed."

data from stations located as far apart as possible, a fact which rendered observations from the European High North valuable in themselves. This was particularly true for the transit of 1769 because that transit took place during the European night, making it necessary to dispatch observers to the regions of the midnight sun in order to catch the entire duration of the phenomenon. As a result, these parts received considerable attention from the international astronomical community.

Politically speaking, the Nordic mainland nowadays consists of four independent states: Denmark and Sweden, as well as Norway and Finland. During the 1760s, however, these territories were all administrated from Copenhagen and Stockholm. Thus, as far as the Venus transits are concerned, the Royal Danish Society of Sciences in Copenhagen and the Royal Swedish Academy of Sciences in Stockholm were the natural co-ordinators of expeditions and other activities in the Nordic countries as a whole. The Russian Empire further included territories that were strategically important for observations of the Venus transit. In 1769, the Imperial Russian Academy of Sciences in St. Petersburg organised expeditions to the Kola Peninsula, close to the borders with Norway and Finland. In the same year, the Royal Society of London, with the permission of the Danish authorities also dispatched observers to Hammerfest and Honningsvåg in northernmost Norway. All these activities will be analysed below.

The Faroe Islands, Iceland, Greenland, Spitsbergen and Bear Island also merit a mention in this context as potential sites for observations. For various reasons, however, no observations took place here. Mainland *Fennoscandia*[4] therefore constitutes the main focus of the present analysis.

Awareness of the Venus transit activities of Sweden, Russia and Britain, close to or even within Danish-Norwegian territory, may be revealing for a number of reasons. First and

[4] 'Fennoscandia' is a convenient term for designating the Scandinavian countries – Denmark, Norway and Sweden – without excluding Finland, Karelia and the Kola Peninsula. The term 'Nordic regions' is less clearcut, especially if the parlance of the eighteenth century is taken into account (see for example Kliemann 2005). Thus, August Ludwig Schlözer (1735-1809) in his *Allgemeine Nordische Geschichte* 1771, includes nearly the whole of the Russian Empire (St. Petersburg, Moscow, Siberia, etc.) in his concept of *Norden* ("the North"). Likewise, the editor of the *Nordische Miscellaneen*, published in Riga in the years 1781-1791, in the preface to the first volume expresses his intention to publish articles on "Russia, Livonia, Estonia and Courland" ("von Rußland, Lief= Ehst= und Kurland": August Wilhelm Hupel, "Vorerinnerung", in *Nordische Miscellaneen* erstes Stuck, 1781, p. 4; cf. pp. 5-6, where Hupel mentions Sweden, Denmark and even Poland as "Nordic" powers). I have used the term 'Nordic regions' as a somewhat ambigious heading to this section in order not to exclude activities in Russia as a whole from the analysis, although Fennoscandia will remain the main focus.

foremost, the history of activities in this region has been under-investigated in previous studies of eighteenth-century transits of Venus, particularly in literature written in French or English.[5] The general impression gained from reading the international literature is that the Venus transit projects of the 1760s were primarily French and British undertakings. We have already witnessed Maximilianus Hell's substantial contribution to the Venus transit project of 1761. Considering the overarching theme of this part of the thesis – the eighteenth-century transits of Venus and the role of Maximilianus Hell – a detailed analysis of activities in Denmark and Norway in both 1761 and 1769 is required in order to contextualise the Vardø expedition in 1769 (to be analysed in Chapter II.3). The story of activities in the Danish-Norwegian kingdom cannot be properly understood, however, without taking the regional dimension into account. Thus, this chapter will employ a comparative perspective, analysing Venus transit activities in Sweden, Finland and Russia, as well as Denmark-Norway proper, in both 1761 and 1769.

The elite ideology of the time measured an empire's 'greatness' not only in its military capacity and economic strength, but also in its participation in the intellectual and cultural progress of the world. Beacons of the Enlightenment, like Voltaire, corresponded overtly with sovereigns abroad, helping them to build up an image as 'Philosophical Princes'. Given the widespread interest in the passages of Venus, and especially the rush of anticipation for the second chance of determining the solar parallax in 1769, it was a matter of national pride to be at the forefront of this international project. The nationality of the observer was not what was at stake. As we shall see, Russia recruited astronomers from other countries for the year 1769. Their observations were nonetheless classified as "Russian", for at the end of the day, the sponsor received no modest share in the honour. Thus, when Denmark-Norway recruited a man with the title of Imperial and Royal Astronomer of Vienna, his expedition was

[5] Thus, while the activities of French and British astronomers are a recurrent theme in the 258-page monograph of Woolf 1959, he has devoted only a few pages to Swedish (pp. 142-143 & 182), Danish (p. 144; pp. 176-178 on Hell's expedition) and Russian astronomy (pp. 144-145 & 179-181). The same applies to more recent works by Maor 2000 (pp. 88-91 on Lomonosov; pp. 126-133 on Hell's expedition); Sellers 2001 (pp. 140-142 on Hell's expedition); and Marlot 2004 (pp. 159-162 on Lomonosov; p. 168 on Hell's expedition); cf. the articles of Chapman 1998 (not a word about activities in Fennoscandia), Verhas 2001 (a single sentence on expeditions in Norway, Sweden and Russia 1761, a couple of sentences about Hell's expedition, but nothing about other activities in Fennoscandia in 1769) and Hudon 2004 (Hell's expedition mentioned, but nothing about other activities in Fennoscandia either in 1761 or 1769). Furthermore, the sets of articles edited by Brosche *et al.* in 1998 and Kurtz in 2005 encompass activities in several countries, but there is no word about Venus transit activities in Fennoscandia (although the article of Marov in Kurtz 2005 is devoted to Lomonosov). It might also be mentioned that the massive success of Bill Bryson, *A Short History of Nearly Everything* (1st edn. 2003), has four pages on the eighteenth-century transits of Venus, but elaborates only on British and French participants in the project (Bryson 2004, pp. 79-82).

nonetheless categorised as a “Danish” undertaking. The system of scientific funding in the *ancien régime* is reminiscent of that of patrons and clients in the field of *belles letters*: a poet’s work was routinely dedicated to a Mæcenas (patron of the arts), and the Mæcenas was highly likely to be a prince.[6] Similarly, as patrons of science, princes expected to receive praise and dedications from the savants whose activities they sponsored.

To the picture of ‘national pride’ belongs the notion of publicity – in particular, publicity within the international Republic of Letters. Thus, the history of Venus transit publications from the Nordic regions will form part of the analysis in this chapter. In present-day science, the use of English is predominant. During the eighteenth century, however, the only language that could compete with the widespread use of Latin was French. True, large numbers of European savants born east of the 5th degree of longitude and north of the 45th degree of latitude were fluent in German, but use of this language for scientific purposes was not yet as widespread as it was to become in subsequent centuries. Thus, science periodicals in Latin and French were read all over the European continent, and even those who had grown up in German-speaking countries tended to communicate with each other in either French or Latin, instead of their mother tongue. Given this historical situation, paying attention to the language used for the publication of reports on the Venus transits may be illuminating.

If we turn to the tables of Woolf (compare Section II.1.5), we find that Sweden delivered substantial contributions to the Venus transit projects of the 1760s, whereas the participation from Denmark-Norway was significantly weaker.[7] A cross-check with the primary sources will lead to a number of corrections to Woolf’s tables, in the same manner as has already been done using Hell’s *Ephemerides Astronomicae* above. However, the general picture will be seen to hold true. Over the pages that follow, a number of factors contributing to the inequality of the quantitative – as well as qualitative – contributions of the two Fennoscandian states will be discussed.

One important theoretical perspective for this chapter is that of ‘dilettantism’. This perspective has already been described in Section I.1.2.1 above, and has been used to some extent in Chapter I.2. In this chapter, however, it will be used in a more systematic manner, to

[6] See, for example, Roger Chartier’s article “Princely Patronage and the Economy of Dedication” 1995. This practice appears to have been particularly common in eighteenth-century Denmark, cf. Rem 2005, pp. 117-118.
[7] Cf. Woolf 1959, pp. 135-140 & 182-187.

analyse the degree of success or failure in the Venus transit programmes of the various Nordic countries. In the context of the Venus transits, the degree of integration or exclusion of amateurs in various countries appears not to have been explored before.[8] In the present comparison of activities in Denmark-Norway, Sweden-Finland and Russia, this aspect will receive particular attention, as such an approach appears to be well suited to explain some of the differences between the various countries.

Individual historical actors and their role as possible explanatory factors in tracing the causes of historical events make up a final analytical approach in this chapter. The infrastructure for science in early modern Europe was, despite numerous epoch-making achievements, still dependent upon a limited number of professionals holding key positions. Sometimes, as we have already seen in the case of Maximilianus Hell (Chapters I.2 and II.1), such individuals might exert their influence in ways that promoted scientific activities well beyond the University cities in which their place of work was located. In other cases, however, individuals holding central positions might neglect to promote research in their own country and scorn international developments within the international research community, thereby causing stagnation. Paying attention to the significance of historical actors in science is crucial in order to explain differing national contexts, not least in the case of international research projects such as the Venus transits.

Starting with an account of the Venus transit activities of Sweden in 1761 and 1769 (Section II.2.1), this chapter proceeds to examine activities in Russia in both 1761 and 1769 (Section II.2.2), and the activities of Denmark in 1761 (Section II.2.3). There then follows an analysis of the significance of activities in Denmark and Norway in 1769 (Section II.2.4), with a subsection on the outcome of observational attempts on Danish and Norwegian soil in the same year (Section II.2.4.1). A final section aims to sum up the results of these analyses from the perspective of modern literature on the eighteenth-century transits of Venus (Section II.2.5). While many of the printed sources for this chapter may be familiar to historians of eighteenth-century astronomy, the majority of the unprinted sources have not, to the best of my knowledge, been used in previous research into the eighteenth-century transits of Venus.

[8] Aspaas 2011*a* (in Norwegian) is an exception.

II.2.1 THE ROLE OF SWEDEN IN THE VENUS TRANSIT PROJECTS, 1761 AND 1769

The author of the 'History of Astronomy in Sweden', N. V. E. Nordenmark, has carried out thorough research on Swedish eighteenth-century astronomy and its main protagonists.[9] According to his studies, Swedish astronomy was integrated in the international, astronomical community by Anders (Andreas) Celsius (1701–1744), who was named Professor of Astronomy at Uppsala in 1730. Shortly afterwards, Celsius embarked upon a four-year journey through Germany, Italy, France and England, where he visited the main centres of learning and was elected a member of various academies and scientific societies. He then joined Pierre Louis Moreau de Maupertuis (1698–1759) on his famous 1736-1737 expedition to Lapland and appears to have been instrumental in persuading Maupertuis to opt for the Swedish Tornedal valley instead of northern Norway or Iceland for his longitudinal measurements.[10] As a result of this expedition, the Earth was proven to be flattened near the poles, not stretched, as the Cartesians had thought.[11]

The process of integrating Swedish astronomy within the Republic of Letters was continued by the next generation of astronomers, of whom Pehr (Petrus) Wilhelm Wargentin (1717–1783) merits particular mention. His thesis 'On the Moons of Jupiter' (*De Satellitibus Jovis*), supported under the presidency of Celsius in 1741, marked the start of what was to become a main activity throughout his career: diligent observations and theoretical work on the moons of Jupiter. The accuracy of Wargentin's observations made them useful for longitude determinations of numerous sites abroad. Even more importantly, Wargentin was also the secretary of the Royal Swedish Academy of Sciences from 1749 until his death in 1783, and corresponded with influential representatives of the entire Republic of Letters. Wargentin was to become heavily involved in the international effort to determine the parallaxes of the Moon, Mars and Venus in the early 1750s, when the *Académie Royale des Sciences* in Paris sent the astronomer Lacaille to the Cape of Good Hope and collaborated with colleagues in Germany, Italy and Sweden in order to obtain corresponding observations from roughly the

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[9] For this section I have used Nordenmark, *Astronomiens historia i Sverige inntil år 1800*, Uppsala 1959 and the same author's *Pehr Wilhelm Wargentin …*, Uppsala 1939. Nordenmark has also written monographs on other Swedish eighteenth-century astronomers. His mastery of Latin, German, French and English, aside from Swedish, combined with a magisterial use of archival as well as library sources, render his studies indispensable. Other major studies of the history of Swedish astronomy in the period have been made by Lindroth and Widmalm; see also Sinnerstad 1989 and the works of Pihlaja (cf. Section I.1.1.3 above).

[10] For a survey of the life and career of Celsius, see Nordenmark 1959, pp. 158-191.

[11] See for example Terrall 1992. When Maupertuis came under attack for his theory, Celsius was one of those who went into the field to defend his findings, cf. Nordenmark 1959, pp. 174-176.

same meridian. For this occasion, Wargentin organised observations from various sites in Sweden and managed to provide valuable data.[12] He thus naturally became an important co-ordinator of activities in connection with the transits of Venus in the decade that followed.

For the 1761 transit, the Academy of Stockholm distributed astronomical equipment to a total of five local academies and colleges throughout the country. Recognising the importance of obtaining data from the far North, it also organised observations in the northern parts of Sweden and Finland. Thus, it financed an expedition to Cajaneborg (or Kajana, Kajaani) led by the astronomer, later Professor of Physics at the Royal Academy of Åbo (Turku) in Finland, Anders (Andreas) Planman (1724–1803), and gave financial support to the amateur astronomer Anders Hellant (1717–1789) in Torneå (Haparanda, Tornio), both of whom succeeded in observing the transit.[13] The weather was evidently good over large parts of Sweden that day, resulting in a series of successful observations. At the academy's observatory in Stockholm, Wargentin and a crew of trained observers received numerous guests outside the field of science, among them the Crown Prince and Princess of Sweden. The noise from the spectators created a nuisance, but at the same time, allowing the public to witness the activities at the observatory was no doubt good PR for the academy.[14]

After the event, lessons to be drawn from the phenomenon were discussed in great detail by Swedish mathematicians. Planman published at least four attempts to calculate the solar parallax;[15] the possibility of an atmosphere around Venus was discussed by Planman,

[12] In 1751-52 the same phenomena were observed simultaneously in at least six countries; Lacaille made observations at the Cape of Good Hope, Eustachio Zanotti in Bologna, A. N. Grischow in St. Petersburg, the young Lalande in Berlin in collaboration with German astronomers, and a total of five observers – among them Wargentin – from various places in Sweden. Furthermore, James Bradley (1693-1762) reported observations from London and several French astronomers observed in France. Initially, Delisle had planned to go to Stockholm himself, but seeing that Wargentin intended to make every effort to provide corresponding observations, he deemed it unnecessary to make this trip (*HARS* 1752 [1756], pp. 103-110; Zanotti 1757; pp. 311-324; Grischow 1761; cf. Nordenmark 1939, pp. 164-171; Nordenmark 1959, pp. 221-223; Aspaas 2008*b*, pp. 289-290).

[13] Nordenmark 1939, pp. 175-176. As for Planman, he had in fact planned to travel further north, but found himself prevented by heavy snowfall from getting any further than Cajaneborg with all his travel gear, see Planman, *Dissertatio de Venere in Sole visa die 6 Junii anni 1761 ...* 1763*a*, pp. 2-3; cf. Holmberg 2008 (presenting extensive quotations from a letter of Planman to Wargentin, in which Planman gives a detailed account of the journey).

[14] Nordenmark 1939, pp. 176-178; cf. Mejer 2004.

[15] Planman 1763*a*, pp. 9-22; *Observationes in calculum Dni De La Lande, Hujus anni Ephemer. Gallic. p. 206 contentum* ... 1764*a*; *Investigatio Parallaxeos Solis ex observationibus novissimi transitus Veneris per discum Solarem* ... 1766; "A Determination of the Solar Parallax attempted, by a peculiar Method, from the Observations of the last Transit of Venus ..." (paper written in 1767) 1769. Summaries of some of these calculations also appeared in the *Kungl. Vetenskaps Academiens Handlingar* – cf. Planman 1763*b*; 1764*b*.

Wargentin and others;[16] the "black drop effect" was described and its possible causes assessed in several reports,[17] and so on. The reports were first published in Swedish in the proceedings of the Royal Academy of Stockholm, but – thanks to the assiduous correspondence of Wargentin – summaries soon appeared in French and Latin as well, in prestigious periodicals abroad.[18] As a matter of routine, the Swedish reports were also translated and reissued in a German edition of the *Kungl. Svenska Vetenskapsacademiens Handlingar* published in Hamburg and Leipzig. If we turn to the study of Woolf, we are informed that in 1761, Sweden organised in total 21 successful observations from twelve stations, eleven of them within the borders of Finland or Sweden. "Surprisingly enough the Swedes […] displace the British from the second position which one would have expected them to occupy, for the British could muster only nineteen successful observations", Woolf comments, adding that "the displacement seems to be one of quality".[19] Thus, with the 1761 transit of Venus Sweden had placed itself in the heart of the international entreprise, both quantitatively and qualitatively. As a country, it was beaten only by France, with its 31 successful observations – according to Woolf – published in the standard literature of contemporary astronomy.

As the 1769 transit approached, Wargentin and his colleagues at the Royal Swedish Academy decided to apply for extra financial support. They had done the same for the lunar parallax project of 1751-52, but not for the Venus transit of 1761, when the Academy had found the necessary funding from its own treasuries.[20] For the project of 1769, however, expectancies were even greater than for the first. Besides, due to a rise in the cost of paper, the expenses of the Academy had risen substantially since the beginning of the decade, whilst its income had not increased. Accordingly, on 14 January 1767, an application for the funding of expeditions and acquisition of instruments was sent to the King of Sweden. In the application, appeals to national pride are vividly emphasised.[21] French and British astronomers had already informed the Academy that they had started to plan expeditions and appoint observers, and as "no place in the whole of Europe, Asia or Africa is better suited [for observations of the transit] than Swedish Lapland", it was a matter of national prestige to have able observers ready at more

[16] See Section I.1.1 above.
[17] Cf. Nordenmark 1939, pp. 178-181. See also Fig. 7 above.
[18] See the summaries of Swedish observations in issues of the *Journal des Sçavans* (Paris), the *Ephemerides Astronomicae* (Vienna; see above, Section II.1.5), and the *Philosophical Transactions of the Royal Society* (London) from this period.
[19] Woolf 1959, p. 141.
[20] Nordenmark 1939, p. 175.
[21] A transcription of the entire application is found in Wargentin 1939, pp. 374-376; cf. pp. 183-186.

than one place in this region.[22] To this end, money was required, both for the purchase of new instruments and to cover the expenses of the expeditions themselves, the application argued. And money was indeed granted: as early as 29 January 1767, the government bestowed upon the Academy an extra grant for this purpose. Thus, the Swedish astronomers were able to start their preparations nearly two and a half years ahead of the transit. Three observations were to be prepared in the north of Sweden and Finland: Torneå, Pello and Cajaneborg. The locations were chosen because their geographical position had already been accurately determined; Torneå by Hellant through many years of observations, Pello by Maupertuis and his team in 1736-37 and Cajaneborg by Planman in conjunction with the Venus transit of 1761.[23] At the same time, observations in southern parts of the kingdom were to be prepared as well.

In the event, only one of the stations in the Swedish North was lucky enough to observe the moments of ingress and egress: clouds spoiled the attempts in both Torneå and Pello.[24] Observers further south in Sweden and Finland had better luck, but they were only able to observe the ingress in the evening, the egress taking place before sunrise. Reports of observations from various parts of Sweden were included in the proceedings of the Royal Swedish Academy (originals in Swedish, German translations appearing as well), and in Latin and French in periodicals such as *Philosophical Transactions of the Royal Society of London* and the *Journal des Sçavans.* According to Woolf, the Swedish Academy managed to co-ordinate in total fifteen individual observations at six stations where at least part of the transit was successfully observed.[25] In the aftermath of 1769, attempts to compute the solar parallax and theories concerning the planet itself were also put forward by Swedish academicians, just like after the previous transit.[26] All in all, Woolf concludes that “Swedish activity in 1769 remain[ed] at about the same level at which it had been in 1761, with highly competent astronomers observing from important northern stations”.[27]

[22] Application to the King of Sweden, dated 14 January 1767 (Nordenmark 1939, p. 374): “ingen ort, hvarken i Europa, Asia eller Africa, är bättre där til belägen, än Svenska Lappmarken”.
[23] Cf. Wargentin “Berättelse, om de anstalter, som varit gjorda i Sverige, at observera Planeten Venus i Solen, den 3 Junii 1769 […]” 1769, pp. 148-150.
[24] Wargentin 1769, pp. 150-151; F. Mallet, “Berättelse om det som kunnat observerats uti Pello, vid Veneris gång förbi Solen, den 3 och 4 Junii 1769” 1769.
[25] Woolf 1959, pp. 182-187.
[26] Cf. Nordenmark 1939, pp. 188-192. See also Section II.3.4 below.
[27] Woolf 1959, p. 189.

II.2.2 THE ROLE OF RUSSIA IN THE VENUS TRANSIT PROJECTS, 1761 AND 1769

In 1761, Russian activity was limited. Several studies have pointed out that this period was marked by conflicts within the Academy between Russian-speaking and foreign (mainly German-speaking) members.[28] Initially, the Imperial Russian Academy's plans for the 1761 transit included only a single Venus transit expedition, which was to be dispatched to Siberia. Doubts were raised, however, as to whether the Academy actually had any qualified observers to hand for this task. Archival studies by Michel Mervaud and others have disclosed that early in 1760, these doubts were voiced in a letter from Gerhard Friedrich Müller (1705-1783), a historian/ethnographer and prominent member of the Imperial Academy in St. Petersburg, to the astronomer Lacaille, a no less prominent member of the Royal Academy in Paris.[29] The academicians in Paris apparently interpreted this as an implicit request for them to send someone to Russia and appointed an assistant at the *Observatoire Royal*, Jean Chappe d'Auteroche (also called l'Abbé Chappe, 1728-1769) to this task. His destination was to be Tobolsk, the chief city of Siberia, situated just east of the Ural Mountains. When the members of the St. Petersburg Academy learned of the plans of their French counterparts, protests were raised, but too late to prevent the arrival of Chappe.[30] Therefore, in characteristically patriotic spirit, the academician Mikhail Vasil'evich Lomonosov (1711–1765) argued in November 1760 that not just one but *two* Russian astronomers should be sent to Siberia. As he saw it, the Professor of Astronomy Nikita Ivanovich Popov (1720-1782) and his adjunct Stepan Iakovlevich Rumovskii (1734-1812) would be the ideal candidates for these expeditions, although he admitted doubts as to whether the latter would be able to acquire the necessary astronomical practice to be really qualified to observe the transit in the space of just six months.[31] Nevertheless, to Lomonosov and other patriots at the Academy it was evidently important to engage their own astronomers in the project, for the sake of national pride. Anyhow, the suggestion of Lomonosov was followed and Rumovskii and Popov dispatched to Siberia in early 1761.

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[28] The hostility of the eminent polymath – poet, historian, grammarian, physicist and astronomer – Mikhail Lomonosov towards foreign academicians appears to have been particularly strong: cf. e.g. Snorrason 1974, pp. 78-79; Schulze 1985; Dulac 2000, p. 261; Comtet 2001; Mervaud 2004, pp. 8-9. Among the 111 full members of the Imperial Academy during the eighteenth century, only 26 were of Russian descent – the rest came from German states (55 in all), Switzerland (7), Sweden (4) and France (4); cf. Moutchnik 2006, p. 210. Although full membership was granted to some Russians, their salaries were generally lower than those of the foreign members: cf. Schulze 1985, pp. 315-316; Snorrason 1974, p. 79.

[29] Mervaud 2004, p. 7. In a letter that reached St. Petersburg in January 1760, Lacaille had informed the Imperial Academy of French plans for the Venus transit (Lomonosov 1955, vol. IX, p. 793).

[30] See for example Lomonosov in Kravets & Chenakal (eds.) 1955*b*, p. 794.

[31] Mervaud 2004, p. 9.

All three observers in Siberia – Chappe, Popov and Rumovskii – managed to observe at least parts of the transit. Popov's station was in Irkutsk by Lake Baikal and, as perceived by some members of the Academy, his observation was far more successful than that of Rumovskii, who was supposed to travel to Nerchinsk (roughly 800 km east of Irkutsk) or even Iakutsk (by the river Lena), but made it no further than Selenginsk, some 100 km East of Irkutsk.[32] However, only the observations of Chappe and Rumovskii were ever published under the auspices of the Imperial Academy. Chappe's observation arrived first, as a separate brochure in St. Petersburg early in 1762[33] and then in more elaborate form in the *Histoire de l'Académie Royale des Sciences* in Paris (published 1763).[34] However, it took another five years for Rumovskii's report to be published in the official periodical of the Academy, the *Novi Commentarii Academiae Scientiarum Imperialis Petropolitanae*.[35] In the meantime, Rumovskii had become appointed Director of the Imperial Observatory and Professor of Astronomy, and in other articles in the *Novi Commentarii*, he positioned himself as an antagonist of Pingré in Paris with regard to the solar parallax (compare Section II.1.2).[36]

Other observations of the 1761 transit of Venus known to have been made in Russia were never published in the official periodical of the academy. This was the case not only for the observation of Popov, but also for the observations of Franz Ulrich Theodosius Aepinus (1724-1802, Rumovskii's teacher),[37] Joseph Adam Braun (1712-1768, professor of physics) and Lomonosov himself, who all observed the transit from private homes in St. Petersburg – and even for those of Andrei Dmitrievich Krasil'nikov (1705-1773) and Nikolai Gavrilovich Kurganov (1726-1796), who had been stationed at the observatory of the Imperial Academy. The observations of Lomonosov and Aepinus appeared in a tiny brochure, printed in Russian

[32] Cf. Mervaud 2004, p. 8 n. 41. The expedition of Popov is mentioned in Rumovskii's report, "Brevis expositio observationum occasione transitus Veneris per Solem in urbe Selenginsk an. 1761. institutarum" 1767*a*, especially pp. 443-445. The observations of Popov were never published, however, and are apparently only mentioned in a Latin manuscript in the archives of the Petersburg Academy (Moutchnik 2006, p. 179).
[33] Chappe, *Memoire du passage de Venus sur le Soleil … Lû à l'Academie Impériale de St. Petersbourg le 8 Janvier 1762* 1762. According to Kravets and Chenakal in Lomonosov 1955*b*, p. 909, the brochure was translated and published in Russian as well. It was, however, never included in the academy's official periodical, the *Novi Commentarii*.
[34] Chappe, "Extrait du voyage fait en Sibérie, Pour l'Observation de Vénus sur le disque du Soleil, faite à Tobolsk le 6 Juin 1761." 1763.
[35] Rumovskii 1767*a*. According to Woolf 1959, p. 246, Rumovskii's report was first printed as a separate brochure in St. Petersburg 1762.
[36] Rumovskii, "Investigatio parallaxeos Solis ex observatione transitus Veneris per discum solis Selenginski habita, collata cum observationibus alibi institutis" 1767*b*; "Animadversiones in supplementum Cel. *Pingre* ad dissertationem eius de Parallaxi Solis" 1768.
[37] On Aepinus' troublesome career in Russia, including his role in the Venus transit project of 1761, see Home 1973.

and German during the summer of 1761 but poorly distributed, whereas those of Braun, Krasil'nikov and Kurganov found their way into the *Ephemerides Astronomicae* of Hell and thus became available to the international community of astronomers.[38]

The lack of co-ordination and weak publicity characterising Russia's participation in the Venus transit project of 1761 did not persist as the second opportunity approached. As in Sweden, preparations for the 1769 transit of Venus started in Russia in early 1767. But here – at least ostensibly – it was the Empress Catherine II ("Catherine the Great", 1727-1796, ruler of Russia from 1762) who took the initiative. This Empress has entered history as an enlightened ruler, energetically promoting literature, art and the sciences. Largely thanks to her influence, the activities of the Imperial Russian Academy have probably never been so integrated in European science as was the case during her period as ruler.[39] A decisive factor in this development was Catherine's success in persuading the world-famous Leonhard Euler (1707-1783) and his family to return to St. Petersburg in 1766, after he had left Russia 25 years earlier following severe conflict within the academy. His oldest son, Johann Albrecht (Jean Albert) Euler (1734-1800) was appointed Secretary of the Academy and was to play a vital role as a networker in conjunction with the Venus transit project of 1769. It also appears that the above-mentioned Rumovskii was influential in planning the 1769 observations. Although no study that I am aware of has been devoted to Russian Venus transit activities as such, the recent works of amongst others Georges Dulac and Alexander Moutchnik analyse aspects of academic life in St. Petersburg circa 1769 and provide in-depth information concerning at least some of the actors involved.[40]

A decisive date in this account is 3 March 1767 (14 March new style), when a letter was issued by the Empress, addressed to the director of the Imperial Academy in St. Petersburg. In this letter, Catherine urged immediate action in preparation for the transit of Venus in 1769. She wished the Academy to make every effort to obtain valuable observations; asked to know what locations were most suitable and which observers had been elected by the Academy for this observation; required to be informed of the personnel required, should the construction of new observatories be necessary; and if the number of astronomers at the Academy should

[38] On the report of Lomonosov/Aepinus, see Section II.1.2. The details of the observations of Braun, Krasil'nikov and Kurganov were published in Hell 1761*a*, pp. 92-94.
[39] See for example Vucinich 1963 or Madariaga 1998.
[40] Dulac 2000 on the role of the secretary of the academy, Johann Albrecht Euler; Moutchnik 2006, pp. 177-232 on the role of the Jesuit Christian Mayer.

prove insufficient to cover all the locations chosen for this observation, would take it upon herself to find candidates from the admiralty to receive the necessary training before the transit took place.[41] Accordingly, the Academy constructed a map indicating where the transit would be visible and proposed four Venus transit expeditions to be dispatched to various parts of the Empire. According to the official accounts later issued by the Academy, the Empress was not entirely satisfied with this proposal. She therefore doubled the number of expeditions, and decided that a number of natural history expeditions were to be dispatched as well.[42] The funding was anything but meagre and – despite the relative shortage of time left before the expeditions were to be dispatched – the Academy managed to supplement its sets of instruments with the best available equipment from London and Paris.[43]

In order to assemble the necessary staff, the Academy adopted a twofold strategy. On the one hand, a number of military officers did receive additional training in practical astronomy to qualify them to work on the Venus transit, as the Empress had suggested. In addition, however, extra staff were recruited from abroad.[44] Thus, during the period 1768-69, eight

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[41] Letter from Empress Catherine II to Count Orlov, dated Moscow 3 March 1767 (RAN St. Petersburg; the entire letter was printed in Rumovskii 1771, pp. 5-6, but with minor alterations in punctuation and spelling, the most significant of which are here given in [brackets]): "Monsieur le Comte Orlow. ayant apris que pendant l'Eté de l'année 1769. l'Etoile nommée Venus repassera devant le Soleil, Je vous ecrit [*MS;* ecris *Rumovskii*] cette Lettre, pour que vous disiez à l'Academie des Sciences de ma part, que Je souhaite. 1) que l'Academie fasse faire ses Observations avec le plus grand soin et que Je desire en consequence de savoir. 2) quels sont les Endroits de l'Empire les plus favorablement placés, et quels [*MS;* qui *Rum.*] sont ceux que l'Academie destine pour cette Observation? Afin qu'au cas qu'il y fallut batir, envoyer des ouvriers et si on put [*MS;* peut *Rum.*] prendre les mesures convenables. 3) que s'il n'y a pas assés d'Astronomes à l'Academie pour que l'Observation soit complette, dans les Endroits, que l'Academie aura choisis [*MS;* choisi *Rum.*], Je propose et me charge de faire chercher parmi les Marins des sujets qui pendant le tems qui reste, jusqu'au passage de Venus pourroient se perfectioner sous les yeux des Professeurs pour cette Observation, afin d'etre employés dans cette Expedition avec utilité au gré de l'Academie. // Vous me feres parvenir Monsieur le Comte la Reponse de l'Academie et son avis bien complet sur tout ceci, afin que Je puisse ordonner tout ce [*Rum.;* a *MS*] qu'il faut sans perte de tems. // à Moscow ce 3[eme] Mars 1767 // Catherine". Cf. Woolf 1959, p. 179 or Anonymous 1797, pp. 73-73 for English translation.

[42] Anonymous, "Praefatio" in *Nov.Comm.* pro Anno MDCCLIX, vol. XIV pars prior (1770*b*); Rumovskii, *Nabliudeniia iavleniia venery v solntse v rossiiskoi imperii v 1769 godu uchinennyia s istoricheskim preduve-domleniem* 1771, pp. 8-14. I am indebted to Kari Myklebost for translating this and other Russian texts for me.

[43] Rumovskii 1771, pp. 17-18 & 30-32.

[44] Rumovskii is careful to give the impression that foreign observers were not called for, but only offered their services on their own initiative, after rumours of the Russian preparations had spread across Europe (Rumovskii 1771, p. 18). However, the examples of Jacques-André Mallet and Christian Mayer indicate that a more active role was played by the Academy. The first letter from Mallet to the Imperial Academy, dated Geneva 18 September 1767 (RAN St. Petersburg) shows that he offers his services upon the encouragement of Daniel Bernoulli (1700-1782), a close friend of Leonard Euler who had spent eleven years at the Russian Academy as a professor of mathematics. It is clear from the wording of Mallet that he takes for granted the need on the part of the Academy to recruit foreign astronomers – perhaps the Academy had in fact contacted Bernoulli, asking him to propose a proper candidate? The response of the Academy was swift and positive, indicating that the academicians were prepared to accept the services of foreign astronomers (draft of letter from J. A. Euler to Mallet, dated St. Petersburg 20 October 1767 [RAN St. Petersburg]). As for Father Mayer, Lalande was explicitly asked to find a proper candidate to preside over the observations to be made from the Imperial

Venus transit expeditions were dispatched: four to the Kola Peninsula (where, in the final event, only three sites were reached) and four to southern and eastern parts of the empire. Rumours of these grand-scale preparations quickly spread across the Republic of Letters, and may well have contributed – along with the preparations of Sweden – to the Danish government's decision to contact Maximilianus Hell (see below).

As mentioned, the transit of Venus of 3 June 1769 was due to take place during the night in Europe, and this fact aroused the concern of prominent members of the astronomical community. Following the advanced age and death of Delisle (in 1768), Lalande emerged as a key figure in the co-ordination of observations worldwide. From his point of view, observations in the northernmost parts of the Russian Empire would be particularly valuable. One of Lalande's letters to the secretary of the Russian Academy, the above-mentioned J. A. Euler, illustrates this quite vividly (dated Paris, 17 May 1767):[45]

> Has the Academy of St. Petersburg really no plans to dispatch someone to observe the transit of Venus from beyond the Arctic Circle in 1769? This would be very important, in order to capture both the ingress and the egress.

Travelling to the High North did indeed form part of the Academy's plans. In a report written by the Academy in response to Catherine's letter of March 1767, it was precisely the advantages provided by the midnight sun that were stressed.[46] This explains why four of the Venus transit expeditions in 1769 were sent to North-West Russia. Rumovskii – who had travelled to Selenginsk in 1761 – went to the town of Kola, close to present-day Murmansk. The plan was that Rumovskii's assistant, Lieutenant Fadei A. Okhtenskii, was to go to the island of Kildin just north of Kola in the Bay of Murmansk but, as Rumovskii explains, the ice did not melt until seven days before the transit took place, much too late for his assistant to travel there safely and make the necessary preparations.[47] Two of the foreign participants in the project, the Swiss astronomers Jacques-André Mallet (1740-1790) and Jean-Louis Pictet

Observatory in St. Petersburg. Having tried – and failed – to hire two of his former students for this task, he passed the job over to Mayer (letter from Lalande to J. A. Euler, dated Paris 25 February 1769 [RAN St. Petersburg]). According to the editor of the travel diaries of Mallet and Pictet, Jean-Daniel Candaux, not only Bernoulli but Lalande, too, had written to Mallet and advised him to participate in the Russian Venus transit project (Candaux 2005, p. 4) – another indication that the Academy had made it clear that they wished to recruit foreign candidates for their expeditions as early as the summer of 1767.

[45] Lalande to J. A. Euler, 17th May 1767 (RAN St. Petersburg): "L'academie de petersbourg ne Se propose-t-elle point d'envoyer quelqu'un en 1769 au dela du Cercle polaire, pour observer le passage de venus, Cela seroit bien important, afin d'avoir l'entrée et la sortie".

[46] Rumovskii 1771, pp. 8-9.

[47] Rumovskii 1771, pp. 35-36.

(1739-1781), covered the eastern and southern coast of the Kola Peninsula, stationing themselves at Ponoi and Umba respectively. The other sites of observation covered by Russian-sponsored observers in 1769 were St. Petersburg, Orsk (just South of the Ural Mountains), Orenburg (to the West of Orsk), Gur'ev (on the northern banks of the Caspian Sea) and Iakutsk (by the River Lena in Siberia).

All the observers spent months or even years involved with their expeditions; they were given extra sets of instruments for meteorological and geophysical observations, and they were supposed to determine not only the exact co-ordinates of their observatories but also of places visited along their travel routes.[48] Various natural historians were concomitantly recruited to the Academy, among them Simon Peter Pallas (1741-1811), who was to embark upon his first in a series of expeditions across the vast Russian Empire in that year.[49] As J. A. Euler put it in a letter of September 1767, "our academy will divide itself in two parts, one of which will travel through all the provinces of the empire and the other of which will remain here".[50] Little wonder, then, that the volume of the *Novi Commentarii* of the Imperial Academy covering the year 1769 had to be split into two halves, the second part being 640 pages long and devoted to data assembled in conjunction with the Venus transit project alone. This feat is unparalleled in the history of the acts of this Academy prior to the nineteenth century (see Table 2).

Publicity surrounding the Russian-sponsored Venus transit observations was kept very high. Even though not all observers succeeded in obtaining complete observations, the relevant data for the co-ordinates of their observatories and whatever they managed to see of the transit itself were extracted from the expedition diaries and published unabridged as soon as the manuscripts reached the capital. These individual reports were distributed widely throughout the Republic of Letters without delay. Although the originals had been written in German, French, Russian or Latin, according to the preferences of the observers, they were all reissued in Latin in the *Novi Commentarii* as well as in a compilation called 'Collection of all the observations that were undertaken in conjunction with the transit of Venus in front of the Sun in the year 1769', and in Russian in a 'Historical report on the observations of Venus in the

[48] Cf. the instructions to the expedition leaders, printed in Rumovskii 1771, pp. 41-46.
[49] See for example Vucinich 1963, pp. 150-154; Donnert 1986, pp. 95-114.
[50] J. A. Euler to the secretary of the Berlin Academy, Heinrich (Henry) Samuel Formey, September 1767 (quoted after Dulac 2000, p. 235): "Notre Académie se divisera […] en deux corps, dont l'un voyagera dans toutes les provinces de l'empire et l'autre restera ici".

Sun in the Russian Empire in 1769' written by Rumovskii.[51] In addition, at least some of the reports were published separately in French translations as well.[52] Worthy of particular mention is the book that one of the foreign participants in the project, the Jesuit Christian Mayer (1719-1783), wrote for the Empress in the autumn of 1769 after he had observed the transit from the Imperial Observatory in St. Petersburg. In 355 pages of plain, lucid Latin it explains the phenomenon pedagogically and places the Russian-sponsored activities of 1769 within the framework of historical developments of astronomy all over the world.[53] The entire book was translated into Russian as well.[54] A work of popularised science addressed to a royal lady (the first words of the title translate as 'To The Most Venerable Empress Catherine II'), it resembles the immensely successful *Lettres à une Princesse d'Allemagne* of Leonard Euler, which were issued in the same period.[55]

The books of Mayer and Rumovskii both emphasised the utility of the project to astronomy and human civilisation in general, perceiving the Venus transit expeditions as part of a large project concerned with the modernisation of the Russian empire. In the aftermath of the transit, a series of calculations of the solar parallax were presented by representatives of the Academy in the *Novi Commentarii* and other publications under the auspices of the academy, as well as in influential periodicals abroad (see Chapter II.3 below).

Taken as a whole, Russia's role in the Venus transit projects of the 1760s is characterised by a strong element of elitism and utilitarianism. Unlike Sweden, Britain or the Viennese-ruled territories, where the observations of amateurs were inserted in official publications, efforts to integrate amateurs in scientific activities in Russia were weak at best. Since 1759, a separate class of "corresponding members" had been elected to the Imperial Academy, upon the

[51] [Anoymous] (ed.), *Collectio omnium observationum quae occasione transitus Veneris per Solem a. MDCCLXIX. iussu Augustae per Imperium Russicum institutae fuerunt una cum theoria indeque deductis conclusionibus* 1770; Rumovskii, *Nabliudeniia iavleniia venery v solntse v rossiiskoi imperii v 1769 godu uchinennyia s istoricheskim preduvedomleniem* 1771.
[52] Thus, the report of captain Ivan I. Islen'ev, which was originally written and published in Russian (Islen'ev 1769), was reissued as *Extrait du journal d'observations faites à l'occasion du passage de Venus devant le disque du soleil a Yakoutsk* [1770].
[53] Chr. Mayer, *Ad Augustissimam Russiarum omnium Catharinam II. Alexiewnam Imperatricem Expositio de transitu Veneris ante discum Solis d. 23 Maii, 1769* …1769*b*.
[54] According to Moutchnik 2006, pp. 221-222, the Russian translation was 395 pages long and appeared in 300 copies. The Latin original was likewise published in 300 copies. By contrast, Rumovskii's Russian report was published in 1,200 copies (ibid.).
[55] L. Euler, *Lettres à une Princesse d'Allemagne sur Divers Sujets de Physique & de Philosophie*. 3 vols, St. Petersburg 1768-1772. For a brief account of this publication, cf. e.g. Lackner *et al.* 2006, pp. 386-388. The impact of Mayer's treatise cannot, however, be compared to the widespread popular acclaim for Euler's *Lettres*; cf. Moutchnik 2006, pp. 221-226.

proposal of Lomonosov. The chief argument was that competent Russians in the provinces, many of whom lacked the knowledge of Latin required to be a full member of the Academy, were to be integrated in the scientific progress of the country. According to a recent study, altogether 30 corresponding members were elected in the course of the years 1759-1803, and at least some of these were actively involved in astronomy and meteorology.[56] However, there is no evidence that any of these correspondents were asked to be on the look-out for Venus in front of the Sun's disc. That task was left to the professionals. True, both Rumovskii and Mayer describe how the Empress herself observed the transit from her summer residence outside St. Petersburg – on the opening page of Rumovskii's account, there is even an engraving of Catherine observing the transit – but neither of them includes a record of the time-keeping or other data of this observation. Mayer does, however, include some information that is lacking from all the other reports published under the auspices of the Imperial Academy in the aftermath of 1769: on the day of the transit, he states that[57]

> the mighty example of her Majesty was capable of setting this most ample and flourishing city in motion; a city which that day seemed to be torn from its seat. Some set off for the neighbouring mountain called Duderhoff, others intended to go further in search of a suitable station for observations of this phenomenon; one day alone was hardly enough to satisfy the wishes of each and every one to test and correct the course of their clocks. There were those who stayed up all night, men from the highest nobility among them; some have personally reported the data of their observations as taken down according to their portable clocks, others have handed in their observations anonymously.

Mayer then proceeds to present the data sets from a couple of these amateur observers, and upon inspection concludes that they were of a high quality.[58] These amateur observations were not, however, subject to much attention from other contemporary astronomers, nor have they entered the modern historiography of the Venus transits. In this respect, the Venus transit projects in Russia form an antithesis to the story of the activities in Sweden and the Habsburg lands, analysed above.

[56] Smagina 2007.
[57] Chr. Mayer 1769*b*, p. 92: "Et valuit sane tantum Maiestate plenum exemplum ad commouendam amplissimam hanc florentissimamque ciuitatem, quae eo die ipsa suis sedibus emota videbatur. Pars ad vicinum *Duderhoffii* montem conuolare, pars longius abire, stationemque obseruando huic phaenomeno idoneam quaerere laborabat: vix dies sufficiebat, vt singulorum voluntati in explorandis ac temperandis eorum horologiis satisfieret: fuere, qui totam noctem egere peruigilem, atque in his e prima Nobilitate Viri: alii suas ad horologium portatile factas obseruationes vel ipsi retulerunt, vel tacito suo nomine remiserunt".
[58] Chr. Mayer 1769*b*, pp. 92-93 footnote.

TABLE 2 ARTICLES ON THE VENUS TRANSITS IN THE *NOVI COMMENTARII ACADEMIAE SCIENTIARUM IMPERIALIS PETROPOLITANAE*

Volume	Year(s) covered	(published)	Number of pages	Articles, pages on Venus transit(s)
I	1747 & 1748	(1750)	76 + 653	--
II	1749	(1751)	35 + 451	--
III	1750 & 1751	(1753)	40 + 473	--
IV	1752 & 1753	(1758)	70 + 492	--
V	1754 & 1755	(1760)	47 + 480	--
VI	1756 & 1757	(1761)	44 + 564	--
VII	1758 & 1759	(1761)	47 + 520	--
VIII	1760 & 1761	(1763)	72 + 532	-- (sic)
IX	1762 & 1763	(1764)	56 + 512	-- (sic) [59]
X	1764	(1766)	71 + 558	3, 111
XI	1765	(1767)	54 + 576	3, 100
XII	1766 & 1767	(1768)	58 + 600	1, 12
XIII	1768	(1769)	52 + 560	1, 20
XIV Pars I	1769	(1770)	52 + 602	-- [60]
XIV Pars II	1769	(1770)	20 + 640	12, 567
XV	1770	(1771)	60 + 683	-- [61]
XVI	1771	(1772)	64 + 710	3, 107
XVII	1772	(1773)	58 + 722	1, 64
XVIII	1773	(1774)	68 + 675	--
XIX	1774	(1775)	76 + 653	--
XX	1775	(1776)	80 + 643	--

Authors	Articles	Volume(s)
Aepinus	1	X
Anonymi	5	XI; XIV Pars II (4 articles)
Chr. Euler	1	XIV Pars II
Heinsius	2	X (2 articles)
Islenieff	1	XIV Pars II
Krafft	2	XIV Pars II; XVI
Lowits	1	XIV Pars II
Chr. Mayer	1	XIII
Mallet	1	XIV Pars II
Pictet	1	XIV Pars II
Rumovski	5	XI (2 articles); XI; XII; XIV Pars II
Lexell	3	XVI (2 articles); XVII

[59] Chappe's *Memoire du passage de Vénus* (1762) mentioned in 'Summarium dissertationum', pp. 66-67, but only in the context of longitudinal measurements.
[60] Account of the Russian-sponsored Venus transit expeditions of 1769 in 'Praefatio' (four pages, [i]-[iv]).
[61] A couple of articles in this volume treat the geodetic measurements resulting from the Venus transit project, but not the transits of Venus as such. The same applies to some articles in the preceding volume (XIV Pars II).

II.2.3 THE ROLE OF DENMARK IN THE VENUS TRANSIT PROJECT OF 1761

Denmark was at that time a country with proud traditions in astronomy. It had after all hosted Tycho Brahe on the island of Hven during the sixteenth century, during those years when he made observations that came to serve as the foundation for a new understanding of the universe. As early as 1642, the famous Rundetårn ('Round Tower') Observatory in Copenhagen was erected, decades before Paris (1671) or Greenwich (1676), not to mention Uppsala (1739) or Stockholm (1753). Among the directors of the Rundetårn Observatory were Ole Rømer (or Olaus Roemer, 1644-1710), famous for his determination of the speed of light, which he presented to the Paris Academy of Sciences during a ten-year sojourn there during the 1670s, and Peder (Petrus) Horrebow the Elder (1679-1764), who was appointed Director of the Observatory in 1714. Horrebow's early years in office appear to have been marked by quite frequent observations and a considerable enlargement of the stock of instruments. However, a fire in 1728 destroyed most of the instruments, manuscripts and books of Peder Horrebow, who never managed to get his observatory properly restored. He retired in 1753, enabling one of his sons, Christian Horrebow (1718-1776) to inherit his post as Director of the Observatory as well as the title *Kongelig Astronom* ('Astronomer Royal'). Since both the relevant transits of Venus took place during his years in office, the career of Chr. Horrebow merits some consideration.

According to the authors of the work 'Four Centuries of Danish Astronomy' – Claus Thykier, Kjeld Gyldenkerne and Per Darnell[62] – Christian Horrebow was an able observer. When it came to political talent, however, he clearly lacked the strategic flair of his Swedish counterpart, Wargentin. On 6 June 1761, prominent visitors showed up at Rundetårn only to find obsolete instruments and bad clocks.[63] The head of the observatory had made no attempt to apply for extra funding to acquire new instruments, or at least to repair those that were not functioning. This situation could probably have been avoided had he contacted the government and emphasised the international prestige involved in the project. Admittedly, Chr. Horrebow did what he could with the equipment he had. He and his staff examined the path of Venus across the Sun's disc carefully and – at least some of them – also managed to observe the moments of egress (the ingress took place during the night and was not observable in Copenhagen). But when the data was sent to Paris, Horrebow forgot to reduce

[62] Thykier *et al.*, *Dansk Astronomi gennem Firehundrede År*, 3 vols., 1990.
[63] Thykier *et al.* 1990, vol. I, p. 93: "Videnskabernes Selskabs formand, Grev Thott, og ikke mindre end 14 astronomer mødte op til umoderne instrumenter og slette ure". See also vol. II, p. 251.

the observed times to Local Mean Time (LMT), a blunder that rendered the crucial moments of contact of Venus with the limb of the Sun incorrect.[64] Thus, the Copenhagen observation was of little value to Lalande, who mentions it only in a tiny notice in the memoirs of the *Académie Royale des Sciences* (published 1763).[65] At his time of writing, Lalande was still awaiting the adjustment of the time to LMT. Horrebow had, however, assured him by letter that the difference between the observed time and LMT for Copenhagen "could not be anything but very insignificant".[66] Several years were to pass until Horrebow finally published an article (in Danish), in which he adjusted the time-keeping of his observation. The adjustment turned out to be anything but insignificant – almost three minutes, in fact![67] No trace of these "second thoughts" is to be found in the international literature, however.[68]

The attention of Horrebow in 1761 appears to have been directed towards the Rundetårn alone. However, Denmark was in possession of greater resources of relevance to the international Venus transit project than the famous observatory in its capital. As has already been explained (Section II.1.1), it was vital to the successful calculation of the solar parallax to have observers distributed over as great a distance as possible. Arguably, eighteenth-century Denmark, with its territories in the North and colonies overseas, had the potential to contribute to the project alongside the Great Powers. As for northern Norway, this region was ideal for obtaining important data for the computation of the solar parallax because both the ingress and the egress were going to be visible there. This fact was perceived by one of Horrebow's colleagues, prominent member of the Royal Danish Society of Sciences and professor of the University of Copenhagen Christian Gottlieb Kratzenstein (1723-1795).

One of the locations where the entire duration of the transit was going to be visible was Trondheim, at the time the northernmost city in Denmark-Norway. Since 1760, a newly-founded Society of Sciences had flourished in Trondheim. However, this society lacked an

[64] Thykier *et al.* 1990, vol. II, p. 251.
[65] Lalande, "Remarques sur les Observations du Passage de Vénus, Faites à Copenhague & à Drontheim en Norwège, par ordre du Roi de Dannemarck" 1763, pp. 113-114.
[66] Lalande 1763, p. 113: "M. Horrebow m'a écrit que la différence ne pouvoit être que très-légère".
[67] Cf. Lalande 1763, p. 113: $2^h\ 3'\ 30''$ & $2^h\ 21'\ 0''$, vs. Chr. Horrebow "Tidens Bestemmelse i Henseende til de Observationer, som skeede i Solen og Venere, da Venus Anno 1761. den 6te Junii passerede igiennem Solen" 1765*a*, pp. 387-388: $2^h\ 6'\ 20'',44$ & $2^h\ 23'.\ 50'',52$.
[68] Axel V. Nielsen has attempted to vindicate Horrebow's Venus transit observation of 1761 by examining the procedures presented in the article of 1765 (Nielsen 1957*a*). It may well be that his subsequent adjustment of the time-keeping was sound, but in the international context of contemporary science Chr. Horrebow certainly failed to make any large impact and I cannot find these adjustments quoted anywhere in the contemporaneous literature on the solar parallax.

astronomer among its members and its founding fathers were mainly devoted to history, philosophy, agriculture and natural history.[69] Accordingly, the Royal Society of Copenhagen dispatched two young astronomers to Trondheim, Thomas Bugge (1740–1815) and Urban Bruun Aaskow (1742–1806). Formally, it was the president of the Royal Society and Director of the University of Copenhagen Count Johan Ludvig Holstein (1694-1763) who had given Professor Kratzenstein orders to find two candidates willing to make this expedition among the "mathematicians" of the University. Bugge and Aaskow left Copenhagen on 5 May and reached their destination on the thirtieth of the same month, barely a week before the transit took place.[70] The observation of Bugge and Aaskow was partially spoiled by bad weather, however, and despite the advantageous geographical position of Trondheim, their contribution is – like that of Horrebow – mentioned only briefly by Lalande in the memoirs of the *Académie Royale des Sciences* in Paris.[71]

That it was Kratzenstein, formally a professor of medicine and experimental physics in Copenhagen since 1753, and not the professor of astronomy who was placed in charge of the planning of the Trondheim expedition, indicates the weak position of Chr. Horrebow at that time. During sessions at the Royal Society of Sciences in March 1761, it was Kratzenstein – not Horrebow – who presented what appears to have been the first public lecture on the transit of Venus in Denmark.[72] This lecture by Kratzenstein was later published in the Royal Society's *Skrifter* (1765) and, to judge from the published version, it contained all the standard elements of such advertisements to a general public.[73] Kratzenstein explains how forthcoming transits are predicted – much like solar eclipses; presents a method of computing the visibility of a transit and illustrates this on a map (not included in the printed version);

[69] Cf. e.g. Aase & Hård 1998; Gilje & Rasmussen 2002, pp. 376-396; Brenna in Andersen *et al.* 2009.

[70] Lalande 1763, p. 114. Kratzenstein was also given the task of providing Bugge and Aaskow with the necessary instruments, cf. Snorrason 1974, p. 86.

[71] Lalande 1763, p. 114. Thykier *et al.* says on the observation of Bugge and Aaskow that they "seem to have had bad weather" (Thykier *et al.* 1990, vol. II, p. 261: "Bugge og […] Aaskov var i Trondheim, men synes at have haft skyet vejr"). This is confirmed not only by Lalande, but also by a Latin poem consisting of 20 elegiac couplets published by the Mayor of Trondheim, Niels Krogh Bredal (1732-1778) just after the transit had taken place. It tells how the two observers struggled with overcast weather during the transit and had to content themselves with the end stages of the transit alone; cf. Bredal "Amicis … Bugge et Aaskov, ad Nidrosiam Veneris Solem transeuntis videndæ gratia iter facientibus per iniuriam nebulosæ athmosphæræ ut plurimum spe frustratis …" 1761.

[72] In the protocol of the Royal Society of Sciences in Copenhagen, it is stated under the entries for 2, 9 and 16 March 1761 that "Professor Kratzenstein læste sin Piece om veneris Gang igiennem Soelen i Junii Maaned" = "Prof. Kratzenstein read his piece on the transit of Venus through the Sun [which is to take place] in the month of June" (KDVS Copenhagen, 'Protocoll 1742-1770', p. 315). In the entry for 9 February in the same protocol, we find that Kratzenstein has delivered to the Society the manuscript of his lecture as well as a map of the various transit sites (ibid.).

[73] Kratzenstein, "Afhandling Om Veneris Gang igiennem Solen Aar 1761 …" 1765.

discusses various locations on Earth from which it would be useful to obtain observations; presents the practical procedures involved in observing the phenomenon, and discusses recent improvements to these procedures; and finally, demonstrates the utility of observations of the transit for the advancement of astronomical knowledge in general. As regards the calculation of the parallax, Kratzenstein explicitly discusses Vardøhus, Arkhangelsk (in the Russian north) and Iceland, along with Japan, Batavia (now Jakarta) and Tranquebar (a Danish colony in India), as potential sites for observations.[74]

Kratzenstein, then, perceived the advantageous position of not only northern Norway but also Denmark's overseas colonies: more specifically, Tranquebar. At the time when Kratzenstein held his public lecture, he had in fact been lobbying for some time to bring a Danish observer to that site. The opportunity presented itself via a cross-disciplinary expedition to the Near East (*Arabia felix*), which set off from Copenhagen in January 1761. The initial aim of the expedition – which was initiated by a proposal from Johann David Michaëlis (1717-1791) of the University of Göttingen – was to study the plants, animals, peoples, languages, etc. of the biblical lands, and thus acquire new knowledge of relevance to theology. However, the scope of the expedition soon expanded to include a wide set of other scientific tasks besides, among them astronomy and cartography.[75] Kratzenstein (again not Horrebow!) was asked to comment on the mathematical and astronomical sections of the programme, and in a very detailed report dated 28 November 1760 he ends by pointing to the importance of the transit of Venus:[76]

> Finally, the transit of Venus in front of the Sun belongs to the mathematical observations that may be conducted upon arrival in Tranquebar […]. The farther apart the two observations are, the more useful they will be. […] On this issue I am pointing out that it would be a great honour to the nation with regard to astronomy if another observer was sent to Trondheim or Vardøhus.

[74] Kratzenstein 1765, p. 527.
[75] On the story of this expedition in view of contemporarneous Danish science and politics, cf. e.g. Rasmussen (ed.) 1990; Harbsmeier 2003.
[76] Kratzenstein, report on the plans for the *Arabia-felix* expedition, dated Copenhagen 28 November 1760 (translated from German into Danish in Rasmussen [ed.] 1990, pp. 46-58, here p. 58): "Endelig hører også til de matematiske iagttagelser, som vil kunne blive anstillet efter ankomsten til Trankebar, Venus' gennemgang gennem solen, som finder sted i begyndelsen af juni neste år, og som på grund af sin store betydning for forbedringen af astronomien har vakt alle astronomers interesse. Jo længere væk fra hinanden de to observationer er, jo nyttigere vil det være. […] Og jeg bemærker her for øvrigt, at det ville være en stor fortieneste for nationen med hensyn til astronomien, dersom der derudover blev sendt en observatør til Drondtheim [Trondheim] eller Wandhuyis [*sic*]".

Thus, Kratzenstein expected the *Arabia felix* expedition to have reached Tranquebar by 6 June 1761, where the astronomer/surveyor Carsten Niebuhr (1733-1815) was to observe the transit.[77] Considering the fact that the ship had already left Copenhagen on 4 January, this was probably not an unrealistic idea. However, by 14 May the party had travelled no further than Marseille, from where it continued no earlier than 3 June. Thus, Niebuhr found himself in the middle of the Mediterranean as the transit of Venus took place, and could only report that he did see the transit, while admitting that an observation on the open sea would be of little – if any – astronomical value.[78] Thus, nothing came out of Kratzenstein's idea of having Danish-sponsored observers of the Venus transit stationed in India as well as Norway. As for Tranquebar, this site was covered by a team of Jesuits, whose observation appeared in the *Novi Commentarii* of the St. Petersburg Academy.[79]

The global scope of Kratzenstein's ideas concerning Danish participation in the Venus transit project is in contrast with the activities of Horrebow and his assistants at the Rundetårn observatory. On 4 June 1761, only two days before the transit, one of Chr. Horrebow's assistants, his brother Peder (Petrus) Horrebow the Younger (1728-1812), submitted a dissertation 'On the Transit of Venus through the Disc of the Sun' at the University in Copenhagen.[80] Here, Peder Horrebow discusses the size of Venus as seen in the Sun; the possibility of an atmosphere surrounding the planet; the utility of the phenomenon for the determination of the nodes of its orbit; and the possible existence of a moon of Venus.[81] As to the calculation of the parallax, however, the younger Horrebow refers exclusively to the method that Halley had suggested back in 1716 and says nothing about Delisle's method (compare Section II.1.2 above). He emphasises Halley's suggestion of stationing two observers as far apart as possible – one in North America and the other in the Far East – without mentioning that an observer in Trondheim or Tranquebar, for example, might obtain

[77] Kratzenstein's proposal went into the Royal instruction to the expedition party (quoted from Rasmussen [ed.] 1990, p. 77): "Først og fremmest skal han, efter beskaffenheden af de omstendigheder, som han til den tid vil befinde sig i, gøre den bedste og mest fordelagtige brug af den så sjældne tildragelse, at Venus går gennem solen den 6. juni 1761" = "First and foremost, as far as the circumstances allow, he is to make the best and most profitable use of the very rare occasion offered by the transit of Venus on 6 June 1761".
[78] Niebuhr, *Reisebeschreibung nach Arabien und andern umliegenden Ländern* 1968 (orig. 1774) vol. I, pp. 12-15.
[79] [Anonymous], "Transitus Veneris per Solem a Iesuitis Tranquebariae in India orientali observatus" 1767.
[80] P. Horrebow, *Dissertatio de Transitu Veneris per discum Solis, qvam publico opponentium examini submittet Mag. Petrus Horrebow […] defendente […] Olao Andreæ Borrebye […]* 1761. By Kragh 2008, pp. 60 & 177 this dissertation is wrongly attributed to Christian Horrebow.
[81] P. Horrebow 1761, pp. 18-21.

valuable data as well.[82] In fact the expeditions of Niebuhr and Bugge/Aascow are not even mentioned.

As regards the publicity of the Danish observations, the Astronomer Royal curiously postponed publication of the exact moments of contact at egress – the only information that really mattered in the ongoing efforts to calculate the parallax. Only a few weeks after the transit had taken place, however, Chr. Horrebow published a Latin dissertation 'On the Path Drawn by Venus upon the Disc of the Sun', where he tries to define the exact path of Venus by means of three different methods.[83] The procedure involved three trained observers – each with their assistant, in addition to a fourth assistant paying attention to the clocks – all of whom were kept busy over several hours in the early morning of 6 June 1761. In the introduction, Chr. Horrebow states that:[84]

> I will say nothing yet on the observations made with larger telescopes for the determination of the egress of Venus, or with a quadrant and a meridian circle for the verification of the time-keeping and the meridian both before and after the conjunction took place; I reserve all this to its proper time and place.

As has already been explained, the adjustments to the time-keeping were not published until 1765, in an article in the vernacular. Besides, only two among the crew of observers had attempted to observe the moments of contact at egress (see Section II.2.5). None of the other important aspects of the transit – the "black drop" effect, the possibility of an atmosphere surrounding Venus, the determination of the visibility of the forthcoming transit of 1769, etc. – are known to have been discussed in any publication by the brothers Horrebow or their assistants in the aftermath of June 1761.

However, one aspect of the theory of Venus that did receive attention in Copenhagen was the question of the "moon of Venus". During the spring of 1764, one of Christian Horrebow's assistants, Peder Rødkier (or Roedkiær, ?-1767), believed he observed the notorious "moon of Venus" on two occasions in the month of March. The instrument maker Johannes Ahl (or Johan Ahl, 1729-1795) also saw the same object. A few days later, the Astronomer Royal

[82] P. Horrebow 1761, pp. 24-29.
[83] Chr. Horrebow, *Dissertatio de semita, qvam in Sole descripsit Venus [...] Die 6 Junii Ao. 1761* (in two parts, presented as a dissertation at the University of Copenhagen on 28 and 29 July 1761), 1761*a* and 1761*b*.
[84] Chr. Horrebow 1761*a*, p. 3: "Nihil heic jam loqvor de observationibus per tubos majores pro determinando Veneris egressu, & per qvadranten & Rotam meridianam pro verificatione temporis & meridiani ante & post conjunctionem factis, has omnes suo loco & tempori reservo".

himself, along with Rødkier, Ahl, Peder Horrebow the Younger and a Christian Boserup – thought they could verify the existence of a moon of Venus by means of a 9½-foot telescope at the Rundetårn. Accordingly, Chr. Horrebow reported their findings in the *Gazette littéraire de l'Europe* of 18 April 1764, as well as at lectures held at the Royal Society of Copenhagen that were published in its proceedings.[85] However, these observations were placed under scrutiny by Maximilianus Hell and elegantly refuted as mere optical illusions in his treatise 'On the Moon of Venus' (see Section II.1.4).[86]

In order to contribute to the Venus transit project, not too much skill was required. The most important thing was to be in possession of a good astronomical tube and a reliable clock for the time-keeping. In principle, it was possible to learn the rest within a few weeks or months of practice.[87] Arguably, Denmark-Norway as a seafaring nation had an unexploited resource in their captains of ships, in the navy for example, since a rudimentary knowledge at least of practical astronomy was required in order to navigate on the open sea. Furthermore, the 1761 transit took place in the midst of a joint Swedish-Danish project of geodesy, by which various surveyors were measuring the still undetermined border between Norway and Sweden/Finland.[88] This also meant that there were experienced surveyors around – another unexploited resource for the Danish Venus transit project of 1761. In Sweden an amateur of astronomy and veteran of the boundary surveying, Hellant in Torneå, was not only invited to participate, but was even sponsored by the Royal Academy to do so (Section I.2.1). Other participants on the Swedish side were various captains of ships, teachers at academies and colleges, and at

[85] Rødkier, "Beretning om een den 3 og 4 Martii 1764. giort Jagttagelse, angaaende Veneris Drabant" 1765; Chr. Horrebow, "Reflexioner, anlangende Veneris Drabant" 1765*a* & "Videre Fortsættelse af Observationerne giorte paa Veneris Drabant" 1765*b*. It is known that Horrebow received a copy of Baudouin's memoir on the satellite of Venus just after it had been published, from the Swedish astronomer Bengt Ferner (or Ferrner, 1724-1802) who was in Paris at the time (Ferner's diary, entries 20-24 May 1761 = Ferrner 1956, pp. 388-390).

[86] Hell 1765, espec. pp. 25-26 & 83-84. For a more elaborate account of the observations and deliberations of Horrebow and other Danish astronomers, see now Kragh 2008, espec. pp. 59-67.

[87] That laymen were in fact encouraged to participate in the project is evident from the pedagogical nature of writings such as Hell's *Transitus Veneris per discum Solis Anni 1761 …* 1760; Martin, *Venus in the Sun: being an Explanation of the Rationale of that great Phænomenon …* 1760; Ferguson, *A Plain Method of Determining the Parallax of Venus by her Transit over the Sun* 1760 (cf. Sellers 2001, pp. 122-123); Röhl, *Merkwürdigkeiten von den Durchgängen der Venus durch die Sonne* 1768; Maskelyne, *Instructions Relative to the Observation of the Ensuing Transit of Venus over the Sun's Disk …* 1768; [Anonymous], *A Copper Plate and Discourse of the Transit of Venus, On the 3d of June 1769 …* [1769]; etc. In 1769, Hell allowed the natural historian Borchgrevink to use one of his three telescopes to observe the transit, despite the fact that Borchgrevink had no previous experience in astronomy (see Section II.3.2). Another natural historian and pupil of Linnaeus, Daniel Solander (1733-1782), was also observing the transit alongside Captain Cook and the astronomer Green on Tahiti, presumably without having any previous experience in astronomy either (Cook 1772).

[88] A border treaty was signed between the two countries in 1751. In an additional document (*kodicill*), it was agreed that the border measurements which had started during the 1740s were to continue for seven more years (in fact, the measurements were not finished until 1767; see for example Tobé 1991, pp. 59-61).

least one instrument maker, as well as other civil servants and officials with a general interest in science.[89] By contrast, nothing comparable took place in Denmark or Norway, where no one took responsibility for planning, co-ordinating or publishing such observations. Instead, non-professional astronomers were left to act on their own initiative.

One example of a person participating in the project of 1761 on his own initiative is the surveyor Jørgen Nicolai Holm (1727–1769), a veteran of the survey of the boundary between Norway and Sweden. As we have seen, Lalande's notices in the *Histoire de l'Académie Royale* in Paris constitute a main source for the Venus transit observations of 1761 in both Denmark and Norway. However, a cross-check with the *Philosophical Transactions* of the Royal Society of London from the same period reveals that another observer managed to observe at least part of the 1761 transit in Trondheim. The source for this information is an article by the British optician and amateur astronomer James Short (1710-1768), who in one of his attempts to compute the solar parallax uses data from a "private letter" he has received from an observer in Trondheim.[90] Comparison with the observation of Bugge, as published by Lalande, demonstrates that the observation is not identical, for the determination of the interior contact at egress differs by more than one and a half minutes between the two.[91] Other sources reveal the identity of this observer as the surveyor Holm, who probably had met Short personally during a visit to London in May 1760.[92] Soon after, he was in possession of a telescope of Short's making.[93] In 1761, he almost certainly acted on his own initiative when he observed the transit from his hometown Trondheim and this may explain why his observation has been anonymised by Short.

Another Norwegian surveyor, Christopher Hammer (1720-1804), observed the transit of Venus from Melboestad in Oppland County in Norway, but appears never to have had his

[89] Wargentin 1761*a*, Hellant 1761; cf. Oseen 1939, p. 152 & p. 362 endotes 76-81.
[90] Short, "The Observations of the internal Contact of Venus with the Sun's Limb…" 1763.
[91] Lalande 1763, p. 114: "on trouve pour le temps vrai du contact intérieur observé $9^h\ 3'\ 27''$"; Short 1763, p. 613 (in a table of observations of the interior contact at egress): "Drontheim at 9 1 49 from a private letter".
[92] Wargentin "Nogle Norske Stæders Geographiske Beliggenhed, bestemt i Anledning af afg. Danske Astronoms og Professors Hr. G. Holms Observationer" 1784, p. 415; Bugge in Hell 1790, p. 373: "Ex Cl. *Holm* observatione transitus veneris Anno 1761 aliam [scil. differentiam meridianorum pro urbe Nidrosiensi] adhuc = 34′50″, deduxit Dom. *Short*. (Vide Philosophical Transactions 1762 pag. 624)" = "From famous Holm's observation of the transit of Venus in the year 1761 another [longitude for the city of Trondheim] – 34′50″ – has been deduced by Mr. Short (see Short 1763, p. 624)". Holm's travels abroad are summarised by Helk 1991, vol. II, p. 147. His participation in the border measurements, as well as his scientific career in general, is currently being studied by Nils Voje Johansen (in preparation).
[93] Wargentin 1784, p. [413].

data published. Hammer's manuscript – preserved at the Gunnerus Library in Trondheim[94] – includes a rough determination of Local Mean Time for the fourth contact, but overall, his report lacks the systematic exposition of the data that characterises the observations of Swedish amateurs published in the periodical of the Royal Swedish Academy of Sciences. This could easily have been avoided had conscious efforts been made to integrate Danish-Norwegain amateurs of science within the project.

II.2.4 THE ROLE OF DENMARK IN THE VENUS TRANSIT PROJECT OF 1769, WITH A GLANCE AT BRITISH ACTIVITIES IN THE SAME YEAR

In preceeding sections (II.2.1 and II.2.2), we have seen how plans for scientific expeditions to locations in the regions near northern Norway were taking form in both Russia and Sweden during the first half of 1767. Leading astronomers from abroad, such as Lalande in Paris and the Astronomer Royal Nevil Maskelyne (1732-1811) in London, soon became involved as encouragers, advisors and intermediaries for placing orders at the instrument makers'. It is not known whether similar letters of encouragement were received at the Royal Society of Sciences in Copenhagen, whose archives from this period are unfortunately incomplete.[95] As explained in Section I.2.3 above, decision to contact Hell was taken in the foreign ministry on 18 August 1767. By that time, we may take for granted that the ministers in Copenhagen had learned of the steps that were already being taken in their neighbouring countries. Furthermore, it cannot have escaped the notice of the Royal Danish Society that, as far as the coming transit of Venus was concerned, representatives of the Great Powers of contemporary astronomy placed high hopes in Swedish and Russian – to the detriment of Danish – astronomy.

[94] Hammer's manuscript "Venus' gang gennem Solen Jakttaget paa Melboestad den 6 Junij 1761" (Gunnerus-biblioteket in Trondheim, 'XA HA Qv. 80 m'), includes a delineation of the path of Venus across the disc of the Sun along with the time for the fourth contact. According to his biographer, Vegard Elvestrand, Chr. Hammer studied geometry in Copenhagen in the late 1740s and was active as a surveyor and cartographer throughout the 1750s and 1760s (Elvestrand 2004, pp. 205-207; 228-238; 250-251; 566-570). See now Aspaas 2011*a* for a facsimile and discussion of Hammer's manuscript.

[95] Archival studies by Nils Voje Johansen and myself in relevant archives in Copenhagen have yielded nothing. Furthermore, the correspondence of the foreign minister Johann Hartvig Ernst Bernstorff (1712-1772), published by Poul Vedel and Aage Friis, contain no information on the Venus transit activities of Denmark prior to June 1768, when Hell had already arrived in Copenhagen (Vedel 1882*a*; Vedel 1882*b*; Friis 1904; Friis 1907; Friis 1913). Likewise, the five-volume history of 'The Royal Danish Society of Sciences 1742-1942', which is based on a thorough study of the entire archival collections of the Society, reveals nothing (Asgeir Lomholt 1942-1973). Nor have we been able to track down any overlooked items in that particular archive that might shed new light on this issue.

Several publications by influential French and British astronomers stressed the importance of being present in the high North of Europe for the transit of 1769. Halley had already pointed to "the northernmost parts of Norway" as an ideal place for observations because of the midnight sun in the *Philosophical Transactions* for the year 1716.[96] This statement was followed up by a later generation of fellows of the Royal Society, among them James Ferguson (1710-1776) and Thomas Hornsby (1733-1810), both of whom pointed to "Wardhuys" (or "Wardhus") in similar papers from the mid-1760s.[97] Ferguson even went so far as to state that "[t]he most proper places for observing this Transit would be Wardhuys, a port Town in Norwegian Lapland, & some of the Solomon Jsles".[98] The astronomers of Paris, too, recognised the importance of making observations in northern Scandinavia. When Lalande in 1764 published a coloured mappe-monde of the visibility of the coming transit, northern Norway, including "Wardhus", emerged as an ideal place for observations. In an accompanying memoir, Lalande explicitly pointed to the region of *Lapponie*, into whose northernmost parts he expected astronomers from Sweden and Russia to penetrate, while saying nothing, however, about representatives from Denmark-Norway.[99] During the winter of 1766-67, another influential French astronomer, Alexandre Guy Pingré (1711-1796) presented to the *Académie Royale des Sciences* a memoir 'On the choice and state of sites where the passage of Venus of 3 June 1769 may be most advantageously observed'.[100] Like Lalande, Pingré pointed to Lapland, where he expected great things of the Swedes and the Russians, while barely mentioning the Danes at all.[101]

The low reputation of Danish-Norwegian astronomy in this period appears to have been widespread. Already in the *Histoire de l'Académie Royale des Sciences* for the year 1757 (published 1762), the editor pointed out that the King of Denmark would be in a position to

[96] Halley 1717, p. 464: "constat *Venerem* extremum *Solis* limbum Boreum quasi centro suo stringere debere, Anno 1769, […] ita ut, ob Parallaxin, in Borealibus *Norwegiæ* partibus, tota intra *Solem* inocciduum apparere poterit".
[97] Ferguson, "A Delineation of the Transit of *Venus* expected in the Year *1769* …" 1764; Hornsby, "On the Transit of *Venus* in *1769* …" 1766. Hornsby's paper was also translated into German and published in the *Neues Hamburgisches Magazin* (Hornsby 1767).
[98] Ferguson 1764, Tab. I.
[99] Lalande, *Explication de la Figure du Passage de Venus sur le Disque du Soleil, Qui s'observera le 3 Juin 1769 …* 1764*b*, espec. pp. 14-17.
[100] Pingré, *Mémoire sur le choix et l'état des lieux Où le passage de Vénus du 3. Juin 1769 pourra être observé avec le plus d'avantage; et principalement sur la position géographique des isles de la mer du Sud* … 1767.
[101] Cf. Pingré 1767, espec. pp. 12-13 & 17-18. One might ask for the opinions of astronomers in other countries. However, a similar memoir from Joseph Louis de Lagrange (1736-1813), read at the Royal Academy of Berlin 12 November 1767, is much less limited in its geographical scope. Apart from several places in Germany, Lagrange mentions only Paris and a couple of places in the Middle East; cf. Lagrange "Mémoire sur le passage de Vénus du 3 Juin 1769" 1768, espec. pp. 295-301.

provide data of the utmost utility by dispatching astronomers to northern Norway in 1769, "if there are, in his Estates, Observers sufficiently experienced, and equipped with instruments of sufficient quality to make this grand observation with adequate precision", he added, with more than a hint of scepticism.[102]

Similarly, on 5 January 1768, the British Astronomer Royal sent a letter to Wargentin, urging the Swedish Academy of Sciences to send observers to *Wardhus* and *Lapponiæ caput septentrionale* ("the northern Cape of Lapland"), both of which lay, as he must have been well aware, within the confines of the Danish-Norwegian Kingdom. This letter was written after the Royal Society of London, at a meeting on 19 November 1767, had singled out Vardø and North Cape as possible sites for British Venus transit observations, "unless it was learned that Swedish or Danish astronomers were planning to make use of these stations".[103] The letter to Wargentin reveals that the Royal Society of London had no idea about the expedition by Hell at this stage. What is more, Maskelyne apparently had such low faith in the qualities of Danish astronomers that he found it futile to encourage them to make observations from these important stations. This explains why he insisted that the Swedes should go to northern Norway to make Venus transit observations in 1769, instead of the Danes:[104]

> The Royal Society wishes strongly, that the coming transit of Venus through the disc of the Sun be observed correctly and in the places necessary for

[102] "Du passage de Vénus sur le Soleil, Qui s'observera en 1769.", *HARS 1757* (1762), pp. 99-108, here p. 106: "Le roi de Danemarck qui a signalé de même son goût pour les Sciences, en envoyant des Astronomes en Norvège pour le passage de 1761, sera à portée de nous procurer le même avantage que la Russie, s'il se trouve dans ses États des Observateurs assez bien exercés, & munis d'assez bons instrumens pour faire cette grande observation avec une précision suffisante".

[103] Woolf 1959, p. 164.

[104] Maskelyne to Wargentin, dated Greenwich 5 January 1768 (CVH Stockholm): "Regia Societas exoptat, ut proxime futurus transitus Veneris per discum solis rite & in debitis locis pro parallaxi solis determinanda observetur. Jtaque verisimile est eos aliquos observatores in exteras regiones missuros [*scripsi;* missuras *MS*] esse; sed interea scire volunt, quibus in locis Astronomi Sueci observationes suas peragere statuerunt [...]. Loci idonei pro observando transitu Veneris apud vos aut non longe a vobis dissiti, sunt Tornea[,] Kittis, Wardhus, & Lapponiæ caput septentrionale. Jn his locis duratio transitus veneris extendetur 11 aut 12 minutis temporis propter parallaxes. Locus ultimo dictus nempe Lapponiæ caput extremum huic observationi optime convenit, quoniam altitudo solis illic in utrisque contactibus internis ad 8 aut 9 gradus ascendet, scilicet major quam in reliquis locis; quamvis non multo humilior erit apud Wardhus; verum apud [*scripsi;* apud *bis MS*] Kittis altitudo solis vix 5 gradus superabit, et apud Tornea vix quatuor cum semisse. Utinam Astronomi Sueci in omnibus his locis observationes instituant; præcipue autem exopto quod vel tu vir doctissime et expertissime, vel doctissimus & observandi peritissimus D[nus] Mallet Ast. Obs. Reg. Ups. in uno aut altero ex his locis duobus primo dictis scil. Lappon. cap. et Wardhus, vel potius, si fieri potest, alter in hoc, alter in illo observationem exoptatissimam peragere velletis. Certe summâ solertiâ præstabitur, et maximus fructus ex ea colligetur. [...] si tu sociique tui dignissimi opus hoc suscipere volunt, Societas regia possunt eo impensius vires suas intendere ad observationes in aliis pluribus locis instituendis. [...] Quid, si vobis placuerit transitum observare apud Lapponiæ caput et Wardhus, anne etiam placebit contemplari transitum per telescopia Gregoriana anglicanis similia, nempe duorum pedum; Jta comparatio inter observatores præstantior erit et certior".

> computation of the solar parallax. Accordingly, it is likely that it will dispatch observers to regions overseas, but in the meantime, it wishes to know in what places the Swedish observers will conduct their observations [...]. Suitable places for observing the transit of Venus in your country or not far away from it, are Torneå, Kittis, Vardøhus, and the northern Cape of Lapland [i.e., the North Cape]. In these places, the duration of the transit will extend 11 or 12 minutes in time because of the parallaxes. The last of the places mentioned – that is, the extreme Cape of Lapland – fits perfectly well for this observation, since there the altitude of the Sun will rise to eight or nine degrees during both interior contacts, which is higher than in any of the other places; although it will not be considerably lower in Vardøhus, the altitude of the Sun will in Kittis hardly be any higher than five degrees, and in Torneå, hardly higher than four and a half. If only Swedish astronomers would take upon themselves to make observations in all these places! Most of all, however, I sincerely wish that either You, most learned and well experienced man, or the most learned and in astronomical observations so well versed Mr. Mallet, astronomer of the Royal Observatory in Uppsala, would take upon Yourselves to conduct this highly wished-for observation in one of the two above-mentioned places – that is, the Cape of Lapland and Vardøhus – or rather, if possible, one of You at this, and the other at the other site. The task will then certainly be conducted with the highest care, and provide the richest harvest. [...] If You and Your highly worthy assistants are willing to take upon Yourselves this task, the Royal Society will be in a position to concentrate its efforts, all the more eager on conducting observations in several other places. [...] May I suggest that You, if You agree to observe the transit from the Cape of Lapland or Vardøhus, may also be willing to observe the transit with Gregorian telescopes similar to the English ones, that is, two feet long? In that way, comparison between the observers will be more eminent and secure.

Thus far Maskelyne. As to his emphasis on northernmost Norway as a region better suited for observations of the Venus transit than Swedish Lapland, the British Astronomer Royal in fact contradicts Wargentin, who in the application to the Swedish King one year earlier had stressed that “no place in the whole of Europe, Asia or Africa is better suited [for observations of the transit] than Swedish Lapland” (see above, Section II.2.1). It might seem strange that Wargentin, as an able astronomer, did not judge the advantages of northernmost Fennoscandia in the same way as his British counterpart. For political reasons, however, Denmark-Norway was not likely to allow Swedish astronomers to make expeditions within their territories anyway. Thus we may guess that it was the PR man speaking, not the astronomer Wargentin, on the above occasion.

Clearly, Denmark-Norway should seize the opportunity offered by the publicity surrounding the transit of Venus and arrange for a qualified observer to be stationed somewhere in northern Norway. Vardø was as good a choice as any. For ages, a fortress and a Danish-

Norwegian garrison had been stationed there, signalling the strategic importance of this easternmost village in Norway.[105]

With a positive answer from Father Hell, widely recognised as an able observer and an expert on the planet Venus, Denmark-Norway had obtained a ‘scoop’. But the government in Copenhagen did not limit itself to the expedition of Hell alone.

Unlike in 1761, action was taken on this occasion to invite local observers in Norway to participate in the project alongside the professionals. One such invitation was sent to the surveyor Jørgen Nicolai Holm, who – as has already been told – had observed the 1761 passage of Venus on his own initiative in Trondheim (See Section II.2.2). Since then, he had been appointed a *Professor designatus* in Copenhagen, although he still resided in Alta in the Finnmark county of Norway, where he had been based during the boundary surveying. It is under the title of “Most noble and erudite Mr. Professor” that the Interior Minister and President of the Royal Society of Sciences, Otto Thott (1703-1785) addresses him in a letter dated 26 March 1768. The field-work involved in the Swedish/Danish boundary survey had now come to an end and the minister appears to be at a loss concerning the professor’s whereabouts. He suggests, however, that Holm should take up a position in Tromsø or some other suitable place in northernmost Norway on 3 June 1769, if “the conditions and health of Mr. Professor” allow this:[106]

> For Professor Jørgen Nicolai Holm // Most noble and erudite Professor! Since His Royal Majesty has most graciously ordered, that besides Father Hell, who is

[105] On the historical significance of the military presence at Vardøhus see for example Willoch (ed.) 1960, Balsvik 1992; Hagen 2008.

[106] Thott to Holm, dated 26 March 1768 (*RA Copenhagen*, Danske Cancelli: Concepter og Indlæg til Obersecretærens Brevbog): “til Professor Jörgen Nicolai Holm. // Velædle og höylærde // H[r] Professor! // Da hans Kongelig Mayt. Allernaadigst har befalet, at, foruden Pater Hell, som afgaaer til Wardöehuus, for der at observere Veneris Gang igiennem Soelen, som skeer den 3 Junii 1769, endnu skal tages samme Observation paa et bequem Sted, i Finmarken, som formeenes at kunde være Tromsöen; Og Man er forsikret, at ingen dertil kunde findes bequemmere end h[r] Professor; Saa ville ieg fornemme, om h[r] Professors Omstændigheder og helbred tillader Dem, at blive saalænge i finmarken, at De kunde paatage sig denne Observation, hvorom ieg, med förste vil vente Deres Svar, og tillige hvad Jnstrumenter De i saafald ere forsynede med, eller endnu dertil maatte behöve; Til hvilken Ende ieg herhos sende en Fortegnelse paa de Jnstrumenter, som til bem[te] Observation eragtes fornödne, og herfra kan erholdes; Men ifald h[r] Professor icke skulle kunde opholde sig der saalænge, for at forrette denne Observation, skal denne min Skrivelse icke hindre Dem fra, at fortsette Deres forehavende Needreyse, da ieg derom ligeledes med forderligste venter Deres Svar, samt tillige at ville meddeele mig Deres Tanker, enten Tromsöen, som meldt, eller hvad andet Sted i finmarken De eragte beqvemmest, til der at kunde foretage denne Observation, Jeg forbliver // Velædle og höylærde h[r] Professors // tienstvillige tiener // O. Thott. // Cancelliet // 26 Martii 1768 // P:S: Skulle h[r] Professor formeene, at dertil den indbemelte Observation, behöves fleere eller andre Jnstrumenter, end paa forteignelsen findes anfört, eller De Selv er forsynet med, ville De udi Deres Svar mig saadant tilmelde.”

going to travel to Vardøhus in order to observe the passage of Venus through the Sun which is to take place on 3 June 1769, another person shall make the same observation from a suitable place in Finnmark – a place which, it is thought, might be Tromsø – and [since] it is certain that no one could be found more qualified for this task than Mr. Professor, I should like to know whether the conditions and health of Mr. Professor are such as to allow Him to remain in Finnmark long enough to be in a position to take upon Himself this observation, concerning which I expect His swift answer, along with information regarding what instruments He, should that be the case, is in possession of, or is perhaps still lacking; to which end I am sending a list indicating the instruments considered necessary for the above-mentioned observation, and which may be acquired here in Copenhagen. If, however, Mr. Professor is not in a position to linger there as long as is required in order to make this observation, this letter of mine shall not hinder Him from His planned return journey; since I am expecting His swiftest possible answer to this request, as well as His thoughts as to whether Tromsø, as stated above, or some other place in Finnmark is considered by Him more suitable for this particular observation, I remain the most noble and erudite Mr. Professor's obliging servant, *O. Thott.*

Added to the letter of the minister is a list of instruments that were considered necessary for the task of observing the transit: a quadrant of a 2 to 2½-foot radius; a 10-foot Dollond telescope with a micrometer; and a Graham clock. In a postscript, however, Thott invites Holm to inform him if he finds the list insufficient.[107]

A curious document in the archives of the Royal Swedish Academy of Sciences reveals that before this letter from Thott reached its addressee, another person had already contacted Holm – the secretary of the Swedish Academy of Sciences, Wargentin. In a letter to Holm dated 16 October 1767, Wargentin had urged this Norwegian surveyor to observe the forthcoming transit of Venus from his residence in Alta. He had also sent a letter of recommendation to the "Rector Dass" in Copenhagen,[108] urging him to make sure that Holm was employed for this task. It was this recommendation from Wargentin, Holm informs us, which had resulted in the invitation from Minister Thott.[109] In the spring of 1768, however, Holm was in fact on his

[107] Added to the document quoted in the preceding note, on a separate sheet of paper, by another hand: "Fortegnelse // Paa de Jnstrumenter, som til at observere Veneris Gang igiennem Solen, eragtes fornödne, // 1. Astronomisk Quadrant paa 2 a 2 ½ Fods Radio // 2. 1 Tubus Dollondianus paa 10 Food med objectiv micrometro. // 3. 1 horologium Grahamianum." For Thott's postscript, see the preceding footnote.
[108] Probably the former Rector of the *Katedralskolen* (ecclesiastical college for trainee priests) in Trondheim, Benjamin Dass (1706-1775). According to Wargentin's own list of letters dispatched to correspondents abroad (printed in Nordenmark 1939, pp. 399-424, here p. 405), the letter to Dass was sent 16 October 1767, on the same day as his letter to "Professor Holm i Norige" = "Professor Holm in Norway".
[109] All this information is revealed in a single document: a letter from Holm to Wargentin dated Copenhagen 26 March 1769 (CVH Stockholm; note that in the repertory of this archive, Holm is wrongly identified as "amtmann Holm").

way to Copenhagen. Even before he made it to the capital, the situation there had changed. As he explains in a letter to Wargentin, dated Copenhagen 26 March 1769,[110]

> when I [...] reached Copenhagen on the very day of Saint John [24 June] and was about to answer, I ran into some strange and very complicated problems, which should be told face-to-face rather than in writing. These problems forced me in dismay to politely refuse the invitation, and thus say no to a task that I, under other circumstances, would have been happy to take upon myself without being officially called upon and paid for it; and may indeed still be foolish enough to undertake.

Holm had not entirely given up the idea of observing the transit from Alta, "particularly since I learned that nobody had received orders to station himself there".[111] One further reason was that he had left his instruments in Alta, so that everything was in fact ready for this observation.[112] Thus, he was secretly pondering about travelling from Copenhagen to Alta that very spring, via Sweden. This trip of some 1,670 kilometers as the crow flies, most of which was to be made on sledge upon the snow, never came about, since Holm suddenly died in April 1769.[113]

Holm does not explain what intrigues he had run into. As of 24 June 1768, however, Father Hell had already been staying in Copenhagen for nearly two weeks. During this period, a sense of shame had spread among the notables of Copenhagen that no Danish astronomer had offered to take upon himself the task of observing this important astronomical event from Norway. In a letter to the foreign minister Johann Hartvig Ernst Bernstorff, dated Copenhagen 18 June 1768, his brother Andreas Peter Bernstorff says:[114]

> Father Hell dined here today, brought here in triumph by Niebuhr, who is in love with him and who has no greater regret in the world than that of not being

[110] Holm to Wargentin, Copenhagen 26 March 1769 (CVH Stockholm): "men brevet [fra Thott] indlöb mig ikke, förend jeg paa Wejen hertil havde naaet Bergen, og da jeg efter en lökkelig Reyse af 4 Dager ankom just St: Hans Dag til Kiöbenhavn og skulde give Svar, mötte nogle forunderlige og meget indviklede Omstændigheder, hvilke bedre mundtlig end skriftlig kunde berettes, og giorde, at jeg med et misnöyet Sind maatte takke og unskylde mig: fölgelig sige Ney til det, jeg under andre Omstændigheder med megen Fornöyelse havde paataget mig uden at være publiquement kaldet og belönnet, ja det jeg maaske endnu er saa daarlig at foretage". On "daarlig" in the sense "foolish" see Kalkar s.v. "Dåre".

[111] Ibid.: "helst siden den Tid jeg fik at höre, at ingen havde faaet Ordre at tage Post der".

[112] Hell and Sajnovics visited Alta in July 1769, where they "tested Holm's 20-foot telescope"; Sajn.s diary, entry on 24 July 1769: "Probatus tubus 20 pedum D^{ni} Holm" (*20 pedum* is almost certainly a misspelling of *2 pedum*, "two-foot").

[113] Lomholt vol. IV, 1961, p. 15.

[114] A. P. Bernstorff to J. H. E. Bernstorff, dated Copenhagen 18 June 1768 (Friis 1904, p. 509): "Le père Hell a dîné aujourd'hui ici, mené en triomphe par Niebuhr, qui en est amoureux et qui ne regrette rien autant que de ne pas pouvoir aller avec à Wardehuus. Il est indigné contre Horreb. et contre les jeunes astronomes d'ici de ce qu'il n'y en a pas un qui aye le même désir, ce qui est effectivement honteux".

> able to travel to Vardøhus along with him. He is furious at Horrebow and the young astronomers of this city for the reason that there is not one among them who wishes to do the same, which is indeed disgraceful.

Two weeks later, A. P. Bernstorff informs in another letter to the minister that:[115]

> Father Hell will leave in two days' time to travel overland to Trondheim, alone with his travel companion [i.e., Sajnovics], as the savant gentlemen from these parts haven't found anyone to accompany him. Kratzenstein is so furious about this situation that he will personally go to Trondheim next year to make his observations there.

At some point, this "disgraceful" situation changed. In a report to His Majesty, dated Copenhagen 9 July 1768, the interior minister Thott refers to an order to dispatch a Venus transit observer to "*Nordlandene* ['the North Lands'; comprising the counties of Nordland and Troms], between Trondheim and Vardøhus". He has nothing to report on this subject, but promises to return to it later.[116] This means that the invitation to Holm must have been withdrawn. Then, in the leading newspaper of Denmark-Norway, *Kiøbenhavns Adresse-Contoirs Efterretninger*, we find on the front page for 15 August 1768 the information that His Royal Majesty has decided that *two* observers are to be sent from the University of Copenhagen to observe the transit of Venus from "*Nordlandene*, approximately halfway between Vardøhus and Trondheim". Combined with the observations of Hell and his companion in Vardø, of Kratzenstein in Trondheim, and of Chr. Horrebow at Rundetårn, the result would be that "this no less important than rare phenomenon" would be "accurately observed from four different places within His Majesty's kingdoms". Accordingly, it was the duty of "every single lover of the sciences" to wish for clear skies and good luck to the observers.[117] The identity of the two observers in Nordlandene is not revealed in the

[115] A. P. Bernstorff to J. H. E. Bernstorff, dated Bernstorff Estate 2nd July 1768 (Friis 1904, p. 514): "Le père Hell part dans deux jours par terre pour Drontheim, seul avec son compagnon, Msrs. les savants d'ici n'ayant trouvé personne pour l'accompagner. Kratzenstein en est si indigné qu'il ira lui-même l'année prochaine à Drontheim y faire ses observations".

[116] Otto Thott, report to His Majesty attached to a letter to J. H. E. Bernstorff, dated Cancelliet [Copenhagen] 9 July 1768 (RA Copenhagen, 'Gehejmekonseilet 45'): "Angaaende den Observator, som Deres Majestæt har befalet at skal opsendes til Nordlandene, for der, imellem Trundhiem og Wardöehuus, ligeledes at giöre Observationer, da skal derom blive givet nærmere allerunderdanigste Eftterretning".

[117] *Kiøbenhavns Kongelig alleene privilegerede Adresse-Contoirs med Posten forsendende Efterretninger*, 1768., 10. Aargang, No. 95, Mandagen den 15 August, "Adskilligt Nyt": "Hans Kongelig Majestet haver af særdeles Omhue for Videnskabernes Beste og Opkomst befalet, at, foruden den berømte Wienerske Astronomiæ Professor Hell og Compagnon […], end videre fra det Kiøbenhavnske Universitet skal sendes 2de Observatores til Nordlandene, for der at giøre samme Observation, omtrent midt imellom Wardehuus og Tronhiem […]. Fremdeles opreyser Hr. Professor Kratzenstein til Foraaret til Tronhiem, for der med lige gode Jnstrumenter at iagttage meerbemelte Veneris Giennemgang. Dens Jndgang i Solen bliver ligeledes af Justitz-Raad og Professor Astronomiæ Horrebow observeret paa det Astronomiske Taarn her i Staden; saa at denne saa vigtige som sieldne

newspaper article. It is stated, however, that they intend to reach their destination before the arrival of the winter, to make themselves ready for the observation.[118] One important preparatory task would no doubt be to determine the co-ordinates of their site of observation, as nearly all the places along the coast north of Trondheim were insufficiently determined. Thus, it would indeed be a great advantage to reach the site of observation well before the arrival of the midnight sun, while dark skies at night were still at hand for geodetic operations.

Various documents found in the archives of the *Danske Kancelli* ('Interior Ministry'), reveal that Christian Horrebow had proposed – and obtained the approval of the Ministry – that the two observers were to be Peder Horrebow the Younger and Ole Nicolai Bützow (1742-1794), a teacher at the *Landkadetakademiet* in Copenhagen (a school providing rudimentary technical instruction for engineers in the military) who had previous experience in geodesy.[119] Their names first appear in a document dated 31 October 1768, but it is highly likely that most negotiations concerning candidates, payment, travel routes, and other practical arrangements for the expedition were agreed orally and were never noted down on any written document.[120] The documents to hand show that their departure from Copenhagen was scheduled for 5 December 1768 and their arrival in Trondheim for February or March, that is, a bit later than suggested in the newspaper article of August. This means they would have been in quite a hurry to reach their destination of Tromsø before the bright skies at night set in around the beginning of April.

As these arrangements took place, the young King Christian VII (1749-1808, ruler of Denmark and Norway from 1766) had left Copenhagen on a tour of Europe. According to

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Tildragelse paa 4re adskillige Steder i Hans Maiestæts Riger med yderste Nøyagtighed bliver observeret, hvortil enhver Videnskabs Elskere bør ønske klart Veyer og god Lykke".

118 Ibid.: "saavel Professor Hell, som disse sidste, agter at være paa de bestemte Stæder førend Vinteren, for desto bedre i Forveyen at kunde giøre de fornødne Jagttagelser og Forberedelser".

119 Thott to Chr. Horrebow, dated Cancelliet [Copenhagen] 31 October 1768 (RA Copenhagen, 'Koncepter og Indlæg til Ober-Sekretærens Brevbog', 1768); Thott to August von der Lühe, dated Cancelliet 31 October 1768 (RA Copenhagen, 'Partikulærekammeret, Regnskaber', Bilag 1768); Thott to J. H. E. Bernstorff, Cancelliet 5 November 1768 (RA Copenhagen, 'Gehejmekonseilet 45'); Chr. Horrebow to Thott, Copenhagen 28 November 1768 (RA Copenhagen, 'Koncepter og Indlæg til Ober-Sekretærens Brevbog', 1768); Thott to August von der Lühe, dated Cancelliet [Copenhagen] 1 December 1768 (RA Copenhagen, 'Partikulære-kammeret, Regnskaber', Bilag 1768); Thott to J. H. E. Bernstorff, dated Copenhagen 10 December 1768 (RA Copenhagen, 'Gehejmekonseilet 45').

120 Thus, the letter to Thott, signed by Chr. Horrebow and dated 28 November (see preceding footnote), is in fact extant in the hand of Peder Horrebow; Chr. Horrebow has only signed it, explaining that: "Jeg havde önsket at ved den leilighed personligen at opvarte, men da jeg maae holde sengen formedelst en rheumatisk tilfælde, saa anbefaler jeg Deres Höygrevelige Excellence de reisendes anliggende skriftligen" = "I had wished to present this personally, but since I have to stay in bed due to an attack of rheumatism, I recommend the business of the travellers for Your Most Noble Excellency in writing".

contemporaneous accounts, he travelled "incognito" as a "Prince of Holstein", with an entourage of 56 persons; servants, notables and ministers, among them Foreign Minister Bernstorff.[121] Rumours claimed that the monarch would be visiting almost every important city in Europe – Rome, Vienna and St. Petersburg included.[122] Of the capitals, however, he ended up seeing only London and Paris, returning to Copenhagen in January 1769. During this trip, signs that the King's mental health was not quite as good as it ought to be were noticed by his advisors.[123] He met Father Hell in Holstein at the outset of the journey in late May 1768, however, and had occasion to discuss the expedition with the Viennese court astronomer personally. Both Hell and Sajnovics refer to this and other audiences with the King with awe and respect, praising his understanding of scientific matters in particular.[124] Another meeting of interest to the history of the Venus transits took place in Paris with the influential astronomer Lalande. The Danish King in fact offered to sponsor Lalande on a trip to St. Petersburg to preside over Venus transit observations to be made from the Imperial Observatory.[125] This generous offer was probably presented during a meeting the king had with numerous prominent members of the *Académie Royale* in November 1768.[126] At around the same time, the Jesuit Christian Mayer contacted Lalande for advice about where to go to observe the transit, since earlier plans to accompany the prominent Jesuit polymath Roger Joseph Boscovich (or Ruggerio Giuseppe Boscovich, Ruđer Josip Bošković, 1711-1787) to North America had stalled. Mayer also wrote to the Royal Society of London, of which he was a member, offering to go wherever the Royal Society deemed best.[127] The result was that Mayer – instead of Lalande – went to St. Petersburg, a decision he took just in time to reach

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[121] For the account of Christian VII's journey, I have used an article by Bernoulli in *Sammlung kurzer Reise-beschreibungen* ...1784, vol. 4, pp. 5-114, which is based upon a variety of printed and unprinted sources, cf. pp. [3]-[4]. See also Holm 1902, pp. 148-167 and Langen 2008, chapter 8.

[122] These rumours are referred to in several of Hell's letters from Vardø, e.g. Hell to Höller, Vardø 15 January 1769; Hell to the General of the Society of Jesus, Vardø 15 January & 6 April 1769.

[123] See for example the letter from J. H. E. Bernstorff and H. C. Schimmelmann to Conrad Holck, dated York 1 September 1768 (Friis 1913, pp. 721-725).

[124] Sajn.s diary, entries 31 May & 1 June 1768, 29 November 1769, and 8 February 1770; Sajn., letters to Splenyi, dated Lübeck 5 June 1768 & Copenhagen 10 February 1770; Hell, letter to Höller, dated Vardø 15 January 1769.

[125] Lalande "Mémoire sur le Passage de Vénus devant le disque du Soleil, observé le 3 Juin 1769 […]" 1772, p. 619: "L'Académie de Pétersbourg avoit invité M. de la Lande à aller dans l'Observatoire de Pétersbourg pour y faire l'observation du passage […]. Il étoit presque déterminé à partir, & le Roi de Danemark qui étoit alors à Paris, avoit daigné lui promettre des facilités pour ce voyage" = "The Academy of St. Petersburg had invited M. Lalande to go to the Observatory of St. Petersburg to observe the transit from there […]. He had almost decided to go and the King of Denmark, who was in Paris at the time, had deigned to afford him the facilities for this voyage".

[126] The King's visit lasted from 21 October to 9 December 1768. In late November, the King invited twenty of the most famous savants of Paris for dinner "and there was no one to whom he did not say something obliging" (Bernoulli 1784, pp. 99-100: "und da war keiner, der Er nicht etwas verbindliches gesagt hätte").

[127] Woolf 1959, pp. 169-170.

his destination with the necessary equipment before the phenomenon took place.[128] In his little-read, 355-page treatise on the transit of Venus dedicated to the Empress of Russia (see Section II.2.4), Father Mayer mentions that he too has received an invitation to go to Norway:[129]

> There is also reason for me to publicly express my most sincere and humble thanks to so great a King, as well as to His Majesty's most illustrious and excellent Minister, the Count of Bernstorff, for the obliging offer to observe the phenomenon from wherever I wanted in the Kingdom of Norway, if shortage of time or unfavourable winds made it impossible for me to go to St. Petersburg; an offer this illustrious and excellent Minister did me the honour of expressing in a letter.

These invitations, politely rejected but duly thanked for in public, indicate how much prestige the Danish monarch (or at least his advisors) invested in the Venus transit project of 1769.

II.2.4.1 THE OUTCOME OF EFFORTS TO OBSERVE THE VENUS TRANSIT FROM DANISH-NORWEGIAN SOIL IN 1769

In London, plans for expeditions can be traced back to the summer of 1766, although a special committee for the planning and co-ordination of these expeditions was not appointed by the Royal Society until November 1767.[130] On 15 February 1768, the Society sent a petition to the King for his economic support of expeditions, and this wish was granted on 24 March. At that time, two expeditions – one to Hudson's Bay and the other to the Pacific (later to materialise as Captain James Cook's expedition to Tahiti) – had been decided upon. In the summer of 1768, the additional destinations of Spitsbergen (Bellsund)[131] and North Cape were being discussed, but the idea of sending a ship to Spitsbergen was dropped, probably because the ice would prevent it from getting anywhere near the island so early in the summer.[132] The result was that a naval frigate, *H.M.S. Emerald*, was given the task of bringing two observers – William Bayly (1737-1810) and Jeremiah Dixon (1733-1779) – to

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[128] For an excellent account of Mayer's journey to Russia, see Moutchnik 2006, pp. 177-232, cf. pp. 112-128 & 389-398.

[129] Chr. Mayer 1769*b*, p. 317: "Est quoque, vnde summas ac demississimas grates tanto REGI, eiusque Illustrissimo ac Excellentissimo Domino Minstro, D. Comiti DE BERNSDORFF publice persoluam pro gratiose data, vbi vellem, in Regno *Norwegiae* obseruandi facultate, si per temporis angustias ventosque contrarios *Petropolim* adire non licuisset, vt literis ad me datis idem Ill. ac Excell. D. Minister significare dignatus est".

[130] This account of the British Venus transit expeditions of 1769, unless otherwise indicated, is based entirely upon Woolf 1959, pp. 161-170.

[131] The information that the destination on Spitsbergen was intended to be Bellsund is given in Chr. Mayer 1769*b*, p. 107. Father Mayer had been a fellow of the Royal Society of London since 1765.

[132] My conjecture, cf. Aspaas 2008*d*.

the northernmost region of Scandinavia. According to Woolf, the Danish King gave his consent to the plans and promised full co-operation on 6 April 1769. This meant that the King of Denmark and Norway had either sponsored, or consented to, a total of four expeditions in the northernmost parts of Norway, where the entire transit was going to be visible. This was in addition to the private expedition of Kratzenstein to Trondheim, and observations in Denmark proper. Over the following pages we shall have a brief look at what came of these efforts.

Bayly and Dixon arrived at Magerøya, the island on which the North Cape is situated, on 28 April 1769. Here, Bayly landed his observatory and set it up just north of present-day Honningsvåg. The frigate then continued to the settlement of Hammerfest, where it arrived on 7 May. Dixon set up his observatory on a hill called Rypeklubben, rising above the southern bank of the bay where the present town is situated.[133] The two Englishmen managed to observe only insignificant parts of the transit on 3 June: Dixon's observation of the interior contact at ingress was made through a thin layer of cloud and considered too uncertain to be of use; the same applied to Bayly's. The egress was totally invisible to both observers because of thick fog. However, Dixon and Bayly succeeded in making maps and drawings of the coastal areas surrounding their observatories. They also determined the geographical positions of their sites fairly accurately by means of zenith distances to the Sun's upper limb and the solar eclipse that took place on 4 June. Instruments used were quadrants of one-foot radius, two-foot achromatic telescopes, four-foot transit instruments and a diversity of astronomical clocks, micrometers, etc. In addition to purely astronomical observations, Dixon and Bayly also made meteorological observations using barometers and thermometers, measured the ebb and flow of the tides and determined the magnetic declination (in Dixon's case, even the inclination). *H.M.S. Emerald* left Hammerfest on 5 June and Magerøya on 21 June. The printed reports of Dixon and Bayly take up twenty pages of the *Philosophical Transactions*, but contain no statement of gratitude either to local helpers or to the King of Denmark and Norway for allowing them to operate within his territories. As the world's leading naval power, Britain perhaps took co-operation from Denmark-Norway for granted. According to Norwegian eyewitness accounts, the crew aboard *H.M.S. Emerald* numbered about a hundred

[133] Although Bayly and Dixon in their expedition reports speak of "North Cape" and "Hammerfost" (sic) as their sites of observation (Bayly 1770, Dixon 1770), the precise location of the sites emerges from the maps added to their reports. Furthermore, they are confirmed by a letter from the *Amtmann* (county prefect) of Finnmark, Ernst Hagerup to Thott in Copenhagen, dated Talvik 27 July 1769 (RA Oslo, "Danske Kancelli […] Saker vedr. prof. Maximilian Hells reise til Vardøhus for å iaktta Venus […] Pakke DK E36. Hyllenr. 4A 115 62").

men, black slaves among them.[134] By comparison, the best ships available to the Copenhagen-financed expeditions were rather modest vessels.[135]

Kratzenstein carried out his plan of going to Trondheim on his private mission to observe the transit, although Hell had written him a letter from Trondheim in August 1768 trying to persuade him to go further north. Hell argued that the Sun would – if above the horizon at all – in any case be extremely low during egress, so from the astronomer's point of view it would be a much better idea for Kratzenstein to station himself further north, for example around the 68th latitude.[136] Despite (or perhaps because of) the fact that Kratzenstein had personally experienced the waters north of Trondheim before,[137] he either chose not, or did not manage to, follow Hell's advice. On his way to Trondheim, Kratzenstein fell victim to a shipwreck

[134] Apart from the letter of Hagerup to Thott (see preceding footnote), an interesting account of childhood memories from a merchant who grew up in Hammerfest in the 1760s and 1770s is extant (published in *Finmarksposten. Et Blad for Finmarken og dem, der interessere sig for denne Landsdel* 12te Aarg. Nr. 49. Lørdag den 8de December 1877; cf. Anonymous 1990).

[135] Bishop Gunnerus in a letter to Thott, dated Trondheim 16 January 1768 (RA Oslo, "Danske Kancelli […] Saker vedr. prof. Maximilian Hells reise til Vardøhus for å iaktta Venus […] Pakke DK E36. Hyllenr. 4A 115 62"), speaks of his own ship – with eights pairs of oars and a cabin for eight persons – as "probably the largest and best" in his entire diocese ("saavidt jeg veed, den störste og beste her i stiftet"). It would require a crew of sixteen sailors plus two *matroser* ('able seamen') and a *los* ('pilot'). Another option for Maximilianus Hell's expedition would be to hire a *vengebåt* (a kind of house boat used for transporting civil servants) with six pairs of oars and room for eight persons in the cabin, Gunnerus argued. In the final event, it was a hired *jekt* (a single-sailed vessel commonly used for merchant voyages along the coasts of North Norway) that carried Hell and Sajnovics on their northbound voyage from Trondheim in the autumn of 1768. This ship had a "rather big cabin" and a crew of five sailors. In addition to Father Hell and his servant Sebastian Kohl it carried Sajnovics, Borchgrevink, the cook Caspar Müller, and amtmann Hagerup with his servant, the surgeon Johannes Ripps (Sajn.s diary, 22 August 1768). In the spring of 1769, on the other hand, the bishop's ship was used for Horrebow/Bützow's expedition. After the Danish observers had disembarked at Dønnes, the ship continued to Hamningberg in Finnmark, where it picked up Hell and his company to bring them back to Trondheim (Sajn.s diary, 30 June 1769).

[136] Hell to Kratzenstein, incomplete draft [Trondheim, August 1768] (facsimile in Hansen & Aspaas 2005, pp. 112-113): "habebitur contactus internus apparens circiter h. 14. 22′. oritur vero sol die [*scripsi;* die *bis MS*] 3 Junij Dronheimij hora 14. m. 23[.] inde colligis dubium valde esse, num contactus internus in egressu Drontheimij observari poterit, maxime si animadvertas urbem Drontheimiensem montibus sat altis cir[c]umseptam qui ortum solis integro horæ quadrante retardare possunt. sapienter igitur et provide feceris, si locum observationis Tibi eligas 30 aut 40 milliaribus Drontheimio septentionem versus distantem, circa gradum latitudinis 68º, in mappa Wangensteeniana plura reperiuntur loca, in quibus habentur Ecclesiæ Prædicatorum, è quibus unum Tuæ stationi commodissimum facile reperies" = "The interior contact of Venus with the limb of the Sun will take place approximately 2.22 am. The Sun rises, however, at 2:23 am in Trondheim on 3 June. Thus, You see that it is highly uncertain, whether the interior contact of egress will be feasible to observe in Trondheim, especially if You take into account that the city of Trondheim is surrounded by rather high mountains which may delay sunrise by an entire quarter of an hour. You will therefore act wisely if You choose a site some 30 or 40 miles further north, around the latitude of 68 degrees; on the map of Wangenstein several places are found where churches of priests are at hand. You will easily find among these places the one which is most suitable for Your station". Hell's prediction for the sunrise fits rather well with a table in the Trondheim newspaper *K. alleene privileg. Trondhiems Adresse-Cont. Efterretning.*, 1768. No. 10. Fredagen d. 11 Mart., where it is stated that sunrise will take place in Trondheim at 2.18 am on 3 June 1768.

[137] In 1752, Kratzenstein embarked upon a sea voyage from Arkhangelsk, along the coasts of Norway and Denmark and through the Baltic to St. Petersburg on behalf of Russia (at the time, he was employed as an professor at the Imperial Academy of Sciences in St. Petersburg), see Snorrason 1974, pp. 84-85.

and had to swim ashore to save his life. He made it to Trondheim just in time before the transit took place, but in the final event he failed to see anything of it because of bad weather.[138]

The expedition of Peder Horrebow the Younger was no more successful. He and his assistant were provided with two clocks – one Graham and one of a smaller and more common type; a ten-foot Dollond telescope with a micrometer; and a quadrant recently fabricated in England. Although the principal goal was not reached, they at least managed to make some geodetic observations in Christiania (Oslo) and Trondheim, which they visited in January-February and February-April 1769 respectively. More than half of the twenty pages of Horrebow's report are devoted to intricate discussions concerning the latitude and longitude of these two towns, and Horrebow repeatedly stresses that in spite of all his efforts, his results were encumbered by an unsatisfactory degree of uncertainty. As late as 18 April 1769, the party set out from Trondheim in the ship of Bishop Gunnerus, whose diocese included the entire northernmost part of Norway. The party did not make it even halfway to Tromsø, however. By 20 May they had reached the island of Dønna in Nordland County, and two days later, with a persistent north wind against him, Horrebow decided to accept an offer of hospitality from Captain Isach Jørgen Coldevin (1724-1793), whose home lay at Dønnes on the northern part of the island.[139] By 29 May, he had his modest observatory (actually a tent erected by the sailors)

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[138] Hell 1790, p. 360: "Cel. D. *Kratzenstein* in itinere maritimo Hafnia Drontheimium tendens terribile Naufragium passus, vitam, *enatando* ad littora, salvare coactus est" = "The celebrated Mr. Kratzenstein experienced a terrible shipwreck during his sea voyage from Copenhagen to Trondheim and had to swim ashore in order to save his life". In the Trondheim weekly *K. allene privil. Trondhiems Adr.-Cont. Efterretn.*, 1769. No. 20. Fredagen den 2 Junii, Kratzentein is mentioned under the rubric *Jndpasserede* ('arriving persons'). In No. 23. Fredagen den 16 Junii, his name appears under *Udpasserede* ('leaving persons'); Hell 1790, pp. 359-360 presents a poem in honour of Kratzenstein by the above-mentioned Bredal. According to the poem, the weather in Trondheim was bad for the entire duration of the transit. See also the interesting letters from Kratzenstein to George Louis Lesage, dated Copenhagen 11 February 1769 & 2 February 1772, printed in Prevost 1805, pp. 396-397 & 399-406 (note that the French translation on p. 400 contains a detail that is not included in the transcript of the Latin original at the bottom of the same page: "La pluie m'ôta la vue du passage. En un mot, je n'ai rapporté de ce voyage que quelques observations de déclinaison de l'aiguille magnétique" = "The rain bereaved me of the observation of the transit. In brief, I have reported nothing from this voyage except some observations of the declination of the magnetic needle". Curiously, there is no word on the shipswreck in Prevost's extracts of Kratzentstein's letters, only that "Ventus continuo fere contrarius effecit, ut nonnisi ultimis, ante transitum Veneris per solem, diebus, Nidrosiam […] pervenire potuerim" = "The wind blowing almost constantly against me, it was impossible for me to reach Trondheim earlier than the very last days before the transit of Venus in front of the Sun took place" [ibid.]).

[139] The dates are according to P. Horrebow's MS, p. 14 ([Peder Horrebow the Younger], unsigned and undated twenty-page manuscript starting with the words "Af hvor stor vigtighed det er…" [KB Copenhagen, Thottske Samling. Quarto, 822. 'Efterretning om sammes astronomiske Observationer i Norge, i Anledning af Veneris Gjennemgang gjennem Solen 1769']. The identity of Peder Horrebow as the author of the report is revealed by his handwriting). According to Sajnovics' account, based upon a meeting with the sailors of the ship used by Horrebow, the party left Trondheim 17 April and reached Dønnes 26 May (Sajn.'s diary, 30 June 1769). Later, having met the Coldevin family, Sajnovics explains that Horrebow and Bützow had arrived at Dønnes *20* May

ready on a hilltop nearby. The weather was bad on 3 June; the visitors from Copenhagen only managed to catch glimpses of Venus in front of the Sun and saw nothing of the moments of contact. In his unpublished expedition report, which is preserved at the Kongelige Bibliotek ('Royal Library') in Copenhagen,[140] Peder Horrebow explains that:[141]

> the outcome has for me been the same as for most others who made expeditions with the same task; the sky was quite cloudy at the time when Venus was to make its passage, preventing me from making any observations at all. Admittedly, I did see Venus in the Sun, but hardly enough, as I shall explain presently; but the Sun was completely covered by clouds at the time when those observations were to be made which were of importance and which were to serve as a basis for conclusions.

Attempts to determine the geographical co-ordinates of Dønnes were conducted over the days and weeks that followed, but again, Horrebow stresses that his results are unsatisfactory, blaming his quadrant for this.

The sailors of Horrebow's ship, who continued northwards to carry Hell and Sajnovics back to Trondheim, told a different story. According to them, Horrebow had been afraid to sail whenever a strong wind started blowing, ordering the sailors to seek port instead. Besides this, they had gone ashore for all their meals, thus wasting a lot of time.[142] If Sajnovics' account is to be believed, this behaviour may explain why Horrebow and Bützow never succeeded in reaching their intended destination. It is known that the Trondheim-based botanist Henrik Tonning (1732-1796), not mentioned by Horrebow, also participated in the expedition. His wish to travel further north was not granted by the leader of the expedition, however.[143]

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and stayed there until 13 June (Sajn.s diary, 18 August 1769). Horrebow's MS, p. 19, however, reports of astronomical observations made at Dønnes as late as 1 July 1769. In the Trondheim weekly, *K. alleene privil. Trondhiems Adr. Cont. Efterretn.*, 1769. No. 30. Fredagen den 28 Julii, Horrebow and Bützow are listed as "Jndpasserede" ('persons arriving'). See also Aspaas & Voje Johansen 2004*b* and Voje Johansen 2011*b*.

[140] See the preceding footnote.

[141] P. Horrebow's MS, pp. 2-3: "det har gaaet mig, som de fleeste andre, som reiste i samme ærinde, at nemlig himmelen var den tid, da Venus skulde passere, gandske tyk, saa jeg slet ingen observation kunde giöre; jeg fik vel Venerem i Soelen at see, dog det neppe nok, som nærmere skal blive forklaret, men Soelen var gandske bedækket af skyer, naar de observationer skulde giöres, som vare af vigtighed, og hvoraf siden noget skulde sluttes".

[142] Sajn.'s diary, 30 June 1769.

[143] Sajn.'s diary, 20 August 1769. Tonning had travelled to Uppsala to study botany under Linnaeus along with Borchgrevink, in 1766. Unlike the latter, he defended a dissertation there in 1768 and could thus claim to be a professional natural historian (cf. Jørgensen 2007, pp. 51-52).

Horrebow and Bützow returned to Trondheim in late July, and reached Copenhagen at the turn of September/October 1769.[144]

These were the results of the observational attempts from northern parts of Norway, apart from those of Hell and his assistants in Vardø, which will be reserved for discussion in the next chapter of this thesis.

Turning now to the PR aspect of the Danish-Norwegian participation in the project, several sources are of interest. One such source is a letter that has been preserved in the archives of the Imperial Russian Academy in St. Petersburg. It is signed by the secretary of the Royal Danish Society of Sciences, Henrik Hielmstierne (1715-1780), Copenhagen 23 September 1769, and is addressed to the secretary of the Russian Academy of Sciences, J. A. Euler:[145]

> *Monsieur!* It is a noble thing for Your Monarch to have placed Her Academy in a state of capability to dispatch so many observers, it is glorious for Your Academy to have already published so many observations of the transit of Venus in front of the Sun which took place on 3 June this year. Our Academy of Sciences expresses its deep gratitude for the five pieces on the subject, that you have been so kind as to send to it [compare Section II.3.3]. If Fortune had been as bountiful to our plans and preparations, we would have been able remunerate you equally, since we have procured for observations at five different places in this country: // 1) Professor Horbow [*sic*] the Elder has observed from Copenhagen, at the Astronomical Tower [Rundetårn]. // 2) Professor Hee has made his observations in the presence of the King and Queen at Frederiksberg [just outside Copenhagen], a castle situated very advantageously for these kinds of observations, where the court has been residing this summer. // 3) Professor

[144] *K. allene privil. Tronhiems Adr. Cont. Efterretn.*, 1769. No. 30, Fredagen den 28 Julii, "Jndpasserede"; *Kiøbenhavns Kongelig allene priviligerede Adresse-Contoirs Med Posten forsendende Efterretninger*, 2 October 1769, "Kiøbenhavn. Jndpasserede".

[145] Hielmstierne to Euler, dated Copenhagen 23rd September 1769 (RAN St. Petersburg): "Monsieur // C'est grand pour Votre Monarque d'avoir mis son academie en Etat, d'envoier tant d'Observateurs[,] c'est glorieux pour votre academie d'avoir deja publié tant d'Observations sur le Passage de Venus par le Soleil arrivé le 3 de Juin passé. La Societe des Sciences ici vous rend bien de remerciments pour les 5 Pieces, que Vous avés eû la Bonte de comuniquer à Elle sur ce sujet. Si le Bonheur avoit secondé nos Desseins, et nos Preparatifs, nous vous aurions rendû le pareil, car on a fait des Observations dans ce Païs en cinq differents Endroits // 1) Le Professeur Horbow Senior a observé à Copenhague dans la Tour astronomique. // *2* le Professeur Hee a fait ses Observations à la Presence du Roi et de la Reine à Fridrichsberg un Chateau située tres avantageusement pour des pareilles Observations, ou la cour a residee cet Eté. // *3* le Professeur Kratzenstein est allé a Trundhiem en Norvegue pour observer la. // *4* le Professeur Horbow Junior avec un assistent a eté envoié à Tromsdalen situé dans le Gouvernement de Trundhiem pour le meme But. // *5* le Pere Hill avec plusieurs assistents est allé à Wardehuus en Finmarque. // Les 4 premiers ont eû le meme sort que les anglois ont eû à Nordcap, Les Hollandois[,] les allemands etc; ou le ciel a eté couvert, ou la Lumiere de Soleil a eté si foible, qu'on ne doit attendre baucoup de leurs Observations; mais en revange le Pere Hill a eù le plus beau Soleil, qu'on pouvoit souhaiter; Les Talents reconnus de cet habile Observateur garantiront l'Exactitude de ses Observations; nous l'attendons ici en 2 ou 3 semaines, il ne tardera pas de publier les Observations, et je ne manquerai pas de Vous les communiquer[.] En attendant j'ai l'honneur d'etre avec la consideration la plus distinquée // Monsieur // Votre tres humble et trés obeisant serviteur // *Hielmstierne*".

> Kratzenstein has travelled to Trondheim to observe from there. // 4) Professor Horbow the Younger, with one assistant, has been sent to Tromsdalen [i.e., the mainland just opposite the island of Tromsø] in the *gouvernement* of Trondheim for the same reason. // 5) Professor Hill [*sic*], with numerous assistants, has travelled to Vardøhus in Finnmark. // The first four of these attempts have met with the same fate as that of the Englishmen situated at Nordkapp, as well as the Dutchmen, Germans, etc: either the sky has been cloudy or the light of the Sun has been too feeble for one to expect much from their observations; but, on the other hand, Professor Hill has had the best sunshine one could have hoped for; the acknowledged talents of this observer will guarantee the exactitude of his observations; we expect him to arrive here in two or three weeks, he will not hesitate to publish his findings and I shall not neglect to send them to You, in the meantime I have the honour to remain [etc.] // *Hielmstierne*

This letter of Hielmstierne is interesting not only for the information included, but almost as much for what is left out. It reveals, in fact, that the circles of Danish-Norwegian learning still lacked a dynamic co-ordinator to include able amateurs in the project.

Thus, in the newspaper *Nordske Jntelligenz-Sedler* published in Christiania (now Oslo), we find in the issues dated 7 and 14 June 1769 that a professor of mathematics and fortification at the military school in Christiania, Michael Sundt Døderlein (1740-1786) has attempted to observe the phenomenon from a private house, but has seen nothing, due to cloudy weather. Døderlein has been careful to ensure a clear view to the north-west (where – good weather providing – the ingress stage would have been visible) as well as to the meridian in the south and north. Furthermore, the owner of the house has offered him the opportunity to spend a whole month adjusting the course of his clock and determining the co-ordinates of the site. For all his practical skills and theoretical insights, Døderlein acted on his own initiative, receiving no salary for his efforts.[146]

Another amateur of astronomy, who likewise appears to have received no official invitation to make his observation, or salary, was a teacher of physics and Co-Rector at *Roeskilde lærde skole* (an elite school preparing pupils for University), Hans Christian Saxtorph (1726-1787).[147] On 3 June 1769 he observed the transit of Venus from his garden in Roskilde, only about 30 kilometres from Copenhagen. One of his pupils, Andreas Christian Hviid (See Section I.2.4), remembers how Saxtorph "made sure that we in the highest class observed it [i.e., the transit of Venus] in his garden, with his own telescope, after he had prepared us well

[146] *Nordske Jntelligenz-Sedler*, No. 23., Onsdagen den 7. [*scripsi;* 6. *ed.*] Juni 1769, "Følgende er til Bogtrykkeriet indsendt", and No. 24., Onsdagen den 14. Juni 1769, "Følgende indrykkes efter Begiering".
[147] According to Hundrup 1854, p. 266, Saxtorph's formal education was as a theologian.

and instructed us concerning this astronomical phenomenon”.[148] No record of Saxtorph’s observation – evidently quite successful – is to be found in the official reports of Danish-Norwegian Venus transit observations. Another observation on Danish soil was made by an anonymous observer using a 6½-inch telescope “a few miles north of Copenhagen”. An account of this observation was published in *Kiøbenhavns Adresse-Contoirs Efterretninger* on 5 June 1769,[149] but the observer lacked a proper clock for the time-keeping and could only say that the exterior contact at ingress took place approximately 8 o’clock in the evening, whereas the interior contact was spoiled by clouds. In the Danish almanac, this contact had been predicted to take place at 7.32 pm, a gross miscalculation on the part of the Astronomer Royal, which the anonymous reporter did not fail to point out.[150]

Another curious piece of information is found in a letter from Nils Schenmark (1720-1788), Professor of mathematics at the University of Lund, to Wargentin. Schenmark had written to his correspondent “Professor Lous”[151] (yet again not Horrebow!) in Copenhagen to hear news of observations from Danish and Norwegian soil. Professor Lous reported the following from Copenhagen:[152]

> In Copenhagen, three companies had gathered: at Rundetårn; at another, private observatory; and at Fredriksberg [...]. All three were within sight of each other and could give each other signals in order to observe the difference of their clocks. The first [exterior] contact was recorded at the private observatory at 8:01:35 [pm] o’clock with a two-foot Gregory-type reflection telescope that showed the objects roughly 120 times larger, as well as a nine-foot Dollond that

[148] Andreas Christian Hwiid, *Udtog af en Dagbog holden i Aarene 1777-1780 paa en Reise igennem Tyskland, Italien, Frankrige og Holland*, Copenhagen 1787, entry on 10 July 1777, quoted from Hviid 2005, p. 56: “Veneris Gang giennem Solen troer jeg aldrig at være bleven observeret bedre af nogen Student ved Universitetet, end han sørgede for, at vi i den øverste Classe i hans Have med hans egen Teleskop observerede den, efter at han i Forveien tydeligen havde bibragt os et klart Begreb derom”.

[149] *Kiøbenhavns Kongelig alleene privilegerede Adresse-Contoirs med Posten forsendende Efterretninger*, 1769., 11. Aargang, No. 83, Mandagen den 5te Junii, “Veneris synlige Gang forbi Solens Skive, saaledes som den saaes Aftenen den 3 Junii fra Klokken 8 til 8 ½, faa Miile Norden for Kiøbenhavn”.

[150] *Kiøbenhavns Kongelig alleene privilegerede Adresse-Contoirs med Posten forsendende Efterretninger*, 1769., 11. Aargang, No. 106, Fredagen den 14 Julii, “Svar paa en Skrivelse i No. 103 i Anledning af Veneris Gang forbi Soelens Skive, for saavidt angaaer Forfatteren af Observationen No. 83”. The almanac in question was surely *Dansk Historisk Almanak, udgiven af Det Kongelige Videnskabernes Societet*, 23 volumes, Copenhagen 1760-1782; cf. Lomholt vol. III, 1960, pp. 119-129, especially p. 127.

[151] Probably Christian Carl Lous (1724-1804), a Professor of mathematics in the Danish marine since 1760, inventor of improved compasses and other instruments and author of several textbooks on navigation.

[152] Schenmark to Wargentin, dated Lund 31 August 1769 (CVH Stockholm): “J Köpenhamn hafva trenne Sälskaper förenat sig: På runde torn, på et annat privat observatorio, och på Fridrichsberg (et Kongl. Lustslott som är belägit på en högd rätt i vester, ungefär ½ mil ifrån Köpenhamn); alla desse tre Kunde se til hvarandra, och göra hvarandra signal för at observera Urens skilnad. På det private Observatorio befants primus contactus Kl. 8. 1′. 35″ med en 2 fots Gregoriansk Reflexions tub som viste objecterna vid pass 120 gånger större, och en Dollondsk 9 fots tub som förgrossade 150 gr. På de tvänne andra ställen skola de hafva observeradt primus contactus några Secunder senare.”

> enlarged 150 times. The first contact is said to have been observed a few seconds later at the two other places

The Copenhagen observations were probably encumbered with some incertainty. The very first contact of Venus with the limb of the Sun, it will perhaps be remembered, was considered extremely difficult to observe (see Section II.1.2).[153] However, in one of his manuscripts, Sajnovics has collected excerpts concerning Venus transit observations from *Kiøbenhavns Adresse-Contoirs Efterretninger*, as well as other newspapers. The manuscript contains details of observations from Altona (by a "Professor Profe"),[154] *Tondern* (i.e. Tønder, by "the mathematician Peter Lorenzen") and Kiel (anonymous)[155] – all places under Danish rule at that time. Other observations figuring among Sajnovics' excerpts were made in Leipzig ("the *mechanicus* and *opticus* of the University, Mr. Christian Fridericus Ernst Reinthaler") and Rostock ("Professor Becker" and others).[156] Of all these observations, there is only one that has found its way into Woolf's tabulation.[157]

Although it would be futile to blame the Danish Society of Sciences for not publishing all these observations, nevertheless, the fact that it did not publish *any* of them at least indicates that amateurs of science were excluded from, rather than invited into the project by the leading scientific body in Denmark-Norway. If someone had taken on the responsibility of distributing the necessary sets of instruments, along with instruction leaflets as to how the phenomenon was to be observed, to colleges and other institutions of learning, Denmark-Norway could easily have boasted more than one single successful Venus-transit observation from 1769 – that of Maximilianus Hell and his colleagues in Vardø.

[153] In an earlier letter, dated Lund 16 July 1769, Schenmark informs Wargentin that (CVH Stockholm): "Uti Tyska Avisorna angifves contactus exterior vara observerad i Köpenhamn kl 8. 1′. 30″, hvarvid göres följande anmärkning: *Doch hat man ursache zu glauben daß diese berührung noch etwaß Zeitiger begonnen, und das starke beben des Sonnenrandes die frühere bemerkung verhindert hat.*" = "The [first] exterior contact is in the German newspapers reported to have been observed in Copenhagen at 8:01:30 o'clock, to which record the following remark has been added: 'There are, however, reasons to believe that this contact began somewhat earlier, and that the strong undulation of the limb of the Sun has prevented it from being observed earlier'". One notes the discrepancy of several seconds between this source and the letter of 31 August.

[154] Probably Gottfried (Godofredus) Profe (1712-1770), who served as a professor at the gymnasium in Altona from 1740 to his death (cf. Hundrup 1854, p. 48).

[155] Probably the observation of Johann Friedrich Ackermann (1726-1804), professor of medicine and director of the astronomical observatory of Kiel. In 1770, he published a *Commentarius observationum physico astronomicarum et meteorologicarum*, which – according to the review in *Jenaische Zeitungen von Gelehrten Sachen* LXXVIII. Stück, Freytags den 28. September 1770, pp. 650-651 – contained his observations of both the Venus transit and the solar eclipse of 1769. See also Bernoulli 1771*a*, pp. 160-161.

[156] Sajn., MS [no heading, starting with the words] "Ex novellis Altonensibus…" (1769-70).

[157] See Woolf 1959, p. 184, under "Kiel". Sajnovics' MS contains details for both the exterior and interior contact of ingress, whereas Woolf in his table lists only "I,2".

Admittedly, with the Venus transit project of 1769 Denmark-Norway succeeded in gaining at least some publicity as a proponent of science. The polite expressions of thanks from Lalande and Mayer have already been mentioned. Much more influential, however, was no doubt the report of Hell. A brief glance at the title page of the Copenhagen edition immediately reveals the identity of the sponsor; in fact, the words *OBSERVATIO* and *CHRISTIANI VII* provide the most conspicuous information of the entire title (See Figure 8).[158] There then follows a dedicatory preface five pages long, which constitutes a veritable eulogy of the King of Denmark and Norway as a supporter of the sciences. In the concluding lines of the report Hell again returns to the role of the Danish monarch, stating that[159]

> these were the data of the transit of Venus, and that which is of relevance to it, which were recorded in Vardø under a favourable sky. If these, as I hope, along with the accurately recorded data of other astronomers, particularly those in the southern part of America, in due time form the basis for a certain and indisputable definition of the solar parallax, the World of Learning and men of erudition for all Posterity will certainly owe their immortal eulogies and deepest gratitude to His Most Clement and Redoubtable Majesty, King CHRISTIAN VII, under whose auspices and thanks to whose most lavish funding of this scientific expedition the extremely subtle – and to the Republic of Letters so important, though since the creation of the world until now not yet sufficiently resolved – investigation of the quantity of the solar parallax (that is, the true distance of the Earth from the Sun) has found its solution once and for all. Furthermore, as any person of learning is perfectly well aware, dependent on this result is a more accurate knowledge of the true extent of our planetary system, the action that the celestial bodies have upon each other, their movements, periodic orbits, etc.; from which knowledge innumerable benefits will be harvested to the benefit of the human race.

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[158] Hell 1770*a*1, title page. Sajnovics' diary shows that the idea of inserting the expression *auspiciis potentissimi ac clementissimi Regis Daniæ et Norvegiæ, CHRISTIANI VII.* ("under the auspices of the highly powerful and highly beneficient King of Denmark and Norway, Christian VII") into the title originated from the Astronomer Royal, Christian Horrebow (Sajn.'s diary, 23 November 1769: "Vesperi aderat D. Horebow. qui Titulum Observationis Veneris edendæ legens, voluisset poni Jussu Regis &ce:"). In the audience with the King on 29 November 1769, Hell asked His Majesty whether he would allow the report to be dedicated to him (Sajn.s diary, 29 Nov. 1769: "Rogante R[do] P. Hellio ut Observationem transitus Veneris typis exscribendam Suo Regio Nomini dedicari pateretur reposuit. *Wird mir lieb seÿn*").

[159] Hell 1770*a*1, p. 82: "Atque hæc sunt momenta illa tum Transitus Veneris, tum ad hunc spectantia, quæ Cœlo favente Wardoëhusii obtenta sunt; si ex his, ut spero, cum ceterorum Astronomorum, cumprimis ad plagam australem Americæ obtentis præcisis momentis certa, atque indubia quantitas Parallaxeos Solaris suo definiatur tempore, erit profecto quod orbis litteratus, totaque doctorum virorum posteritas habeat, unde Regi Clementissimo, Potentissimo CHRISTIANO VII. & laudes immortales, & summas debeat gratias, cujus auspiciis, & amplissimis in Expeditionem hanc Litterariam prufusis sumptibus, summi in Republica Litteraria momenti, nec ab orbe condito usque nunc satis unquam solutam subtilissimæ inquisitionis quæstionem. Quantitatem scilicet certæ Parallaxeos Solaris, seu veræ distantiæ telluris a Sole, definitam, certamque habebunt; Ex qua totius Systematis Planetarii veræ magnitudinis, actionum horum corporum cœlestium invicem, motuum, orbiumque periodicorum &c. certiorem pendere notitiam, ex hac vero notitia innumera in genus humanum derivanda emolumenta, nemo Doctorum est, qui ignoret".

Arguably, these concluding lines are no more than an echo of the impression given on the title page, that it was the "observation of Christian VII" (*Observatio ... Christiani VII*) that the report was all about.[160] While a modern reader may be quick to dismiss this as mere flattery, it was certainly not considered insignificant in a Europe still under the Old Regime.

Needless to say, Hell continued to express his gratitude to the Danish monarch even after he had returned to Vienna. In his first treatise on the solar parallax, for example, we find him stating that he has determined it to within a margin of error of 1/870, or 8.70 ±0.01″; adding that astronomers now[161]

> have cause to convey to eternal memory the munificence of Kings and Rulers, owing above all their immortal gratitude to the highly supreme King of Denmark, *Christian VII*, thanks to whose munificence and auspices – and most wise government's careful organisation and support – they have obtained the observation from Vardø, as complete and perfect as may be achieved, an observation which, along with the highly successful observation of the Englishmen in Tahiti, will serve as the safest of bases, and the firmest of fundaments, upon which the entire definition of the parallax rests.

Furthermore, to judge from the introductory chapter of the *Expeditio litteraria ad Polum arcticum*, edited below, we may safely conclude that this encyclopædic work on northern Norway would not, had it materialised, have allowed its readers to forget the role played by the Danish monarch in 1769.[162]

When consulting the publications of British and French astronomers in the aftermath of 1769, we find that the propaganda of Denmark-Norway did in fact have a certain impact. The presence of Father Hell in Vardø meant that the participation of the Danish-Norwegian state could no longer be neglected. On the British side, the Oxford Professor of Astronomy, Thomas Hornsby, is known to have been calculating the solar parallax. In his published and

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[160] Admittedly, the praise of the King in the concluding lines of the report is the only element that was included in all subsequent editions of the report. Neither the reprint in the *Nova Acta Eruditorum* (Hell 1770*a*2) nor that in the *Eph.Astr.* (Hell 1770*a*4) included the dedicatory preface to the King, and the same applies to the Danish and German translations (Hell 1770*a*3; Hell 1793). What is more, the expression "auspiciis … Christiani VII" is omitted in the *Eph.Astr.* reprint and therefore also in the German translation, which bases itself upon that edition (Hell 1770*a*4; Hell 1793). See also Table 5 (at the end of Section II.3.2 below).

[161] Hell, *De Parallaxi Solis ex Observationibus Transitus Veneris Anni 1769* 1772, p. 108: "habent [scil. Astronomi], unde Regum, & Principum munificentiam æternæ comendent memoriæ, sed cumprimis Augustissimo Daniæ Regi *Christiano VII.* immortales debent gratias, cujus munificentia & Auspiciis, Ejusque Ministerii Sapientissimi cura & favore Wardhusianam obtinuere observationem, eamque completissimam [*scripsi;* completissimum *ed.*], perfectissimamque, cui tanquam basi tutissimæ, fundamentoque firmissimo una cum observatione Anglorum Taïtensi absolutissima negotium omne definitæ Parallaxeos innititur […]".

[162] See Chapter III.3, especially §. 5.

unpublished works on the subject he clearly rates Hell's data highly, though he fails to mention on whose behalf this observer had travelled to Vardø.[163] However, when some of the most authoritative periodicals of continental science published Hell's results – the *Nova Acta Eruditorum* of Leipzig and the *Journal des Sçavans* and *Journal encyclopédique* of Paris – the editors were careful to emphasise the identity of the sponsor.[164] The review in the *Journal des Sçavans* even went so far as to state that:[165]

> Astronomy, which has owed so much to the King of Denmark from the sixteenth century onwards, is on this occasion obliged to Him once more, for a most meticulous and important voyage: this monarch could have made no better choice than to employ Father Hell for this mission; we have had occasion more than once to comment on how much this astronomer has been a credit to the sciences, and this voyage is proof that his zeal equals his learning.

In similar terms, the *Journal encyclopédique* foresaw that "the success of this undertaking […] will serve to immortalise the glory of the Monarch".[166] The prestige invested in the expedition, then, paid off in a certain sense. King Christian VII, who is remembered primarily as the mentally ill, indecisive marionette of manipulative figures at court,[167] on this occasion received his share of praise as a supporter of the sciences. In fact, the historical significance of his sponsorship of Father Hell's expedition was compared to the achievements of Tycho Brahe, another client of the Danish kingdom.[168]

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[163] Hornsby "The Quantity of the Sun's Parallax, as deduced from the Observations of the Transit of Venus, on June 3, 1769" 1772. Extracts from a manuscript ("Radcliffe MS 7") containing the details of Hornsby's calculation is available on the web pages of the Museum of the History of Science in Oxford, http://www.mhs.ox.ac.uk/venus/html/gallery/prints.htm (accessed 9 January 2008).

[164] Hell 1770*a*2 (editor's foreword), pp. 1-2; *Journal des Sçavans*, Septembre 1770, pp. 619-622; *Journal encyclopédique*, Mai 1770, pp. 344-352. For the role of international journals of general science in the Republic of Letters, see for example Bots & Waquet 1997, pp. 132-133; 143-148.

[165] *Journal des Sçavans*, Septembre 1770, p. 622: "L'Astronomie qui eut dès-le 16e siécle de si grandes obligations au Roi de Dannemarck lui doit encore dans cette occasion le voyage le plus curieux & le plus important; ce Prince ne pouvoit mieux choisir qu'il n'a fait en donnant au P. Hell cette mission; nous avons eu occasion de remarquer plus d'une fois combien ce célébre Astronome avoit bien mérité des Sciences; ce voyage est une preuve que son zéle égale son sçavoir".

[166] *Journal encyclopédique*, Mai 1770, p. 345: "Le succès de l'entreprise qui servira à perpétuer la gloire du Monarque". See also the widely-read afterword to the posthumously-published account of the expedition of Chappe d'Auteroche to Baja California, where the expedition of Father Hell is listed as one of the three most important expeditions world-wide in the year 1769 (the other two being Chappe d'Auteroche's and Captain Cook's) and the skills of Father Hell are praised with the comment that "[l]e choix du Souverain Danois ne pouvoit qu'être digne d'éloge dans cette occasion" = "the choice [of Father Hell] by the Danish Sovereign could not be worthy of anything but praise on this occasion" (J.-D. Cassini, "Histoire abrégée de la parallaxe du soleil" 1772, pp. 150-151, here p. 151).

[167] For his biography, see now Langen 2008 (in Danish).

[168] The reference to Tycho Brahe is implicit in the review in *Journal des Sçavans*, quoted above, and virtually explicit in the dedication to the King in Hell's *Observatio Transitus Veneris* (1770*a*1, pp. [i]-[vi]).

The success was short-lived, however. Jean (Johann) Bernoulli III, editor of the *Recueil pour les Astronomes*, wrote to Wargentin in 1772:[169]

> May I be so bold as to ask You again whether You cultivate a correspondence with any astronomer in Denmark and if You could obtain for me some news from that country? If I am to believe a two-leaf brochure – in French, but published in Germany – about the state of science in Denmark, Astronomy is scarcely cultivated there at the moment.

Bernoulli soon developed an impressive network of correspondents, but appears never to have opened a correspondence with either Christian or Peder Horrebow, using instead Kratzenstein and to some extent Hell and Wargentin, as witnesses for activities in Denmark.[170]

It is known that minister Thott had hoped that Hell was to accomplish a "full reform" of Danish astronomy.[171] This reform had to wait several years, and it was not accomplished by Father Hell. Not until Peder Horrebow the Younger was dismissed in 1778 and Thomas Bugge took over the chair as Astronomer Royal at Rundetårn in Copenhagen, did the reputation of Danish-Norwegian astronomy abroad start to increase. That epoch lies beyond the scope of this thesis, however.

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[169] Bernoulli to Wargentin, dated Berlin 17 May 1772 (CVH Stockholm): "Oserois-je vous demander encore si vous êtes en correspondance avec quelque Astronome en Danemarc et si vous pourriés me procurer des nouvelles de ce pays? si j'en crois une brochure de deux feuilles françoises mais publiées en allemagne sur l'état des sciences dans le Danemarc, l'astronomie n'y est gueres cultivée actuellement".

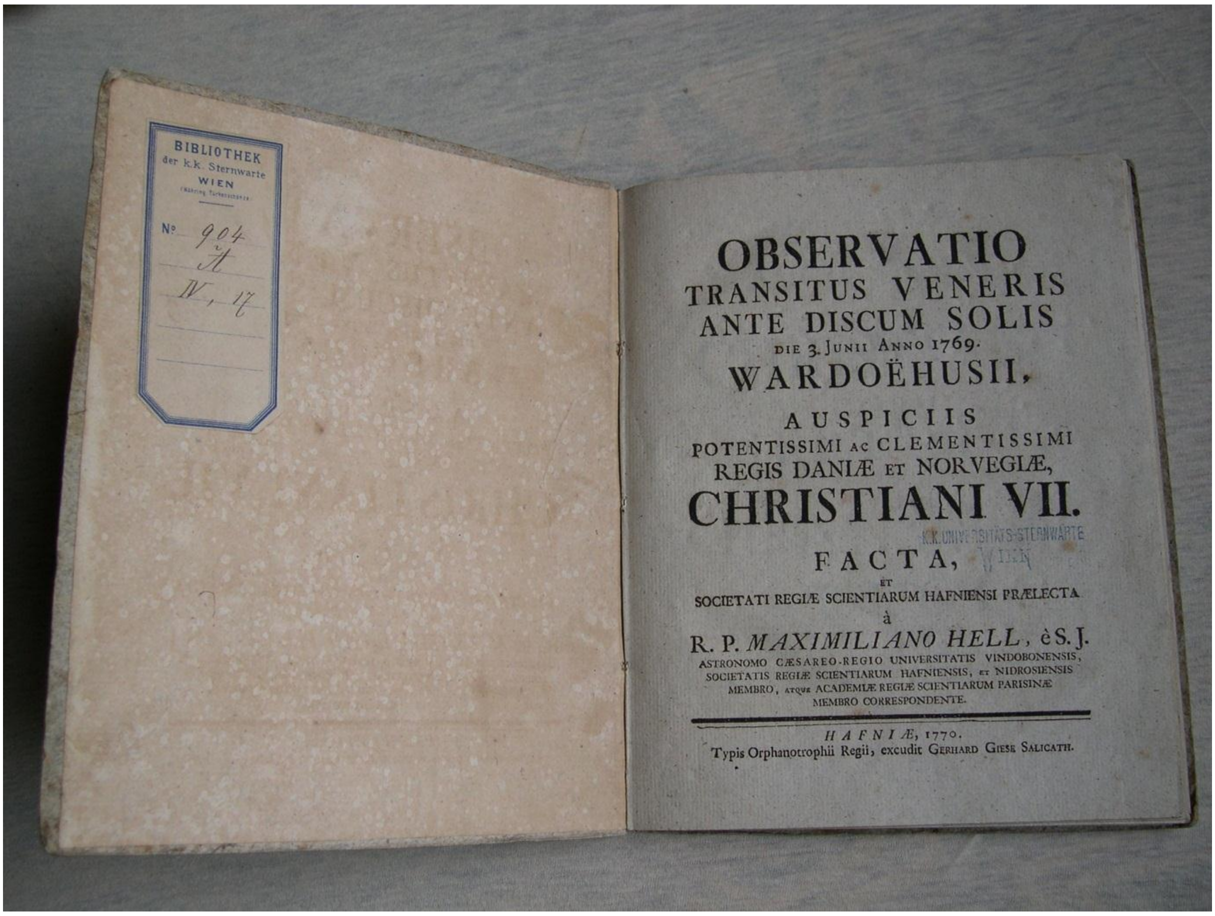
[170] Cf. Bernoulli 1771*b*-1779*b*.

[171] Sajnovics' diary, entry on 19 October 1769, Copenhagen (WUS Vienna): "A Com: Toth Vocati [ad] eundem post 9^{am} adivimus horæ spatio multa hilariter et gaudenter locutus. plenam Astronomiæ Danicæ reformationem à R. P. Hell fieri optabat." = "Invited by Count Thott we went to him after 9 o'clock and had a nice and good-humoured conversation with him that lasted for about an hour. He hoped that Honourable Father would bring about a full reform of Danish astronomy".

FIGURE 8 TITLE PAGE OF MAXIMILIANUS HELL'S *OBSERVATIO TRANSITUS VENERIS ... WARDOËHUSII ... FACTA* (HELL 1770a1)

The first edition of the Venus transit report from Vardø leaves no room for doubt about the identity of the sponsor of Hell's expedition. Translated into English, its title is: '*Observation of the Transit of Venus in front of the Disc of the Sun, made in Vardøhus* on 3 June in the year 1769, under the Auspices of the Redoubtable and most Clement King of Denmark and Norway, *CHRISTIAN VII*, and read to Royal Society of Sciences in Copenhagen by Honourable Father Maximilianus Hell of the Society of Jesus, Royal and Imperial Astronomer at the University of Vienna, Member of the Royal Society of Sciences in Copenhagen and in Trondheim, and Corresponding Member of the Royal Academy of Sciences in Paris'

Digitised by the author.*



II.2.5 ASSESSMENT OF VENUS TRANSIT ACTIVITIES IN THE NORDIC REGIONS

The above account of activities in the Nordic regions has followed a deliberately descriptive line. This choice has resulted in at least two achievements. On the one hand, information concerning a number of individual actors whose impact on the Venus transit projects has scarcely been described in the international literature before, is now available to non-Scandinavian readers. On the other hand, some of the sources presented here have not – to the best of my knowledge – been published in historical studies before, in any language.

In the historiography of science, studies focusing on representatives of a particular nation have long been the order of the day. True, there is a certain emphasis on Denmark-Norway in the present investigation. However, this study has also attempted to follow a comparative perspective. From a contemporaneous point of view, the Nordic region was indeed conceived as a single area, with similar geographical advantages as far as the Venus transits were concerned. At the same time, the challenges were very similar in the various countries; no institutionalised infrastructure for science existed in the remote regions that were best suited for observations of the transit. This situation either called for the use of local amateurs of science, or it meant that professional astronomers had to be dispatched on scientific expeditions. Denmark-Norway opted for the second solution: attempts to include amateurs in the project were half-hearted at best. Sweden (including Finland) pursued a combination of the two, with great success. Russia also followed a sort of combination – at least in 1769 – although professional academicians dominated the scene. The advantages of Sweden’s choice seem obvious: although the procedures of calculating the solar parallax and some of the theoretical questions concerning the planet Venus were very complicated, the observation itself was not. By including amateurs of science in the project, then, the Swedish Academy of Sciences succeeded in providing the international community of astronomers with observations from a much larger area than the professionals could possibly have managed on their own, without risking the quality of the observations. Thus, by paying attention to the aspect of ‘dilettantism’ a crucial difference between the activities and achievements in the three Fennoscandian states has emerged.

The comparative perspective in the present account has also included a glance at the significance of the Venus transit projects in terms of national pride. It was evident to every person of learning that the efforts of Denmark-Norway in conjunction with the 1761 transit of Venus had been anything but impressive. The low reputation of Danish astronomy among the Great Powers of contemporary astronomy, combined with Russian and Swedish plans for expeditions close to the borders of northern Norway that took shape during the first half of 1767, are likely to have been impulses leading to the government in Copenhagen taking action. For geopolitical as well as purely astronomical reasons, Vardø was a natural choice to station an observer: for ages, it had been the site of a fortress and a Norwegian garrison marking the presence of the Danish-Norwegian state vis-à-vis the empires of Sweden and Russia; in the quest to find the solar parallax, it had been singled out as an ideal place for observations – implicitly by French and explicitly by British astronomers. Efforts to win international recognition for the King of Denmark and Norway as an 'enlightened monarch' and a 'Father of the Sciences' by inviting Maximilianus Hell were at least partly successful, although in the ensuing debates over the solar parallax the reputation of Hell was to become slightly more ambiguous than it had been before (see Chapter II.3).

The differences between the countries cannot be explained by paying attention to socio-political strucures alone. The individual actors holding key positions in society – the secretaries of the Royal Academies and Societies, the 'Royal Astronomers' and other influential professors in various mathematical fields – have been seen to have the potential either to inspire activity or to cause stagnation. Comparing Horrebow with Wargentin, and Lomonosov with J. A. Euler, has facilitated insights into the contrasting stories of Venus transit activity in Denmark versus Sweden, and in 1761 versus 1769.

When Woolf writes that "Russian interest in the second transit of Venus was even greater than it had been for the first",[172] this suggests a continuity within the Imperial Academy of St. Petersburg throughout the 1760s. This suggestion is plainly wrong. Instead, the integration of the Imperial Russian Academy of Sciences in the international Venus transit enterprise turned from slow, hesitant 're-activity' in 1761 to swift, determined 'pro-activity' at the very top level in 1769. One might argue that Russian participation in 1761 would in any case have suffered from the ongoing Seven Years' War, which attracted resources and attention that might otherwise have been directed towards scientific events. However, the same might be said of Sweden, another participant in the same war. Here, however, scientific activity

[172] Woolf 1959, p. 179.

remained at a very high level in both 1761 and 1769. Thus, one cannot escape the individual actor as a plausible explanation for the change of focus within the Academy of St. Petersburg from 1760-61 to 1767-69.

International publicity has formed part of the descriptive aims of this chapter. By paying attention to how swiftly or slowly the data were published, and in what languages and formats, there are hints as to how actively the individual actors engaged themselves in the scientific debates of the Republic of Letters. There is a giant leap from the weak publicity surrounding Danish activities in 1761 to the universal interest in Hell's expedition in 1769, and an equally giant leap from the slow, reluctant and unsystematic publication of Russian results in 1761 to the swift, determined and systematic way in which the results of the project of 1769 were published. Again, these shifts cannot be fully understood without taking individual factors into account.

Following these general analytical points, it is time to proceed to the details of observations made in 1761 and 1769. For the sake of brevity, Russia's observations will be omitted here and I shall content myself with a closer look at observations in Fennoscandia. The criteria are the same as those followed for Hell's *Ephemerides* above (Section II.1.5).

In 1761, according to Woolf, successful Venus transit observations were made by twenty individual observers in Sweden (including modern Finland). In addition, one observation was made by a Swedish astronomer in France, giving a total of 21 observers distributed over eleven sites. Woolf has found evidence for the Swedish observations in the German translation of the proceedings of the Royal Academy of Stockholm, as well as in the *Histoire de l'Académie Royale des Sciences* of Paris.[173] The original proceedings were, however, published in Swedish. Accordingly, I have cross-checked Woolf's table against the issues of *Kungl. Vetenskaps Academiens Handlingar* dating from 1761. In this periodical, two papers, one by Wargentin and the other by Hellant, present the entire harvest of the Venus transit observations made on Swedish and Finnish soil that year.[174] The observations reported in the two papers are summarised in Table 3a, where my findings are compared to Woolf's study in a similar fashion to Table 1 above. As we can see, there were a total of 26 individual

[173] Woolf 1959, pp. 135-139.
[174] Wargentin "Observationer På Planeten Veneris gång genom Solens Discus, d. 6 Junii 1761" 1761*a*; Hellant "Venus i Solen, Observerad i Torne Den 6 Junii 1761" 1761.

observations on Swedish and Finnish soil, not the 20 stated by Woolf. It might be advisable to leave aside Mr. Frosterus observing from Cajaneborg, since his observation differs considerably from that of the trained observer Planman. Other observations made at identical sites, however, differ by only a few seconds between each other and should therefore have been of value to contemporaneous astronomy. This gives 25 individual observations in Sweden and modern Finland, instead of 20. In Table 3a the names of observers overlooked by Woolf are highlighted. (The observation of Wilcke has already been identified in Table 1.)

A cross-check with German versions of the reports, used by Woolf, gives the same result. The German edition is unabridged and the information is all there, the only difference being minute differences in the spelling of some names of individuals and places.[175] I do not know what has led Woolf to overlook so many individual observations from Swedish and Finnish soil. Perhaps German was not his strong point as a historian of science? In any case, the result of this investigation only enhances the impression that the Royal Swedish Academy – in particular its secretary – delivered a strong contribution to the Venus transit project of 1761.

The contribution on the part of Denmark-Norway in 1761 was not quite so strong. As stated above, official participation from this power was limited to Christian Horrebow and his assistants in Copenhagen, and to Bugge and Aaskow in Trondheim.[176] Some initial details concerning the observations in Copenhagen and Trondheim may be of interest. At Rundetårn, Chr. Horrebow was the only observer to determine the interior contact at egress, although he expressed some doubt concerning the accuracy of his own determination of this moment.[177] His brother Peder had at that moment left the quadrant, which he was using to determine the

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[175] Compare Wargentin 1764*a* and Hellant 1764 vs. Wargentin 1761*a* and Hellant 1761.

[176] According to the tabulation of Woolf, a third "Danish" observation was made by Heinsius in Leipzig and published in the *Novi Commentarii* of the Imperial Academy in St. Petersburg (Woolf 1959, p. 137). This Heinsius could be none other than Gottfried Heinsius (1709-1769), born in Naumburg an der Saale, teacher at the University of Leipzig from 1734, professor of astronomy in St. Petersburg from 1736, and professor of mathematics in Leipzig from 1743 until his death there in 1769. Thus, the identification of him as "Danish" is surely a mistake.

[177] Chr. Horrebow 1765*a*, p. 387: "man pleyer temmelig nøye at kunde bestemme den Tiid, naar Venus eller Mercurius røre Solen indvendig, men jeg tør dog ikke forsikkre, at min Observation er gandske accurat, thi jeg var saa forlegen for at vilde observere gandske nøye, at jeg just derover ikke blev i Stand til at giøre det; jeg sat længe forud, forend Contactus skulde skee, og attenderede meget stærkt baade paa Venus og Solen, men herover blev mit Øye saa træt og mat, at alting blindedes for mig, da Contactus skeede, saa der kan let være begaaet en liden Feyl i min Determination" = "It is common to be able to determine quite accurately the moment when Venus or Mercury touches the [limb of the] Sun internally. I cannot, however, be sure that my observation is entirely accurate, for I was so concerned to make a completely accurate observation, that I for this very reason became incapable of doing so; I sat at my telescope a long time ahead of the contact, paying intense attention to both Venus and the Sun, but this exhausted my eye so thoroughly that my vision was completely blurred at the time when the contact took place; so there may easily have been committed a small error in my determination".

path of Venus, in order to mount a 17-foot telescope, which he intended to use for the observation of the moments of contact. Before he had his telescope ready, however, "the phenomenon was already over".[178] By the time the exterior contact at egress took place, however, both brothers were ready. They both managed to determine the exact moment, and they agreed to the second, according to Chr. Horrebow.[179] This information is not found in the publication of Lalande to which Woolf had access, however, only in the Danish report published in 1765. If we turn to the Trondheim observation, careful reading of Lalande's notice makes it clear that only Bugge's determination of the contacts at egress is stated; nothing is said about any observations made by his assistant Aaskow.[180] The name "Hascow" may thus be deleted from the list of successful observations of the 1761 transit of Venus, whereas Peder Horrebow perhaps merits a mention.[181] Holm's observation should certainly be included in this kind of table, even though it has been anonymised by Short.[182] There may have been more amateurs of science who observed the 1761 transit of Venus from various places in Denmark and Norway, but since they – like Hammer – failed to have their observations published in the standard periodicals of contemporary astronomy, they should in any case be left out of tables like those of Woolf.

With these minor adjustments, the total number of successful observations of the 1761 transit of Venus is raised to 130, instead of Woolf's 120, including a total of three, instead of two individual observations on Danish and Norwegian soil (see Table 3b). Since the quantitative contribution of Sweden and Finland has already been raised to 25 instead of 20 successful observations, these minor adjustments can do nothing more than corroborate the picture that has already been formed: Denmark-Norway evidently underestimated the importance of the event in the contemporaneous Republic of Letters, and certainly lacked a dynamic 'nodal

[178] Chr. Horrebow 1765*a*, p. 387: "Contactum internum fik min Broder slet ikke at see, thi han var nyelig gaaet fra Quadranten, som han den hele Tid observerede med for at opstille en Kikkert paa 17 Fod at giøre denne Observation med; men inden Kikkerten blev opstilt, var allerede Phænomenon forbi".
[179] Ibid.
[180] Cf. Lalande 1763, p. 114: "l'on ne put observer que la fin, & même au travers des nuages: ce fut avec une lunette de huit pieds que M. Bugge observa le contact intérieur en temps de la pendule $10^{h}\,2'\,10''$, & le contact extérieur $10^{h}\,18'\,58''$, ce dernier est moins exact que le premier, suivant le rapport de l'observateur" = "it was only possible to observe the end [of the transit], and even that through clouds. It was with a telescope of eight feet that Mr. Bugge observed the interior contact when the clock indicated 10:02:10, and the exterior contact at 10:18:58. This latter moment is less exact than the former, according to the report of the observer".
[181] Cf. Woolf 1959, p. 137, where he has entered "Bugge & Hascow" as observers of E,1-2 in Trondheim, but only "Horrebow" in Copenhagen.
[182] Several of the observations that figure in Woolf's tables were made by anonymous observers, compare Section II.1.5 above.

astronomer', such as Pehr Wargentin in Stockholm or Maximilianus Hell in Vienna, to pull strings and bring amateurs of science into the fold.

As to the various observations in 1769, a few adjustments to Woolf's tables remain to be made here as well. This year, Woolf tells us, fifteen individual observations were made on six sites in Sweden and Finland.[183] The number of individual observations of the 1769 transit on Swedish/Finnish soil has been adjusted in Table 4a. A single observer in Stockholm – Strussenfelt – has been overlooked. Woolf has also missed the observation made by a crew of anonymous military officials at Hven, at the site of Tycho Brahe's old observatory in the sound between Sweden and Denmark. A third point to make is that there is a four-second variation in the determination of the exterior contact at egress, as observed by the crew of observers in Hernösand, which therefore should be counted as two individual observations, not just as one. Thus, where Woolf speaks of a total of "151 observers from 77 stations" in 1769, there is in fact evidence of 154 individual, successful observations made from 78 sites. Of this total, eighteen (not fifteen) observations were made from seven (not six) sites in the countries now known as Sweden and Finland.[184]

Not much remains to be adjusted as far as the observations from Danish and Norwegian soil in 1769 are concerned. An investigation of observations preserved in manuscripts or in newspapers aimed at the general public may be an interesting task in itself, since this would give an idea of the general interest aroused by the Venus transits well outside professional circles of learning. Nonetheless, such data sets do not merit insertion in the tables of successful observations that made their way into standard publications of contemporaneous astronomy. The only reason for including tabular corrections to Woolf's work is that there are

[183] My counting on the basis of the table of Woolf 1959, pp. 182-187.
[184] For reasons explained earlier, observations that are known to have been made from sites in Sweden and Finland, but which failed to be published, have been omitted from the discussion here. This was the case in 1761, when Wargentin ends his survey of observations by stating that: "Åtskillige andre Vittre Män hafva väl ock til Kongl. Vetensk. Academ. insändt sina vid detta tilfälle gjorda Observationer, som i sig sielfve torde vara riktige nog; men för någon ovisshet om Urets gång och rätta tiden, som härvid är så angelägen, kunna de ej med lika säkerhet, som de föregående, nyttjas, och besparas därföre til vidare pröfning" = "Several other able men, it is true, have also submitted to the Royal Academy of Sciences their observations made on this occasion, and these appear to be reliable enough, but even so, because of some uncertainty concerning the running of the clock and the true time, which is so crucial in this matter, they cannot be used with the same certainty as the preceding ones, and will be saved for further testing" (Wargentin 1761*a*, p. 166). Similarly, an observation made by a "Törnquist" at Frösön (near modern Östersund) is discussed in the correspondence between Wargentin and Planman in the autumn of 1769, where uncertainty concerning time-keeping was also at stake (letter from Planman to Wargentin in Stockholm, dated Åbo 17 November 1769 [CVH Stockholm]; this man is probably identical to the surveyor Johan Törnsten, whose Frösön observation is mentioned in Lindroth 1967, vol. I.1, p. 408.

a number of inaccuracies in his summary of the observations made in Vardø by Hell, Sajnovics and Borchgrevink. Consulting Hell's original report, we find that Hell and Sajnovics observed the second, third and fourth contacts of Venus with the limb of the Sun, not "I,1-2;E,1-2" (Hell) and "I,1-2;E,2" (Sajnovics) as stated by Woolf. Borchgrevink, on the other hand, in fact observed all four contacts, not "I,2;E,2" only (See Table 4b).[185]

Such tables of successful observations have obvious limitations, as Woolf himself concedes.[186] For one thing, they tell only of successes and nothing about failures. A mere glance at the tables might easily give the false impression that Danish-Norwegian activities remained at the same level in 1761 and 1769, or even that there had been a decline (four observers in two places in 1761; three observers at a single site in 1769). Bad weather has wiped more than one observational effort out of the historiography. By focusing not only on the successes but also on the planning and conducting of the observational attempts that were actually made, a broader and more nuanced picture emerges.

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[185] Hell 1770*a*1, pp. 69-80, espec. pp. 78-79. Woolf states that he has not used Hell's original report, but the summary in Newcomb 1890, pp. 301-305, for these data (Woolf 1959, p. 183). In these pages, Newcomb compares the relevant pages of Hell's MS "Observationes Astronomicæ et Cæteræ Jn Jtinere litterario Viennâ Wardoëhusium usque factæ" (1768-69) with the Vienna edition of his printed report (Hell 1770*a*4), paying particular attention to the moments of interior contact as observed by the three observers. The discussion is packed with details and intricate argumentation, making it easy for a layman to get lost. In the same work by Newcomb, however, all the ingress and egress data from Vardø are inserted into a tabular overview of all the successful observations made in 1769 (Newcomb 1890, pp. 364-371). For some reason, this tabular overview appears to have been overlooked by Woolf.

[186] Cf. Woolf 1959, pp. 141 & 188.

TABLE 3a OFFICIAL SWEDISH REPORTS ON THE 1761 VENUS TRANSIT COMPARED TO WOOLF 1959, pp. 135-140

WARGENTIN 1761, HELLANT 1761					WOOLF 1959	
Location [modern name]	*Observer*	*page(s)*	*Observation*	*Remark*	*No. in Tab.*	*Obs.*
Cajaneborg [=Kajaani]	Planman	158-160	**I,1**-2;E,1-2	I,1 uncertain	No. 14	I,2;E,1-2
ibid.	**Frosterus**	158-160	**I,1-2;E,1**	Instr.: 5 feet Dollond. E,1 differs 40 sec. from Planman	---	---
Torne [=Tornio, Torneå]	Hellant	180-183	I,2;E,1-2		No. 15	I,2;E,1-2
ibid.	Lagerbohm	180-183	I,2;E,1-2		No. 16	I,2;E,1-2
ibid.	**Häggman**	180-183	E,1-2	Instr.: 8 1/2 feet telescope	---	---
ibid.	**Steinholtz**	180-183	E,1-2	Instr.: 7 feet telescope in camera obscura	---	---
Åbo [=Turku]	Justander	160	I,2;E,1-2		No. 17	I,2;E,1-2
ibid.	**Wallenius**	160	I,2;E,1	Instr.: 3 feet telescope. I,1 differs 5-6 sec. from Justander	---	---
Stockholm	Wargentin	153-158	**I,1**-2;E,1-2		No. 20	I,2;E,1-2
ibid.	**Wilcke**	153-158	I,2;E,1-2	I,2 & E,2 differs 6 & 10 sec. from Wargentin. E,1 uncertain	---	---
ibid.	**von Seth**	158	E,2	Instr.: 3 feet Dollond	---	---
ibid.	Klingenstierna	152-157	I,2;E,1-2		No. 21	I,2;E,1-2
Hernosand [=Härnösand]	Gissler	161	I,2;E,1-2		No. 22	I,2;E,1-2
ibid.	Ström	161	**I,1**-2;E,2	I,1 uncertain	No. 23	I,2;E,2
Uppsala	Mallet	144-151	**I,1**-2;E,1-2	I,1 uncertain	No. 24	I,2;E,1-2
ibid.	Strömer	144-152	I,1-2;E,1-2	I,1 very uncertain	No. 25	I,2;E,1-2
ibid.	Melander	147-151	I,2;E,2		No. 26	I,2;E,2
ibid.	Bergman	145-151	I,2;E,1-2		No. 27	I,2;E,1-2
Calmar [=Kalmar]	Wikström	162-163	**I,1**-2;E,1-2	I,1 uncertain	No. 28	I,2;E,1-2
Carlscrona [=Karlskrona]	Bergström	163-164	E,1-2		No. 29	E,1-2
ibid.	Zegollström	163-164	E,1-2		No. 30	E,1-2
Lund	Schenmark	164-165	E,2		No. 31	E,2
ibid.	Burmester	165	E,2		No. 32	E,2
Landscrona [=Landskrona]	Brehmer	165	E,1-2[?]	not stated who observed E,2 in Landskrona	No. 33	E,1-2
ibid.	Dehn	165	E,1-2[?]		No. 34	E,1
ibid.	Landberg	165	E,1-2[?]		No. 35	E,1
Various places(in Sweden?)	Anonymi	166	not stated	uncertain time keeping prevents publishing	---	---
Passy, La Muette (France)	Ferner	---	---		No. 92	E,1-2

TABLE 3b REPORTS ON DANISH-NORWEGIAN OBSERVATIONS OF THE 1761 VENUS TRANSIT COMPARED TO WOOLF 1959, pp. 135-140

SHORT 1763, LALANDE 1763, HORREBOW 1765					WOOLF 1959	
Location [modern name]	*Observer*	*publication*	*Observation*	*Remark*	*No. in Tab.*	*Obs.*
Drontheim [=Trondheim]	Bugge	Lalande	E,1-2	Observation of assistant Aaskow not stated	No. 50	E,1-2
ibid.	**Anonymus**	Short	E,1	Observer = J.N. Holm (cf. Hell 1790,p.373)	---	---
Kiøbenhavn [=Copenhagen]	Chr. & P.Horrebow	Horrebow	E,1-2	E,1: Chr.H. only; E,2: Chr. & P.H. Instr. P.H.: 17 feet	No. 49	E,1-2

TABLE 4a OFFICIAL SWEDISH REPORTS ON THE 1769 VENUS TRANSIT COMPARED TO WOOLF 1959, pp. 182-187

WARGENTIN 1769, PROSPERIN 1769, GADOLIN 1769, PLANMAN 1769*b*, SCHENMARK 1769, GISSLER 1769 | WOOLF 1959

Location [modern name]	*Observer*	*page(s)*	*Observation*	*Remark*	*No. in Tab.*	*Obs.*
Pello	Mallet	148-151	neither I nor E	clouds spoiled observation	---	---
Torne [=Tornio, Torneå]	Hellant	148-151	neither I nor E	clouds spoiled observation	---	---
Cajaneborg [=Kajaani]	Planman	214-216	I,2;E,2		No. 23	I,2;E,2
ibid.	Uhlwijk	216	E,2	E,2 differs only 3 sec. from Planman	No. 24	E,2
Wanhalinna Berg,near Åbo [=Turku]	Gadolin	173-175	I,1-2		No. 27	I,1-2
ibid.	Justander	173-175	**I,2**		No. 28	I,1-2
Stockholm	Wargentin	152-154	I,1-2		No. 29	I,1-2
ibid.	Ferner	152-155	I,1-2		No. 30	I,1-2
ibid.	Wilcke	153-157	I,1-2		No. 31	I,1-2
ibid.	**Strussenfelt**	152-157	**I,1-2**	Instr.: 1 1/2 feet telescope	---	---
Hveen (site of Tycho Brahe's obs.)	**Anonymi**	157-158	**I,1**	Instr.: several, incl. 20 feet telescope	---	---
Hernosand [=Härnösand]	Gissler, **Ström, & Eurenius**	225-226	I,1-2	Instr.: Telescopes 22, 22, and 10 feet	No. 32	I,1-2
ibid.	**iid.**	226	I,1-2	determinations of I,2 varies 4 seconds.	---	---
Uppsala	Prosperin	159-160	I,1-2		No. 33	I,1-2
ibid.	Strömer	159-160	I,1-2		No. 34	I,1-2
ibid.	Melander	159-160	I,1-2		No. 35	I,1-2
ibid.	Bergman	159-161	I,1-2		No. 36	I,1-2
ibid.	Salenius	159-161	I,1-2		No. 37	I,1-2
Lund	Schenmark	223-224	I,1-2		No. 40	I,1-2
ibid.	Nenzelius	223-224	I,1-2		No. 41	I,1-2

TABLE 4b HELL'S PUBLICATIONS ON DANISH-NORWEGIAN OBSERVATIONS OF THE 1769 VENUS TRANSIT COMPARED TO WOOLF 1959, pp. 182-187

HELL 1770*a*1, HELL 1772, HELL 1790 | WOOLF 1959

Location [modern name]	*Observer*	*page(s)*	*Observation*	*Remark*	*No. in Tab.*	*Obs.*
Wardoëhusii [=Vardø]	Hell	1770*a*1,78-80	**I,2**;E,1-2	made no attempt to observe I,1	No. 16	I,1-2;E,1-2
ibid.	Sajnovics	1770*a*1,78-80	**I,2**;E,1-2	made no attempt to observe I,1	No. 17	I,1-2;E,1-2
ibid.	Borchgrevink	1770*a*1,78-80	**I,1**-2;**E,1**-2		No. 18	I,1-2;E,1-2
Dunoes [=Dønnes]	P.Horrebow & Bützow	1772,86-87	failed,clouds		---	---
Drontheimii [=Trondheim]	Kratzenstein	1790,359-360	failed,clouds		---	---

II.3 THE ROLE OF FATHER HELL IN THE VENUS TRANSIT PROJECT OF 1769

> Taiti & Wardhus *binæ erunt columnæ, quibus veluti fulcris æneis innixa vera Solis Parallaxis 8″,70 ad æternam Posterorum memoriam inconcussa servabitur, quamque sera Posterorum ætas suis identidem decoratura est Palmis*
>
> - Maximilianus Hell, July 1772 [1]

> *Que pensés vous du P. Hell, l'avés vous vu observer, est il adroit, est il instruit? Je vois avec un extreme regret que son observation de Wardhus ne s'accorde avec aucune autre, et qu'il faut la rejetter*
>
> - Lalande in a letter to Boscovich, 10 March 1772 [2]

Maximilianus Hell's role in relation to the second Venus transit of his century is certainly far better known than his role in relation to the first. For more than a hundred years, the 1769 observations from Vardø were essential – albeit controversial – data sets in the international quest to determine the solar parallax. As has already been explained (Sections II.1.1 and II.1.2), it was desirable to obtain data from stations located as far apart as possible, a fact which rendered observations from the European High North valuable in themselves. This was particularly true for the transit of 1769 because that transit took place during the European night, making it necessary to dispatch observers to the regions of the Midnight Sun in order to catch the entire duration of the phenomenon. As a result, these parts received considerable attention from the international astronomical community. However, while most efforts in the "Lapland" area were spoiled by bad weather, Father Hell and his team had good weather during the crucial stages of ingress and egress.

Maximilianus Hell's Vardø observation – and the debates that followed in its wake – has been described in various works on the general history of astronomy as well as in articles and

[1] Hell, "De parallaxi Solis ex observationibus Transitus Veneris Anni 1769." 1772, p. 109: "*Tahiti* and *Vardø* will be the two columns upon which the true Solar parallax of 8.70 seconds will rest firmly and be preserved – like upon pillars of bronze – to the eternal memory of Posterity, a memory which a distant past will decorate again and again with its palms of victory".

[2] Letter printed in Varićak 1912, pp. ccclxxiii-ccclxxvi, here p. ccclxxvi: "What is your opinion of Father Hell, have you seen him observing, is he able, is he well trained? I conclude with the utmost dismay that his observation from Vardøhus is in accordance with no other, and that it has to be discarded".

chapters of books of a more or less academic character.[3] Among these works, there are some re-assessments of the sets of data from Vardø, undertaken by professional astronomers.[4] This does not mean that all aspects of the story have been explored. For one thing, important sources lie scattered in archives in various countries, posing practical (and economic) challenges to the modern historian. Besides, there is the linguistic nature of the sources: apart from series of lengthy and mathematically complicated treatises in a rhetorically charged Latin, contemporaneous texts in French, Swedish, German, English and Russian call for scrutiny as well. Add to the practical and linguistic challenges posed by the primary sources a considerable amount of twentieth-century literature in Hungarian, Slovak, Danish and Norwegian, and it is easy to see why most modern works on Maximilianus Hell's role are based upon a very limited selection of the secondary literature and hardly any of the primary sources.

It is the aim of this chapter to revisit the primary sources surrounding Maximilianus Hell's Venus transit observation from Vardø and the ensuing debates concerning the solar parallax. Given the exaggerated and highly contradicting accounts in the literature, it appears necessary to go *ad fontes* in the old-fashioned way. This chapter will primarily be descriptive and focused on clarifying details.

Most sections of this chapter may appear unnecessarily descriptive and detailed to the tastes of most professional historians of science and its cultural aspects. The mode of writing results, however, from a deliberate choice. It is my experience that precisely these kinds of details are most cherished among those astronomers – be they amateurs or professionals – that are interested in the history of their discipline. A concluding section (II.3.5) will address notions found in previous studies on the Vardø observation of Maximilianus Hell and the debates that followed in its wake, and probably appeal more to the historian by profession.

In terms of technicalities, a couple of remarks will perhaps be helpful. All references to Hell's Venus transit report from Vardø will be to the *editio princeps* (Hell 1770*a*1). Those who have

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[3] Works based upon scrutiny of primary sources: Pinzger 1920 (with a German summary in Pinzger 1927); Kragemo 1933, 1960 and 1968; Sarton 1944; Nielsen 1957*b*; Ferrari d'Occhieppo 1957 and 1973; Woolf 1959, pp. 176-178; Horský 1970; Pinsker 1971; Voje Johansen 2009; Aspaas 2010. Popularisations, based primarily or exclusively upon secondary literature: Ashbrook 1984, pp. 218-221 (originally published in *Sky & Telescope*, April 1961); Maor 2000, pp. 126-133; Kafka 2003, pp. 6-21; Aspaas & Voje Johansen 2004*a*; Botez 2004; Steinicke & Brüggenthies 2004; Alnæs 2004, pp. 13-24; Thorvaldsen 2004, pp. 270-272.
[4] For example Littrow 1835; Encke 1824 & 1837; Powalky 1864; Faye 1869*a* and 1869*b*; Newcomb 1883 and 1890; Nielsen 1957*b*.

another edition to hand are advised to inspect Table 5 at the end of Section II.3.2. Another central source in the descriptive sections of this chapter is the so-called "Astronomical Notebook" (*Observationes Astronomicæ et Cæteræ Jn Jtinere litterario Viennâ Wardoë-husium usque factæ*), covering the period from 27 July 1768 to 18 June 1769. All references to this notebook are to the original kept at the Vienna University Observatory, which has yet to be edited in its entirety. However, Littrow's *P. Hell's Reise nach Wardoe* (1835, pp. [15]-84) and later works by Faye (1869*b*) and Newcomb (1883; 1890, pp. 301-305) include substantial parts of this manuscript, and there are facsimiles of single pages to be found in Nielsen 1957*b*; Aspaas & Voje Johansen 2004*b*; and Hansen & Aspaas 2005. Likewise, all references to the travel diary and letters of Sajnovics are to manuscripts kept in the archives of the Vienna University Observatory and the Hungarian Academy of Sciences respectively. Littrow's notoriously unreliable German translation of large parts of Sajnovics' diary (1835, pp. [85]-166) should be avoided.[5] Readers of Hungarian may, however, consult the new edition of the diary and letters of Sajnovics dating from 1990. As for the correspondence of Hell, this is usually quoted from originals kept in various archives (See Unprinted Sources 1*a* and 1*b*). Many of the letters quoted can also be found in the original language in works by Pinzger (1920-27), Rabenalt (1986) and Vargha (1990-92). The listings of Unpublished Sources towards the end of this thesis make up an implicit reference for quotes from letters and other manuscripts.

II.3.1 TWO REJECTED INVITATIONS AND ONE ACCEPTED

Father Hell's invitation to Denmark-Norway has been discussed in various works, amongst them a short article by the author of this thesis (Aspaas 2008*d*). It has also been touched upon in Sections I.2.3 and II.2.4 above. However, a couple of questions stand in need of being addressed. The first question pertains to Hell's claim to have received two invitations before the ambassador of Copenhagen approached him in September 1767. Who were these inviters? The second question has to do with another claim, that Father Hell had no contact with Copenhagen prior to September 1767. Is this really true? An implicit question emerging from both the preceding ones is why he, as an astronomer, accepted to go precisely to Vardøhus. How might that promote his career?

[5] This applies of course also to the Norwegian and Slovak translations of Littrow's German version (Daae 1895; Littrow 1977), although the comments of those editors are informative (See the footnotes and introduction of Daae and the introduction by Tibenský in Littrow 1977).

As already explained, the 1769 transit of Venus was pre-calculated to take place during the European night. To travel abroad for the occasion must have been a tempting idea to almost any astronomer on the European Continent. In mainland France and on the British Isles, it would only be possible to see the ingress of the transit. This implied that by taking recourse to Delisle's method (described in Section II.1.2), French and British astronomers who stayed at home could still contribute to the project, even though expeditions overseas would be far more likely to produce essential data sets. By contrast, most observatories in countries where the Society of Jesus still persisted would miss the phenomenon entirely or the sun would be too low above the horizon to allow for accurate observations.[6] Their only possible contribution would be indirect and by no means unique: staff at Jesuit observatories could, by observing the solar eclipse of 4 June 1769, help establish the longitude of sites of observation abroad. The prospect of the Central-European astronomer was thus somewhat different from that of peers who lived further west.

In certain sources written by Father Hell, we find the intriguing statement that he – before he received the invitation to go to Norway – had already rejected two similar invitations. The question of the identity of these inviters is open to speculation.

As the Imperial and Royal Astronomer of Vienna, Maximilianus Hell used to fill a triple role. He was involved in *practical astronomy* by making astronomical observations from his observatory; he was calculating the ephemeris and publishing various treatises on *theoretical astronomy*; and he was a *networker* (or 'nodal astronomer'), instigating, coordinating and publishing the observations of others. As has been described in Sections II.1.3 and II.1.4, he contributed in all three ways for the Venus-transit project of 1761. As the next transit was approaching, however, Hell's plans were different. In his subsequently published report on his Venus transit observation from Vardø, he tells us that he was intending to make no observations himself, concentrating instead on the theoretical (and perhaps networking) part of the project:[7]

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[6] The sole exception would be the Jesuits in Asia.

[7] Hell, *Observatio Transitus Veneris ... Anno 1769. Wardoëhusii ... facta* 1770*a*1, p. 1: "Cum Anno 1767 nihil minus in animum meum admitterem, atque causa futuræ Anno 1769 observationis celebris Transitus Veneris ante discum Solis, mihi Vindobonæ invisibilis, Stationem meam, meumque observatorium, vel ad momentum relinquere, atque ita obfirmato animo, *deprecatis jam tum binis ad exteras partes invitationibus*, quietus ex observandis ab aliis Astronomis momentis supputationes Parallaxeos Solaris a me subinde suscipiendas, securo jam animo Vindobonæ volverem […]" (my italics).

> In the year 1767, nothing was further from my thoughts, than to leave – even for a moment – my post at the observatory in order to observe the transit of Venus in front of the Sun that was going to take place in 1769, invisible to me in Vienna. Thus, having firmly made up my mind I had already rejected two invitations to go abroad, intending instead to rest in Vienna and make calculations of the solar parallax on the basis of data sets observed by other astronomers [...].

Father Hell nowhere reveals the identity of those who had invited him to go abroad. This should come as no surprise. In fact, administrative documents demonstrate that the authorities in Copenhagen asked for secrecy when they gave the Viennese ambassador orders to contact Hell.[8] Thus, had he declined, it would certainly have been very difficult to find evidence for such an invitation. As has been explained in Section II.2.4 above, the first meeting between Hell and the Danish ambassador took place in Vienna 5 September 1767. If his own words are to be believed, the Imperial Astronomer of Vienna had by that time already declined two invitations, but from whom? Some colleague from the Society of Jesus would be a possibility, or else some sponsor on national level. Father Hell explains that he saw his advanced age, the dangers and difficulties of travelling, and concern for his own health as obstacles for embarking upon an expedition,[9] and that would make a sea voyage to a distant continent or a long journey overland likely to have been rejected. Over the following pages, the possible identity of the two inviters will be discussed. First, a possible Jesuit inviter will be discussed, then the candidacy of a few national sponsors.

A Jesuit inviter of Hell may at first sight seem unlikely, since the Jesuits during this time were encountering problems in several countries and the order as a whole had been pushed on the defensive. Nevertheless, it is known that the most eminent Jesuit polymath of Hell's generation, *Roger Joseph Boscovich*, already in the spring of 1766 had made an agreement with the Royal Society of London, whose member he was, to go to North America for the transit of 1769 (Baja California in present-day Mexico was later fixed to be his site of

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[8] See Section I.2.3 above.

[9] Cf. Hell 1770*a*1, pp. 1-2: "veluti ictu improviso infirmatus, non ætatem meam jam provectiorem, non itinerum difficultatem, vitæque pericula, non denique debilioribus meis corporis viribus periculosam ad arctos cæli, aërisque inclementiam magni pendens […], magno, intrepidoque animo iter ad Arctos petii" = "as though I had been weakened by a surprising slap, not laying much weight on my already well advanced age, nor on the difficulties of travelling, the risks to your life, or the danger imposed upon my feeble bodily strength by the inclemency of the climate in the Arctic […], I embarked upon the journey to the Arctic in a lofty and fearless spirit". See also the introductory chapter of the *Expeditio litteraria* (edited in Chapter III.3 below), §. V: "I, who because of my failing bodily strength twice already had rejected invitations to make a similar expedition, found myself overwhelmed by the unexpected proposal presented by His Excellency Count von Bachoff".

observation).[10] Later in the same year, the Spanish government informed the British Royal Society that they would allow Boscovich to travel through its dominions along with another member of the Jesuit order.[11] Could this fellow have been Father Hell?

Boscovich had stayed in Vienna for long periods in the late 1750s and early 1760s, and during the mid-1760s he held a position as professor of mathematics at the collegium in Pavia, which was under Habsburg rule.[12] He surely must have met Hell at some stage. The historian of Jesuit science Steven Harris points to the parallel roles of Hell and Boscovich in the design and construction of astronomical observatories (Boscovich in Milan, Hell in Claudiopolis, Tyrnavia and Vienna), and claims that "Boscovich was in contact with Hell" and other founding fathers of observatories in the German assistancy in this context. Harris does not, however, present any evidence for such contacts.[13] By contrast, the Danish historian of science Helge Kragh has, in his recent analysis of the scientific debates concerning the spurious "moon of Venus", pointed out that when Boscovich in 1767 published a work in which he denied the existence of such a moon, he used a very similar argumentation to that which Father Hell had used in his *De Satellite Veneris*, published only two years earlier (See Section II.1.4). The work of Boscovich in question was even published by the same publisher as Hell's, Trattner in Vienna. Despite this circumstance, Boscovich does not mention the work of his confrère by a single word. Contrary to Harris, therefore, Kragh concludes that "there is no indication in the literature that Hell and Boscovich were in contact with one another".[14]

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[10] The President of the Royal Society, Charles Morton, sent Boscovich a letter of invitation early in 1766. In his response, dated Pavia 9 May 1766, Boscovich expressed willingness to undertake the expedition (letter printed in Tolomeo 1992, pp. 283-286). Only then was the formal decision to invite Boscovich taken by the Royal Society, in a meeting on 5 June 1766 (according to Woolf 1959, p. 163). Rumour then spread quickly, and the plans for Boscovich's expedition is mentioned in for example a letter from Lalande to Weiss in Tyrnavia, dated Paris 14 October 1766 (printed in Vargha 1990, pp. 61-62).

[11] Morton to Boscovich in Pavia, dated London 22 December 1766 (printed in Tolomeo 1992, pp. 298-299).

[12] Boscovich visited Vienna in the period April 1757-March 1758 and again in January-May 1762 (Hill 1961, pp. 47-51 & 79; cf. pp. 79-83 on Boscovich's period in Pavia).

[13] Harris 1993, pp. 536-539, here p. 538.

[14] Kragh 2008, pp. 84-86, here p. 85. The book by Boscovich in question is the *Dissertationes quinque ad dioptricam pertinentes* (Vienna 1767; even reissued in German translation by Carolus Scherffer in the same year). A detail that might be of interest is that Father Hell seems to have tried to make sure Boscovich read his book on the moon of Venus. In a fragmentary draft for a letter that appears to be addressed to some Italian astronomer (internal evidence points to the second half of the year 1765 as the time of writing), Hell goes into details concerning the *De Satellite Veneris*, adding that (WUS Vienna, top of page beginning with the words "claritatem variata"): "si Tibi cum Patre Boscovichio convenire datum fuerit, scio equidem Eum prima fronte plura contra hæc mea prolaturum, utpote qui sententiam suam Hugenianam à me pag. 31. et 56 rejectam defendere conabitur, sed Si id egerit, tum eum cervos in arboribus venaturum credam. […] Quæso num à Parisinis eruditis nihil adhuc inaudivisti de mea dissertatione satellitis ♀. ego enim transmissis mense martio duodecim Exemplaribus ad varios à nemine adhuc vel verbum responsi accepi, ut adeo mirer, quid Viris istis

Neither claim is entirely correct. In an online inventory of Boscovich's correspondence, published by the *Commissione Scientifica Edizione Nazionale R.G. Boscovich* in Milan, there is in fact listed a single letter from Hell to Boscovich in Pavia, dated Vienna 27 February 1764.[15] February 1764 was obviously well before the idea of an American expedition had emerged, and the letter in question turns out to contain no mention of the coming Venus transit. Furthermore, neither the satellite of Venus nor the construction of observatories is mentioned, either. The wording of the letter yields clear evidence that the two were not close colleagues or allies.[16] Furthermore, this single extant letter from Hell to Boscovich contrasts to 36 surviving letters addressed to the same man by Josephus Liesganig and thirteen by Carolus Scherffer, both Viennese Jesuits engaged in astronomy and related topics (See Subsection I.2.2.1 above).[17] It might be added that in his elaborate *Aurorae Borealis Theoria*

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eruditis factum sit, offensos non puto, qui tanta cum cautella de ipsis loquor. R. P. Noghera amantissime quæso mei loco complectaris atque saluta. vale" = "If You get the occasion to meet Father Boscovich, I am confident that he at first sight will raise a lot of objections against my point of view, for he will attempt to defend his own opinion, which is in line with that of Hugenius, but rejected by me on pages 31 and 56 [cf. Hell 1765*a*]. However, if he does so, I should think he will be chasing deer in the treetops. […] Please tell me, haven't You heard anything yet from the savants of Paris concerning my dissertation 'On the Moon of Venus'? You see, I sent twelve copies to various scholars in March, but I haven't yet received a word of response from any of them. This makes me wonder what may have happened to these savant gentlemen. I do not think they are offended, since I talk of them with such caution. Please give Honourable Father [Giambattista] Noghera a warm hug on my behalf and bring him my regards. Farewell".

[15] http://www.brera.inaf.it/boscovich/progetto-sito/Nuovo_catalogo_lettere.doc (accessed 29 October 2008).

[16] Hell to Boscovich in Rome, dated Vienna 27 February 1764 (digital copy kindly provided by Luca Guzzardi of the *Commissione Scientifica Edizione Nazionale R.G. Boscovich* in Milan). The contents of the letter are as follows: thanks for a work that Boscovich has sent as a present to Hell in Vienna through Father Noghera ("munus hoc profundissimi ingenij partus eximius, etsi gratissimum ipsum mihi fuerit, multo tamen jucundissima erat cogitatio, qua intelligebam mei, qui coram sæpius R[evere]ntiæ V[est]ræ admirator fueram, memoriam qualemcunque haberi" = "even though this gift, a product of Your Reverence's deeply subtle intellect, was most welcome to me in itself, the most wonderful thing of all was that it made me aware that I, who had so often publicly stated my admiration for Your Reverence, was in fact kept in some sort of remembrance", Hell adds); congratulations with Boscovich's appointment as professor in Pavia; mention of letters from Fathers Liesganig and Scherffer that are to be sent to Rome by the same mail; debates concerning achromatic telescopes of Viennese and Parisian fabrication (Bianchi, Liesganig, Antheaulme and Clairaut mentioned in this context); Hell's dispute with Cassini de Thury concerning the degree of meridian between Vienna and Paris; Pingré's *Observations Astronomiques pour la determination de la parallaxe du Soleil* (Pingré 1763) and Hell's reaction to this work (Mason and Lalande also mentioned in this context); promises to send as a gift to Boscovich the latest volume of the *Ephemerides Astronomicae*, which contains Hell's work on the use of Jupiter's satellites for meridian determination. In short, flattery and humble respect permeate the letter, not the kind of familiarity and frankness that characterise Father Hell's letters to most other colleagues.

[17] Cf. http://www.brera.inaf.it/boscovich/progetto-sito/Nuovo_catalogo_lettere.doc (accessed 29 October 2008). The Latin correspondence of Father Boscovich is currently being edited by Dr. Oreste Trabucco of the University of Naples. As for Scherffer, the 1777 edition of his *Institutiones astronomiæ theoreticæ* contains many references to Lalande, Lacaille, Halley, Boscovich and so forth, but none to his peers in Vienna. Despite treating topics in which his colleague Hell ought to be considered an expert, he makes no reference to him. Thus, when mentioning the story of the so-called satellite of Venus, he presents in brief the same explanation as Father Hell had used in *De Satellite Veneris*, but without any reference (Scherffer 1777, p. 8). And while a brief section is devoted to "De transitu Veneris, vel Mercurii infra discum Solis", he quotes Lalande only as an authority on the solar parallax and says that the parallax is probably 8.5 arc seconds "or perhaps even lower" (Scherffer 1777, pp. 389-392, here p. 391).

Nova, published in 1776, Hell refers to the theories and observations of a wide range of authors, but avoids mentioning that the famous Boscovich had treated the phenomenon in several works.[18] Boscovich' silence on Hell's *De Satellite Veneris* was thus 'echoed' by Hell on that occasion. All this can be taken as strong indication, albeit not as definite proof, that Maximilianus Hell can hardly have been on top of Father Boscovich's list when he searched for a companion for his expedition.

Further evidence is found in a selection of Boscovich's correspondence that was published by Rita Tolomeo in 1992. Among these letters, there is a section of 28 letters relating to the plans for the Baja California expedition, dating from May 1766 to July 1767. Interestingly, Maximilianus Hell is not mentioned by name in any of these letters.[19] Instead, it emerges that the head of the Jesuit observatory in Vienna, Josephus Liesganig was invited by Boscovich to be his travel companion. Liesganig failed, however, to obtain permission to participate in the expedition from the Habsburg chancellor Kaunitz, who moreover was reluctant to grant Boscovich the necessary leave from his position in Pavia.[20] Boscovich then turned to the Jesuit Christianus Mayer, court astronomer of Mannheim and – like himself – a fellow of the Royal Society of London, asking him to join in the expedition instead of Liesganig.[21] The abolition of the Jesuits from Spain and all her colonies in April 1767 brought an end to these plans, and in a letter to Boscovich dated 12 May 1767, the president of the Royal Society

[18] Hell, *Aurorae Borealis Theoria Nova …* 1776. Boscovich is known to have published works on the Aurora Borealis in 1738 (*De Aurora Boreali*, anonymous dissertation published twice in the same year, Rome), 1747 (*Caroli Noceti e Societate Jesu. De Iride et Aurora boreali Carmina Illustrissimo ac Reverendissimo Praesuli Bernardino Giruadio dicata. Cum Notis Josephi Rogerii Boscovich ex eadem Societate*, Rome), 1748 ("Dialoghi sull'aurora boreale del P. Ruggiero Boscovich della Compagnia di Gesù lettore di Matematica nel Collegio Romano", in *Giornale de' Letterati per l'anno 1748*, pp. 192-202, 264-275, 293-302, 239-336, 363-368; also published as a separate booklet) and 1760 (*Philosophiae recentioris a Benedicto Stay in Rom[ano] Archigym-n[asio] Eloquentiae Profess[ore] versibus traditae Libri X, ad Sylvium Valentium Cardinalem amplissimum, cum adnotationibus, et Supplementis P. Rogerii Josephi Boscovich S.J. in Collegio Rom[ano] Publ[ico] Matheseos Professore* Tomus II, Rome); cf. e.g. Tolomeo 1992, pp. 13-14; Lisac & Marki 1998, pp. 54-55; and the online inventory http://www.brera.inaf.it/boscovich/progetto-sito/opere_a_stampa.pdf (accessed 30 October 2008).
[19] See Tolomeo 1992, section on "Ruggiero Giuseppe Boscovich: Carteggio con corrispondenti diversi su un'ipotesi di viaggio in California (1766-1767)", pp. 281-386; cf. pp. 29-35 & 355-358.
[20] After nearly three months of lobbying, Liesganig in a letter to Boscovich in Pavia, dated Vienna 26 February 1767, finally found himself forced to say "adieu Amerique!" (printed in Tolomeo 1992, pp. 311-312).
[21] See the letter from Boscovich to Morton in London, un-dated but probably – to judge from Morton's answer of 12 May 1767 – dated 22 April 1767 (printed in Tolomeo 1992, pp. 319-320; cf. p. 321). Chr. Mayer mentions plans to accompany Boscovich on this expedition in his long treatise on the Venus transit (Mayer 1769*b*, p. 84): "deserta *America*, quo ab hinc biennio cum celebri P. BOSCOWICH, sumptibus Societatis Regiae Anglicanae […] abire debebam, me in hanc vrbem appulisse" = "… that I, having quitted America, which I two years ago, financed by the Royal Society of England, was supposed to travel to, instead arrived in this city [i.e. St. Petersburg]".

effectively withdraws the invitation.[22] I have not come across other plans of Venus transit expeditions involving Jesuit astronomers prior to September 1767.

As for *other possible inviters* of Father Hell, one might as well proceed by using the method of elimination. Sweden is not likely to have invited foreign observers, since the Swedish Academy of Science had sufficient personnel within its own ranks and on top of that was reluctant to invite foreigners for patriotic reasons;[23] nor is France, for similar reasons; and as for Britain, Maximilianus Hell was not a fellow of the Royal Society and is not known to have been in personal contact with British astronomers prior to 1769.[24] Further possible sponsors asking the Viennese court astronomer to travel to faraway territories would be Portugal or Spain, but the fact that the expulsion of the Jesuits from their lands took place in June-September 1759 and February-April 1767 respectively makes such an invitation highly unlikely. What is more, no Catholic power still favoring the Jesuit order – Austria included – is known to have organised any Venus-transit expeditions whatsoever in 1769.

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[22] Morton to Boscovich in Pavia, dated London 12 May 1767 (in Tolomeo 1992, pp. 320-321).

[23] A remark in the application for funding to the Swedish King (compare Section II.2.1) is especially revealing. Here, Wargentin states that (quoted from Nordenmark 1939, pp. 375-376): "Allernådigste Konung! Skickelige Män där til äro hos oss at tilgå, men medel til deras utrustande, när den tiden kommer, och til så många Instrumenters anskaffande, vet Academien inga, utan nödgas nu strax bekänna för de utländska Academierne sin oförmögenhet at i detta mål fullgöra deras åstundan, på det de i tid må vara betänkte, at sielfve hitsända några Astronomer […]. Eders Kongl. Majestets höga ynnest för Vetenskaper, Nåd för Des Academie och ömhet om Rikets heder vid et så besynnerligt tilfälle, torde ei tillåta Academien at göra för Utlänningar en sådan bekännelse om sin oförmögenhet […]" = "Most gracious King! Able men are to hand in our country, but the Academy possesses no funding either for their travel gear, when that time comes, or for acquisition of the necessary number of instruments. Instead, the Academy will some day soon be forced to admit to the foreign academies its inability to fulfil their wishes in this matter, so that the foreign academies may have the time to consider dispatching some astronomers to us themselves […]. His Royal Majesty's great care for the sciences, His grace for His Academy and care for the honour of His kingdom in such an extraordinary case, would hardly allow the Academy to make to foreigners such a confession of its poverty".

[24] When in the mid-1770s Hell was charged with the construction and equipping of a new observatory in Agria (See Section I.2.4 above), he contacted the British Astronomer Royal Nevil Maskelyne, asking him to place orders for instruments at the appropriate instrument makers' in London (Hell to Bishop Eszterházy in Agria, dated Vienna 22 August 1775 [Vargha priv.]). However, Maskelyne seems to have been slow or reluctant to provide this help (letter from Hell's student Joannes Madarassy to Bishop Eszterházy in Agria, dated Vienna 27 January 1776 [Vargha priv.]). The low priority given to the matter caused Hell to write to his confrère Chr. Mayer, who had just finished the instrumentation of his new observatory in Mannheim, which consisted to a large extent of English instruments. Having lost patience with Maskelyne, Hell asked Mayer to procure the instruments from England on his behalf or at least to give advice on what instrument makers he could contact in London (Madarassy to Bishop Eszterházy in Agria, dated Vienna 3 March 1776 [Vargha priv.]). Finally, on 23 April 1776 Hell writes that Maskelyne has at last responded to Hell's request and given him a list of prices for the various instruments needed (Hell to Bishop Eszterházy in Agria, dated Vienna 23 April 1776 [Vargha priv.]). A year later, however, no instruments had yet arrived and a "Count Dormer" in London was asked to urge the instrument makers as well as Maskelyne himself to speed up the process (Madarassy to Bishop Eszterházy in Agria, dated Vienna 5 April 1777 [Vargha priv.]). Only in September 1777 – more than two years after Hell first wrote to Maskelyne – could he inform the Bishop of Agria that the instruments had finally started to arrive from England (Hell to Bishop Eszterházy in Agria, dated Vienna 8 September 1777 [Vargha priv.]). The affair suggests that Maximilianus Hell lacked close contact with British astronomers, at least prior to 1775.

Paradoxically, if Hell received invitation from a national government or ruler, the situation in Catholic countries around 1766/67 makes a non-Catholic power more likely to have been the inviter. One such power with colonies overseas would be the Dutch Republic. Indeed, the *Verenigde Oostindische Compagnie* ('Dutch United East India Company') is known to have cooperated with Delisle concerning the planning of a Venus-transit observation from the beaches of Batavia (present-day Jakarta) in 1761. By 1769, however, this situation had changed. The resident amateur astronomer Johan Maurits Mohr (1716-1775) had in the meantime, on his own initiative, constructed a private observatory and acquired high standard instruments from Europe, without financial support from either the *Compagnie* or the state. No other observations are known to have been made from Dutch colonies in 1769, and given the business-oriented emphasis of the Dutch United East India Company, it appears unlikely that it would be prepared to spend money on recruitment of foreigners for such a task. [25]

Another possible inviter of Father Hell is the Imperial Academy of Sciences in St. Petersburg. As has been explained (Section II.2.2), the academicians of Russia started planning their expeditions already in the spring of 1767, and they were quick to call for help from abroad. With the strong links between the St. Petersburg Academy and the German-speaking world, a tempting conjecture would be that the leading astronomer of the Austrian Empire might have been among those invited. However, I have been unable to find evidence of contacts between Hell and the Academy of St. Petersburg in this period.[26] One cannot rule out, however, that Father Hell – or perhaps some correspondent of his – interpreted the general 'call for competence' of Empress Catherine in the spring and summer of 1767 as a an invitation aimed at the likes of himself.[27]

In the end, it was the French astronomer Chappe d'Auteroche that went to Baja California along with two Spanish observers. They succeed to observe the Venus transit, but most of the company – Chappe included – perished soon after from an epidemic disease. Boscovich stayed in Italy and saw nothing of the Venus transit, whereas Father Mayer upon advice from

[25] Zuidervaart & Van Gent 2004; Van Gent 2005.
[26] Hell did in fact cultivate some contact with members of the academy in St. Petersburg in the early 1760s, as is evident from some volumes of the *Ephemerides Astronomicae* (cf. e.g. the appendix of *Anni 1762* [Hell 1761, pp. 92-94]). Among the manuscripts of Hell in Vienna, letters exchanged between Hell and Gerhard Friedrich Müller as well as Joseph Adam Braun have been found (cf. Unprinted Sources, 1*a* and 1*b*): Müller to Hell, St. Petersburg 6 June 1761; Hell to Braun, Vienna 8 February, 31 March, 10 April & 5 May 1761; Braun to Hell, St. Petersburg 5 May 1761. These letters all concern the Venus transit of 1761. Unfortunately, evidence for Hell's correspondence in the years 1765-68 is far more meagre than for the period around 1761.
[27] See Section II.2.2 above.

Lalande became one of the Venus-transit observers financed by the Russian Academy of Sciences in 1769 (See Section II.2.2). He was not invited until late in the year 1768, however.

In conclusion, the circumstances of the two invitations that the Viennese court astronomer claims to have received – and rejected – prior to September 1767 remain mysterious. The accepted invitation from Denmark, however, is well documented. The only problem is whether Hell's own words in this context are entirely reliable.

In the introductory chapter of the *Expeditio litteraria ad Polum arcticum* (edited in Chapter III.3), Father Hell explains that the decision of inviting him had been taken unanimously during a meeting between the three mightiest ministers in Copenhagen – Bernstorff, Moltke and Thott. To Hell, however, the invitation from the Danish ambassador came as a total surprise, for he had "so far never had any scientific correspondence (*commercium litterarium*) with anyone in Denmark". In rhetorical climax, the Viennese astronomer explains that he was convinced that no one had even heard of his name "in that country, especially not in Copenhagen, and even less so among the highest ministers at the King's Court".[28]

At this point Maximilianus Hell either has a failing memory or is deliberately concealing the truth. Preserved at the Royal Library in Copenhagen is a letter in Hell's own hand, dated Vienna 5 October 1766 and addressed to Thomas Bugge, by that time an experienced surveyor and cartographer.[29] Hell opens the letter by thanking Bugge for a preceding letter "especially because You, by means of that letter, have wished to initiate a truly erudite scientific correspondence (*pererudito commercio tuo litterario*) from Your part".[30] It emerges that Bugge had sent Hell his observation of a lunar eclipse 24 February 1766 from Copenhagen, and Hell now urges him to observe also the moons of Jupiter, and to communicate these as well as other observations to him in the future:[31]

> trust me, nothing more agreeable happens to me, than when I, through scientific correspondence (*per commercium litterarium*) obtain works by means of which I am able to make my *Ephemerides* precious and useful to others.

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[28] See Hell's unfinished introduction to the *Expeditio litteraria* (edited in Chapter III.3 below), §. V.
[29] Letter printed in Pinzger 1927, pp. 3-5.
[30] Pinzger 1927, p. 3: "Litterae tuae humanissimae juxta, ac doctissimae maximo me affecerunt gaudio, Vir celeberrime, eo maxime nomine, quod his pererudito commercio tuo litterario initium dare volueris".
[31] Pinzger 1927, pp. 4-5: "crede, nihil mihi jucundius accidere, quam per commercium litterarium obtinere labores hujusmodi, quibus Ephemerides meas aliis pretiosas, atque utiles reddere valeam".

The flattery evidently went home. Correspondence between Hell and Bugge continued over the years to come.[32] Besides, in a report of Bugge, dated 8 January 1768 and preserved among Otto Thott's papers at the Royal Library in Copenhagen, the surveyor refers to Maximilianus Hell as "the most learned and diligent astronomer of our age".[33] Bugge was later to emerge as the Astronomer Royal of Denmark (appointed in 1777, after the death of Christian Horrebow and subsequent removal of the *Professor designatus*, Peder Horrebow the Younger). As early as 1759, at the age of 19, Bugge had become involved in the official survey of Denmark; in February 1761, he had presented the results of his work to the Danish Royal Society, which soon after hired him for future surveying; and later in the same year he had been entrusted with the task of observing the transit of Venus from Trondheim.[34] He was clearly a man with influential supporters. In Copenhagen's Royal Society, the prominent member Kratzenstein certainly favoured the young Bugge (Section II.2.3). And the President of the Royal Society had since 1763 been none other than Otto Thott, who was also the *Obersecretair* of *Det Danske Cancelli* (in effect, Interior Minister of Denmark). The same Thott was one of the three men responsible for Hell's invitation, according to his own account. Perhaps Bugge was the one who proposed Hell as a candidate for the Vardø expedition? There is a regrettable lack of sources to answer these questions. However, Hell's claim, that he had no *commercium litterarium* with anyone in Denmark prior to 1767, is definitely not correct. It is difficult to ascertain whether his claim of having received two previous invitations is exaggerated as well.

Denmark-Norway's reasons for inviting Father Hell to Vardø have been discussed in Sections I.2.3 and II.2.4 above. From the astronomer's perspective, a main reason to accept the invitation must have been that Father Hell, as an expert on the transits of Venus, was well aware of the advantages of being stationed on the northern shores of Lapland in June 1769. He had himself undertaken calculations of the transit, and the region had, after all, been

[32] Not all letters are intact. For a complete list of the letters that have been available for the present study, see Unprinted Sources, 1*a* and 1*b*.
[33] T. Bugge, "Observatio eclipseos lunaris, quæ anno 1768 tempore astronomico die 3 Januarii, tempore autem civili die 4 Januarii contigit, factæ Havniæ", manuscript signed "Havniæ d: 8 Januarii 1768" (KB Copenhagen, MS Thott 822. 4^{o}): "Eâdem Methodô observavi eclipsin lunæ die 24 Februarii anno 1766, quam communem feci cum Clarissimo et Diligentissimo nostri ævi astronomo Windobonensi P. Maximiliano Hell. Celeberrimus hic Vir meas observationes cum suis comparavit, et exinde reperiit Havniam a Wienna Austriæ distare versus occidentem 17^{m}. 27^{s} in tempore" = "I used the same method to observe the lunar eclipse of 24 February 1766, which I shared with the most enlightened and diligent astronomer of our age, Father Maximilianus Hell of Vienna. This highly famous man compared these observations of mine with his own, and found from this comparison that Copenhagen lies 17 minutes 27 seconds in time west of Vienna".
[34] Lomholt vol. I, 1942, pp. 511 & 530, vol IV, 1961, pp. 15-32; Thykier *et al.* vol. II, 1990, 254-257; Kragh 2005, pp. 93-100.

singled out in several recent works of leading French and British astronomers (See Section II.2.4). In fact, going to Vardø would give Maximilianus Hell a central position in the whole project, allowing him to provide the international community of astronomers with observations that would be essential to the calculation of the solar parallax. Furthermore, his choice of going to Vardø would not preclude Hell from his role as a theoretical astronomer; it would only strengthen his position, in fact. The combination of having personally obtained an important observation of the transit, and then drawing on that experience in the calculation of the parallax, was likely to enhance the authoritative character of his work – and promote his career.

As a networker, however, Father Hell would be precluded from wielding his habitual influence by going to Vardø. This is illustrated by a letter from one of the colleagues he used to offer advice in matters of astronomy, the Jesuit professor Franciscus Huberti (1715-1789) in Herbipolis (Würzburg). At the time Hell was about to leave for Vardø, Huberti was renewing his observatory and needed the Imperial Astronomer's advice in this process. However, Father Hell embarked upon his expedition without leaving any instructions to his confrère. This situation is probably behind Huberti's remark in a letter to the Jesuit astronomer Franciscus Weiss in Tyrnavia, dated 10 December 1768:[35]

> Father Hell has promised to send me some day an instruction for the correct adjustment of the meridian line, but who will turn to a man who, as a citizen, is dead (*virum civiliter mortuum*)?

As of December 1768, Hell was in Vardø, and it is probably this Huberti alludes to when describing the court astronomer as a *vir civiliter mortuus*. From a continental-European Jesuit's point of view, Father Hell was perhaps temporarily "dead". But he was far from idle. The next section will describe how he planned and conducted his observations in Vardø during 1768/69.

[35] Huberti to Weiss, dated 10 December 1768 (printed in Vargha 1990, p. 72): "Pollicitus est R. Pater Hell, se aliquando artificium construendae ad amussim lineae Meridianae traditurum: at quis recurret ad virum civiliter mortuum?" The information that Huberti constructed his observatory in 1768 is given in Lalande 1792, p. xxxix: "En 1768 on a bâti un observatoire à VURTZBOURG, […] sous la direction du P. Huberti" = "In 1768, an observatory was built in Würzburg, […] under the direction of Father Huberti".

II.3.2 FATHER HELL'S DETERMINATION OF THE COORDINATES OF HIS OBSERVATORY AND OBSERVATION OF THE VENUS TRANSIT IN VARDØ

The organisers of Hell's expedition offered him a generous pick of instruments to bring to Vardø from Copenhagen's Rundetårn ('Round Tower') observatory. Among these were an astronomical clock made by Julien Leroy (1686-1751) in Paris, a ten-foot telescope of Dollond's making and a three-foot quadrant made by Johannes Ahl in Copenhagen.[36] A piece of particular symbolic value was a two-foot traveller's quadrant that had originally been made by Johann Tobias Mayer (usually referred to as Tobias Mayer, 1723-1762) in Göttingen. This instrument now belonged to Mayer's former student Carsten Niebuhr, who had used it during his famous expedition to the Near East in the years 1761-67.[37] Furthermore, Hell brought with him a temperature-compensated pendulum clock made in Vienna by his observatory assistant Antonius Pilgram as well as achromatic telescopes 8½ and 10½ feet long, also made in Vienna.[38] Essential to his time keeping was a six feet high gnomon used to determine the local meridian line and the Sun's transit through the meridian.[39] All these instruments were used for the determination of the longitude and latitude of Vardø as well as for the observation of the Venus transit itself.

Shortly upon arrival in Vardø in October 1768, Hell started constructing his modest observatory, as an annex to the house that he was offered during his stay. The construction consisted of two small rooms, *observatoriola* (or "small observatories"), with hatches in the roof and walls for observations of the sky. The two small observatories faced north and south respectively. In the middle, between the northern and southern observatory, was a small laboratory. Soldiers from the local garrison, Vardøhus Fortress, were hired to take care of the construction process. By Christmas, the building was finished, and Hell unpacked his instruments and started mounting these in early January.[40] The rest of this section will describe how Hell determined the longitude and latitude of his observatory, and how the Venus transit observation was undertaken.

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36 Hell 1770*a*1, pp. 5-6. Ahl's name is misspelled "Aal" by Hell.

37 For Niebuhr's expedition, see Section II.2.3 above. More on the quadrant below.

38 Hell 1770*a*1, pp. 6 & 71; Hell's MSS "Observationes Astronomicæ et Cæteræ Jn Jtinere litterario Viennâ Wardoëhusium usque factæ" (1768-69) and [no heading, starting with the words] "NB De Horologiis" (1769). See also Thykier *et al.* 1990, vol. II, pp. 252-253.

39 Hell 1770*a*1, pp. 4-5.

40 The best source-based, contextualised study of Hell's stay in Vardø is still Kragemo 1960 (in Norwegian; a German translation was issued by the Tornedalica Foundation in 1997 [not seen]). See also Hansen & Aspaas 2005; Aspaas & Hansen 2007; Aspaas 2008*c* (in Norwegian) & 2008*d*; Voje Johansen 2009 (in Norwegian), with references found in those works.

As explained in Section II.1.2 above, the determination of the exact coordinates of all observational sites was of crucial importance to the Venus transit project. Maximilianus Hell planned to determine the *longitude* of Vardø by various means. In addition to a solar eclipse that was expected around midday on 4 June 1769, he intended to make use of occultations of satellites of Jupiter; a lunar eclipse that was to take place 23 December 1768; occultations of fixed stars by the Moon; and transits of the Moon through the meridian compared to the positions of stars. Accordingly, he contacted Wargentin beforehand, asking him to provide corresponding data sets from Sweden.[41] In Vardø, however, all these attempts failed, partly because of the high southern declination of Jupiter, partly because of overcast weather. The only feasible data Hell obtained were those of the solar eclipse that took place the day after the transit, as well as the observation of the transit itself.[42] However, use of the Venus transit data for the purpose of determining the longitude would only be of indirect value, as a crosscheck after the solar parallax had been calculated. At the time Hell wrote his Venus transit report from Vardø, this was far too early, since only European observations had reached him by then.[43] As for the solar eclipse, this was obviously followed closely not only by Father Hell and other astronomers on Venus-transit expeditions across the world, but also by staff at all the high standard observatories of Europe. For observing the eclipse, Father Hell used the 8½ feet long telescope, and Sajnovics the 10½ feet. According to Hell's report, the two astronomers determined the end of the eclipse as identically as could be done, only a single second differing between them.[44]

Having returned to Copenhagen in the autumn of 1769, Hell was able to determine the longitude of Vardø by means of corresponding observations of the solar eclipse of June 1769 provided by Maskelyne in Greenwich, Messier in Paris, Christian Horrebow and assistants in

[41] Hell to Wargentin, dated Copenhagen 30 June 1768 (CVH Stockholm): "Rogatum Te volui, ut hoc meum propositum cum Collegis et Correspondentibus Tuis commune facias, quo observationes suas astronomicas cumprimis ad longitudinem geographicam pertinentes satellitum [Jovis], Eclipsium ʘ et [Lunæ], occultationum fixarum à [Luna], aut transituum [Lunæ] per meridianum comparatorum cum fixis instituere, et mecum communicare dignentur" = "I would like to ask You to make known to your colleagues and correspondents this proposal of mine: that they care to obtain astronomical observations, especially such that pertain to the determination of the longitude – that is, the moons of Jupiter, eclipses of the Sun and Moon, occultations of fixed stars by the Moon, or transits of the Moon through the meridian compared with positions of fixed stars – and that they show me the kindness of sharing these observations with me". It is likely that Hell asked colleagues at other sites for similar observations, but further letters containing such requests have not been found.
[42] Hell 1770*a*1, pp. 30-31.
[43] Hell 1770*a*1, p. 31.
[44] That is, within a margin of error of ±½ second (cf. Hell 1770*a*1, p. 31). Other observations of the same moment made at identical sites by multiple observers varied up to ±5 seconds (cf. Hell 1770*a*1, pp. 33-42, espec. p. 38).

Copenhagen, Wargentin and Ferrner in Stockholm, Father Christianus Mayer in St. Petersburg, Father Pilgram and the amateur Sambach in Vienna and Father Aman in Ingolstadt.[45] In this way, he found a longitude of $3^h\ 14^m\ 41.8^s$ East of the island Ferro, or $1^h\ 55^m\ 6^s$ East of Paris, corresponding to $2^h\ 4^m\ 27^s$ East of Greenwich.[46] As Hell saw it, however, this was only a preliminary result, for he was still waiting to check his figure on the basis of Venus-transit reports from *America* (which in Hell's parlance included the Pacific).

The site of Hell's observatory is nowadays determined as 31º 6′ 27″, or $2^h\ 4^m\ 25.9^s$ East of Greenwich. This means Hell's initial determination was only 1.1 seconds, or 170 meters incorrect![47] It is important to note, however, that this remarkable accuracy resulted from a bit of luck as well as excellent observational and calculating skills. With the data at hand, Hell might as well have opted for, say, $2^h\ 4^m\ 24^s$ or $2^h\ 4^m\ 29^s$. It would still have been a very good determination by eighteenth-century standards.[48] For the determination of the *latitude*, Hell used a more unusual method, which merits some consideration.

There was a widespread notion in contemporaneous astronomy that the atmosphere in the north was thicker and the refraction greater than in for example Paris, where the best tables of refraction had been made.[49] Consequently, Hell was puzzled how to test the accuracy of his quadrants as well as the geographical position of his observatory. His choice was to use a selection of pairs of stars culminating in the same zenith distance, one in the north and the other in the south. In this way, any influence of a thicker atmosphere was eliminated:[50]

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[45] Hell 1770*a*1, pp. 33-45.
[46] Hell 1770*a*1, p. 50 (mentioning only Ferro and Paris). I am indebted to Truls Lynne Hansen for figuring out the Greenwich value.
[47] I am indebted to Bjørn Geirr Harsson and Truls Lynne Hansen (pers.comm.) for this determination.
[48] I rely on Truls Lynne Hansen (pers.comm.) for this assessment.
[49] See for example Heinsius, "De Refractionibus in Oris Septentrionalibus" 1761, where the author begins his discussion by stating that he finds it logical that the refraction be greater in the North than close to the Equator, but concludes by affirming that this is not the case. Also Hell admits that he was convinced that the refraction would be greater in Vardø than in Paris, and explains that his wish to examine the as-yet unexplored degree of refraction at the 70th latitude was the main reason for him to spend the winter in Vardø (Hell 1770*a*1, p. 17): "Quod maximi momenti dubium inter cetera hyemem Wardoëhusii exigendi motiva præcipuum erat omnino" = "This doubt, of the utmost importance, was certainly the most important among the motives leading me to spend the winter in Vardøhus".
[50] Hell 1770*a*1, pp. 7-29; here pp. 10-11: "In methodo enim ordinaria fixæ sumuntur quævis, sub aliis scilicet altitudinibus ad austrum, aliis ad boream culminantes, in qua methodo necesse omnino est, ut refractio aeris determinata, & præcise nota habeatur. Secus se habet in mea methodo: nam, cum in mea methodo fixæ seligantur, quæ sub eadem altitudine tam ad austrum, quam ad boream culminant, effectus refractionis, quiscunque is sit, idem omnino esse debet in fixa ad austrum culminante, qui habetur in fixa culminante ad boream, atque adeo, quacunque Tabula refractionis utamur, idem omnino error Quadrantis, aut saltem paucis secundis differens prodire debet". See also Hell's article "Methodus astronomica Sine usu Quadrantis, vel Sectoris, aut alterius cujusvis instrumenti, in gradus Circuli divisi, item sine notitia refractionis, ope solius tubi

> in the ordinary method, stars of no particular position are chosen – that is, some stars culminating at various zenith distances in the south, others in the north. That procedure requires that the refraction of the atmosphere is accurately determined and known to the observer,

Hell explains. “But this is not so in my method”, where “the effect of the refraction, however great or small that may be”, is ruled out. After a long series of observations, of which only an extract is given in the Venus transit report, Hell concludes that the latitude of his observatory in Vardø was 70º 22′ 36″ north.[51]

A more straightforward method of calculating the latitude was to observe the apparent distance of the Sun’s upper limb from the horizon when it reached its highest point at noon. This method yielded data of sufficient accuracy for the needs of ordinary navigation, but not for the delicate calculations of the solar parallax, where each observatory had to be determined as exactly as possible. The method presupposed, for example, that the refraction of the site was exactly known. On his trip back and forth, Hell used this less exact method to determine the latitude of 37 sites between Copenhagen in the South and Vardø in the North. He estimated the degree of uncertainty involved in these measurements to be around ±15″, or for some around ±30″.[52] According to the astronomer Truls Lynne Hansen, who has studied Hell’s descriptions of Niebuhr’s quadrant, 15 arc seconds in the latitude would equal only 0.05 mm on the circle of the quadrant during observation,[53] a fact that makes it hard to believe that Hell’s claim to an uncertainty of only ±15″ is a reliable figure. It may be added that for surveys in central parts of Sweden around the mid-eighteenth century, an uncertainty of ±30″

instructi micrometro filari, singula secunda indicante, et in apto ad hunc usum fulcro mobili applicati, elevationem Poli cujusvis loci, in continente siti, accuratissimam definire” 1774, espec. p. 5.

[51] Hell 1770*a*1, pp. 17-29, espec. p. 27.

[52] Hell 1770*b*, p. 622 (in Danish) = Hell’s MS “Latitudines Geographicæ Locorum Finmarchiæ, Nordlandiæ, Norwegiæ et Sueciæ Observationibus à Maximiliano Hell et Societati Regiæ Scientiarum Hafniensi Oblatæ die 18 May 1770” (1770), fol. 5; Hell 1792, pp. 309-310.

[53] Truls Lynne Hansen (pers.comm.). In Hell 1770*b*, pp. 621-622 = Hell’s MS “Latitudines Geographicæ …” (1770), fol. 4, and in Hell 1790, pp. 308-309, the radius of the quadrant is stated to be two feet: “Den [i.e. Qvadranten] er af to Fods Radius” = “Radius quadrantis duorum est pedum”. The same size is given in a letter from Niebuhr to Franz Xaver von Zach in Gotha, dated Meldorf 9 July 1801 (originally published in Zach’s *Monatliche Correspondenz* IV [1801], pp. 240ff; here quoted from Niebuhr 1968, vol. III, Anhang, p. 3): “Zu Beobachtungen auf dem festen Lande hatte Mayer für mich einen Quadranten von 2 Fuß im Radio verfertigen lassen” = “Mayer had made for me a quadrant of two-foot radius for observations on land”. In a more detailed description in Hell’s MS “Observationes Astronomicæ et Cæteræ Jn Jtinere litterario Viennâ Wardoëhusium usque factæ” (1768-69), p. [1], the radius of the quadrant is said to be *one* foot and two Viennese inches, whereas its tube was 2 feet 2 inches: “Hic Quadrans in radio est I ped. II dig. Vien. defert tubum mobilem 2 ped. 2 dig.”. Probably, “I ped. II dig.” is a slip of the pen for “II ped. II dig.”. In that case, the exact radius of Niebuhr’s quadrant was 2 feet 2 inches, or 26 inches.

was deemed acceptable, whereas Hellant in his surveys of Lapland argued that ±1′ must suffice.[54]

It would have been interesting to learn whether Hell tested the two methods comprehensively against each other in Vardø. However, neither his Venus transit report nor his subsequent treatises on the solar parallax give any evidence of this.[55] The question is whether he actually did so. In order to answer this question, we need to look into the letters of Hell and Sajnovics, the travel diary of Sajnovics and other surviving manuscripts from the Vardø expedition. (The term "pole height" used below means geographical latitude.)

In a letter to his replacement at the Vienna University Observatory, the above-mentioned Father Pilgram, dated 12 November 1768, Hell says that upon his arrival in Vardø 11 October, [56]

> my first wish was to acquire a preliminary knowledge of the latitude, but I had as yet no suitable place at hand from which to conduct this work; I measured from the entrance hall some altitudes of the Sun at noon, and have […] found the pole height to be between 70º 19′ 30″ and 70º 20′. This result is only preliminary, however, until I determine it accurately by means of observations of the vertical stars.

In a letter to Chr. Horrebow, also dated 12 November 1768, he mentions the same result, adding that it was the travellers' quadrant of Niebuhr that had been used for this measurement.[57] In various other letters from Vardø, dated from November 1768 to January

[54] Cf. Widmalm 1990, p. 79.

[55] Admittedly, Father Hell mentions an initial result of 70º 20′ for the pole height in a more elaborate treatise on his method of calculating the latitude, but gives no details as to whether he cross-checked this result with other solar observations later in his stay in Vardø (Hell 1774, p. 31).

[56] Hell to Pilgram, dated Vardø 12 November 1768 (quoted from Pinzger 1927, p. 10): "meine erste begirde war, die Pollhöhe von Wardoëhus beyläufig zu wissen, ich hatte aber noch keinen bequemen orth zu dieser arbeith; ich mass doch im Vorhause einige mittägige Sonnenhöhen, und habe […] die Pollhöhe gefunden zwischen 70º 19′ 30″ und 70º 20 minuten, sie ist aber nur beyläufig, bis ich selbe durch Vertikal-sterne genau bestimmen werde […]".

[57] Hell to Chr. Horrebow, dated Vardø 12 November 1768 (quoted from Pinzger 1927, p. 32): "Alhie habe ich auch vorläuffig und beym gleichen die Pohl höhe gemessen, allein theils aus mangels des orths zum observiren, denn ich observirte nur im Vorhofe, wo der Quadrant auf dem nicht recht festliegenden bodenbrettern stunde, theils weil die mittags Sonne schon sehr nieder stunde, nur 4 bis 5 grad hoch, mithin die Pariser Refraktion Tabell in dieser höhe unrichtig, in solchen umständen die Pohl höhe nur beyläuffig zu wissen, so habe ich Selbe durch 4 mittägige Sonnen höhen und eine des Fixstern Altair im Adler culmination gefunden zwischen 70º 19′ 30″ und 70º 20′ beyläuffig […]" = "I have here [in Vardø] also measured [the pole height] preliminary and with the same instrument [i.e., Niebuhr's quadrant]. However, partly because of the lack of a proper place to observe from – for I observed in the forecourt [*sic*], where the quadrant rested on the not entirely fixed wooden floor – partly because the midday sun was already quite low, only four or five degrees high […], I have found it, by

1769, Hell speaks of a latitude of 70º 20′, but without explaining the methods used for this determination.[58]

The diary of Sajnovics gives additional information on the first attempts to determine the latitude of Vardø. In the entry on 14 October, it is said that:[59]

> The quadrant of Niebuhr was mounted, since clouds full of snow came in intervals and gave us reason to hope for a view to the Sun. The complement of the altitude of the [upper] limb of the Sun was 78º 28′ 30″, giving a pole height of 70º 26′, [which is only] an approximation, because clouds disturbed the observation.

The entry on 16 October 1768 tells that "a wind from SSW melted the snow completely and brought back the serenity in the sky. The complement of the altitude of the Sun's upper limb was 79º 9′ 0″".[60]

Finally, on 18 October, Sajnovics says: "I have observed the altitude of the Sun, which gives a pole height of 70º 20′".[61]

Other entries in the travel diary demonstrate that further attempts to measure the latitude were made as late as 25 October and 5 November, but then the subject is dropped and never mentioned again in this text.[62]

means of four Sun heights at midday and one culmination of the star Altair in the Eagle, to be approximately between 70º 19′ 30″ and 70º 20′".

[58] Hell to Gunnerus in Trondheim, dated Vardø 12 November 1768 (Pinzger 1927, p. 26); Hell to Mercier in Copenhagen, dated Vardø 15 January 1769 (WUS Vienna, relevant part of letter not included in Pinzger); Hell to Chr. Horrebow in Copenhagen, dated Vardø 15 January 1769 (ditto). Cf. Sajnovics to Splenyi in Tyrnavia, dated Vardø 14 November 1768: "Jnsula Wardoë sub elevatione Poli 70. 20. circiter sita est" = "The Vardø Island is situated at a pole height of approximately 70º 20′".

[59] Sajn.s diary, 14 October 1768: "erectus quadrans Nyburgianus, cum nivosæ nubes per intervalla Venientes spem solis videndi fecerint. Observatum complementum alti: limbi ʘ superioris fuit 78. 28. 30. unde Elevatio poli 70º. 26′. circiter ob nubes nempe intercurrentes Observationi".

[60] Sajn.s diary, 16 October 1768: "Ventus S.S.West. nives penitus solvit. et serenitatem cœlo revexit. Compl: Alt: Lim[:] ʘ super. 79º. 9′. 0".

[61] Sajn.s diary, 18 October 1768: "accepi altitudinem ʘ. ex qua Elevatio poli. 70º. 20."

[62] Sajn.s diary, entries 25 October and 5 November 1768. Further accounts of solar observations in the diary seem not to be concerned with the pole height at all. Thus, observations 19 and 20 November 1768 and 19 and 21 January 1769 are related to the length of the polar night; observations 10, 18, 19, 20, 22, 23 and 24 April 1769 are concerned with efforts to establish a meridian line for observations of the magnetic declination (a correct meridian line was a prerequisite for this activity, which started 27 April, cf. Hansen & Aspaas 2005, p. 16); 27 May, 3 and 4 June 1769 concern the time keeping during the Venus transit and solar eclipse; 17 June 1769 on the refraction of the atmosphere (see also footnote 65 below).

Hell's manuscript 'Astronomical and Other Observations made during the Scientific Journey from Vienna to Vardø' (the "astronomical notebook") gives additional information.[63] Here, Hell records even more observations of the Sun than those that are found in Sajnovics' diary, and what is more, the observations are accompanied with calculations and sometimes even theoretical deliberations. The conspicuous difference between the preliminary results of November 1768 and the final conclusions in the printed report – from approximately 70º 20′ or even 70º 19′ 30″, to 70º 22′ 36″ – is explained by the error of the quadrant, which had not yet been determined in the autumn.[64] Thus, when Hell in his notebook on 16-18 October 1768 records observations giving pole heights ranging from 70º 20′ 26″ to 70º 21′ 12″, ending with a mean value of 70º 20′ 25″ (sic), he has added in a slightly different ink, *+1 30 error Quadr.*, and concluded that the pole height should be 70º 22′ 55″. Of course, 70º 20′ 25″ plus 1′ 30″ does not give 70º 22′ 55″, but 70º 21′ 55″. Neither figure is, however, too far from that of 70º 22′ 36″, which ultimately appeared in the Venus transit report. The difference between the 70º 20′ 25″ in the astronomical notebook of October 1768 and the approximate value of 70º 19′ 30″ or 70º 20′ in the letters of November and January suggests that Hell initially believed his quadrant's error to be about -30″, instead of +1′ 30″ (or even +2′ 30″). To judge from the astronomical notebook, no further efforts to measure the pole height by means of the sun were made, not even in late May or June, when the sun was available day and night and the stars were in any case invisible.[65]

In conclusion, there is nothing in the sources to indicate that Hell bothered about the latitude any more after he had determined it by means of observations of stars during the winter and early spring of 1769. I have no good explanation as to why Hell apparently never undertook a comprehensive, comparative study of the pole height yielded by observations of the Sun versus that yielded by the stars.

[63] Hell's MS "Observationes Astronomicæ et Cæteræ Jn Jtinere litterario Viennâ Wardoëhusium usque factæ" (1768-69).
[64] Hell's MS "Observationes Astronomicæ …" (1768-69): "factæ item Sunt quadrante Domini Nieburg, qui examinandus est deinceps" = "[these observations] were also made with Mr Niebuhr's quadrant, which needs to be examined later".
[65] Further observations of solar heights recorded in the astronomical notebook are not concerned with the pole height. Thus, solar observations recorded 19-21 November 1768 and 19-21 January 1769 contain deliberations concerning effects of the refraction upon the length of the polar night; various observations from 24 January to 18 March 1769 are either implicitly or explicitly undertaken in order to determine refraction; observations are conducted from 10 to 26 April 1769 in order to establish a correct meridian line for observations of magnetic declination; observations from 29 April to 9 June 1769 are evidently made in order to test the running of the clocks; and finally, observations in the night between 17 and 18 June 1769 have the additional aim of checking the refraction (the Midnight Sun being very low above the sea level, this was a convenient crosscheck against the results obtained from observations of stars made earlier in the year).

Incidentally, Hell's final conclusion concerning the latitude of his observatory – 70º 22′ 36″ – is today found to be somewhat more inaccurate than his determination of the longitude. According to Bjørn Geirr Harsson at *Statens Kartverk* ('Norwegian Mapping and Cadastre Authority'), the astronomical latitude should be 70º 22′ 15.5″ N, that is, 20.5 seconds, or 632 meters further south than Hell's figure. It is important to note, however, that this modern value depends on a more accurate knowledge of the curvature of the Earth's surface than that which existed in the eighteenth century.[66] An overall examination of Hell's activities as a surveyor during his expedition, with assessments of his results in the light of the history of Nordic geodesy, is a desideratum.[67]

In any case, Maximilianus Hell felt that he had safely determined the latitude of his observatory, when the third day of June 1769 approached. The running of the clocks had already been tested for weeks, and the frequency of these tests was intensified in the last days before the transit. Ideally, such tests involved observations of the Sun as it passed the meridian in the South at noon and the meridian in the North at midnight. The transit was going to take place when the Sun was in the North, meaning that the northern room of his observatory (the *observatoriolum septentrionale*) would be used for this crucial observation. Having checked the time keeping at twelve o'clock in the day, Hell had to move his instruments over to the northern chamber in the afternoon of 3 June in order to be prepared for the transit of Venus. By the next morning – 4 June – at least two of his telescopes must have been moved back again, as these were used to observe the eclipse of the Sun, which took place between 9:22 and 11:22 am, and would only be visible from the *observatoriolum australe*.[68]

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[66] Bjørn Geirr Harsson (pers.comm.). The astronomical latitude, observed by Hell, is related to the plumb line at the station, whereas the latitude obtained from a GPS receiver is related to the normal at the ellipsoid. "The angle between the plumb line and the vertical of the ellipsoid is called the deflection of the vertical," Harsson explains. "In Vardø the geoid is tilting to eastnortheast, which means that the deflection of the vertical has a component in direction north, even if the main component is in direction east. The north component of the deflection of the vertical is computed to be 2.5 second of an arc at today's post office in Vardø. So if 2.5″ is added to the GPS-latitude, the two latitudes can be compared. Hell's latitude was 70º 22′ 36″ and the GPS-latitude is 70º 22′ 13″. If we add the 2.5″ to the GPS-latitude we get 70º 22′ 15.5″. The difference of 20.5 seconds corresponds to a latitude for Hell to be 632 meters north of today's GPS position of the same place" (pers.comm.).

[67] An investigation of the latitude for a single location (in Christiania, now Oslo) by Harsson in 2003 gave a discrepancy of only nine arc seconds, or 270 meters between Hell's determination and the modern value (Aspaas and Voje Johansen 2004*a*, pp. 5-6). It would be futile, however, to conclude much from the examples of Oslo and Vardø alone.

[68] Cf. Hell 1770*a*1, p. 81.

How did Hell and his crew proceed to conduct the *observation of the transit of Venus* around midnight 3-4 June? Of the four contacts of Venus with the limb of the Sun, Father Hell deemed the first exterior contact impossible to observe with anything near the accuracy required. Accordingly, he ordered his assistants Sajnovics and Borchgrevink to be on the look-out for this event "so as to avoid, by this useless staring at the Sun, to weary and weaken my eye, which I wanted to spare for the precise determination of that utterly important, first interior contact".[69] As soon as they had exclaimed that they saw "a sort of black thing" (*rem quampiam nigram*) about to enter the limb of the Sun, Hell placed his eye on the lens of his telescope and estimated, on the basis of the proportion of the disc of Venus that had entered so far, that the real exterior contact probably had taken place some 30 seconds earlier, or 9:14:47 pm according to the Viennese clock. Borchgrevink used the ten-foot Dollond, Sajnovics the 10½-foot and Hell the 8½-foot telescope for this first observation.[70]

Before the interior contact at ingress (which took place some seventeen minutes later), Hell and Borchgrevink switched places. Hell now took charge of the Dollond and left the 8½-foot telescope for Borchgrevink, whereas Sajnovics continued to use the 10½-foot. The statement concerning the interior contact is divided in two: first, Hell records the moment when the Sun and Venus appeared to the three observers to be perfectly round, then, a moment taking place a few seconds later, when "the shining thread of the Sun's limb appears" (*Apparet filum lucidum limbi Solis*). It is the latter of these moments that Hell considers to be the moment of *ingressus totalis Veneris* ("total ingress of Venus"), although he concedes that some observers define the former moment as that of 'real', interior contact. The latter moment was seen by Hell at 9:32:48 pm according to the Viennese clock, and by Sajnovics three seconds earlier. The amateur observer Borcgrevink in his turn saw it 35 seconds earlier than Sajnovics.[71] Only some seven minutes after total ingress had been observed, clouds started blocking their view to the Sun, and the sky remained overcast nearly continuously until less than half an hour before egress began. By the time the moments of egress were observed, the sky had again become perfectly clear.[72]

[69] Hell 1770*a*1, pp. 71-72, here p. 71: "Ego, cum contactus primus externus observatu sit impossibilis, ut Supra ostendi, atque adeo nulli fere usui, ne oculum, quem pro summi momenti contactu primo interiore præcise observando conservatum volui, inutili hac solis contemplatione fatigarem, & debiliorem redderem […]".
[70] Ibid.
[71] Hell 1770*a*1, p. 73.
[72] Hell 1770*a*1, pp. 74-75.

The interior contact of egress is described by Hell somewhat different from that of interior contact of ingress. Here, Hell speaks of the *gutta nigra* (“black drop”), which starts forming some eleven seconds before it “in an instant disappears, and so-to-speak bursts, and the limbs of the Sun and Venus flow together as one”.[73] Hell and Sajnovics had, according to Hell’s account, determined this moment only a single second apart – at 3:26:17 and 3:26:18 am respectively according to the Viennese clock – whereas Borchgrevink noted what he simply called “the interior contact” (*contactus interior*) at 3:26:10 am.[74]

The moment of total egress was, according to the same account, encumbered with some uncertainty. However, it was observed by Hell, Sajnovics and Borchgrevink within a range of seven seconds, the moment expressly stated as *egressus certus* (“certain egress”) being recorded by Sajnovics and Hell only a second apart – at 3:44:26 and 3:44:27 am, Viennese clock.[75]

The above extract is based upon the printed report alone. Moreover, it does not render justice to the intricate theoretical deliberations accompanying the data. The account of the observation itself is found very near the end of the 82-page report, after an elaborate account of instruments used, procedures followed in the testing of the clocks, definitions of “true” and “optical” contacts, the black drop effect and so forth (See Table 5). This feature of Hell’s report is – to the best of my knowledge – unparalleled in all other Venus-transit reports of the year 1769; no other observer produced a first edition of his observation that included such long and intricate theoretical discussions. But where theory and detail might be an advantage in a report of such momentum, the time consumed in writing and publishing it was not. Father Hell took his time when travelling back to Copenhagen, which he reached only on 17 October 1769. Here, during three sessions at the Royal Society – 24 November, 1 and 8 December 1769 – he presented his report on the Venus transit observation from Vardø.[76] He also had an audience with King Christian VII on 29 November, during which he obtained permission to dedicate the printed version of the report to His Majesty.[77] The printing process took its time,

[73] Hell 1770*a*1, pp. 75-76, here p. 76: “Gutta hæc momentanee disparet, & veluti diffluit, limbusque Solis & Veneris in unum confluunt […]”.
[74] Ibid.
[75] Ibid.
[76] Sajnovics, travel diary 1768-70 (WUS Vienna), entries on 24 November, 1 and 8 December 1769; the protocol of the Royal Danish Society of Sciences (KDVS Copenhagen), entries 24 November, 1 and 8 December 1769.
[77] Sajnovics, travel diary 1768-70 (WUS Vienna), entry 29 November 1769: “Rogante R^{do} P. Hellio ut Observationem transitus Veneris typis exscribendam Suo Regio Nomini dedicari pateretur reposuit. *Wird mir lieb seÿn*”

however, and not until 8 February 1770 could Father Hell present a copy of the work to its dedicatee.[78] Immediately afterwards, copies were distributed to learned societies and individual savants abroad.[79]

During the eight months of secrecy in-between observation and publication, no foreign astronomer had been allowed to inspect the data sets from Vardø. This caused suspicion and even anger amongst some of his colleagues abroad. It is the implications of that atmosphere of suspicion and anger that are the subject of the next sections of this chapter.

= "When Reverend Father Hell asked him if he would allow the *Observatio Transitus Veneris* that is going to be printed, to be dedicated to His Royal Name, the King answered: 'That will be a pleasure to me'".

[78] Sajnovics, travel diary 1768-1770 (WUS Vienna), entry 8 February 1770: "Circa 4^am^ ad Regiam itum. Circa 5^am^ [5a *MS*] Augustissimus Rex portam aperuit. R^dus^ P. Hell Ei exemplar unum Observationis obtulit. acceperat illum perquam benigne, modiceque inspexit. Tum Sermonem quasi ad ½ horam protraxit de aurora Boreali, de decrescentia Maris, de Jdiomate Ungarorum [Ungarom *MS*] et Lapponum &ce: Verba faciens, imo etiam de quadratura Circuli. Apparebat ex omnibus, eum de laboribus Hellianis valde bene instructum fuisse. atque luculenter ostendit, Exspectationi Suæ, Ceterorumque abundanter esse Satisfactum" = "Around 4 o'clock we went to the palace. At about 5 o'clock His Highness the King opened the door. Honourable Father Hell offered him a copy of the *Observatio*. He accepted it very generously and inspected it for a while. Then he kept talking for about half an hour, mentioning the Northern Light, the decrease of the sea level, the language of the Hungarians and the Lapps, etc., and finally, the quadrature of the circle. It emerged from all this that the King had been quite well informed concerning the works of Father Hell. He also demonstrated quite clearly that His own as well as the others' expectations had been amply fulfilled".

[79] Hielmstierne to J.A. Euler in St. Petersburg, dated 9 February 1770 (RAN St. Petersburg); Hielmstierne to Wargentin in Stockholm, dated Copenhagen 10 February 1770 (CVH Stockholm). These examples corroborate a claim made by Hell in the "De Parallaxi Solis…" 1772, p. 110, that his Venus-transit report was published in Copenhagen 8 February and distributed by the post "to all academies" the next day: "Vera sunt […] ipsa die 8. Haffniæ vulgatam, dieque sequente 9. Februarii typis Haffniæ editam dissertationem cum orbe Astronomico illico communicandam *ad omnes Academias* per Tabellarios transmissam" (my italics).

TABLE 5 THE CONTENTS OF THE VARIOUS EDITIONS OF HELL'S *OBSERVATIO TRANSITUS VENERIS ... WARDOËHUSII ... FACTA.*

1770*a*1 = 1st Latin edition (Copenhagen, 8 February 1770)

1770*a*2 = 2nd Latin edition, in *Nova Acta Eruditorum*, issues Jan-Feb-Mar 1770 (Leipzig)

1770*a*3 = Danish translation, in *Skrifter Kiøb.*, vol. X (Copenhagen, summer/autumn 1770)

1770*a*4 = 3rd Latin edition, appendix to *Eph.Astr.* for the year 1771 (Vienna, autumn 1770) *

1793 = German translation in *Beyträge*, vol. III (Wrocław & Jelenia Góra, 1793)

* The same edition was also distributed as a separate booklet, presumably with identical pagination (Vienna, Trattner [not seen]).

	1770*a*1	1770*a*2	1770*a*3	1770*a*4	1793
Dedication to the King of Denmark and Norway	[i-vi]	*missing*	*missing*	*missing*	*missing*
Editor's preface	*missing*	1-2	*missing*	*missing*	*missing*
Hell's preface "To The Astronomers"	[1]-7	2-8	527-543	1-8	[173]-182
"Test of the Quadrant from Copen-hagen"	7-15	9-21	543-551	9-18	183-200
"Errors of the Quadrant Defined by Observations"	16-17	22-23	552-553	18-19	200-202
"On the Latitude, or Pole Height of the Vardøhus Observatory"	17-29	23-37	553-565	19-33	202-218
"On the Longitude, or Difference of Meridian of Vardøhus"	30-50	38-66	566-587	34-58	219-255
"On the Method of Observing the Optic Contacts in the Transit of Venus in front of the Sun's Disc"	51-61	67-79	587-597	58-71	256-272
"Observations of 2nd, 3rd, and 4th June Pertaining to the State of the Clock"	61-69	79-87	597-604	72-81	273-285
"Observation of the Transit of Venus in front of the Disc of the Sun on 3rd June"	69-80	87-100	604-616	81-94	285-304
"Observation of the Eclipse of the Sun on 4th June, during Clear and Quiet Weather"	81-82	101-102	617-618	95-96	304-306

II.3.3 THE PUBLICATION OF THE VARDØ REPORT, UNDULY LATE?

As already explained (Section II.1.2), most astronomical data sets are useless if they are not compared with corresponding observations from other sites. This situation was true, to an extreme degree, as far as the Venus transits were concerned. This was the last chance for more than a century to provide data sets for the determination of that coveted measure, the solar parallax. And in 1769, data sets from the High North of Europe were, along with corresponding ones from the southern Pacific, more precious than observations from anywhere else in the Old World. Sajnovics' travel diary gives an idea of the suspense felt when the important day arrived:[80]

> *3^{rd} June, Saturday. This day was the cause and origin of our Expedition.* Although the sky had been totally overcast yesterday evening, around 3 o'clock the clouds spread sufficiently to make the Sun distinctly visible, before the sky again was covered by clouds. Around 4 o'clock, after the mass, these clouds disappeared and the clearest of skies appeared, allowing the altitudes [of the Sun] to be recorded. Bands of clouds, purely white and very similar to Northern Lights, were drifting in various directions, by a gently breeze arriving from the North at first, then from the West and South, until it around 11 o'clock [am] turned to the East before returning to the South soon after, only to arrive from the West at 1 o'clock [pm]. The culmination of the Sun in the meridian line was recorded, and after lunch corresponding heights were observed. Around 3

[80] Sajn.s diary, entry on 3 June 1769 (WUS Vienna): "Junius dies 3^{a}. Sabbathum. Hæc fuit Causa et Origo Expeditionis nostræ. // licet heri Vesperi Cælum totum obductum fuerit. ita tamen nubes dissipatæ sunt, ut hora 3^{a} sol. distincte videretur. dein nubibus Cælum iterum obductum. circa 4^{am} post sacra dicta, nubes hæ disparuerunt et serenissimum [*scripsi;* serenissinum *MS*] Cœlum apparuit. Unde altitudines acceptæ. Nubium tractus albissimi et Luci boreali simillimi hinc [*scripsi;* hin *MS*] inde ferebantur, Ventulo primum Nord tum West. ac Sud spirante, qui circa 11^{am} versus in Ost brevi per Sud redivit, ita ut hora 1^{a} a Vest spiraret. Culminatio solis in linea meridiana obtenta est. post prandium Correspondentes acceptæ. sub quarum finem nempe hora 3^{a} Cœlum totum Obductum Nubeculis candidis et dissociatis[.] horizon Boreus et Australis erant sat mundi adhuc. Ventulus spirat à S. West. paulo post ex Sud Vest venere nubes copiosæ ita, ut studiosus Burgreving non potuerit exerceri, in sole Observando usque ad horam 6. tum interdum emicuit sol et observare instructus est. Eædem nubes continuarunt usque ad 8[.] post 9^{am} horam 3 tubos in solem direximus qui per intervalla e nubibus emicuit. denique tali loco sole existente, exterior et interior contactus observatus est, DEO singulariter favente. Mercator. tormenta sua Novem explosit, et Vexillum pro signo letitiæ appendit [*scripsi;* eppendit *MS*], Exemplum ex parte secutus Comendans Vexillum in fortalitio exponi fecit. Admissi ad observatoria Hospites, ijsque Venus in ʘ ostensa sed nec 5 minutis eam videri, cum atris nubibus sol obtectus est. nec ulla positio per spatium 6. horarum (incredibile! sed tamen verum!) accipi poterat. de exitu Videndo omnes eramus solliciti, sed nemo spem habebat ob nubes atras et Cælo quasi affixas in eo loco ubi [è Sole] egredi debuisset. circa 3^{am} horam matutinam Ventus Sud Ost potens incepit, et nubem quæ solem texerat deturbavit de statione, unde. Contactus interior et exterior ♀ benè observata sunt. iterum Mercator tormentula sua tria sexies explosit. solatium imane erat apud Vardœianos omnes. Nos Te DEum Laudamus sincerissimo affectu deprompsimus. et tantisper quieti indulsimus. de Barometro et Acu magnetica nec tempus nec animus cogitandi fuit. // 4. Dom: III post Pentecostis. Dictis de SSS. Trinitate sacris[.] Correspondentes acceptæ Cælo toto Serenissimo, modico nord spirante. Sub quibus. hora 10. 9'. tempore horologij Haffniensis [*scripsi;* Haffiniensis *MS*] animadversum est Ecclipsim solis inchoari. Hanc Observavit R. P. Hell. finem ego etiam. Tum meridies acceptus. post prandium Correspondentes altitudines ʘ. Dum ultimam altitudinem [*scripsi;* altitudo *MS*] adscribo, ecce totus aer plenissimus densæ nebulæ [*scripsi;* nebula *MS*], et roris vel pluviolæ instar in terram deciduæ. quæ dein toto Cœlo æquabiliter diffusa. Caliginem Obduxit nescio quamdiu duraturam. male si heri sic fuisset!"

o'clock, as these operations came to a close, the sky was totally covered by small, white clouds which were not connected with each other. The horizon in the North and South, however, was still rather clear. A gentle breeze blew from the South-West. Shortly afterwards there arrived such a multitude of clouds from the South-West that the student Borchgrevink could not be set to work to observe the Sun until 6 o'clock, when the Sun again broke through the clouds from time to time and he received his instructions for observing. The same clouds continued until 8 o'clock. After 9 o'clock [pm], we directed the three telescopes to the Sun, which broke through the clouds every now and then. And finally, when the Sun stayed in such a place, the exterior and interior contacts [of ingress] were observed, thanks to the singular grace of God. The merchant exploded his gun nine times, and raised the flag as a sign of joy. The commander followed his example, and made sure the flag at the fortress was raised as well. Guests were allowed into the chambers of the observatory, and Venus in the Sun shown to them. But for no more than five minutes was she visible, until the Sun again was covered in black clouds, and no position of Venus – how incredible! but nonetheless true! – could be recorded over the course of six hours. We were all anxious to observe the egress, but no one hoped for this because of black clouds which were glued to the sky, so to speak, in that region where [the planet] was supposed to leave the Sun. Around 3 o'clock in the morning a strong wind from the South-East began, and the cloud which covered the Sun was driven away from its position. Thus, the interior and exterior contacts of Venus were well recorded. Again the merchant fired his gun, this time three times six. A great sense of satisfaction spread among all the inhabitants of Vardø. We burst into a *Te Deum laudamus* with the sincerest of sentiments, and allowed ourselves some rest in the meantime; there was neither time nor the mood to think of the barometer or the magnetic needle.

4th [June], Sunday, the 3rd after Pentecost.

After mass for the Holy Trinity, the corresponding altitudes were recorded in the clearest of skies, with some wind from the North. During these operations, at 10:09 [am] according to the Copenhagen clock, the eclipse of the Sun was noted to begin. Honourable Father Hell observed this moment; and I too observed the end. Then the meridian was recorded, and after lunch the corresponding altitudes of the Sun. As I take down the last of these altitudes, suddenly the entire sky is completely filled by the thickest of fog, falling down to the ground like dew or drizzle, covering everything in a darkness that is likely to last for a very long time. How bad if it had been like this yesterday!

As is regularly the case with Sajnovics' diary, his account makes no attempt to give the details of the observations themselves. Thus, neither the moments of contact of Venus with the limb of the Sun, nor the moments of beginning and end of the eclipse, are stated with anything near the degree of exactitude required. Among the surviving manuscripts, these details can only be found in Hell's 'astronomical notebook'. This crucial set of data was, however, apparently never shared with anyone until the formal report was presented to the Royal Society of Copenhagen. This caution on the part of Hell even included his employer. Thus, when on 5 June 1769 an express letter was sent from Vardø to Thott in Copenhagen, the leader of the expedition revealed nothing except the fact that his observations of both the Venus transit and the solar eclipse had been successful.[81] Sajnovics, for his part, wrote a similar letter to his Jesuit friends in Hungary, where the crucial observations are described thus:[82]

> From 27th May to 3rd June we could not see the Sun because of perpetual clouds, and on the last-mentioned day, after we had recorded its corresponding heights, it disappeared in clouds again. Around 9 o'clock in the evening we – myself, Honourable Father Hell, and the student from Trondheim [i.e., Borchgrevink] – stood at our telescopes, our moods fluctuating between hope and fear as we waited in suspense to see whether it would be possible to observe Venus entering the Sun, if it should happen to dive out from the clouds for a little while. Soon afterwards an opening in the clouds emerged, and we could see the Sun as if through a window, and both contacts of Venus in ingress were elegantly observed. But not more than five minutes passed by, before the Sun again was enveloped in thick clouds and no longer came forth in its entirety. Dark clouds stubbornly accompanied the Sun for altogether five hours; and we had lost all hope of observing the egress. Our hosts stood there with us, sad, their faces in mourning, and expressing by means of utter silence their sorrow and sympathy. How we ourselves felt, is easier to guess than to describe. Our only hope was that God, if he should wish to do so, would come to our aid with some miracle. In the meanwhile, as the time when Venus was supposed to leave the Sun drew closer, the rays of the Sun suddenly began dissolving the extremely thick cloud which stood in their way, finally dispelling it altogether. And behold! The Sun came forth in full splendour, and both contacts of Venus during egress were recorded exactly; with how much joy, with how many thanksgivings to Divine Clemency, I am incapable of expressing. Our hosts, to whom the word 'miracle' is an uncommon, perhaps even ridiculous concept, nonetheless agreed fully that the way in which the appearance of the sky had changed – so neatly and congruously – could not be due to any human or natural cause, but must be ascribed to the utterly exceptional and incredible favour of

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81 Hell to Thott in Copenhagen, dated Vardø 5 June 1769 (Pinzger 1927, pp. 102-103).

82 Sajnovics to Splenyi in Tyrnavia, dated Vardø 6 June 1769 (MagAkad): "A die 27a Maji usque ad 3. Junij solem non vidimus ob perpetuas nubes, hac die postquam correspondentes ejusdem altitudines accepimus, iterum nubes ingressus disparuit. Circa 9am vespertinam stabamus ad tubos ego, R. P. Hell et studiosus Nidrosiensis spem inter et metum præstolantes, si forte paululùm emergente Sole ingredientem Venerem observare liceret. Paulo post apertura in nubibus facta, et Solem quasi per fenestram conspeximus, et utrumque contactum ingredientis veneris eleganter vidimus. Nondum 5. minuta effluxerant, Cum iterum densis nubibus involutus sol non amplius integer prodiit, euntem comitabantur atræ nubes per horas omnino 5. pertinaciter; de egressu videndo plane fuit conclamatum. Stabant hospites nostri juxta nobiscum tristes, et mæsto obtutu, altoque Silentio dolorem et Commiserationem loquebantur. Nobis quid animi fuerit? facilius est Conjectare, quàm scribere. Spes unica in Deo, et quidem si voluerit, miraculose succursuro. Jnterim tempus imminebat, quo Venerem egredi oporteret, cum Radii solis oppositam sibi densissimam nubem dissolvere sensim et tandem plene disjicere Cæperunt. Apparuit luce plena sol, et uterque Veneris exeuntis contactus adamussim observatus est, quanto cum gaudio? quantis divinæ Clementiæ laudibus, non possum dicere. Hospites nostri, quibus miraculi nomen inusitatum, et fortasse ridiculum est, uno tamen ore fatebantur non humanis aut naturalibus Causis, sed singulari prorsus, et incredibili Numinis favori esse referendum, quod hæc Coeli facies ita aptè, atque congruè mutabatur. Ego miraculi magnitudinem, dum vixero, gratus venerabor. Jbat dein per sudissimam Coeli Regionem sol; accuratissimè ecclypsis ejus observata est idem in linea meridiana acceptus. Post prandium mundissimo Coelo correspondentes altitudines iterum acceptæ, quarum ultimam dum adscribo, eodem momento turbo e Septemtrione oritur, teterrimis nubibus Cælum, terras, et maria involvens, neque solem ab illo tempore videre licuit, licèt jam dies 6ta Junij agatur."

the Supreme Being. I for my part will cherish the magnitude of this miracle for as long as I live. The Sun then wandered through a very clear part of the sky, and its eclipse was observed most accurately and its passage through the meridian recorded. After lunch its corresponding heights were again recorded in the clearest of skies, but just as I was busy taking down the very last of these observations, in the same moment a strong wind rose from the North, enveloping the sky, earth, and sea in the darkest of clouds. From that moment onwards, the Sun has not been possible to observe, although it is by now the sixth day of June.

As time passed by, the secretive descriptions became more and more sophisticated. Father Hell's letter to Wargentin, dated Copenhagen 7 November 1769, is a good example:[83]

> I have received Your highly friendly letter, eminent fellow, in which You congratulate me with my successful return from Lapland. I thank You sincerely both for Your friendly affections and especially for the astronomical news and that set of accurate observations of Yours. I am very sorry to learn that Venus has been so unfair in showing herself to all the other observers by the Arctic; it is like a miracle, how she showed herself graciously to me, who very nearly had given up all hope, but in doing so, she offered herself to be seen in such a parsimonious, and almost feminine manner, that apart from all the contacts – that is, her four kisses with the Sun, which she displayed with an uncovered face – she hid herself away with her Apollo behind a thick cloud for almost the entire duration of their rendezvous, as if being shy. I did not mind the clouds much, however, for after the observation of the first interior contact, which took place while the upper limb of the Sun was 6 degrees and 33 arc minutes high, the Sun dropped down closer and closer to the horizon, so that, during its passage through the northern meridian it was barely three degrees above the horizon. Because of the vapours of the horizon, which in this place [Vardø] are extremely dense and fluctuating so close to the horizon, it would in any case have been impossible to determine the position of Venus accurately. The interior contact of egress took place when the Sun was 10º 4′, and the exterior contact when it was 11º 13′ high, and they were observed by me so precisely, and in such clear and quiet atmospheric conditions, that I barely dare to doubt for more than a single second. After egress the sky remained totally clear,

[83] Hell to Wargentin in Stockholm, dated Copenhagen 7 November 1769 (*CVH*): "Redditæ mihi sunt peramicæ Tuæ litteræ Vir Celeberrime; quibus reditum mihi è Lapponia gratularis felicissimum. gratias habeo maximas tum pro amico hoc affectu Tuo, tum cumprimis pro communicatis novis Astronomicis, Tuisque observationibus accuratissimis; Plurimum doleo, Venerem Cæteris omnibus ad Arctos observatoribus se adeo iniquam exhibuisse; miraculo simile est, quod se mihi propemodum desperanti, propitiam exhibuerit, adeo tamen avarè, et prope fœmineo modo, se conspiciendam præbuit, ut præter Contactus omnes, hoc est, oscula quaterna Soli vultu sereno exhibita, toto fere tempore congressus, veluti pudibunda cum Apolline suo densam intra nubem se se condiderit; Nec multum tamen indignabar nubibus; nam cum post contactum primum interiorem Limbo solis superiore 6 grad. et 33′. alto, observatum, sol magis et magis ad horizontem inclinaret adeo, ut tempore transitus per Meridianum boreum vix tribus supra horizontem emineret gradibus, ob vapores horizontis hic loci in tanta horizontis vicinitate admodum spissos, et agitatos, nulla certa positio Veneris obtineri potuisset; Contactus interior in egressu limbo solis alto 10º. 4′. et in contactu exteriore gradibus 11 et 13 m. Cœlo serenissimo, et quieto adeo præcise à me observatus est, ut vix de uno secundo dubitare audeam; Post egressum Veneris cœlum mansit Sudissimum sine ulla nube ad horam usque mediam quartam pomeridianam diei 4 Junij; Unde et correspondentes, et Eclipsim solis, et solem in linea mea Meridiana sex pedes alta, accuratis observationibus obtinui".

> without a single cloud until 3:30 pm on 4 June, allowing me to accurately observe both the corresponding heights and the solar eclipse, and the Sun on my six feet high meridian line.

Let those examples suffice to illustrate the flourishing, but artfully covert wording used by Hell and Sajnovics when they described their observations prior to February 1770. A question that needs to be addressed is whether the publication was really unduly late. And if so, was Father Hell in any way personally to blame for the problems that he incurred? In order to assess this problem, it is necessary to employ a comparative perspective, both with regard to the year 1761 vis-à-vis 1769, and the conduct of the Royal Society of Copenhagen vis-à-vis various national scientific bodies.

As of 1761, Maximilianus Hell was a newcomer on the international arena. He had only recently begun expanding his network of correspondents outside the Jesuit circles of the Habsburg lands. In doing so, he followed the work instruction that he had received when being appointed Imperial and Royal Astronomer (See Section I.2.2). As a corresponding member of the *Académie Royale des Sciences* of Paris (appointed December 1758), he shared theories and observations with several colleagues in that stronghold of theoretical astronomy (Section II.1.3). Not surprisingly, he sent the details of his Venus transit observation to Paris by letter less than a week after the event in 1761.[84]

This way of sharing ideas and data sets was in harmony with the ideals of the *Res publica litteraria*. It also fitted well to the self-esteem of the astronomers of Paris, who considered themselves the natural coordinators of international programs such as the transits of Venus.

In the run-up to 1769, *Jérôme de Lalande* emerged as the leading figure in the Venus transit enterprise.[85] As the elderly Delisle retreated, Lalande was issuing memoirs, offering personal advice and placing orders at the instruments makers' on behalf of academies and individuals in various countries. It is illustrative how he advised the Imperial Academy in St. Petersburg on how to proceed, and offered to send one of his students to preside over the observations at

[84] See Aspaas 2010, pp. 133-137 (with a facsimile of Hell's letter to Lalande, dated Vienna 12 June 1761 on pp. 136-137). The observations of Hell were soon shared amongst the astronomers of Paris, who in turn communicated them with colleagues across Europe long before they had been printed (see for example the letter from Lacaille to Tobias Mayer in Göttingen, dated Paris 28 June 1761, published in Forbes & Gapaillard 1996, p. 538).

[85] See for example Pecker 1998; Dumont 2007, pp. 36-43.

the official observatory of that academy. Lalande also kept an assiduous correspondence with fellow astronomers in Sweden and England in this period.

Not surprisingly, Lalande received news from all over the world in the weeks and months after 3 June 1769. Thus, thanks to his close contacts with astronomers on the other side of the Channel, Lalande received all British observations and summarised them in the *Journal des Sçavans* long before they were printed in the *Philosophical Transactions*.[86] Similarly, the Imperial Russian Academy extracted the Venus-transit observations from the expedition diaries of its observers, printed them immediately, and sent them to Lalande. And by mutual agreement, its secretary – Johann Albrecht (Jean Albert) Euler – received news of French and British observations from Lalande in return.[87] Furthermore, Wargentin in Stockholm summarised all Swedish (including Finnish) observations in letters to Lalande soon after the transit had taken place.[88]

No comparable agreement existed between Lalande and the Royal Society of Sciences in Copenhagen – quite the contrary, in fact. Hell's refusal to share his observations with anyone else, as explained in his letter to Wargentin quoted above, evidently included the academicians of Paris. Despite Hell's status as a corresponding member of the *Académie Royale des Sciences*, with none other than Lalande as his personal contact, no details whatsoever were revealed to Lalande or his confrères until a copy of Hell's *Observatio Transitus Veneris ... Wardoëhusii ... facta* finally reached Paris 4 March 1770, exactly nine months after the transit had taken place.[89] By that time, Lalande had received reports from all over Europe, and even from Hudson's Bay in present-day Canada. The only crucial observations he lacked were a couple of Siberian observations by Lowitz and Islen'ev (published in French in May/June 1770),[90] the observations of Chappe and his companions in

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[86] See *Journal des Sçavans*, Septembre 1769, pp. 644-645; Décembre 1769, pp 835-836; Avril 1770, pp. 227-228 & Décembre 1771, pp. 825-826 (the last being a 'letter to the editors' dated 13 September 1771, in which he explains that he had received the Tahiti observations of Cook's team two days earlier). For a recent analysis of Lalande's contacts with British astronomers, see Fauque 2010.

[87] J.A. Euler to Lalande in Paris, dated St. Petersburg 14 / 26 May 1769 & 8 / 19 September 1769 (RAN St. Petersburg); Lalande to J.A. Euler in St. Petersburg, dated Bourg-en-Breste 26 July 1769 & Paris 12 January 1770 (RAN St. Petersburg).

[88] Wargentin is known to have sent letters to Lalande in Paris, dated 9 June & 11 July 1769 (see the list of outgoing correspondence in Nordenmark 1939, pp. 399-424, here p. 406). It is probably the contents of these letters that appeared in Lalande's "Lettre sur le passage de Vénus; adressée à Messieurs les Auteurs du Journal des Sçavans", published September 1769, p. 645.

[89] According to Hell, *De Parallaxi Solis ex Observationibus Transitus Veneris A. 1769* 1772, p. 92.

[90] On 19 June 1770, J. A. Euler sent to Hielmstierne (secretary of the Royal Society of Sciences in Copenhagen) the two reports, "qui viennent d'être publié tout nouvellement" = "which were published quite recently" (KDVS

Baja California in present-day Mexico (reached Paris December 1770),[91] and those of Captain Cook's crew in Tahiti, in what is now French Polynesia (reached Paris September 1771).[92] For all these cases, there were good excuses for the delay: Lowitz continued his expedition in Siberia for several years until he was actually killed by rioting local inhabitants,[93] and it took a while before the package containing his manuscripts arrived in St. Petersburg; Islen'ev's site of observation had been Iakutsk, almost 8,500 kilometres East of the capital, and even he continued his expedition for a long while before returning to St. Petersburg; Chappe, along with nearly all his travel companions, had perished from a plague while still in America; and James Cook and his team had observed the transit literally from the other side of the planet and still had some explorative tasks ahead of them before they returned home. The professional astronomer of Cook's crew, Charles Green, even lost his life in Asia.

In the web of swift and open collaboration characterising the Venus transit projects of the eighteenth century, Denmark-Norway had been – or had let itself be – left in a backwater in 1761. Its non-communicative mode of behaviour continued in 1769, and it is reasonably clear that neither Hell nor the organisers in Copenhagen asked for Lalande's advice in the planning of the Vardø expedition. The Venus transit report from Vardø did indeed arrive quite late, it was unusually – and perhaps unnecessarily – long and detailed, and both its lateness and its wealth of detail left it open to attack.

II.3.3.1 CONTEMPORANEOUS REACTIONS TO THE LATE ARRIVAL OF HELL'S REPORT

Over the following few pages, we shall have a look at the immediate reactions to Hell's report among peers in Sweden, Russia, Germany and France. Four names will be used as examples – Anders Planman in Åbo (Turku), Anders Johan Lexell in St. Petersburg, Abraham Gotthelf Kästner in Göttingen and Lalande in Paris. Besides being astronomers of an international

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Copenhagen). As of 18 March 1770, Lalande still had not received any news concerning the observations of Lowitz and Islen'ev (letter to J.A. Euler, dated Paris 18 March 1770 [RAN St. Petersburg]). On 16 April, Lexell informed Wargentin that the manuscript of Lowits had just arrived and was about to be printed (letter to Wargentin in Stockholm, dated 16 April 1770 [CVH Stockholm]).

[91] Cassini IV, "Avant-Propos" in his edition of Chappe, *Voyage en Californie*, Paris 1772, no page.

[92] Lalande, "Lettre sur le passage de Vénus …", in *Journal des Sçavans* for December 1771, pp. 825-826. Observations made at Jesuit observatories in China had the potential of being valuable as well. Indeed, the observations of the Jesuit Fathers Dollas and Dollières in Beijing are commented on by Lalande in a paper originally read in 1771 at the *Académie Royale des Sciences*, but he does not state when the letter containing their observations reached him, cf. Lalande "Mémoire sur la parallaxe du soleil, Déduite des Observations faites dans la mer du Sud, dans le royaume d'Astracan, & à la Chine" 1774, pp. 789-791.

[93] See for example the "Précis de la vie de M. Lowitz" in Bernoulli 1779*b*, pp. 41-50.

reputation, they had another thing in common: as of the spring of 1770, when they received the report from Vardø, they had never met Father Hell in person.

Anders** (Andreas, Andrew, André)* ***Planman (in German often referred to as Planmann, 1724-1803) received his education in natural sciences in Åbo and Uppsala. As a *docent* of astronomy at Uppsala University, he was sent to Cajaneborg in 1761 on behalf of the Royal Swedish Academy of Sciences (see Section II.2.1). A couple of years later, he was appointed professor of physics at the university in Åbo (Turku) in present-day Finland, a position he kept for the rest of his life. From his base in Åbo, he had presented a series of calculations of the solar parallax on the basis of that transit of Venus, arguing for a solar parallax of about 8.3 arc seconds (Section II.1.2). In 1769, Planman was again dispatched to Cajaneborg, where his observation was partly successful, in so far as he did see both the external and internal contact during ingress, but only the external contact during egress because of clouds. His data sets were reported by letter to Wargentin in Stockholm, who distributed them promptly to colleagues abroad. Like any other astronomer well versed in the noble art of calculating, Planman was eager to see the observations of his peers in order to recalculate to solar parallax from a completely new set of data. In late February 1770, Planman had not yet received the observation of Maximilianus Hell in Vardø. In a letter to Wargentin, he states that:[94]

> I thank my Mister [Wargentin] humbly for the observations of Venus that he has deigned to share with me, and will shortly embark upon the calculation of the solar parallax. I find Father Hell highly puzzling, since he has not yet published his observations: such a way of behaving appears rather suspicious to me.

At that moment, Hell's report had in fact just been released, and Planman's curiosity was soon satisfied. Seeing that the observations from Vardø did not match perfectly with any other observations, Planman "free[d] him from all suspicions about the veracity of his observation".[95] It might be added, however, that the Åbo professor was not only critical of the lateness of Hell's report. Also the swift and unpolished manner in which the Russian observations were published had its disadvantages, mainly because they contained only the moments of contact of the transit along with the raw material for the latitude and longitude of

[94] Planman to Wargentin in Stockholm, dated Åbo 23 February 1770 (CVH): "För den del, min Herre behagat lemna mig af observationerna öfver Venus, tackar jag ödmiukel. och skall jag innan kort gripa an sol-parallaxens uträkningar. Jag undrar högeligen på Pater Hell, som icke ännu giort sina observationer bekanta: ett sådant förhållande förekommer mig nog misstänkt".

[95] Planman to Wargentin in Stockholm, dated Åbo 22 June 1770 (CVH): "jag […] befriar honom från alla misstankar om observationens rigtighet".

each site, without any calculations or reductions to local mean time.[96] As he explained in a dissertation presented at the Åbo University on 26 May 1770, his own way of publishing the data sets – by an open letter first, then in brief articles in the proceedings of the Royal Academy of Sciences in Stockholm and finally in a more elaborate dissertation – was superior to both the Jesuit Father of Vardø and the Imperial Academy in St. Petersburg:[97]

> In this way, it will become evident what elements of the observation are certain and settled and what are dubious. For, those who publish their data stripped of the circumstances in which they were obtained, can hardly be considered to serve the world of learning better than those who delay sharing their observations until they have had the occasion to compare them with the observations of others. Whereas the latter can hardly avoid being stigmatised by suspicion that they may have wished to publish observations that were either made up or altered in order to fit to the observations of others, the former leave the reader in suspense as to whether or not the data sets have been obtained under appropriate conditions. Both parties are all the more to blame when considering how crucial it is, in the comparison of observations involved in the investigation of the solar parallax, to apply observations that are trustworthy in all respects.

Although no names are mentioned, the identity of the "two parties" would be recognisable for all astronomers. A university dissertation was not necessarily shared with many outside the circle that witnessed the ceremony, but from Planman's correspondence with Wargentin, it is evident that he expected his piece to be communicated to Maximilianus Hell: "it would hurt me, if he [i.e., Father Hell] should find himself offended by my disputation; however, my unawareness of what came to pass [in Vardø] will serve as my excuse", he wrote in a letter shortly after the dissertation.[98]

The reaction of Planman, then, can be summed up as rather implicit and ambiguous. He found Father Hell's behaviour suspicious at first, but since the data sets from Vardø turned out not to match his own, the Jesuit could hardly be accused of having forged them on the basis of the Cajaneburg observations. There was also a discrepancy between the observers in Vardø.

[96] Planman to Wargentin in Stockholm, dated Åbo 17 November 1770 (CVH).
[97] Planman / Widqvist, *Expositio observationum Transitus Veneris per Solem, Cajaneburgi A:o 1769, D. 3 Junii factarum* … [1770], p. [2]: "quo sic patescat, quid in observationibus certum & exasciatum, quidque dubium sit. Quippe vix melius orbi erudito consulere putandi sunt, qui nude, absque adjectis circumstantiis, momenta sua exhibent; quam qui observationum suarum divulgationem procrastinant, usquedum eas cum aliorum observationibus conferre licuerit. Ut enim hi suspicionis notam haud effugiunt, observationes, aut prorsus fictas, aut ad aliorum observationes conformatas, publici juris facere voluisse; ita illi in suspenso relinquunt, num rite se habeant momenta capta. Utrinque certe eo gravius peccatur, quo majoris momenti est, in comparatione, parallaxeos Solis investigandæ gratia instituenda, adhibere observationes per omnia comprobatas."
[98] Planman to Wargentin in Stockholm, dated Åbo 22 June 1770 (CVH): "det skulle göra mig ondt, om han funne sig genom min disputation læderad; Men min okunnighet om rätta förlopet blir min ursägt".

Although the observations of Sajnovics and Hell were almost identical, the moments recorded by Borchgrevink diverged by several seconds from the two Jesuits. Planman of course noticed this fact, and noted to Wargentin that "besides, the observations of Mister Borgrewing match my own accurately, if a solar parallax of 8.3 arc seconds is supposed. That satisfies me."[99]

Anders Johan *(Andreas Joannes, André Jean)* ***Lexell*** (1740-1784) was born and raised in Åbo, where he attended university and was noticed for his brilliance in mathematics. No positions were vacant in Swedish universities, however, and it may be that he had higher ambitions as well. Be that as it may, in 1768, he sent two treatises of mathematics to the Imperial Academy in St. Petersburg. Leonard Euler examined them and made sure that Lexell obtained a position as his *adjunctus* (assistant) at the Academy. One of Lexell's first tasks was to observe the transit of Venus from the academy building. He did so along with the secretary of the academy J. A. Euler, the Jesuit Mayer and his assistant Stahl SJ.[100] Having gained access to the observations from St. Petersburg, Planman commented in a letter to J. A. Euler that the observations of Lexell matched his own best, under the precondition that the solar parallax was 8.3 arc seconds.[101]

Unlike Planman, however, Lexell was not convinced of the accuracy of his own observation – or of a solar parallax of 8.3 arc seconds for that matter. He was soon entrusted the task of calculating the solar parallax on the basis of the observations of 1769. In this process, Lexell declined all temptation to accord the St. Petersburg observations any special reliability. Quite the contrary, in a letter to Planman dated 25 June 1770, Lexell said that:[102]

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[99] Ibid.: "dessutom instämma H^{r} Borgrewings observationer accurat med mina, posita Parallaxi ʘ = 8″,3: och dermed är jag till freds."

[100] Stahl and Lexell used comparatively small telescopes, while the two largest and best were used by Euler and Mayer (cf. Mayer 1769*a*).

[101] Planman to Jean Albert Euler in St. Petersburg, dated Åbo 26 September 1769 (copy in Planman's handwriting, CVH Stockholm): "Ut autem hæc mea observatio cum Vestris Petropolitanis comparari posset; supputandus erat effectus Parallaxeos respectu horum locorum. Assumta itaque Parallaxi Solis = 8″,3 quam ex observationibus transitus anni 1761 obtinui, inveni, facta supputatione, emersionem totalem fieri debuisse 22″ citius Cajaneburgi, quam Petropoli [...]. Mea itaque observatio ad Lexellianam proxime accedit, a Mayeriana autem maxime discrepat" = "In order to be able to compare my observation with yours from St. Petersburg, it was necessary to calculate the effect of parallax with regard to these places. Assuming a solar parallax of 8.3 arc seconds, which I obtained from the observations of the transit in 1761, I found that, after calculation, the total emersion should have taken place 22 seconds earlier in Cajaneborg than in St. Petersburg [...]. Thus, my observation is closest to that of Lexell and least in harmony with that of [Christianus] Mayer".

[102] Lexell to Planman in Åbo, dated St. Petersburg 25 June 1770 (HUB Helsinki, Planman-samlingen no. 61, transcript generously provided by Johan Stén): "Hwad Pater Hells observationer för de bägge siste contactus angår wet jag ei hwad jag skal säga, han har tör hända fabricerat dem efter de Petersburgiska, och då har han ei just warit mycket lyckeligt, ty wåra observationer äro säkert ei af de accurataste."

> As far as Father Hell's observations of both last contacts [of Venus with the limb of the Sun] are concerned, I do not know what to say. He may perhaps have tried to fabricate them according to the Petropolitan observations. In that case, he was hardly that lucky, for our observations are surely not the most accurate that exist.

This comment was made in a private letter and would no doubt have caused a strong reaction if it had reached Father Hell. It is intriguing to note, however, that Lexell was convinced that the Jesuit in Vardø had made up his observations; there could be no other cause for the late publication than that he needed time to manipulate his data sets.

A man in whom Planman and Lexell both confided, Pehr Wargentin in Stockholm, evidently felt responsibility for the situation. Accordingly, he asked the amateur astronomer Hellant in Torneå (now Haparanda, Tornio) to check whether the weather conditions in Vardø really had been as favourable as Hell claimed. When Hellant visited a market in Utsjok on the borders between the Danish-Norwegian and Swedish(-Finnish) realms, a representative of the local population of Vardø confirmed that the weather had been beautiful ("smukt"). This testimony appears to have convinced Wargentin, at least.[103]

The leading university of the German-speaking world during the Enlightenment, the Georgia Augusta in Göttingen, had been the workplace of Tobias Mayer, who passed away in 1762. His successor, ***Abraham Gotthelf Kästner*** (1719-1800), may not have been an astronomer of Mayer's eminence, but as a book reviewer, he was something of a hack. Notably, Kästner published numerous reviews in the German equivalent to the *Journal des Sçavans*, the *Göttingische Anzeigen von gelehrten Sachen*. Like its French predecessor, reviews in the *Anzeigen* were as a rule published anonymously. However, in the copy that has been scanned and made accessible on the internet by the Göttinger Digitalisierungszentrum, the identity of the reviewers are usually noted in the margin. So also in the issue for 7 April 1770, where we find a review of Hell's Vardø report with the handwritten note "Kästner".[104] Presuming that the person who entered these notes was well informed, the review may be read as evidence for Kästner's first reaction to the printed report.

[103] Cf. Tobé 1991, pp. 147-149.
[104] *Göttingische Anzeigen von gelehrten Sachen unter der Aufsicht der Königl. Gesellschaft der Wissenschaften* 42. Stück. Den 7. April 1770., pp. 353-356, here p. 353.

The review is astonishingly positive and also quite long. Kästner characterises the method of determining the pole height as "scharfsinnig" ('sagacious') and there is no hint of scepticism concerning any of the practical procedures or theoretical deliberations of Father Hell. Nor is it mentioned that the report arrived rather late. In sum, the overall assessment is that the *Observatio Transitus Veneris ... Wardoëhusii ... facta* contains "so much new and important, that this will excuse the length of this summary [i.e., review]".[105]

Even more lengthy was the review in the *Journal des Sçavans*, which appeared in the issue for September 1770.[106] Although the name of the author is suppressed, there can be little doubt about his identity – ***Jérôme de Lalande***. The review is balanced. The boldness of Hell, who took upon himself this strenuous and dangerous expedition, is emphasised at the outset, and the concluding lines are certainly full of flattery of both Hell and his sponsor, the King of Denmark, who "could have made no better choice than that of giving this task to Father Hell".[107] In-between, however, the reviewer raises some objections. "We are unaware of what might have forced Father Hell to keep an important observation hidden for so long, while Europe's astronomers made haste to publish their data",[108] he states, without exploring the matter further. Furthermore, he criticises strongly Hell's determination of the latitude of Vardø. The reviewer finds the method hilarious, and is quite explicit on this. The same applied to the determination of the longitude of Vardø, which Hell had calculated through a method differing from that exposited by Lalande in his *Astronomie*. Thus, according to the reviewer, Hell based both his latitude and his longitude investigations on false premises. He also disagrees with the Jesuit's determination of the duration of the transit, criticising his peculiar definition of the moments of "true contact" between Venus and the limb of the Sun. However, all these objections did not detract from "the importance of this observation from Vardø, the most complete that we have received from the European North".[109]

For all its criticism, then, Lalande's official review was written in a sober style. The stinging sentence has to do with the incomprehensible "hiding" of the observation, but that is not the

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[105] Op.cit., p. 356: "Jn gegenwärtiger [scil. Abhandlung] ist so viel Neues und Wichtiges, das solches die Länge dieses Auszuges entschuldigen wird".
[106] *Journal des Sçavans*, Septembre 1770, pp. 619-622.
[107] Op.cit., p. 622: "ce Prince [i.e., le Roi de Dannemarck] ne pouvoit mieux choisir qu'il n'a fait en donnant au P. Hell cette mission".
[108] Op.cit., p. 619: "Nous ignorons quelle est la cause qui a pu obliger le P. Hell de tenir si long-tems cachée une observation importante, tandis que tous les Astronomes de l'Europe s'empressoient de publier de leurs".
[109] Op.cit., p. 622: "Nous avons insisté sur ces détails à cause de l'importance de cette observation de Wardoë, la plus complette que nous ayons reçue du nord de l'Europe".

same as accusing the author of fraud. 'Behind the scenes', however, the tone was harsher. In a letter to the Royal Danish Academy of Sciences, Lalande expressed queries for the belated communication of the Vardø observation, adding threats which Hell found rather abusive. Lalande also characterised the Danish Society as "virtually unknown" and wondered whether it had in mind to publish memoirs, and if so, when, etc. Lalande expressed these queries to the Danish Society in a letter which he probably wrote immediately after the reception of Hell's report. Unfortunately, the original is lost, and we know its contents only from the travel diary of Sajnovics.[110]

The criticism of Lalande was not shared by every savant of Paris. An anonymous reviewer in the *Journal Enyclopédique*, May 1770, wrote very favourably about the *Observatio* and added flattery about "the thoroughness and clarity that are characteristic of him [i.e., Father Hell] and that render his works so useful for those who cultivate practical astronomy". No hint of skepticism is detectable, except that Father Hell's observation had been awaited with impatience ("avec impatience").[111]

Even though substantial parts of the correspondence of Father Hell is lost or awaiting discovery, there is enough evidence to demonstrate that he was informed of far harsher accusations. In a letter dated 23 June 1770, the archbishop and amateur astronomer Cardinal de Luynes wrote the following:[112]

> My Honourable Father! I have received, My Honourable Father, and read with the greatest possible pleasure, the details of Your observation of Venus passing in front of the disc of the Sun. I admire Your good fortune in having had clear weather, and perfectly clear weather at that, during the two most important

[110] Sajnovics, travel diary 1768-1770, entry on 3 April 1770 (WUS Vienna): "heri Venit Epistola a De la Lande in qua Satis arroganter queritur tarditatem Comunicatæ Observationis cum Parisinis, et minas satis Contumeliosas adjicit. Sub finem de societate scientiarum Danica quasi ignota perconctatur, et num in animo habeat acta edendi, et quando? querit &ce:" = "A letter arrived from Lalande yesterday in which he rather arrogantly complains about the late communication of the observation with the astronomers of Paris, adding some rather abusive threats. Towards the end of the letter he characterises the Danish Society of Sciences as virtually unknown, and asks if it plans to publish some journal, and if so, when, etc.".

[111] *Journal Encyclopédique*, Mai 1770, pp. 344-352, quotation from p. 345: "l'étendue & la clarté qui lui sont ordinaires, & qui rendent ses ouvrages si utiles à ceux qui cultivent l'astronomie pratique".

[112] De Luynes to Hell, dated Paris 23 June 1770 (a copy in the handwriting of Hell at WUS): "Mon R. Pere. J'ay recu, et lú avec le plus grand plaisir Mon R. Pere le detail de Votre observation de Venus passant sur le disque du soleil, j'ay admire votre bonne fortune d'avoir eu le tems serein, et parfaitement serein dans les deux moments les plus importants, et les excellentes methodes, que vous avés employées pour suppler aux commodites, que vous manquoient. *On à voulu elèver* à notre Academie des difficultes, sur ce, que le detail de votre observation nous etoit arrivé si tard, ce retardement pouvant donner lieu aux critiques, de pretendre, que votre delay pouvoit donner lieu de soupçonnes, qu'ayant eu les tems de recevoir les autres observations, vous auria pu y accomoder la votre".

> moments, as well as the excellent methods that You have employed to meet the lack of commodities which You were facing. Efforts have been made at our Academy [i.e. the *Académie des Sciences*] to raise objections concerning the fact that the details of your observation reached us so late, a delay which was capable of making room for criticisms, claiming that Your lateness could make room for suspicions that You, having had the time to receive the other observations, could have made Your observation match theirs.

Although de Luynes did not state who had raised these allegations, and notwithstanding the fact that he vigorously rejected them and gave the Viennese Jesuit his full support, a scientific controversy was in the making.

II.3.4 THE CONTROVERSY OVER THE SOLAR PARALLAX, 1770-1775

In descriptions of the status of the Vardøhus data in the controversy over the solar parallax, it is sometimes forgotten that there had been a similar controversy also in the aftermath of 1761. The principal calculations based upon that year's observations have been presented in Section II.1.2 above. At one end stood Alexandre Guy Pingré, who had observed the transit from the Cape of Good Hope in Africa. His observation was hard to reconcile with other data sets, and besides struggles over the accuracy of his observation, Pingré had a hard time defending his solar parallax of more ten arc seconds. At the very other end of the scale was Anders Planman, who argued for a solar parallax of about 8.3 arc seconds.

In this situation, Father Hell opted for a preliminary parallax of about nine arc seconds, in the *Ephemerides* for the year 1764. Lalande agreed completely, and used almost exactly the same wording as Hell in the first edition of his textbook *Astronomie*, published in 1764. In a letter dated 29 December 1769, Lalande reveals to Hell that[113]

> Monsieur Pingré was really annoyed because of the letter that you wrote to him. He complained to me, as if I was behind it. However, it is first and foremost he himself who is to blame for criticising in an indecent manner the observations of Yours, which are more valuable than his own.

During the 1760s, Father Hell gradually became more self confident and disputed not only Pingré's parallax, but also some other works by French astronomers, as recounted in Section

[113] Lalande to Hell in Vienna, dated Paris 29 December 1763 (quoted after Pinzger 1927, p. 191. Mrs Vargha's transcript of the same letter is inaccurate): "M. Pingré a été bien fâché de la lettre, que vous lui avés écrite, il m'en a fait des plaintes, comme si j'en étois la cause; mais il avoit tort le premier de critiquer d'une manière indécente vos observations, qui valent mieux, que les siennes".

II.1.4 above. However, prior to 1770 he seems not to have been engaged in any disputes with the man whom Jean-Claude Pecker characterises as "the most important French astronomer of the eighteenth century" – Lalande.[114] For all its fragmentary status, the epistolary evidence to hand suggests that Hell and Lalande remained close allies during the 1760s. That changed with Lalande's reaction to the Vardø report.

Around the year 1761, Father Hell and Lalande were both 'shooting stars' in the European Republic of Letters. Lalande waited impatiently behind the back of Delisle to become the main nodal astronomer on the international stage of contemporary astronomy. Father Hell was almost as ambitious, but Vienna was hardly any great power in matters of astronomy. As a nodal astronomer, Hell's main 'capital' was Central Europe and its surroundings, along with certain Jesuit connections in China. It was from from these regions that he was able to assemble exclusive data sets and theoretical expositions for his *Ephemerides*.

Lalande considered himself a nodal astronomer for more than France. In his own eyes at least, he was the world wide coordinator of the entire Venus transit enterprise. The first seed of discontent was probably sown when neither Hell nor Denmark-Norway asked for his advice in the planning of the Vardø expedition. But their independent behaviour went beyond that. The data sets from Vardø were not shared with Lalande immediately – he had to wait in line behind the Danish King, along with every astronomer except the few Copenhagen-based savants that attended oral presentations given in the sessions of the Danish Society of Sciences in November and December 1769 (see Section II.3.2). A third element that annoyed Lalande was the peculiar method in calculating the coordinates of Vardø, especially the pole height method described above. The fourth issue at stake was of course the conclusions drawn concerning the solar parallax itself. Unlike the previous occasion, Lalande and Hell disagreed fundamentally here. Instead of standing on the side-lines, the two stepped forward to become main characters in a heated scientific controversy.

When calculating the solar parallax, contemporaneous astronomers could choose between two strategies. One option was to wait for all observations to be published and then undertake a thorough survey of all the available data. Ideally, such a survey would lead to a decisive conclusion, 'the author's final word' on the matter. Another *modus operandi* was to make

[114] Pecker 2007, p. 3: "Lalande fut en effet sans doute le plus important astronome français du XVIII^{e} siècle."

repeated calculations as the various data sets emerged. Tentative adjustments following preliminary calculations would be followed by new tentative adjustments and so forth. Father Hell chose the former, Lalande the latter strategy.

Lalande published parallaxes of 9″ (*Gazette de France*, January 1770) or 9.18″ (*Journal des Sçavans*, April 1770) before he had gotten access to the observation of Hell. Having received the Vardø observation as well as Chappe's from California, he adjusted it to approximately 8.75″ (*Gazette de France*, December 1770) or 8.80″ (*Journal des Sçavans*, May 1771) or again 8.75″ (2nd edn. of the *Astronomie*, August 1771), until he upon the arrival of the Tahiti observation changed it yet again, to 8.50″ (*Gazette de France*, September 1771; *Journal des Sçavans*, December 1771). From then on, he stayed fixed on 8.50″, or 8.60″ as a maximum (3rd edn. of the *Astronomie*, 1792).

If we look behind these numbers and pay attention to how Lalande arrived at his results, we find that he – although dismayed at its late arrival – initially held no prejudices against the Vardø observation. Quite the contrary; in a letter to Boscovich, dated 15 December 1771, he puts together a table in which the observations of Cajaneborg and Vardø are compared to those of Hudson Bay, California and Tahiti, adding that[115]

> The largest difference between the three results yielded by comparisons with Cajaneborg is 0.5 arc seconds, whereas with Vardøhus it is only 0.3″. This makes it probable that the the Vardøhusian observation is more exact than the former. Thus, if we were to take the mean between the three comparisons, staying closer to the observation of Vardøhus than that of Cajaneborg in a 5:3 relation and then taking the mean between the three last results, we get [a solar parallax of] 8.6″ rather than 8.5″.

Simultaneously, Hell arrived at his conclusion of 8.70″, which he based primarily upon his own observation from Vardø and that of Charles Green from Tahiti. The observers in Tahiti varied several seconds between each other in their determinations of the moments of contact, but Hell stuck to the observation of the professional astronomer Green, skipping those of the admiral Cook and the natural historian Daniel Solander. The same applied for the Vardø observation, where the inexperienced Borchgrevink diverged substantially from Hell and

[115] Lalande to Boscovich, dated Paris 15 December 1772 (Varićak 1912, pp. ccclxviii-ccclxx): "la plus grande difference des trois resultats avec Cajanebourg est de 0″5, et avec Wardhus de 0″3 seulement, en sorte qu'il y a plus de probabilité pour l'exactitude de l'observ. de Wardhus. Si donc on vouloit prendre le milieu entre les trois comparaisons en se tenant plus près de l'observation de Wardhus que de celle de Cajanebourg dans le rapport de 5 a 3 et qu'on prit ensuite le milieu entre les trois derniers resultats on auroit plustot 8″6 que 8″5".

Sajnovics. Trusting the professional and most experienced observers, Father Hell rejected all other observations and tried to persuade his colleagues that the question of the parallax was now settled to the accuracy of ±0.01″.[116] It is known that on 20 December 1771, Hell wrote a letter to Lalande, in which he tried to persuade him to exclude the observation of Planman entirely from the calculations of the parallax.[117] The tone of the letter was perhaps a bit too self confident, for by 10 March 1772, Lalande had become convinced of the opposite, as is seen in a letter to Boscovich: "What is your opinion of Father Hell, have you seen him observing, is he able, is he well trained? I conclude with the utmost dismay that his observation from Vardøhus is in accordance with no other, and that it has to be discarded".[118] Similarly, he advised his colleague Jean Bernoulli III in Berlin, "do not trust the remarks of Father Hell, he is surely wrong, and this will do no honour to your work [i.e., the *Receuil pour les Astronomes*]".[119]

Lalande published his rejection of Hell's data in April 1772, in the 44-page *Mémoire sur le passage de Vénus devant le disque du Soleil* ('Memoir on the transit of Venus in front of the disc of the Sun).[120] Here, Lalande explained how he had found the mean solar parallax to be 8.50″, by means of virtually every other observation than that of Vardø. As for the competing observation by Planman, Lalande's conclusion was quite devastating to Hell.[121]

> This observation from Cajaneborg has become the most important among all those that were made in Europe, for it has served as confirmation and the element of comparison for all remote observations, with which it is in perfect harmony.

Lalande's memoir was received as little short of a declaration of war by the Viennese Jesuit. In less than three months, he managed to compose – and print – an apology of 116 pages, 'On

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[116] Hell to Weiss in Tyrnavia, dated Vienna 26 December 1771 (Pinzger 1927, pp. 107-109); Hell to Fixlmillner in Cremifanum, dated Vienna 17 July 1772 (Rabenalt 1986, p. 117); Hell, "De parallaxi Solis …" 1772, pp. 107-108.

[117] Hell 1772, p. 6.

[118] Lalande to Boscovich, dated 10 March 1772 (see footnote 2 above).

[119] Lalande to Bernoulli in Berlin, dated 18 March 1772 (to be published in Dumont & Pecker [eds., in preparation]): "Défiez vous des remarques du p. Hell, il se trompe à coup sûr, et cela ne figurera pas bien dans votre ouvrage." I am indebted to Mme Dumont for permission to quote this work in progress.

[120] I have not had access to the original, but have used the extensive summary in the *Journal des Sçavans*, Septembre 1772, pp. 613-623 ("Mémoire sur le Passage de Vénus devant le disque du Soleil, observé le 3 Juin 1769, pour servir de suite à l'explication de la Carte publiée en 1764 ... Paris") and other sources.

[121] Lalande, *Memoire sur le passage de Venus ...*, p. 14 (quoted from *Handl.Stockh.*, April-June 1772, p. 191): "Cette observation de Cajanebourg est devenue la plus importante de toutes celles d'Europe, en ce qu'elle a servi de confirmation & de terme de comparaison pour toutes les observations éloignées, avec lesquelles elle s'accorde complettement".

the Parallax of the Sun Deduced From Observations of the Transit of Venus of the Year 1769' (*De Parallaxi Solis ex Observationibus Transitus Veneris Anni 1769*). The memoir contains both a detailed calculation of the solar parallax and a furious attack on Lalande. As Hell wrote in one of his letters accompanying the monograph (to Wargentin, dated Vienna 15 July 1772):[122]

> If my style, so untypical of me until now, seems a little over-aggressive to you, I would like you to consider the un-heard-of, and totally unfounded, accusation of having made up or altered the data that has been put forward by Monsieur Lalande against my person (who did not exactly start my career in astronomy yesterday); this had actually deserved a much stronger response. In more than one letter, I have advised Lalande to abstain from defending the Cajaneborg observation and cease attacking the one from Vardø, but in response to my friendly, even privately, communicated advice, he has decided to brand me in public, an act I deemed I should certainly not pass by in silence.

In the *De Parallaxi Solis*, Hell blames Lalande for having shown too much of that arrogance characterising some representatives of great powers. Lalande, he argues, must clearly have felt dismayed that neither Hell nor the court in Copenhagen asked for his advice in the planning of the Vardø expedition. Besides, he and his French colleagues were obviously offended that Hell did not dispatch an extract of his observation journal in manuscript directly to Paris, "as to a tribunal of astronomy" (*tamquam ad Tribunal astronomicum*), with the first express mail possible. Hence, when the report finally arrived, they judged that it must have been "adulterated".[123] This prejudice must have brought Lalande to neglect the fact that Planman had been been stationed at a site (Kajaani) where the Sun was extremely low above the horizon, causing the limbs of the sun to undulate strongly, whereas Hell in Vardø had enjoyed perfect atmospheric conditions with the Sun elevated more than 6 ½ and 10º above the sea during ingress and egress respectively. Hell meant he could prove Planman to have either defined the longitude of his site erroneously by at least 35 seconds, or observed the exterior contact of egress wrongly by 35 seconds.[124] Lalande, on the other hand, who considered Hell's report worthy of rejection, had made various sophisticated calculations in order to make the Kajaani observation as complete as he needed it. The interior contact of

[122] Hell to Wargentin, dated Vienna 15 July 1772 (CVH): "si Tibi stylus meus, mihi hactenus insolitus, concitatior videatur, perpendisse Te velim, quod inauditum fictionis, aut correctionis crimen à celeberrimo de La Lande, mihi, qui non heri natus sum Astronomus, sine ullo fundamento intentatum, longe majora meritum fuisset; non unis à me De La Landius admonitus est litteris, ut à defensione Cajaneburgensis observationis abstineret, Wardhusianumque impugnare cessaret; pro amica hac, eaque privata admonitione publicam mihi inurere voluit notam, quam sine dubio silentio prætereundam non censui".
[123] Hell 1772, pp. 86-93.
[124] Hell 1772, pp. 8-39.

egress – unobserved by Planman because of clouds – was found by Lalande by altering the diameter of both Venus and the Sun by a number of seconds. In this way, he managed to fit Planman's observations to the data obtained in Tahiti and California, thereby defending his result of 8.50″ for the mean horizontal parallax of the Sun.[125] Repeatedly, Hell dismisses his Paris antagonist as "the protector and defender of the incomplete and erroneous Cajaneborg observation" and as a friend of his personal ambition rather that the truth.[126] But if Planman's observation really had been as exact as Lalande wanted it to be, each and every colleague of his must have been mistaken by between 24 and 48 seconds in time![127] This absurdity would no doubt lead neutral colleagues to agree that the parallax value of Hell, rather than that of Lalande, was correct. In sum, Hell concluded that "*Tahiti* and *Vardø* will be the two columns upon which the true Solar parallax of 8.70″ will rest firmly and be preserved – like upon pillars of bronze – to the eternal memory of Posterity, a memory which coming generations will decorate again and again with their palms of victory".[128] For,[129]

> we are now living in a time [...] when both England, Germany, Italy, Denmark, Sweden and Russia excel in their own astronomers, who know very well how to decide for themselves what difference there is between truth and wrong.

One of the "neutral" and able calculators alluded to by Hell was the young Lexell in St. Petersburg. Lexell published various attempts between the autumn of 1770 and the end of the year 1772, arriving at parallaxes of 8.80″, 8.76″ and 8.63″.[130] During the controversy, he was virtually bombarded with letters from both Hell and Lalande, and the latter even went as far as asking the pupil of Euler to act as a judge in the quarrel that had broken out between himself and the Viennese.[131] Lexell's correspondence with Hell and Lalande has – with one exception – not been available for this study. His reactions to their activities can be studied, however, in

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[125] Hell 1772, pp. 103-105.
[126] Hell 1772, pp. 8, 38, 86, 94, 110, etc.
[127] Hell 1772, pp. 100-101.
[128] Hell 1772, p. 109 (see footnote 1 above).
[129] Hell 1772, pp. 114-115: "Ea nunc vivimus tempora, quibus hodie, ut olim, & Anglia, & Germania, & Italia, & Dania, & Svecia, & Russia suis excellunt Astronomis, qui ipsi quoque discernere norunt, quid veritatem intersit, & errorem".
[130] A. I. Lexell, "Determinatio accuratior verae Parallaxis Solis et reliquorum elementorum", in Anonymous (ed.) *Collectio omnium observationum quae occasione Transitus Veneris per Solem A. MDCCLXIX iussu Augustae per Imperium Russicum institutae fuerunt una cum Theoria indeque deductis conclusionibus* 1770, pp. 533-574, especially pp. 538-539 & 556; *Disqvisitio de investiganda vera qvantitate Parallaxeos Solis, ex Transitu Veneris ante discum Solis Anno 1769. cui accedunt animadversiones in tractatum Rev. Pat. Hell de Parallaxi Solis* 1772, especially p. 59.
[131] Lexell to Wargentin, St. Petersburg 5 October 1772 (CVH).

the frequent letters he sent to Wargentin in this period, all preserved in Stockholm.[132] In fact, Lexell found the arguments of both Hell and Lalande unconvincing. For one thing, he was puzzled that Planman (and Lalande) was so sure about the accuracy of the Kajaani observation[133]. Instead of rejecting one of the observations, Lexell argued that the duration of the transit as observed in Vardø and Kajaani had to be adjusted by at least 10 seconds in each of the two places[134]. In one of his published memoirs on the parallax, we find him criticising Lalande and Hell equally when he sums up his arguments by explaining that "I could not bring myself – contrary to all probability, and in favour of a single observation – to accuse all others of being erroneous, nor to put such faith in one particular astronomer, however experienced he may be, that I reckon him to be in possession of some sort of prerogative over others for being infallible"[135]. His wording in private letters is even harsher. To Wargentin, Lexell writes that Father Hell in the *De Parallaxi Solis* has proven himself to be "the worst charlatan possible [...] not even endowed with sufficient theoretical knowledge to investigate the question of the parallax".[136] His judgement on Lalande is no less severe:[137]

> What sway prejudices hold over human beings, even in such matters where they should be led by their love of truth alone, I have had occasion to witness in Lalande […]. If every person who writes about this theme would act as honestly, one can easily find whatever parallax seems most agreeable.

[132] Altogether 111 letters from Lexell to Wargentin are kept at the Centrum för vetenskapshistoria in Stockholm. Of particular interest are his reaction to Lalande's *Mémoire sur le passage*, dated 13 July 1772 and his reaction to Hell's *De Parallaxi Solis*, dated 7 September 1772.

[133] Lexell to Wargentin, St. Petersburg 13 July 1772 (CVH): "Det förekommer mig besynnerligt af Planman, at han håller sina observationer för så infallibla, där jag likwäl kan bewisa honom så wisst som 2 gånger 2 är fyra, at hans observation på den sista contactus är felaktig åtminstone på 10″" = "I find it ackward of Planman to maintain that his observations are so infallible, when I can demonstrate to him that, as sure as to and to makes four, his observation of the last contact is wrong by at least 10 seconds".

[134] Lexell, "Disqvisitio de investiganda Parallaxi Solis ex Transitu Veneris per Solem Anno 1769" as printed in the *Novi Commentarii* for the year 1772 (1773), pp. 609-672, espec. pp. 639-647.

[135] Lexell, "Disqvisitio de investiganda …" 1773, p. 669: "Id certe a me impetrare non potui, vt contra omnem verisimilitudinem, in fauorem vnius obseruationis, omnes reliquas erroris accusarem, vel vt crederem quempiam Astronomum vtcunque exercitatum aliqua infallibilitatis praerogatiua prae caeteris instructum esse".

[136] Lexell to Wargentin in Stockholm, dated St. Petersburg 7 September 1772 (CVH): "Dock tror jag wäl kunna förswara både Prof: Euler och mig i synnerhet mot Pat: Hell, hwilken i synnerhet genom denna sista skrift ådagalagt, at han är den största quacksalfware som kan gifwas. [...] Hwad Pat: Hells egna undersökningar angående Parallaxen angår, måtte jag bekänna, at jag aldrig kunnat förmoda dem så felaktiga, så barnsliga och löjeliga. Det förekommer mig, at han ei ens är underbygd med nog Theorie, at undersöka detta ämne".

[137] Lexell to Wargentin in Stockholm, dated St. Petersburg 25 February 1771 (CVH): "Hwad fördomar äga för magt på menniskor, äfven i sådana mål där Kärlek til sanningen endast borde drifva dem, har jag haft exempel på i de la Lande [...]. Wilja alla som skrifva i detta ämne lika upriktigt handla, så kan man wäl utan möda, finna hwad Parallax hälst behagas".

Another participant in the debate, Anders Planman, followed the same line as Lalande and Lexell. In publications ranging from the beginning of 1771 until the end of 1774, he argued for parallaxes of approximately 8.24″, 8.43″, 8.51″ and finally 8.40″.[138]

The temperature was at its highest in the year 1772. In December of that year, Planman published a dissertation where he found the parallax to be exactly as Lalande had concluded, and rejected Hell's *De Parallaxi Solis* as "a mishmash of errors" (*errorum farraginem*). The only data from Vardø that could possibly be used were those of the amateur Borchgrevink, he argued.[139] In this turmoil, we find a single diplomatic voice; the network figure who stayed in close contact with all the participants in the quarrel, Wargentin. As Lalande, Planman, Lexell and Hell attacked each other in public, they all confided their feelings to Wargentin as a neutral, yet influential and respected colleague. The Swede disliked the strife, however, and tried his best to cool down the temperature. In a letter to Hell's confrère Weiss, dated Stockholm 9 March 1773, Wargentin says:[140]

> I strongly dislike the all too harsh controversy which has arisen between Lalande, Hell and Planman, over the observations of the last transit of Venus. There ought to be no doubt that both Hell and Planman have exerted all their efforts – their eyes as well as their intellect – while observing, and that they have published it *bona fide*. They may have made mistakes of a few seconds each, for they are, after all human beings […]. The safest solution would therefore have been to concede something to each observer, by placing one's faith in a mean parallax, calculated on the basis of both observations.

The effect of Wargentin's (and perhaps other sensible minds') diplomacy can be seen in the *Journal des Sçavans* for February 1773, where Lalande lets print a 'Letter concerning the

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138 Planman, "Formuler, At Uträkna Parallaxens verkan för observerade in- och utgångs momenter, vid en Planets gång under Solen", in *Handl.Stockh.* for January-March 1771, pp. 66-74; "Om Solens Parallaxis, i anledning af Observationer öfver Venus i Solen, år 1769", in *Handl.Stockh.* for April-June 1772, pp. 183-191; *Animadversiones Subitaneæ in Appendicem Hellianam ad Ephemerides Anni MDCCLXXIII, De Parallaxi Solis*, Åbo 1772; "Förklaring på de Formler, at uträkna Parallaxens verkan, för observerade in-och utgångs-momenter vid en Planets gång under Solen, som anfördes uti Handlingarne för år 1771", in *Handl.Stockh.* for October-December 1774, pp. 306-319.

139 Planman / Kreander, *Animadversiones subitaneae* ... [1772*b*], p. 12.

140 Wargentin to Weiss in Tyrnavia, dated Stockholm 9 March 1773 (printed in Vargha 1990, pp. 106-107 [my corrections in brackets]): "Magnopere mihi displicet controversia, inter Lalandium, Hellium et Planmanum orta, et nimis acerbe agitat[a], de observationibus ultimi Transitus Veneris[.] Nullum esse debet dubium, quin uterque posteriorum in observando omnes oculorum et animi nervos intenderit et observata bona fide retulerit. Uterque autem paucis secundis errare potuit, homines enim sunt, et, qui expertus est, facillimum esse in istis momentis determinandis errorem, nulla observatoris culpa, concedat necesse est. Tutissimum itaque fuisset, suum cuique observatori tribuere, et mediae acqui[e]scere Parallaxi, ex utraque observatione conclusae".

calculations by Monsieur Lexell and Father Hell' as well as a 'Letter on the solar parallax'.[141] The tone has now become more mild.[142]

> Father Hell […] appeared to declare war on all the astronomers of Paris in his booklet, by contesting the quality of the observation of Monsieur l'Abbé Chappe, by bringing back old disputes concerning the alleged moon of Venus, the longitude of Vienna, the geodetic measurements made in Germany […], but he should make these concessions to me: that our correspondence has always been filled with friendship and respect from my part, that I have praised him on every occasion and that I have never given place in our dispute for any personal complaints except that which concerns his having made the astronomers wait for so long for an observation that was so necessary to them.

Furthermore, Lalande was careful not to attack Lexell; he even admitted some errors in the *Memoire sur le passage* which the latter had pointed out. As to the parallax, he still believed that the value of 8.50″, or a maximum of 8.55″, was most likely to be true. But with surprising humbleness he added that[143]

> To sum up, if the parallax is 8.55 arc seconds or 8.70, the difference is no more than a 57th part of the total, and the expedition of Father Hell will nevertheless have the advantage of having contributed to draw the limits of our uncertainties closer to each other.

A rapid exchange of letters between Hell and Lexell in the winter of 1772/73 also ended in a sort of reconciliation. Hell in fact took the liberty of publishing one of Lexell's letters in his *Ephemerides*, but added to almost every sentence such long and intricate footnotes that in effect, the voice of Lexell was almost drowned.[144] Remarkably, Hell recognised that he had committed several errors in the calculations of the *De Parallaxi Solis* (although for a number of mistakes he blamed the printer), but refused to alter his initial conclusion; the parallax, he maintained, was still nothing short of 8.70″, or 8.70″ ±0.03″ at the most.[145]

[141] *Journal des Sçavans*, Février 1773, "Lettre sur les calculs de M. Lexell et du P. Hell" (pp. 90-93) and "Lettre sur la parallaxe du Soleil" (pp. 113-115).
[142] *Journal des Sçavans*, Février 1773, p. 113: "Le P. Hell […] paroît déclarer la guerre à tous les Astronomes de Paris dans sa Brochure, en contestant la bonté de l'observation de M. l'Abbé Chappe, en rappelant d'anciennes contestations sur la prétendu Satellite de Vénus, sur la longitude de Vienne, sur les mesures géodesiques faites en Allemagne […] mais il doit me rendre cette justice, que notre correspondance a toujours eté pleine d'amitié & de respect de ma part, que je l'ai célébré dans toutes les occasions, & que je n'ai mis dans notre dispute actuelle d'autre plainte personelle contre lui, que celle d'avoir fait attendre si long tems aux Astronomes une observation qui leur étoit si nécessaire".
[143] *Journal des Sçavans*, Février 1773, p. 115: "Enfin que la parallaxe soit de 8″55 ou de 8″70, la différence n'est que de la 57e partie du total, & le voyage du P. Hell n'aura pas moins l'avantage d'avoir contribué à resserer les limites de nos incertitudes".
[144] Letter from Lexell to Hell in Vienna, dated St. Petersburg 22 February 1773, printed in the "Supplementum dissertationis de Parallaxi Solis", in *Ephemerides Astronomicae* for the year 1774 (1773), pp. 15-68.
[145] Hell 1773, p. 62.

Simultaneously, Pingré was busy presenting to the Academie des Sciences a series of lectures, where he concluded that the solar parallax had to be 8.80″, "à très-peu-près" ("quite accurately").[146] The approach of Pingré was more open-minded than that of Hell or Lalande. The only thing he rejected was the exterior contact of egress as observed in Cajaneborg; Planman's ingress data could still be used, he argued. As for Tahiti, Pingré upon investigation found that the observation of Green had to be left out; the same he did with Borchgrevink's data from Vardø. He even tested thoroughly Rumovskii's observation from Kola, something Lalande, Lexell and Planman had all neglected.[147] Lalande was upset, but felt confident that he would be able to make a fool of him, as he said in a letter to Wargentin.[148] Hell, on the other hand, felt an enormous relief. The difference between their conclusions – 8.80″ instead of 8.70″ – he found to originate from Pingré's use of Cook's observation instead of that of Green. But this was hardly any offence; the Jesuit Father found that his credibility had been restored and the notorious egress data from Cajaneborg had been rejected from the calculations.[149]

At least publicly, Lalande appears to have carried no more logs to the fire. And after publishing a 162-page *Supplementum* to the memoir *De Parallaxi Solis* in the autumn of 1773, Hell too withdrew from the debate. Planman published an apology against this last work of Hell in 1774. He there argued for a probable parallax of 8.40″, but the article appears not to have been widely disseminated.[150] Lexell groaned to Wargentin that the Jesuit could only have had two reasons for publishing a private letter of his in the *Supplementum*; the first being a desire to defend his conclusion of 8.70″ for the parallax, the second, a desire to hurt Lexell's reputation. Lexell explained that he too planned to publish another apology against Hell, "if the Academy agrees to its publication", but this plan appears to have come to nothing.[151]

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[146] Pingré, "Mémoire sur la parallaxe du Soleil, Déduite des meilleurs Observations de la durée du passage de Vénus sur son disque le 3 Juin 1769" 1775, p. 419.
[147] Hell had, it is true, presented a brief investigation of Rumovskii's observation and concluded that it gave a parallax of 8.73″, but without putting much weight on this; cf. Hell 1772, pp. 80-84.
[148] Lalande to Wargentin in Stockholm, dated Paris 5 January 1773 (CVH): "mais je crois que je pourrai me mocquer de lui".
[149] Hell to Weiss in Tyrnavia, dated Vienna 6 April 1773 (Pinzger 1927, pp. 114-117).
[150] In *Handl.Stockh.* for October-December 1774, pp. 306-319 (Planman 1774).
[151] Lexell to Wargentin in Stockholm, dated St. Petersburg 11 / 22 June 1774 (CVH).

The strife ended there, with parallaxes ranging from 8.40″ (Planman) to 8.80″ (Pingré). In the meantime, Maximilianus Hell had become an ex-Jesuit and all Jesuit observatories in Central Europe were taken over by the state. His abilities as an observer and calculator had been questioned and his ‘capital’ as a nodal astronomer had suffered severe losses with the suppression of the Society of Jesus.

Table 6 provides an overview of principal observers and sites in 1769, from Iakutsk in the East to Tahiti in the West. The abbreviations I,1-2 and E,1-2 represent the exterior and interior contacts during ingress and the interior and exterior contacts during egress respectively. To use Iakutsk as an example: in this case, the published report states that the leading observer Islen’ev observed the interior contact at ingress along with both contacts of the egress, whereas his anonymous assistant observed only the interior contact at egress. The sources for the table have in nearly all cases been the original reports.[152] Shortcuts for readers who wish to inspect the actual data are provided by Encke (1824) and Newcomb (1890).

At what time the data sets in question reached Paris has been recounted in Section II.3.3 above. A chronological overview of calculations of the solar parallax based upon the Venus-transit observations of 1769 is given in Table 7. The table highlights the contributions of Lalande, Hell, Planman, Hornsby and Lexell. Other calculations are known to have been made by other astronomers, but these did not influence the international scientific controversy in the same degree and are therefore omitted. Various letters preserved at the Russian Academy of Sciences in St. Petersburg, at the Vienna University Observatory and at the Royal Academy of Sciences in Stockholm have served as a basis for the table, along with printed monographs and journal articles by Lexell, Pingré and Hornsby as well as Lalande and Hell from the period 1770-1775. Finally, a manuscript of Lalande recently published by the Observatoire de Paris has been used as well.[153] Where ever this has been possible, an extremely brief resumé of the observations that have served as the basis for the calculation has been entered in parentheses.

[152] Exceptions are the observations of Don Joseph de Alzate y Ramirez and Joaquin Velázquez de León, which have been culled from Cassini’s “Histoire abrégée de la parallaxe du soleil” (1772).
[153] The manuscript in question has been digitised and is found on the *Les rendez-vous de Vénus* CD Rom.

TABLE 6 IMPORTANT VENUS TRANSIT OBSERVERS AND SITES, 1769

Principal observations, from East to West		Other observations, E to W	
		Iakutsk	Islen’ev. Assistant: Anonymous I,2,E,1-2 E,1
		Batavia (Jakarta)	Mohr E,1-2
		Beijing	Dollières,Collas E,1-2
		Orsk	Christophe Euler E,1-2
		Orenburg	Krafft E,1-2
		Ponoi	Mallet I,1-2
		Gur’ev	Lowits. Assistant: Inochods’ev E,1-2 E,1-2
Kola Town	Rumovskii. Assistants: Okhtenskii, Borodulin I,1-2,E,1-2 both: I,1-2,E,1		
Vardø	Hell. Assistants: Sajnovics, Borchgrevink I,2,E,1-2 I,2,E,1-2 I,1-2,E,1-2	St. Petersburg (Imperial Obs.)	Mayer w/Stahl,Lexell,J.A.Euler all: E,1-2
Cajaneborg (Kajaani)	Planman. Assistant: Uhlwijk I,1-2,E,2 E,2	“North Cape” (Honningsvåg)	Bayly I,2
		Martinique	Father Christoph (Capuchin Fr.) I,2
		Cambridge, Mass.	Winthrop I,1-2
		Cap-Haïtien	Pingré w/deFleurieu,delaFilière, all: I,1-2 Destoures
		Lewes Town (City of Lewes)	Biddle; Bayley I,2; I,1-2
		Philadelphia	Shippen,Williamson,Prior,Tho- all: I,2 mson,Erwing
		Norristown	Rittenhouse,Lukens,Smith all: I,2
Hudson Bay (Fort Prince of Wales)	Wales, Dymond both: I,1-2,E,1-2	Mexico City	Don Jos. de Alzate y Ramirez I,2
Baja California (San José del Cabo)	Chappe. Assistants: Pauly;Doz,Medina I,1-2,E,1-2 E,1-2; both:I,1-2,E,1-2	Baja California (Santa Ana)	Joaquin Velázquez de León I,1-2,E,1-2
Tahiti (Pointe Vénus)	Green, Cook. Assistant: Solander both: I,1-2,E,1-2 I,1-2,E,2		

TABLE 7 CHRONOLOGY OF PARALLAX CALCULATIONS, 1770-1775

LALANDE		HELL / OTHERS	
12 Jan. 1770 *Gazette de France,* *letter to J.A.Euler*	9″ (Pingré,Dymond/Wales,Planman)		
18 March 1770 *letter to J.A.Euler*	9.10″ (Hell,Dymond/Wales)		
30 March 1770 *letter to Weiss*	approx. 9″ (“les observations Ameriques”)		
April 1770 *letter in Journal des Sç.*	9.18″ (Dymond/Wales,Planman)		
3 April 1770 *letter to Boscovich*	9.10″ (Vardø,HudsonBay)		
15 April 1770 *letter to J.A.Euler*	9″ (“les observations d’Amerique”)	PINGRÉ, 25 April 1770 *Mémoir read at the Académie des Sciences*	9″
14 May 1770 *letter to Wargentin*	9″ (Pingré 8.9″;Hell,Dymond/Wales 9.1″)		
		LEXELL, 31 Aug. 1770 *letter to Wargentin*	8.67″ (Cajaneborg,Vardø in N.)
15 Dec. 1770 *letter to Wargentin*	a 8.36″, b 8.80″, c 8.54″ (a Chappe,Planman; b Chappe,Hell; c Chappe,Dymond/Wales)		
21 Jan. 1771 *Manuscript in Observatoire de Paris*	8.80″		
8 Feb. 1771 *letter to Wargentin*	8.75″ (the observations of 1761 & 1769 together)		
18 Feb. 1771 *letter to Boscovich*	a 8.75″, b 8.80″ (a the observations of 1761 & 1769; b California,Vardø)		
22 Feb. 1771 *letter to J.A.Euler*	8.80″ (Vardø,California)		
May 1771 *Anonymous article in Journal des Sçavans*	a 8.36″, b 8.88″, c 8.58″, d 8.80″ (a California,Cajaneborg; b Calif.,Vardø; c mean value between a & b; d probable value)		
August 1771 *2nd edn. of l’Astronomie*	8.75″ (preliminary result,Tahiti data missing)		
17 Sept. 1771 *Gazette de France*	8.50″ (all 1769 observ.,Tahiti data included)		
13 Oct. 1771 *letter to Boscovich*	8.50″ ± 0.20″ (Tahiti,HudsonBay,Vardø)		
28 Oct. 1771 *letter to Wargentin*	a 8.70″, b 8.30″, c 8.50″ (a Tahiti,Vardø; b Tahiti,Cajaneborg; c mean value between a & b)		
Autumn of 1771 *Mémoir read at l’Acad.des Sc.*	a 8.50″, b 8.60″ (a probable, b maximum)	PINGRÉ, autumn of 1771 *Mémoir read at l’Acad.des Sc.*	8.88″ ±0.05″ (all 1769 observ.)

LALANDE	HELL / OTHERS
Dec. 1771 8.50″ *letter in Journal des Sç., dated 17 Sep. 1771* (Cook/Green/Solander, Dymond/Wales,Hell)	LEXELL, Dec. 1771 8.55″ ±0.15″ *Article in Handl. Stockh.* (Tahiti,California,HudsonBay, “observations from Lapland”)
15 Dec. 1771 8.50″ *letters to Wargentin and Boscovich* (Cajaneb./Vardø,Hudson Bay,California/Tahiti)	HORNSBY, 17 Dec. 1771 8.78″ *Paper read at Royal Soc.*(Hell,Rumovskii,Wales/ Dymond,Chappe,Cook/Green/Solander)
	HELL, 26 Dec. 1771 8.70″ ±0.01″ *letter to Weiss* (“omnes Americanae”,Vardø) HELL, 27 Dec. 1771 8.70″ *letter to Fixlmillner* (Tahiti,Hell)
21 Jan. 1772 a 8.50″, b 8.60″ *letter to Boscovich* (a probable, b maximum)	HELL, 1 Jan. 1772 8.70″ ±0.01″ *letter to Wargentin* (Green,Hell)
April 1772 8.50″ *Mémoire sur le passage…* (Planman only in European North)	WARGENTIN, 7 April 1772 less than 8.5″ *letter to Lalande*
12 May 1772 minimum 8.50″ *letter to Wargentin*	
	PLANMAN, June 1772 8.43″ ±0.06″ *Article in Handl.Stockh.* (Cajaneb.only in North)
	HELL, July 1772 8.70″ ±0.01″ *De Parallaxi Solis…* (Hell,Dymond/Wales,Green)
	LEXELL, 13 July 1772 minim. 8.60″ *letter to Wargentin*
	LEXELL, autumn of 1772 8.63″ ±0.06″ *Disquisitio...Parallaxi Solis* (all complete 1769 observations,except Kola)
	PLANMAN, 28 Nov. 1772 a8.53″,b8.51″ *Animadversiones subitaneae ...*(a Planman/Borch-grevink in Europ.North; b Planman only)
Feb. 1773 a 8.50″, b 8.55″ *letter in Journal des Sçav.* (a probable, b maximum)	
	PINGRÉ, early in 1773 8.80″ *Mémoire read at Acad. des Scienc.* (Planm./Hell/Sajnovics/Rumov. in North,Cook/Solander in S.)
	HELL, summer/autumn of 1773 8.70″ ±0.03″ *Supplementum…de Parallaxi Solis*
	PLANMAN, Dec. 1774 a8.40″, b8.50″ *Article in Handl.Stockh.* (a probable, b max.)

II.3.5 THE *NACHLEBEN* OF HELL'S VARDØ OBSERVATIONS

The term "Nachleben" (afterlife) is a familiar expression in humanistic studies, where the reception and history of effect ("Wirkungsgeschichte") of canonised classics is a traditional research field. This section will explore the Nachleben of Hell's observations of the Venus transit in Vardø, not as an artefact of literature, but as a set of scientific data.

We have seen above how Father Hell, in his own age, was in fact never overtly accused of having forged his observations from Vardø. Such allegations were kept private and not included in any serious, scientific publication. Rumours were, however, kept alive and may have been nurtured by the fact that Hell ever since the suppression of the Society of Jesus proved himself to be a staunch opponent of the radical Enlightenment associated with Ignatius a Born and others.[154]

The next generation of astronomers in central and eastern parts of Europe were eager to get rid of the heritage of ex-Jesuits like Hell and Liesganig, who were seen as obstructing recruitment of non-Jesuits to the few posts that existed in professional astronomy. As examples of the 'new astronomers' in the area we shall have a brief look at Johann Franz Encke and Carl Ludwig Littrow.

The child of a Lutheran pastor in Hamburg, ***Johann Franz Encke*** (1791-1865) was educated by Carl Friedrich Gauss at Göttingen. Thanks to Gauss' recommendation, he gained a post as an assistant at the observatory at Seeberg near Gotha, in 1816.[155] The director of the observatory was Franz Xaver von Zach (1754-1832), born in Hungarian Pest and educated by piarists. From a troubled start as Liesganig's assistant in Leopolis he had embarked upon a tour of Europe that eventually brought him from London to a position as court astronomer in Gotha, in 1786.[156] From his base in peaceful Gotha, Zach became a highly successful 'networker' who published various journals and books in the same vein as Jean Bernoulli III had done in Berlin in the 1770s and 1780s. Unlike Bernoulli, however, Zach was a staunch antagonist of the Jesuits. Both Liesganig and Hell were frequently attacked in Zach's writings. When in the 1820s Zach's pupil Encke took upon himself the task of re-calculating the solar

[154] See Section I.2.4.
[155] Information on Encke's life has been taken from August Kopff in *Neue Deutsche Biographie* Band 4 (1959) and from Michael Meo in Hockey *et al.* (eds.) vol. I.
[156] See Brosche 2009*a* and Balázs *et al.* (eds.) 2005.

parallax on the basis of the observations of the 1760s, he was thus liable to a certain degree of scepticism towards the data sets from Vardø.

Encke first issued a calculation of the solar parallax based on all observations from 1761. This yielded a solar parallax of 8.490525″,[157] a figure in perfect agreement with Lalande's position. When he proceeded to investigate the solar parallax on the basis of observations from 1769, Encke clearly had no doubts that the late Jesuit could have been capable of manipulating his data sets. As he saw it, Hell's calculations of the solar parallax were of no value, his abilities as an observer more than questionable and his excuses for the late arrival of his report "utterly futile".[158] Accordingly, in a treatise on the solar parallax based on the observations from 1769, Encke found on the basis of all observations – Hell's excluded – a parallax of 8.5776″ ±0.037″.[159] When he included the data of the Jesuit in the calculation, the result was 8.60″. As Encke himself conceded, that difference was "well within the limits of likely error".[160] However, given the fact that his earlier investigation based on the 1761 observations had yielded 8.49″, Encke was reluctant to pay heed to the Vardø observations at all. Like Lalande had done earlier, he simply discarded them. Unlike Lalande, however, Encke did not refrain from giving voice to prejudices against Father Hell as a representative of the Jesuit order.

At the time when Encke undertook his calculations, a regime change took place at Hell's old workplace in Vienna. Father Hell's assistant, the ex-Jesuit Triesnecker, had died in 1817. Triesnecker's former assistant Johann Tobias Bürg (1766-1834), who had been attached to the observatory since the 1780s, was allegedly not a proper candidate for the post because he was deaf.[161] Instead, the new director was recruited from outside. Originally educated in Prague, Johann Joseph Littrow (1781-1840) after posts as an astronomer in Cracow, Kazan and Buda, ascended to the chair as director of the Vienna University Observatory in 1819. Shortly afterwards, the Viennese Observatory acquired the collection of manuscripts from Maximilianus Hell that it still keeps today. Johann Joseph gave the task of investigating Hell's papers to his son, the observatory adjunct *Carl Ludwig Littrow*.

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[157] I have not consulted Encke's *Die Entfernung der Sonne von der Erde aus dem Venusdurchgange von 1761 hergeleitet*, Gotha 1822. The parallax value is, however, given in Verdun 2004, p. 322.
[158] Encke, *Der Venusdurchgang von 1769 ...* 1822, *passim* (quotation on p. 18: "ganz und gar nichtig").
[159] Encke 1824, p. 109: "[...] dass die Parallaxe nicht kleiner ist als 8,″5406 und nicht grösser als 8,″6146".
[160] Encke 1837, p. 302: "So gab die Mitbenutzung der Wardoehuser Bestimmungen die Parallaxe = 8″,60, die sämmtlichen Beobachtungen ohne sie 8″,58, eine Differenz, die ganz innerhalb des wahrscheinlichen Fehlers lag" = "The inclusion of the Vardøhusian observation yielded a parallax of 8.60 arc seconds, whereas all the other observations, the Vardøhusian excepted, yielded 8.58, a difference [etc.]".
[161] Kastner-Masilko 2005, p. 72.

Upon inspection of the 'astronomical notebook', Carl Ludwig Littrow concluded that Hell had altered and manipulated the data sets, often with a different kind of ink. The results were published in 1835, in the sensational book *P. Hells Reise nach Wardoë.*[162] In it, Littrow concluded bluntly that the Venus transit observations of Hell and Sajnovics – as published by Hell in the *Observatio Transitus Veneris ... Wardoehusii ... facta* (1770) – were worthless, whereas the observation of the untrained Borchgrevink, whose moments differed many seconds from those of the two Jesuits, was "the only true" observation and could be used.[163] Littrow thereby restored the Vardø observations, but in doing so, he furnished the reader with 'proofs' of Father Hell's unreliable character and incompetence as a scientist. Through Littrow's book, the name of Hell had been tainted with the worst thinkable scientific crime – manipulation of data sets.

Littrow's publication found an immediate response from the expert on the solar parallax to whom it was dedicated, Johann Franz Encke. At a session of the Berlin Academy of Sciences on 30 April 1835, Encke explained that his skepticism towards the veracity of Hell's Vardøhus observation originated in the general impression that he had formed of his personality, first and foremost because "he was Jesuit".[164] Encke had now gladly devoured Littrow's account and found that it confirmed all his prejudice towards the late Viennese Jesuit, who clearly not only had altered his data sets in a very clumsy and incompetent manner, but also had been unable to keep correct track of the running of his clocks and had calculated the longitude and latitude of Vardø wrongly. Thanks to Littrow's edition of the original 'astronomical notebook' of Father Hell, Encke was now able to apply what he believed to be the necessary reductions of all the data. He entered the 'restored' Vardø observation into his calculation, and found that it supported a solar parallax of 8.57116″, only 0.0064″ different from the one he had found without using the Vardøhusian data sets ten years earlier![165]

Ironically, Littrow and Encke had in fact committed an act of "Schlimmverbesserung", or 'improvement that makes things worse than they already were'. For one thing, the solar

[162] According to Nielsen 1957*b*, p. 96 note 27 it was printed already in 1834, despite the information on the title page.
[163] Littrow 1835, p. 77: "[...] die *Borgrewing*'sche Beobachtung als die allein wahre anzunehmen".
[164] Cf. Encke 1837, here p. 301: "er war Jesuit".
[165] Cf. Encke 1837, espec. p. 309.

parallax advocated by Encke was plainly wrong. Worse still, the manuscripts inspected by Littrow – with one insignificant exception, which he overlooked – in fact contained no additions in a different-coloured ink, as he claimed. Instead, as Simon Newcomb (1835-1909) later was to discover, the young Littrow had been so blinded by his prejudices against the late Jesuit that he forgot to consider that he himself was in fact colourblind![166] The conclusions of the 1830s nonetheless remained unchallenged for more than three decades.

In 1864, however, the astronomer Karl Rudolph Powalky (1817-1881) at the University of Kiel defended a doctoral thesis on the Venus transit of 1769 and the solar parallax that could be calculated thereof. He inspected Littrow's book as well as Encke's treatises, but could not bring himself to agree to their hostile conclusions. Instead, Powalky found that[167]

> The corrections that Hell allowed himself to make in his manuscript appear to have been extremely unimportant. This, the good quality of the telescopes used by himself and Father Sajnovics and the good accordance of the contacts observed during egress along with the remarks made on this occasion allow the observations to be treated as quite certain. [...] Furthermore one should note that Hell and Sajnovics were skilled observers and that the Sun was higher above the horizon during both ingress and egress than in any other site in Europe, with the exception of Orenburg, where only the egress was observed.

In his thesis, Powalky concluded that the solar parallax probably was around 8.86″,[168] thus far larger than Encke's conclusions and more in tune with Father Hell.

In 1869, a prominent astronomer at the *Académie des Sciences* in Paris, Hervé Auguste Étienne Albans Faye (1814-1902), presented a paper in which he questioned some of Encke's and Littrow's conclusions, particularly concerning the solar parallax (Faye advocated a solar parallax of 8.80 ±0.01″, which is indeed entirely correct).[169] C. L. Littrow, who in the meanwhile had been appointed director of the Vienna Observatory, reacted promptly by dispatching facsimiles of Hell's manuscript to Paris. Of course, Professor Faye had no chance

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[166] Cf. Newcomb 2006 (orig. 1903), pp. 78-82. For a brief assessment of Newcomb's career, see Carter & Carter 2009.

[167] Powalky 1864, pp. 15-16: "Die Correcturen, die sich Hell in seinem Manuscripte bei seinen Beobachtungen erlaubte, scheinen äusserst gering gewesen zu sein. Dies, die Güte der von ihm und P. Sainowics benutzten Fernröhre und die gute Uebereinstimmung der Berührungen beim Austritte nebst den Bemerkungen lässt die Wahrnehmungen als sehr sicher voraussetzen. [...] Ausserdem ist zu bemerken, dass Hell und Sainowics geübte Beobachter waren, und die Sonne beim Eintritt und beim Austritt höher stand als an irgend einem Punkte in Europa, mit Ausnahme von Orenburg, wo nur der Austritt beobachtet wurde."

[168] Cf. Duerbeck 2005, p. 60.

[169] Faye 1869*a* and 1869*b*. See also Nielsen 1957*b*.

of detecting errors in Littrow's conclusions on the basis of the sets of black-and-white reproductions offered him. In a follow-up article he therefore agreed that the original journal must indeed have been edited before publication. Nevertheless, while admitting that Hell had arrived at some misguided conclusions in his theoretical works, he maintained that the editing in any case had been made with the best of intentions and underscored that Hell's original manuscript proved his abilities as an observer. Looking ahead to the transit of Venus that soon was to take place, Faye concluded that[170]

> the error of Father Hell's observation, which he made without understanding its meaning, thus does not exceed 2.2 seconds in time. It will be difficult for us to do any better in 1874.

The solar parallax question was not resolved by the new sets of international observations of the Venus transit in 1874, and the Swiss astronomer Rudolf Wolf in his 'History of Astronomy' (in German, published 1877) still believed in Littrow's and Encke's conclusions concerning Father Hell. Wolf conceded, however, like Faye that the solar parallax probably was somewhat larger than Encke had concluded.[171] The main blemish on Hell's memory, the crime of having manipulated a set of scientific data, therefore remained. Thus, when an article on him was included in the *Allgemeine Deutsche Biographie* (vol. XI, published 1880), the story of his fraudulent alteration of the Venus transit observation from Vardø was repeated without reservation.[172]

Only three years later (1883), Simon Newcomb published his remarkable demonstration that Littrow was plainly wrong, a conclusion he corroborated in his later work "Discussion of Observations of the Transits of Venus in 1761 and 1769" (1890). Newcomb had experience from the transits of Venus in both 1874 and 1882 to draw upon, and his conclusion concerning the solar parallax was virtually identical to the one that had been advocated by Faye in 1869. The data sets from Vardø corroborated this conclusion. Thus, Hell's Vardø observations turned out to support a parallax of 8.79″ (Newcomb) or 8.80″ (Faye), and have since then been 'canonised'.

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[170] Faye 1869*c*, p. 287: "Ainsi, l'erreur de l'observation du P. Hell, observation qu'il a faite sans en connaître le sens, se réduit à + 2^{s},2. Il nous sera difficile de faire mieux en 1874". See also Faye 1869*a*, espec. pp. 47-49; Faye 1869*b*, espec. p. 70; Faye 1869*c*, *passim*.
[171] Wolf 1877, pp. 645-646.
[172] Christian Bruhns in *Allgemeine Deutsche Biographie*, Elfter Band (Leipzig 1880), pp. 691-693, here p. 692. See also the article of Nielsen 1957*b* for more examples.

Newcomb's demonstration found a reverberant echo among Jesuit apologists. For example, the Jesuit-run periodical *Stimmen aus Maria Laach* announced Newcomb's detection as a remarkable feat (in 1888 and 1890)[173] and the German Jesuit historian Bernhard Duhr (1852-1930) included it in his widely read 'Jesuit Fables' (in German, 2nd edn., 1892).[174] Black had turned into white, or to use another metaphor: a monster's fraud had turned into the glorious achievement of a saint.

I let the brief overview of the Nachleben of Hell's Vardø observations end here. Recent advances in electronic measuring have brought the solar parallax to be fixed at 8.794148″.[175] To translate it into familiar terms, this means that the Sun, in its mean distance from Earth, "is a couple of meters shy of 149,597,870,700 m[eters]" away.[176]

II.3.6 ASSESSMENT OF FATHER HELL'S ROLE IN THE VENUS TRANSIT PROJECT OF 1769

At the end of this account of Father Hell's role in the Venus transit project of 1769, an assessment of certain notions that emerge from the modern literature is called for. One problem is whether he was ordered to keep secret the details of his observation, or if this was his own idea. A second question is whether Father Hell acted in an indecent manner during the debates over the solar parallax. A third and more complex issue is the extent to which Hell's adherence to the Jesuit order can be used to explain the vicissitudes he went through.

In his thorough study of the Vardø expedition, Helge Kragemo suggests that the late publication was a deliberate choice made by the Jesuit himself:[177]

> "everyone who had results [i.e., successful observations] to share did so as quickly as possible, everyone except the Jesuit Father. Hell knew that he had the

[173] See L. v. Hammerstein 1890; Hagen 1917, p. 100 also refers to an earlier article in the *Stimmen*, vol. 34 (1888), pp. 551-553 (not seen). Incidentally, Hagen published his work in the *Stimmen der Zeit*, the continuation of the above-mentioned *Stimmen aus Maria Laach*; cf. http://www.stimmen-der-zeit.de/zeitschrift/geschichte/geschichte_der_zeitschrift_html (accessed 9 February 2009).
[174] Duhr, *Jesuiten-Fabeln: Ein Beitrag zur Culturgeschichte* 1892, p. 465. Altogether four editions of this book appeared in the years 1891-1904.
[175] According to Ian Ridpath, entry on "solar parallax" in *A Dictionary of Astronomy*, Oxford University Press, 2007. The number of decimals could probably have been expanded.
[176] Standish 2005, p. 174.
[177] Kragemo 1960, p. 120: "Alle som hadde resultat å publisere kom med dem hurtigst mulig, alle unntatt jesuittpateren. Hell visste at han satt med trumf, observasjoner i syd hadde liten verdi om de ikke kunne kombineres med observasjoner i nord".

> trump card in his hand, for observations in the South were of little value if they could not be compared with observations in the North".

This contradicts Father Hell's statement in his letter to Wargentin from November 1769 (quoted above) as well as various other sources, where he explains that it was the Court in Copenhagen that had ordered him to remain silent. However, Kragemo is not alone in suggesting that the idea was Hell's own. As we saw in the reactions of Planman, Lexell and Lalande recounted above, even they took for granted that this ban could be nothing other than a pretext invented by Hell himself.

This notion lingered on through the generations of astronomers following Hell's passing. The above-mentioned Franz Xaver von Zach, court astronomer in Gotha, made the following statement in a journal article from the year 1818:[178]

> Father Hell had all the time in the world to adjust his observation (not upon the calculation [...], but upon the numerous observations of other observers who had published their reports earnestly). Father Hell excused himself by stating that the observation was not his own property and that he could not share it with others, nor make it public, until he had paid tribute to the King of Denmark, who had asked for Father Hell from the Empress Maria Theresa in order that he should make this observation in his estates. However, an astronomical observation is not a state secret, and you hardly need nine months to print the couple of lines needed to explain the entire observation.

Not surprisingly, Carl Ludwig Littrow concluded similarly:[179]

> a circumstance that appears to be worthy of pointing out is that in the entire diary [of Sajnovics] there is no trace to be found of the ban that was supposed to have been issued by the King of Denmark against publication of the Vardø observation. This fact confirms the assumption that has already been put forward, that the whole thing may well have been invented by Father Hell, to serve him as an excuse for the late publication of his report.

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[178] Zach in *Correspondance Astronomique, Géographique, Hydrographique et Statistique du Baron de Zach* Premier Volume (1818), p. 176: "Le P. Hell avait tout le tems d'ajuster son observation (non pas sur le calcul [...]), mais sur les nombreuses observations des autres observateurs qui avaient sur le-champ franchement publié les leurs. Le P. Hell s'excusa sur ce que l'observation n'était pas sa propriété, qu'il n'a pu en disposer, et la rendre publique, avant d'en avoir fait hommage au Roi de Dannemarck, qui avait demandé le P. Hell à l'Impératrice Marie-Thérèse pour faire cette observation dans ses états. Mais une observation astronomique n'est pas un secret d'État, et il ne faut pas neuf mois pour imprimer un couple de lignes, dans lesquelles toute l'observation peut être renfermée."

[179] Littrow 1835, p. 163: "Bemerkenswerth scheint der Umstand, dass im ganzen Tagebuche sich nirgends eine Spur des vorgeblichen Verbotes von Seite des Königes von Dänemark, die Wardhuser Beobachtung bekannt zu machen, findet, eine Bestätigung der, schon früher geäusserten Meinung, dass das Ganze wohl nur von P. *Hell* erfunden seyn mag, um ihm mit als Entschuldigung für die späte Bekanntmachung zu dienen".

Littrow's conclusion appears to be somewhat exaggerated. Father Hell spent three weeks in Copenhagen on the northbound part of the journey, and we must assume that many arrangements concerning his expedition were settled here. The problem is that the part of Sajnovics' diary covering this period has been lost, along with nearly all Hell's letters written from Copenhagen. In any case, this is the kind of instruction that might well have been given orally and never taken down in any document. Even if it may never have been stated expressly, one may conjecture that the ban against sharing the observation with anyone else until after the King had received his copy of the report was perceived by Hell as part of his duty. We ought to assume that he had a certain flair for courtly etiquette from his many years as court astronomer. Besides, to seek intimate contact with potentates and inner circles at court by means of scientific work was a typical strategy followed by Jesuits when visiting non-Catholic countries.[180] Thus, one might reverse the assumption of Littrow, by asking: how would the King and government of Copenhagen have reacted, if an astronomer in their service told lies without any foundation whatsoever? Surely, such a way of laying the responsibility on his sponsor for the late communication of a much-longed-for observation would have caused an outcry, if it had been completely unfounded. If we widen the scope beyond the Vardøhus expedition itself, more evidence suggests that the scientific data sets from Vardø may indeed have been considered 'state secrets' by the Danish authorities.

As Sverker Sörlin has pointed out, the participants at the Danish-sponsored expedition to *Arabia felix* in the years 1761-1767 (from where Carsten Niebuhr returned as the sole survivor), were under strict orders not to publish any results of their expedition elsewhere than in Copenhagen. In fact, the scientific staff of that expedition was not even allowed to communicate their findings by letter to foreigners.[181] Incidentally, the man who was in charge of the Arabia felix enterprise, minister Moltke, was also the host of Father Hell in Copenhagen in June 1768. Since Hell's expedition was planned under the same regime as Niebuhr's, it is not unlikely that he received similar instructions. So, the ban against private communication of the data sets from Vardø may well have been in breach with the ideals and practices of the Republic of Letters, but it was in accordance with Danish behaviour under very similar circumstances only a few years earlier.

[180] See for example Hsia 1999; Standaert 1999; Pagani 2006.
[181] Sörlin 1993, pp. 58-61. See also Section I.1.2.1 above.

The next question, concerning the behaviour of Father Hell during the debates over the solar parallax, has also been raised by Kragemo. Taking recourse to Johann Franz Encke's work on the Venus transit of 1769, published in 1824, Kragemo says that the Jesuit proved himself to be a lousy debater who "used all kinds of tricks; erroneous calculations, wrong longitude determinations and incorrect parallax effects".[182] This may be true, but at the same time we may safely conclude that this was simply the order of the day; Lexell voiced exactly the same criticism against Hell, Planman and Lalande alike. Even Hell's insistence that Lalande must have been led more by his personal ambition than by a quest to find the truth, is echoed by Lexell. And already in January 1770, when Lalande published his first in a series of calculations of the parallax based on the observations of 1769, another of Wargentin's correspondents in Paris remarked that "the merit of this savant, however huge in itself, would have been doubled if only he had been less inimical to the merit of others".[183] In their constant quest for personal fame and glory, the Viennese astronomer and his Parisian colleague were probably on an equal footing, and it would be unfair to place all the blame for the heated debate on just one of them.

This brings us to the final question, to what extent religious antagonism played a role in the controversy. In a contribution to the history of Jesuit science, Mordechai Feingold has pointed to the story of Maximilianus Hell and the debates following his Venus-transit observation of 1769 as "symptomatic of the highly charged feelings the Jesuits elicited on the eve of the dissolution of the Order".[184] Horst Kastner-Masilko, in his biography on Hell's successor as director at the Vienna Observatory, even gives the information that Lalande as an atheist was a personal enemy of the Jesuits, "aggressively waging war against them".[185] Also Jean-Claude Pecker, in a biographical essay on Lalande, talks of "the unfair suspicion of a notorious atheist against a priest with a predestined name".[186] Now, do these characterisations really fit? Lalande helped the Jesuit Christianus Mayer go to St. Petersburg for the same purpose as Hell had travelled to Norway, and he cultivated a close friendship with Father Boscovich

[182] Kragemo 1960, pp. 121-122: "Her viser han seg imidlertid som en dårlig debattant"; "Han [i.e. Encke] påviste hvordan Hell i sitt forsvar for sine observasjoners fortreffelighet hadde brukt alle slags knep og: regnefeil, gale lengdebestemmelser og feilaktige parallaksevirkninger".

[183] François Charles de Baër to Wargentin, dated Paris 18 January 1770 (*CVH*): "le merite de ce sçavant, très grand en lui meme, le seroit doublement s'il etoit moins ennemi de celui des autres".

[184] Feingold 2003, p. 1.

[185] Kastner-Masilko 2005, p. 48: "[...] es kam zu einer äuβerst heftigen Auseinandersetzung mit Lalande, der als Atheist sehr aggressiv gegen die Jesuiten zu Felde zog".

[186] J.-C. Pecker 1985, p. 19: "l'injuste soupçon d'un athée notoire vis-à-vis un prêtre au nom prédestiné". It should be mentioned that Pecker afterwards revised his opinion on the quarrel between Lalande and Hell (cf. Pecker 1998).

throughout the dispute with his confrère in Vienna. Lalande, himself a pupil of the Jesuits, is in fact known to have deplored the abolition of their "illustrious society".[187] Admittedly, investigation of the letters of Lexell to Wargentin reveals that he – in the heat of the moment – did not hesitate to dismiss the arguments of his Viennese counterpart as sophisms characteristic of a Jesuit.[188] But such sentiments were never voiced in any serious, scientific publication on the parallax, nor did Lexell – as far as we can tell – brand Hell for being Jesuit in his correspondence with him.[189] Much more conspicuous is Hell's polemic against French Science as a whole. Whereas Hell in his survey of observations of the 1761 transit of Venus had extolled France as "the highly fertile parent and nurse of the best astronomers of our age", he in the *De Parallaxi Solis* (1772) criticised virtually every action taken by the French.[190] In the meantime, France had of course expelled the Jesuits (begun around 1761, finished by 1768) and was pressing the Pope to order the same for every Catholic country. Hell is careful to protect not only his own observation from Vardø, but also that of Jesuit missionaries in Beijing, from criticism.[191] In fact, the Jesuit of Vienna appears to have been more biased against Lalande – as a representative of French science – than anyone else, Lalande included, was against him as a Jesuit.

In conclusion, it would seem that most notions concerning the role of Father Hell in the Venus transit project of 1769 have their origin in the 'golden age of Jesuitphobia' in the first half of the nineteenth century. Zach, Encke and Littrow were quick to jump to hostile conclusions with scarce foundation in source materials. The contemporaries of Hell in fact fared more mildly with him, at least in their official publications. It is often forgotten that Lalande reconciled himself fully with Father Hell. I let the *éloge* read by Lalande at the *Académie*

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[187] See for example Heilbron 1979, p. 109.
[188] Letters from Lexell to Wargentin in Stockholm, dated St. Petersburg 12 April 1772, 7 September 1772 and 23 March / 3 April 1773 (all located in the *CVH*).
[189] Lexell to Wargentin in Stockholm, dated St. Petersburg 23 March / 3 April 1773 (*CVH*): "Emedlertid har jag försäkrat honom, at jag anser sådana små konster för nedriga, barnsliga och löjeliga; jag tänkte at de skicka sig för en Jesuit, men det sade jag dock icke" = "[...] I have ensured him, that I find such petty arts loathsome, childish and ridiculous; I thought that they were worthy of a Jesuit, but I did not say so". It is also worth noting that Lexell developed a close friendship with the Jesuit Chr. Mayer during his visit in St. Petersburg and recommended him to Wargentin; Lexell to Wargentin, St. Petersburg 10 / 11 June 1770 (*CVH*). Thus, neither Lexell nor Lalande were unequivocally biased against Jesuits as such.
[190] Contrast Hell 1761*a*, p. 36: "*Gallia* fœcundissima præstantissimorum hodiernorum Astronomorum *Genitrice* & *Altrice*" *versus* 1772, pp. 111-114.
[191] Hell 1772, pp. 79-80.

Royale des Sciences (post-revolutionary *Institut national*) upon the death of his correspondent stand as evidence to this fact:[192]

> The [Vardø] observation of Father Hell [...] was a complete success; [...] it is in fact one of five complete observations that were made at huge distances from each other, where the duration of Venus during its passage shifted the most. This has made us know the true distance of the Sun and all the planets from the Earth, an epoch-making feat in the history of astronomy, in which the name of Father Hell is deservedly inscribed. His expedition was just as rewarding, interesting and painstaking as those made to the southern sea, to California and to Hudson Bay, for the sake of this famous transit of Venus in front of the Sun.

[192] Lalande 1803, p. 722: "l'observation du P. Hell [. . .] réussit complétement; [. . .] elle s'est trouvée, en effet, une des cinq observations complétes, faites à de grandes distances, et où l'éloignement de Vénus changeant le plus la durée du passage, nous a fait connaitre la véritable distance du soleil et de toutes les planétes à la terre; époque remarquable dans l'histoire de l'astronomie, à laquelle se trouvera lié à juste titre le nom du P. Hell, dont le voyage fut aussi fructueux, aussi curieux et aussi pénible que ceux de la mer du Sud, de la Californie et de la baie d'Hudson, entrepris à l'occasion de ce célébre passage de Vénus sur le soleil".

Part III

EDITIONS OF PRIMARY SOURCES

III.1 MAXIMILIANUS HELL'S CALL FOR SUBSCRIPTIONS TO THE *EXPEDITIO LITTERARIA AD POLUM ARCTICUM* AND HIS UNFINISHED INTRODUCTION TO THAT WORK

> Integram lectoribus commentationem damus, quod in talibus abesse ne *γρὺ* quidem oportere putamus.
>
> - The editors of the *Nova Acta Eruditorum*
> in their Preface to Hell 1770*a*2 [1]

The texts edited in this part of the thesis both belong within the framework of a single work, the three-volume *Expeditio litteraria ad Polum arcticum* ('Scientific Expedition by the North Pole'). The work in question was never published in its entirety, although some texts that Maximilianus Hell intended to include in it were published either by himself or by his assistant Sajnovics in their own lifetime (See Section I.2.3). After Hell's death, various parts of the corpus of texts pertaining to the *Expeditio litteraria* have been published by others, and it is the aim of this part of the thesis to supplement that list.

First, some words of clarification for the non-specialist. A source-based, historical study (like the two preceding parts of this thesis) will tend to include citations from primary sources, be they manuscripts or printed works. Sometimes even entire documents will be included in the running historical discussion, like the letter from Josephus Mayer to Maximilianus Hell presented in Subsection I.2.2.1 above. That does not imply that such quotations count as *textual editions per se*. The aim of a textual edition is different. Its main aim will be to present either an entire work (or, so large a part of a work that is extant) or a series of interrelated works, usually with an introduction and explicatory commentary added. *Translations* will likewise tend to present original sources *in extenso*, but in another language than that of the original. A *critical edition* is a textual edition that discusses variant versions of the same text where such are available, and offers opportunity to correct errors. In a critical edition, all important variant readings and corrections should be stated in an *apparatus criticus* or *appendix critica* (critical

[1] Anonymous editorial remark in Hell, "Observatio transitus Veneris ante discum Solis … Wardoëhusii … facta …" 1770*a*2, p. 2: "We offer our readers the entire report, for in cases like these we consider that not even even the least trifle should be left out".

apparatus or appendix). Often, as in the case of an old language like Latin, the textual edition will include a translation into a modern language as well. The present critical editions establishes a Latin text on the basis of various pieces of textual evidence. Variant readings are listed in a critical apparatus, and there is a facing translation in English. The use of explicatory footnotes to the English translation has been kept to a minimum.

Modern editions of Hell's works began with Carl Ludwig Littrow's *P. Hell's Reise nach Wardoe* ('Father Hell's Journey to Vardø', 1835), which included substantial parts of Hell's manuscript *Observationes Astronomicæ et Cæteræ Jn Jtinere litterario Viennâ Wardoëhusium usque factæ 1768* ('Astronomical and other observations made during the scientific journey from Vienna to Vardøhus in 1768 [and 1769]'). That particular manuscript contains the Venus transit observation itself and formed the basis upon which Father Hell composed his report from Vardøhus, as discussed in Chapter II.3 above. Littrow even included in his book substantial extracts from the travel diary of Joannes Sajnovics in a loose German translation.

Various miscellaneous articles have presented some particular source, for example Ferdinánd Mencsik's transcript of a letter from August Ludwig Schlözer to Hell in the journal *Történelmi Tár* (1905). In three more elaborate works, numerous letters and other manuscript sources have been edited. These are the contributions by Ferenc Pinzger (1927), Ansgar Rabenalt (1986) and Magda Vargha (1990-92). In addition, a report by Truls Lynne Hansen and the author of this thesis included facsimiles of manuscripts from the expedition in Norway with palaeographical comments (Hansen & Aspaas 2005).

For all their academic value, however, hardly any of the contributions mentioned are critical editions in the sense outlined above. The closest we get is Ansgar Rabenalt's edition of the correspondence of Fixlmillner and Hell (in German, 1986). Unlike Pinzger and Vargha, Rabenalt gives information on variant readings in footnotes. Furthermore, he presents brief summaries of the contents of each letter and explains difficult glosses in his footnotes. Unfortunately, the same kind of diligence is not observed by either Pinzger or Vargha. It would be harsh to blame those authors for this. It is the privilege of a doctoral candidate at a Norwegian university in 2012 to neglect commercial considerations and printing costs. In writing a monograph, he can allow himself to go deeper into the matter than the average popular science writer can.

Two texts will be edited in the present critical edition. The first, and shorter text is Maximilianus Hell's call for subscriptions to the *Expeditio litteraria*, which provides a summary of the contents of the three planned volumes as well as a plan for their publication. The second, and somewhat more elaborate text is his previously unpublished introductory chapter to the *Expeditio litteraria*, in which he places his expedition within an international framework of Venus transit expeditions undertaken in the same year. Both texts are edited with a critical apparatus in Latin and facing translations and commentary in English.

The fate of Father Hell's manuscripts has been discussed in Section I.1.2.2 above. As regards the call for subscriptions, only an early draft for the various chapter headings has been found. There are, however, five printed sources of value, in Latin, German and French.

For the introductory chapter of the *Expeditio litteraria* there are four manuscript versions preserved, all in Latin. Two of these are in Hell's own hand, whereas the two others appear to be in the hand of a secretary. Presumably, the fourth and final version was meant to be printed, but along with the third version it breaks off earlier than the two drafts in Hell's handwriting.

It is common for critical editions to include reflections concerning the author's syntax, choice of words etc. – and in the case of manuscripts, even a description of the handwriting. Those features have been omitted here.[2] Although I have consulted several dictionaries when translating and assessing variant readings both in the critical editions and elsewhere in this thesis, I have rarely included these readings in my footnotes or

[2] See, however, the comments on Hell's and Sajnovics' handwriting in Hansen & Aspaas 2005, pp. 45, 61 & 115.

discussions.[3] The main ambition of this part of the thesis is to present previously unpublished texts by Maximilianus Hell, in a reliable Latin version accompanied by English translations. With these texts to hand, philologers are invited to extract from them whatever information they need concerning linguistic issues, orthography and lexicon. *Non omnia possumus omnes!*[4]

III.1.1 EDITING, TRANSLATING AND COMMENTING NEO-LATIN TEXTS

Editing manuscripts or printed materials may seem rather straightforward, especially in cases where we have access to autograph manuscripts. The main challenge, it could be argued, must consist in interpreting a foreign language and perhaps difficult handwriting, but as soon as the editor has acquired familiarity with these constituent aspects of the source material, editing it must be an easy task. If we turn to the discipline of Classical Philology, however, the methodology quickly becomes more complicated.

The traditional texts edited by classical scholars stem from an age when no recognisable system of punctuation existed (at least not a system comparable to modern conventions), when all letters were either minuscules or capitals, and no printing press had been invented. Except for the case of some inscriptions and papyri (almost exclusively in Greek), no autographs are extant. Thus, when editing texts from Greco-Roman Antiquity, scholars feel free to introduce whatever system of punctuation and choice of capital letters they consider best. In points of detail, this practice may vary between individual editors and between the major publishing houses (the Teubner, Budé and Oxford editions are generally held in the highest esteem),[5] but broadly speaking, it would be fair to say that a more or less consistent typography has been used for editions of classical texts for

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[3] The dictionaries that have most frequently been consulted are the following: Bartal 1901 on Hungarian Neo-Latin; Kirsch 1774 on Neo-Latin from German-speaking regions; Kalkar 1881-1907 on early-modern Danish; *Ordbok över svenska språket (Svenska Akademiens Ordbok)* 1898- on Swedish, currently covering letters A-T; *Oxford English Dictionary* 2nd edn. 2004 on English (cf. Helander 2001 for its usefulness to Neo-Latinists); *Thesaurus Linguae Latinae* 1900- on classical Latin, at present covering letters A-O; *Oxford Latin Dictionary* 1968-1982 and Lewis & Short 1879 on classical Latin.

[4] "Not all of us are able to do all things", cf. Virgil (Publius Vergilius Maro), *Eclogae* VIII.63.

[5] Teubner texts, or *Bibliotheca scriptorum Graecorum et Romanorum Teubneriana*, are published in Stuttgart and Leipzig by B.G. Teubner Verlagsgesellschaft; Budé texts, or texts from *l'Association Guillaume Budé*, are published by le Société d'édition Les Belles Lettres in Paris; Oxford classical texts, or *Scriptorum Classicorum Bibliotheca Oxoniensis*, are published by Oxford University Press.

more than a century. Not quite so when medieval documents from the Holy See are concerned. The so-called *diplomatic editions* of medieval documents entail presentations in a ‘documentary’ manner, with abbreviations and original punctuation preserved in print, however odd these features may appear. Modern editions of Latin material from Medieval Times will therefore be readily recognisable from the basis of typography alone, in which respect they diverge from editions of Cicero or other prose material from Antiquity.[6] Book historians are familiar with these aspects. To name but one example, Jens Bjerring-Hansen has in a recent article demonstrated how a book in the vernacular might be judged as “Latin, not Danish” merely because an eighteenth-century publisher changed from Gothic to Roman types.[7] If typography has had such a strong influence on readers in the past, can we then feel confident that we are not affected by such aspects in our own reading today?

Scholarly interest in *Neo-Latin* texts, that is texts dating from the Renaissance up to about 1800,[8] or even up to the present day,[9] is of a comparatively new date. It should be obvious that the textual situation, especially when we are dealing with texts dating from the introduction of printed matter in the 1450s onwards, is different from that of texts originating from both Antiquity and the Middle Ages. However, perhaps as a result of the fact that most editors of Neo-Latin texts have been educated within the field of classical philology, they tend to take the liberty of altering systems of punctuation, use of capital letters and orthography extant in the printed texts and/or manuscripts, introducing whatever system they see fit. Having been taught to concentrate their textual criticism on choice of words and syntax, they seem to have dropped paying attention to what they see as artificial systems of lay-out with little or no influence on the meaning. In order to get the original ‘message’ through to a modern reader, this choice seems well founded; better to do some adaptation, than risk confusing the reader.[10] Other arguments appear to be

[6] By the term “typography” I mean what we in Norwegian call “skriftbilde” (in German “Schriftbild”, in French “présentation typographique”), that is the general appearance of the text as a result of lay-out, use of typeface, fonts, abbreviations, emphasis markers, punctuation, etc. combined.
[7] Bjerring-Hansen 2010 (in Danish).
[8] Helander 2001, p. 7.
[9] J. IJsewijn, 1990, p. [v].
[10] Arguments in favour of a “pedagogical” text presentation are found in e.g. Rabbie 1996; Deitz 1998; Roggen 2002, pp. 302-321.

based on a sort of craving for rules and regulations, where the editor sees it as his mission to rid the text of anomalies and irregularities in order to arrive at a consistent use of commas, capital letters, etc. – based on tacit adherence to the motto "Ordnung muss sein".[11] Some Neo-Latinists have taken a different approach, however. One example is Hans Helander and his students in Uppsala, who tend to argue that original orthography and to some extent even punctuation should be paid attention to. Thus, in a debate article in the journal *Symbolae Osloenses* of 2001, Helander argues that the original spelling and use of diacritical marks should be preserved, on the grounds that these were constituent parts of Latin usage at the time (obvious examples are: *charus* = "dear, beloved" / *carus* = "dear, expensive", *verè* [adverb] / *vere* [ablative of *ver*], *quum* [conjunction] / *cum* [preposition]). However, when it comes to abbreviations, ligatures and punctuation, Helander and his followers tend to adapt their texts to modern conventions.[12]

A more radical programme for retaining original features of Neo-Latin texts in modern editing has been presented by Helga Köhler of Heidelberg University.[13] Köhler stresses the fact that in the Neo-Latin period conventions of punctuation were already fully developed, and argues that ruling out these conventions from our textual presentation may easily mislead the reader. The punctuation of a sixteenth-century author like Joseph Scaliger is of a rhetorical kind, where those parts of sentences which constitute 'building bricks' of meaning are separated by ample use commas and semicolons. The early-modern use of capital letters and diacritical markers (*quàm* ["than"] / *quam* [relative pronoun], *fugâ* [ablative] / *fuga* [nominative], etc.) are other ways of guiding the reader through the text. Thus, removing these features from a modern edition does not necessarily mean aiding the reader. Besides, if the modern reader opens a book and finds exactly the same typography as in a Teubner, Budé or Oxford edition, this will give her (or him) the false impression that she will find the same sort of Latinity as the classical norm implies. Retaining features characteristic of Neo-Latin will, on the contrary, serve as an aid to the reader; she will immediately recognise this as a distinct sort of Latinity,

[11] Cf. H. Hofmann in Helander *et al.* 2001, pp. 51-53.
[12] See Helander's arguments in his 2001 debate article, pp. 27-32 & 89-90; and the doctoral theses of his students Krister Östlund (2000) and Urban Örneholm (2003), cf. the review of Östlund by Kraggerud 2001.
[13] Köhler, "Towards the modern 'Lesetext'?" (in German, 1998).

and will be prepared to assess it as such.[14] Following Köhler, I would say we achieve at least two effects by adapting Neo-Latin texts too eagerly to modern conventions:

First, the reader misses the opportunity to be introduced to conventions characteristic of the period, publisher or author in question. If I may use Maximilianus Hell as an example; ruling out the conventions used by this highly productive writer would make the reader rely exclusively on my adapted texts, withholding from her key information on how to interpret other contemporary texts which have never been, and probably will never be, published in any modern adaptation. Thereby, pedagogical service is turned into disservice.

Second, important hints as to how the author wished his text to be interpreted, may be missed entirely. Again with Maximilianus Hell the example; his use of capital letters, punctuation, accents and emphasis markers such as italics, change of typeface for individual words, and the like, may seem alien at first sight. His conventions in for example use of initial capital letters are neither the modern German ones (each noun with initial capital letter, every other word without), nor are they comparable to the conventions used for classical authors in the Teubner, Budé and Oxford editions. Frequently, an adjective will be given an initial capital letter – apparently for emphasis – whereas the connected noun is spelled without. Thus, normalising these ‘anomalies’ to modern conventions in vogue for editions of classical Latin, may amount to stripping such words of their intended emphasis. Again, service is turned into disservice.

The only real service to the reader will, in my view, be rendered by presenting along with the edition images of the original(s), whether in the form of facsimiles of printed pages or photographic reproductions of manuscript pages; a description of various features of the text material, including the author’s use of punctuation, capital letters, diacritical signs,

[14] The choice of typography is one of the constituent aspects discussed in Gérard Genette’s *Paratexts* (orig. *Seuils*, 1987) 1997, Chapter 2, pp. 33-36.

etc.; and a if necessary a guide to the interpretation of these features, which (admittedly!) may be unfamiliar to the reader.[15]

Ideally, given the limited readership of Latin today, a translation should also be included in modern editions. The translation will follow the contemporary conventions of the language in question, and will in most cases be the quickest guide for the Latin-competent but puzzled reader, whether orthography, punctuation, vocabulary or syntax obstructs her reading of the original. In this way, pedagogical concerns are given full service, and demands for historicity are taken into account as well, since – at least within the discipline of History – a 'clean' text will generally be preferable to an adapted one.

Are we, then, back at the easy task alluded to above – the mere transcription of all the conventions, spellings and punctuation practices found in the manuscripts? In some cases a mere facsimile might do the job better than any transcription.[16] But as soon as more than one textual witness is involved, things get more complicated. Various practical solutions must be found depending on the character of the source material; so far, no one has come up with a 'manual' for all Neo-Latin texts. Even Köhler ends her article by stating that "no uniform solution can be used for all editions, not even [for all texts] from the same age".[17] However, although the field is still disputed, the more 'authentistic'

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[15] See also my review of a recent edition of Hugo Grotius (in Norwegian, 2011*b*).

[16] This, I would argue, was the case with Hell's geomagnetic observations from Norway (Hansen & Aspaas 2005).

[17] Köhler 1998, p. 188: "Allen Editoren […] ist bewußt, daß es keine einheitliche Lösung für alle Editionen, auch nicht der gleichen Epoche, geben kann". It might be added that the problem of orthography is by no means limited to neo-Latin philology alone. Thus, the classicist Louis Havet of the *Collège de France* in a debate with his colleague Antoine Meillet once argued that "il faut partir de cet axiome qu'*il n'y a pas d'orthographe latine*. Le mot même d'orthographe est un non-sens quand il s'agit du latin. Sur les questions litigieuses, il n'y a jamais eu d'accord et de règle impérative. Que pouvons-nous donc faire, sinon représenter l'incohérence réelle? En établissant une norme, nous modernisons, nous francisons, nous défigurons le latin […]. Pratiquement, le mieux est de choisir, entre les différentes sources manuscrites, celle qui peut prétendre au plus d'autorité et d'en reproduire la graphie" = "our point of departure should be the axiom that *there is no such thing as Latin orthography*. The very word 'orthography' is nonsensical as far as Latin is concerned. On the disputed points, there has never existed any agreement or imperative rules. What, then, are we to do, except representing that actual incoherence? In establishing a norm, we modernise, we 'frenchify', we deform the Latin language […]. In effect, the best option is to choose among the extant manuscripts that which can lay claim on the highest degree of authority and to reproduce its mode of spelling" (Havet in Meillet et al. 1924, pp. 33-34, italics in the original).

approach of sholars like Helander and Köhler has in recent years been received favourably in some programmatic articles.[18]

As for *translating* Neo-Latin texts, the challenge is probably daunting for every person whose mother tongue is not English. Any aspirations of elegance have in my case been out of the question. My sole aim has been to try to render the sense of Hell's sentences intelligible to the modern reader. Comparison will quickly show that long Latin sentences have been split by stop marks, explicatory words and phrases have occasionally been inserted in [brackets] or in footnotes, and titles of works in French and Latin have been translated into English.

Textual variants are usually of interest chiefly to linguists. The reader interested in the sense of the text ('what is the author's message'?) will probably go directly to the English version for quick reading. There is no reason to slow down such a reader by inserting into the English text footnotes about all kinds of orthographical, grammatical or stylistic matters such as word order and the like. In the texts edited below, only the mot important textual variants have been included in the English commentary (by "important" I mean cases where textual deviation affects sense, i.e. the 'message' is different in different versions). It should be acknowledged that for full appreciation of all kinds of textual variants, more than a rudimentary knowledge of Latin is required. Realising this, the editor has followed a long kept tradition in classical philology by composing an *apparatus criticus* to the Latin text in Latin.

III.1.2 THE EDITING OF THE CALL FOR SUBSCRIPTIONS

The versions collated for this edition are all dating to the period between the summer of 1770 and the summer of the next year, and they all refer specifically to Hell's three-volume *Expeditio litteraria*, asking for readers to subscribe to it. The name of the publisher, Ghelen, also figures in all the texts collated except one.

[18] See for example Karlheinz Töchterle (in German, 2004) & Johann Ramminger (in English, 2006) *versus* Rüdiger Niehl (in Latin, 2006) & Jean-Louis Charlet (in French, 2006).

I have designated the texts thus:

L N m G F J

L refers to a printed leaflet in Latin, four pages in quarto, undated and with no indication of place, but apparently printed by the Ghelen press in Vienna (Hell 1771*a*1). This is the fullest version of the text, omitting only some details on the price and size found in the dispatch note of the publisher (**F**). As regards choice of words, I have chosen to follow **L** as the most authoritative text. The copy used was found among Hell's manuscripts at the Wiener Universitätsternwarte, and contains pencil remarks by Hell in the margin and between lines. These remarks have apparently been made at a later date, however, and although they merit a discussion in Chapter I.3, they have – with one exception (*Tomi I. Pars III. Caput VII.*) – been omitted in the editing of the text.[19]

N refers to a Latin version included in the journal *Nova Acta Eruditorum* of Leipzig for September 1770, pp. 427-432 (Hell 1770*c*). This text omits some details on the first page, namely, the unnecessary repetition of Hell's title and membership in scientific societies found in **L**. The heading *Relatio* ('Announcement'; **L**) is also missing. Apart from these omissions, an occasional variation of phrasing between **L** and **N** occur in the *Relatio* section. However, although the grammar varies, the meaning is fairly identical. These variations can may be taken as indications of the existence of different manuscripts; possibly they came as a result of creative editing from the part of the journal or the publishing house Ghelen. Be that as it may, in the list of chapter contents **N** is consistently corresponding to the text **L**, with only minor variations. However, as far as orthography, punctuation and use of capital letters are concerned, there are numerous deviations between this text and Hell's practices as detectable in **L** and other printed works. These deviations result, I suspect, from a wish on the part of the publisher to have a consistent, recognisable lay-out in the journal. In this respect, the conventions followed by the editors of the *Nova Acta Eruditorum* certainly deviate from those of Hell in e.g. the *Ephemerides Astronomicae*, and I have chosen to omit them in my apparatus. The

[19] Alexius Horanyi presented a seemingly loyal transcript of **L** in his *Memoria Hungarorum* from 1776. This is reprinted in Pinzger 1920, pp. 50-52. I have not collated the Horanyi/Pinzger version.

copy used is a scanned version of the text, available at the Gallica website of the Bibliothèque nationale de France.[20]

m is a version in Hell's own hand, called *Oeconomia sive Partitio Totius operis Expeditionis Litterariæ ad Polum Arcticum*, seven pages in folio, found among Hell's manuscripts in Vienna. It contains no plan for publication of the various volumes, only the list of chapter and section headings for the *Expeditio litteraria*. The name of the publisher Ghelen is absent. The manuscript is undated, but on the basis of its less detailed description of certain parts of the work, it is probably earlier than both **L** and **N**, but hardly earlier than the summer of the year 1770. I have chosen to follow its orthography and use of punctuation in the edition below, but in choice of words I have usually followed **L**.

G refers to a printed leaflet in German, four pages in quarto, dated Vienna, 2nd March 1771, apparently printed at the Ghelen press (Hell 1770*a*2). This version is almost identical to the texts **L** and **N**, except that it occasionally either omits superfluous words or adds new pieces of information. The most striking examples of such deviations have been indicated in the apparatus. In one particular instance, a misprint found in both **L** and **N** is corrected by **m** and supported by **G** (see *Tomi I. Pars II. Caput X.*). The copy used was found among Hell's manuscripts in the Wiener Sternwarte. It lacks the pencil remarks found in **L**.[21]

F refers to a one-page, printed dispatch note, in French, dated Vienna, 4th April 1771, signed "Jacques Antoine noble de Ghelen Libraire". The letter was no doubt distributed along with the leaflet **L** (and possibly also **G**), as seen from the opening phrase "I have the honour to send you the enclosed advertisement for a work highly wished for by the

[20] There is also a manuscript containing Hell's call for subscriptions preserved at the Gunnerus library in Trondheim, XA HA Qv. 43 (10 pp.). The manuscript has belonged to the eager collector of books and manuscripts Christopher Hammer. Comparison between the manuscript and the various printed texts shows that it is nothing other than a very accurate transcript of **N**. It has therefore not been collated here.
[21] It might be mentioned that **G** is summarised in *Jenaische Zeitungen von Gelehrten Sachen*, XXXXVIII. Stück. Montags den 17 Junius 1771., pp. 399-400 and (in French) in Bernoulli's *Recueil pour les Astronomes*. I have not collated those versions.

connoisseurs, which I am going to print at my expense".[22] Then follows a summary of the first two pages of the text as edited here, but with some pieces of information that is left out in **L**, **N** and **G**. Notably, **F** alone makes an estimate on the size and price of the volumes, and gives a time limit for subscribers. These pieces of information are lacking in all the other versions, but have been restored into the text here – in [brackets]. The copy of **F** used here is found among Hell's manuscripts at the Wiener Sternwarte.

J represents a summary of the call for subscriptions, in French, printed in the *Journal des Sçavans* of Paris for July 1771, pp. 499-500 (Hell 1771*a*3). The first few lines of this advertisement contain the title and author of the work, in Latin, whereas the rest of the entry is entirely in French. Certain details have been entered in the apparatus for comparison, but most of the information in **J** is seen as second-hand and therefore left out. At the very outset, however, an error in **LN** is corrected by means of **J** (*Societatum Regiarum ... quæ ... florent* **J** is better than *Societatis Regiæ ... quæ ... floret* **LN**). The copy used is a scanned version of the text, available at the Gallica website of the Bibliothèque nationale de France.[23]

Epistolary sources show that Father Hell used German and Latin with equal ease, but in scientific treatises he wrote almost exclusively Latin, leaving it to others to translate his scientific work into other languages. Some misunderstandings in the German and French versions demonstrate that this must have been the case even here (for example *Christiani VIII* **J** for *Christiani VII* **LN**; "Lappland, Finnmark" **G** for *Lapponiæ Finnmarchicæ* **LN** "Reise zu Lande" **G** for a route going partly over sea [*Jter* only in **LN**]; "Finnland" **G** for *Finonia* [Fyn] in Denmark **LN**). On the other hand, there are cases where I have made use of **J** and **G** to rid the Latin text of obvious misprints (see above).

Whether the printed texts were based on different manuscript, or the various printers have interpreted one and the same manuscript differently, is difficult to tell. Either way, with

[22] "J'ai l'honneur de vous envoyer ci-joint l'Avertissement d'un ouvrage tant souhaité des connoisseurs, que je vais faire imprimer à mes frais & depens".
[23] The text of **J** is also quoted in full in George Sarton's article on Father Hell (Sarton 1944).

the lack of Hell's autograph (apart from the early draft **m**), comparison of the various printed texts has been deemed necessary in order to establish a reliable text.

The text edited is thus based on **L**, with notable variant readings entered in the critical apparatus. Only in cases of evident misprints have the readings of **N** or **m** been followed and the readings of **L** displaced to the apparatus. However, the orthography of the manuscript (**m**) has been followed, for example words ending in double *i*, where **L**'s *–ii* has been tacitly replaced by **m**'s *–ij*. This is in accordance with the practices followed by Hell in his manuscripts. In the rare case when there are variants in **N**, **m**, **F**, **J** or **G** that affect sense, or key information is found in other sources than **L**, this has been explained in a footnote to the English translation.

In a PDF document edited by the author of this thesis, **F**, **L, m** and **G** are all photographically reproduced. This document is stored in the open-access database *Munin*.[24] Thanks to the digitisation service *Gallica* of the Bibliothèque nationale de France, even **N** and **J** can likewise be easily downloaded from the internet.

As could be expected, the German text is printed in Gothic letters, whereas the typography of the French and Latin versions resembles modern printing. I admit that ideally, the fonts used in the present edition should have been closer to the main source, **L**. That would have given the typography more of an 'eighteenth-century ambience'. However, lacking the necessary technical expertise, I opted for what I saw as the next best solution; to at least differentiate between my analyses and Hell's original. Although it does not resemble the heavily serifed typography of **L**, the sans-serif font arial used below is at least different from the familiar Times New Roman. If not creating a particularly eighteenth-century ambience, it is my hope that the font chosen will in the very least bestow a sort of 'alien look' to the text that will help the reader interpret it as something else than a Oxford, Budé or Teubner edition.

[24] Available at http://hdl.handle.net/10037/3800 (Aspaas 2012*a*).

III.1.3 THE EDITING OF THE UNFINISHED INTRODUCTION

The editing of the introduction to *Expeditio litteraria* has posed different challenges than the call for subscriptions. Although they are all in Latin, the various manuscript sources are of a different kind and seem to have been written over a longer period of time.

Combined, the four manuscripts collated for the editing of this text fill 28 pages *in folio* (roughly 32.5 x 26 cm). According to their interdependence, they have been named **A B C D**. In addition comes a loose page with fragmentary notes, here referred to as **b**. Of these, **ABb** have been written in Hell's own hand, whereas **C** and **D** are preserved in the hand of another person, presumably one of his secretaries.

Even these texts have been photographically reproduced in a PDF edited by the present author and stored in the *Munin* database.[25]

A is clearly an early, probably the very first draft, with numerous erasures in the text and additions of single words or even entire sentences in the margin and between lines. In fact, Hell here uses a right margin filling half the width of the page, leaving space for extensive additions and changes of mind. **B** also contains erasures and additions, but here they are far fewer than in **A**, and the margins are narrower. **B** breaks off a little before **A**, so that **A** is the only witness for the very last part of the text. **CD** end simultaneously, far earlier than **B**. **C** follows **B** conscientiously, except for some minor errors. Some of these errors have been corrected by Hell himself. In such cases, **C1** refers to the text in the hand of Hell's secretary, and **C2** to the correction of Hell. **D** is clearly the final version, ready for printing, although not proofread by Hell.

As can be seen in the call for subscriptions, volume one of the *Expeditio litteraria* was meant to be published in the autumn of 1772. These four manuscripts, however, have all been written after July 1773. This is evident in **B**, where the dissolution of the Jesuit order is explicitly mentioned in the very last footnote, and in the last pages of both **A** and **B**, where Hell describes Joannes Sajnovics and Antonius Pilgram as members of the

[25] Available at http://hdl.handle.net/10037/3799 (Aspaas 2012*b*).

Jesuit order “at that time” (*id temporis de Societate JESV*). Had the order still been functioning, he would no doubt have dropped the qualification *id temporis*. Since **CD** are both based on **B**, it follows that they too must have been written after the dissolution of the Society of Jesus.

Why then note the readings of **A**, **B** and **C**, instead of just reproducing the “final” text **D**? The diligent reader will find cases where the text **CD** deviates from **AB**, probably because the assistant has misinterpreted Hell’s handwriting. Father Hell, who apparently did the proofreading of **C** himself, sometimes failed to notice these mistakes. Accordingly, they have found their way also into **D**. It is also noteworthy that **B** has more commas than the later versions, and the spelling is slightly different. I therefore stick to **B** as the version most in tune with Father Hell’s intentions. Only in a few exceptions preferred the versions of either **A**, **C** or **D**.

As mentioned, the text **A** is probably the very first draft. At least it is the earliest version found among the manuscripts in the Vienna Observatory. At the outset, the text of **A** is not very different from that of the rest. But after a few pages, the deviations in **A** are of so substantial a character as to render the line by line presentation of all textual variants unpractical. **B** and the subsequent soon diverge from **A** not only in the choice of single words, but also in the syntactical construction of entire sentences.

As for the *apparatus*, the choice left for the editor is between two extremes: either to give a painstaking presentation of the whole text **A** in the *apparatus criticus* section (and thereby risk drowning the much less frequent variations between **B**, **C** and **D**), or to leave out text **A** altogether (and thereby missing the opportunity to look for wordings which might be of importance). A third option is somewhere in between and has been attempted here. The more than average interested reader is invited to consult the facsimile of the manuscripts in *Munin* (Aspaas 2012*b*).

In a sense, this editor has chosen to merge two separate editorial approaches. The variants between **B**, **C** and **D**, although not very numerous, have been rated important enough to be listed exhaustively in the apparatus. On the other hand, the deviations in **A**, being the earliest draft and clearly never intended for publication, have been rated insignificant enough to be left out, except in cases where the text of **A** takes on a wholly different meaning or contains pieces of information not found in the other manuscripts. The apparatus thus offers a fairly complete repertory of variants for **B**, **C** and **D**, but is no more than a highly selective apparatus for **A**.

III.2 THE CALL FOR SUBSCRIPTIONS TO THE *EXPEDITIO LITTERARIA AD POLUM ARCTICUM*

[Maximiliani Hell è S. J.
INVITATIO AD SUBSCRIBENTES OPERIS
*EXPEDITIONIS LITTERARIAE
AD POLUM ARCTICUM*
ex textibus impressis et manuscriptis autographis edita, apparatu critico, versione et notis Anglicis instructa]

[Maximilianus Hell of the Society of Jesus,
INVITATION TO SUBSCRIBERS FOR THE WORK *SCIENTIFIC EXPEDITION
BY THE NORTH POLE*,
edited from printed texts and autograph manuscripts and furnished with a critical apparatus, translation and commentary in English][1]

1. Title page added by the editor. For an analysis of the contents of the work, see Section I.2.3 above. That section also contains a discussion of why the title should be translated 'Scientific Expedition by the North Pole'. Photographic reproductions of the sources **F L G m** are found in Aspaas 2012*a*; images of **N J** are found in the Gallica database of the Bibliothèque nationale de France.

EXPEDITIO LITTERARIA
AD
POLUM ARCTICUM

in tres divisa Tomos, quorum primus Historicus, secundus Physicus, tertius Mathematicus, & Astronomicus. Auspicijs CHRISTIANI VII. Daniæ, & Norwegiæ Regis, à M A X I M I L I A N O H E L L e S. J. Astronomo Cæsareo-Regio Universitatis Vindobonensis, Societatum Regiarum Scientiarum, quæ Haffniæ & Nidrosiæ florent Socio, Academiæ Regiæ Scientiarum Parisinæ Membro correspondente. &c. &c.

RELATIO.

E Bibliopolio Viennensi à *Gheleniano* notum sit Publico, Eruditis cumprimis & rerum Septentrionalium curiosis Lectoribus, typis à *Ghelenianis* imprimendam fore *Expeditionem litterariam ad Polum Arcticum* auspicijs *Christiani VII.* Daniæ & Norwegiæ Regis, facta à R. P. Maximiliano Hell e S. J. Astronomo Cæsareo-Regio Universitatis Viennensis, Societatum Regiarum Scientiarum, quæ Hafniæ, & Drontheimij florent Socio, Academiæ Regiæ Scientiarum Parisinæ membro Correspondente &c. &c.

Expeditio hæc litteraria tribus in folio Tomis, & centenis pluribus elegantissimis æri incisis figuris & novis mappis geographicis illustrata absolvetur.

Tomus I. nundinis autumnalibus circa festum D. Michaelis Anni 1772. in publicum prodibit, alter Anno sequente 1773, & Tertius Anno 1774. Deo benedicente ijsdem nundinis autumnalibus finiendus speratur.

1-7 LJ *et (usque ad litteras* e S. J.*)* **N** *omittunt* **Gm** **7-11 LJ** *omittunt* **NGm** **12 LG** *omittunt* **NJm** **13-27 LNG** *summariam exhibent* **FJ** *omittit* **m**

6 Christiani VII. **LN** Christiani VIII. **J** **8-10** Societatum ... socio **J** Societatis Regiæ Scientiarum, quæ Haffniæ & Nidrosiæ florent Socio **L** **11** &c. *bis* **L** *semel* **J** **13** à GHELENIANO **L** Gheleniano **14-15** typis à GHELENIANIS **L** typis Ghelenianis **N** **15** litterariam **N** litterrariam **L** Reisebeschreibung nach dem Nordpol, in lateinischer Sprache **G** la Description du voyage ... ecrit en Latin **F** **17-18** Universitatis Viennensis **LN** der hiesigen weltberühmten hohen Schule **G** **18-19** Societatum ... florent *scripsi (cf. lin. 9-10);* Societatis Regiæ Scientiarum, quae Hafniæ, & *(vel* et*)* Drontheimii *(vel* Dronthemii*)* florent **LN** **21-22 LNGJ** chacun à peu prés de 500. feuilles **F** **22-23** centenis ... geographicis **LN** plus de 100. Estampes en taille douce, & quelques nouvelles mappes geographiques **F** schönen Kupfern und Landkarten **G**

SCIENTIFIC EXPEDITION
BY
THE NORTH POLE

divided into three volumes, of which the first is Historical, the second Physical, the third Mathematical and Astronomical, made under the auspices of CHRISTIAN VII, King of Denmark and Norway, by M A X I M I L I A N U S H E L L of the Society of Jesus, Imperial and Royal Astronomer at the University of Vienna, member of the Royal Societies of Sciences that flourish in Copenhagen and Trondheim, corresponding member of the Royal Academy of Sciences in Paris, etc.

ANNOUNCEMENT.

The Viennese publishing house *Van Ghelen* wishes to make known to the public, and to erudites and those with an interest in northern subjects in particular, that the publisher *Van Ghelen* is to print the work *Scientific Expedition by the North Pole*, made under the auspices of *Christian VII*, King of Denmark and Norway, by the Honourable Father Maximilianus Hell of the Society of Jesus, Imperial and Royal Astronomer of the University of Vienna, member of the Royal Societies of Sciences that flourish in Copenhagen and Trondheim, corresponding member of the Royal Academy of Sciences in Paris, etc.

This *Scientific Expedition*[1] will consist of three volumes *in folio* and more than a hundred beautiful illustrations in the form of copperprints and new geographical maps.[2]

The *First Volume* will be published during the autumn market around Saint Michael's day of the year 1772, the *Second*, in the following year 1773, whereas the *Third*, with the blessing of God, will hopefully be finished for the same Autumn market in the year 1774.

1. **FG** add the information, not found in **LNJ**, that the work will be entirely in Latin. Furthermore, the title is rendered "Description of the voyage" in **FG**; the word *litteraria* has thus been omitted in these translations.
2. **F** explains that each volume will exist of "approximately 500 pages".

Pretium cujusvis Tomi nunc quidem definiri & statui non potest, attamen certiores reddimus publicum, illud pro ratione impensarum, quam maxime tollerabile statuendum fore.

Ut igitur opus hoc pretio quam maxime levi venire possit, viam subscriptionis inire placuit, qua innotescat Exemplarium numerus tam chartæ elegantiori Scriptoriæ, quam impressoriæ exprimendorum, clarum enim est, quo plures subscriptores censebuntur, eo minori pretio opus venire.

Acceptabuntur autem Subscriptiones & hic Viennæ in Bibliopolio sic dictæ Domus *Michaelerhaus* & in omnibus cæteris per Europam Bibliopolijs [ad finem mensis Augusti hujus Anni].

Subscribentibus opus hoc pretio 5 pro centum leviori & quidem in Charta Scriptoria dabitur, eorumque Nomina Tomo I. ordine Alphabetico inserenda promittimus. Expensæ litterarum seu Epistolarum ad rationes Subscribentium acceptabuntur; curabitur autem diligentissime, ut Exemplaria expensis quam minimis cuivis Subscribenti tempestive transmittantur.

Eorum ergo Lectorum, & Subscribentium gratia, qui opus hoc sibi comparandum in animum inducturi sunt, sequentem generalem totius operis conspectum ipsis communicandum duximus.

[Viennæ, die 2 Martii Anni 1771.]

1-20 LNG *summariam exhibent* **FJ** *omittit* **m** **21** *habent* **FG** *omittunt* **LNJm**

1-3 attamen *etc.* **L** *et fere* **GJ** attamen persuaderi cupimus reip. litter. illud pro ratione impensarum, quam maxime tolerabile constitutum iri **N** mais il sera toujours très equitable, & je crois que tous les 3. Volumens ne couteront tout au plus que 6. à 7. Ducats Imperiaux **F** **5** qua **L** ut **N** **6** chartæ ... impressoriæ *(casu dativo; erratum tamen typographicum* impressioriæ *correxi)* **L** charta elegantiori scriptoria, quam impressoria *(casu ablativo)* **N** *omittit (sed vide infra ad lin. 12-13)* **G** **7-8** clarum enim *etc.* **LN** *omittit* **G** **10** Domus <u>Michaelerhaus</u> **LN** im neuen Michaelerhause **G** chez le Libraire **J** **11** [ad finem *etc.*] *scripsi;* bis Ende August dieses Jahrs **G** Vers la fin du Septembre prochain **F** *omittunt* **LNJ** **12** Subscribentibus **LN** Nur diejenigen, so subscribieren **G** **16-17** cuivis Subscribenti tempestive **LN** *omittit* **G** **21** [Viennae *etc.*] *scripsi* Wien den 2. März 1771. **G** <u>Vienne</u>, le 4. Avril 1771. **F** *omittunt (sed vide introductionem meam anglice conscriptam)* **LNJ**

The price cannot yet be established for any of the three volumes. However, the public may rest assured that we will make sure it will be fixed so low as expences allow.[1]

In order to facilitate a cheapest possible price for this work, we have decided to issue an invitation for subscriptions, so that the number of copies to be printed on the more beautiful writing paper, as well as the number to be printed on book paper, can be ascertained; for it is obvious that the higher the number of subscribers, the lower the price of the work will be.

Subscriptions will be accepted both here in Vienna, at the bookstore known as the *Michaelerhaus*, as well as at all other bookstores around Europe [until the end of August this year].[2]

Subscribers will obtain the work at a 5 percent lower cost and on writing paper,[3] and we promise to include their names in alphabetical order in the first volume. Expenses for correspondence will be accepted for the bills of the subscribers; however, one will diligently seek to distribute the copies quickly and at the lowest cost possible to every subscriber.

For the sake of those readers and subscribers who will make up their mind to acquire this work, we have deemed it appropriate to allow them to inspect this general overview of the entire publication.

[Vienna, 2nd March 1771][4]

1. **F** has "I believe that the three volumes will not cost more than 6 or 7 *Ducats Imperiaux*".
2. Text in brackets taken from **G**. **F** has "until the end of September this year". No time limit stated in **LNJ**.
3. "Subscribers will ..." **LN**. **G** has the stronger formulation "Only those who subscribe will ...".
4. Place and date omitted in **LNm**. Dating of **L** uncertain. **N** appeared already in the issue of *Nova Acta Eruditorum* for September 1770, **F** is signed "Vienna, 4th April 1771" and **G** is signed "Vienna, 2nd March 1771". **J** was printed in the issue of *Journal des Sçavans* for July 1771.

CONSPECTUS TOTIUS OPERIS
Expeditionis Litterariæ ad Polum Arcticum.

Opus totum complectetur tres Tomos in folio, cum figuris æri incisis; Tomus I. Historicus, II. Physicus, III. Mathematicus & Astronomicus.

TOMUS I. HISTORICUS

In tres dividitur Partes. Pars I. Complectitur diarium totius itineris. Pars II. descriptionem Lapponiæ Finnmarchicæ, & quidquid ad Lappones pertinet. Pars III. tractabit de Jdiomate Lapponum, & Ungarorum, de Origine Lapponum & de Patria natali Ungarorum.

PARS I. TOMI I.

Sequentia complectetur Capita in suos paragraphos distribuenda.

Caput I. complectitur ea, quæ causa Expeditionis hujus litterariæ inter Regem Daniæ, Aulam Cæsareo-Regiam, & Patrem Hell Anno 1767. Viennæ acta sunt, scopus itineris, præparationes ad iter, & discessus Vienna Anno 1768. die 28. Aprilis.

Caput II. Jter per Pragam, Dresdam, Lipsiam, Hamburgum, Lubecam usque.

Caput III. Jter Lubeca Travendahlium ad Regem Daniæ, mora triduana Travendahlij cum Rege, & iter maritimum Lubeca Haffniam.

1 LNGm 2-5 Lm *et (plus verbose)* **G** *omittit* **N 6 LNGm 7-23 LNGm 1-23** *summariam exhibet* **J**

1-2 Conspectus *etc. (nisi quod erratum typographicum* litterraiæ *correxi)* **L** Entwurf der ganzen Reisebeschreibung nach dem Nordpol **G** *lin. 1 solum exhibet* **N** Oeconomia sive Partitio Totius operis *etc.* **m 3-4** Opus totum *etc.* **L** *et fere* **m** Das ganze Werk wird in 3. Foliobände in lateinischer Sprache, mit Einbegrif vieler in Kupfer gestochener Landkarten, Landschaften, Trachten, Seltenheiten, und mathematischer Abrisse, eingetheilet *etc.* **G 7-8** diarium totius itineris **Nm** *et (voce* diarium *erasa,* Ephemeridem *supra linea manu, ut videtur, Patris Hell addita)* **L** ein genaues und lesenswürdiges Tagebuch von der ganzen Reise des Herrn P. Hells und seiner Gefährten **G 8-9** Lapponiæ Finnmarchicæ, & *(vel* et*)* **LNm** Lappland, Finnmark, und **G 11** Patria natali Ungarorum **LN** dem eigentlichen Heumath der Hungarn **G** de origine Ungarorum **m 15-18** complectitur ea *etc.* **LN** continebit Propositionem Nomine Regis Daniæ per legatum suum comitem de Bachoff mihi factam itineris ad Polum arcticum causa observationis Transitus Veneris Anno 1769 Wardoehusij faciendæ, acceptatio Propositionis Regiæ ab Augustissima Jmperatrice, præparationes ad iter etc etc: **m 22** Lubeca *scripsi* Lubeco **LNm** von Lübeck *(sicut lin. 23)* **G 22-23** Haffniam **Lm** Hafniam **N**

OVERVIEW OF THE WHOLE WORK[1]
entitled Scientific Expedition by the North Pole.

The work will consist of three volumes *in folio*, with copperprints:[2] Volume One will be historical; Volume Two, physical; Volume Three, mathematical and astronomical.

VOLUME ONE. HISTORICAL

is divided into three parts. Part One contains a diary of the whole journey;[3] Part Two, a description of the Lapland of Finnmark, and subjects pertaining to the lapps; Part Three will treat the language of the Lapps and Hungarians, as well as the origin of the Lapps and the native country of the Hungarians.[4]

FIRST PART OF VOLUME ONE.

will consist of the following chapters, to be subdivided into their paragraphs.

Chapter I. contains an account of the transactions for the sake of this expedition between the King of Denmark and the Imperial and Royal court and Father Hell in Vienna in the year 1767, the scope of the journey, preparations made for the journey, and the departure from Vienna on 28 April of the year 1768.[5]

Chapter II. The journey through Prague, Dresden, Leipzig and Hamburg, all the way to Lübeck.

Chapter III. The journey from Lübeck to Traventhal and the King of Denmark, the three days' stay in Traventhal with the King, and the sea voyage from Lübeck to Copenhagen.

1. **LN** reads "Conspectus", **m** "Oeconomia sive Partitio", **G** "Entwurf". Instead of "overview" one might translate "division", "plan" or "structure".
2. "three volumes *in folio* with copperprints" **LNm**. **G** is more specific: "three volumes in Latin, *in folio*, including numerous maps, landscapes, regions, rarities and mathematical figures in the form of copperprints".
3. **G** adds "... an *accurate and interesting* diary by Hell *and his travel companion*" (my italics). In his own copy of the call for subscriptions (**L**), Hell has erased the word *diarium* and added, with a pencil, the synonym *Ephemeridem*.
4. "the native country of the Hungarians". **G** has "the real homeland...".
5. **m** has a different wording: "... will contain the proposal in the name of the King of Denmark that was presented to me by his ambassador Count Von Bachoff, namely that of undertaking a journey by the North Pole in order to observe the transit of Venus in the year 1769 from Vardøhus, and the approval of the Royal proposal by Her Highness the Empress, the preparations for the expedition etc etc."

Caput IV. Quæ Haffniæ causa Expeditionis hujus litterariæ acta, ad discessum Haffnia die 2. Julij 1768.

Caput V. Jter Haffnia per Sueciam ad primam Norwegiæ urbem Christianiam usque & quæ Christianiæ acta.

Caput VI. Jter Christiania per Norwegiam ad ultimam Norwegiæ urbem Drontheimium usque, & quæ Drontheimij acta.

Caput VII. Memorabile iter maritimum Drontheimio Wardœhusium usque à die 22. Augusti ad 11. Octobris 1768.

Caput VIII. Quæ Wardœhusij à die 11. Octobris ad 27. Junij 1769. acta.

Caput IX. Reditus Wardœhusio per mare Drontheimium usque à die 27. Junij ad diem 31. Augusti 1769.

Caput X. Reditus Drontheimio per Norwegiam & Sueciam Haffniam usque.

Caput XI. Quæ Haffniæ à die 18. Octobris 1769. ad 22. Maij 1770. acta.

Caput XII. Reditus Haffnia per Seelandiam[,] Finoniam, Slesvicum, Holsatiam, & totum Jmperium Viennam usque, impensis in iter universim annis duobus, & tribus mensibus à die 28. Aprilis 1768. ad 12. Augusti 1770.

TOMI I. PARS II.

De Lapponia Finnmarchica & Norwegica.

Caput I. Descriptio Lapponiæ Finnmarchicæ & Norwegicæ.

Caput II. De Origine Lapponum.

Caput III. De constitutione corporis, & ratione vestiendi Lapponum.

Caput IV. De Domicilijs, lectis, & cubilibus Lapponum.

Caput V. De cibo, potu, & varia Lapponum suppellectile.

Caput VI. De Cervis Rangiferis, eorumque apud Lappones tractatione.

1-30 LNG *et (minus verbose)* **m** *summariam exhibet* **J**

1-2 Quæ Haffniæ *etc.* **L** *et (nisi quod* Hafniæ *habet; cf. infra)* **N** Quæ Haffniæ acta sunt, usque ad iter terrestre Haffniâ Christianiam usque **m** was zu Koppenhagen dieser gelehrten Reise wegen für Zubereitungen geschehen **G** **3-4** Iter Haffnia *etc.* **LN** *et fere* **m** die Reise zu Lande von Koppenhagen **G** **14-17** Haffniam ... Haffniæ ... Haffnia **Lm** Hafniam ... Hafniæ ... Hafnia **N** **17** Finoniam **LN** Finnland *(sic)* **G** *omittit* **m** **18** totum Imperium **LN** Jmperium **m** das ganze heilige römische Reich **G** **18-20** impensis in iter *etc.* **LN** Woraus sich ergiebt, daß mehrbeiobter Hr. P. Hell gerade in zwey Jahren und drey Monaten ... diese gelehrte Reise glücklich vollendet hat **G** *omittit* **m** **21** TOMI I. **LG** *omittit* **N** **22** Lapponia Finnmarchica **m** Lapponia Finnmarchica & Norwegica **L** Lapponia, Finnmarchica et Norwegica **N** **23** Descriptio *etc.* **LN** eine vollkommene und besonders lesenswürdige Beschreibung von Lappland, Finnmark und Norwegen **G** **27** De Domicilijs *etc.* **mN** *et (nisi quod mendum typographicum* Domicielis *correxi)* **L** von den Wohnungen, Betten und andern Wohnungen der Lappländer **G** **29** De Cervis Rangiferis **LN** De Rangiferis **m**

Chapter IV. The activities in Copenhagen for the sake of this scientific expedition, until the departure from Copenhagen on 2 July 1768.

Chapter V. The journey from Copenhagen through Sweden to the first city of Norway, Christiania, and the activities there.

Chapter VI. The journey from Christiania through Norway all the way to the last city of Norway, Trondheim, and the activities carried out in that city.

Chapter VII. The memorable sea voyage from Trondheim all the way to Vardøhus, from 22 August to 11 October 1768.

Chapter VIII. The activities carried out at Vardøhus from 11 October to 27 June 1769.

Chapter IX. The homeward sea voyage from Vardøhus all the way to Trondheim, from 27 June to 31 August 1769.

Chapter X. The homeward journey from Trondheim through Norway and Sweden, all the way to Copenhagen.

Chapter XI. The activities in Copenhagen between 18 October and 22 May 1770.

Chapter XII. The return journey from Copenhagen through Sjælland, Fyn,[1] Schleswig, Holstein, and the entire [Holy Roman][2] Empire all the way to Vienna, two years and three months having been spent on the journey, from 28 April 1768 to 12 August 1770.

PART TWO OF VOLUME ONE.

On the Lapland of Finnmark and Norway.[3]

Chapter I. Description of the Lapland of Finnmark and Norway.[4]

Chapter II. On the origin of the Lapps.

Chapter III. On the bodily constitution of the Lapps and the way they dress.

Chapter IV. On the houses, beds, and lairs of the Lapps.

Chapter V. On the food, drink, and various furnishings of the Lapps.

Chapter VI. On the reindeers and their use among the Lapps.

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1. The Latin "Finoniam" (Fyn) is in **G** mistakedly rendered as "Finnland".
2. Text in [brackets] found only in **G**.
3. "Finnmark and Norway" is an odd expression. Hell frequently uses the name of the northernmost county of Norway, *Finnmarchia*, as something different from other parts of Norway, usually *Nordlandia* (which comprised the present counties Nordland and Troms at the time) and *Norwegia* (in the sense of southern Norway). On some occasions, however, *Finnmarchia* is - like here - differentiated from a *Norwegia* that appears to include Nordland and Troms.
4. "Description of...". **G** has the more elaborate "A perfect and highly readable description...". Note that the designations "Lapps" and "Lapland" have now become virtually obsolete in North Norway. Instead, the terms *Sámi* and *Sápmi* are used.

Caput VII. De Jnstrumentis vectarijs, & ratione itinerandi Lapponum.

Caput VIII. De venatione, & piscatione Lapponum.

Caput IX. De opificijs Lapponum.

Caput X. De Lapponum indole, vitijs, virtutibus, & varijs moribus.

Caput XI. De Nuptijs, educatione Prolium, & varijs ludis Lapponum.

Caput XII. De morbis, ratione medendi, & Exequijs Lapponum.

Caput XIII. De Dijs, Sacrificijs, Superstitionibus Lapponum ante inductam Religionem Christianam.

Caput XIV. De artibus magicis Lapponum per tympana Runica ante inductam Religionem Christianam.

Caput XV. De Missione, & Missionarijs Danicis Lapponiæ Finnmarchicæ.

TOMI I. PARS III.

De Jdiomate Lapponum, unitate Jdiomatis Ungarici, & Lapponici, atque universim de Jdiomate Asiatico.

Caput I. Origo, & occasio inquisitionis in Jdioma Lapponicum.

Caput II. De convenientia Jdiomatis Ungarici cum Lapponico.

Caput III. De Unitate Jdiomatis Lapponici, Ungarici & universim Asiatici cum Jdiomate Sinico, & de populis idem idioma Lapponicum seu Asiaticum habentibus.

Caput IV. De Patria natali Ungarorum, Magyarorum, Jugrorum, sive Juhrorum, Ungariam incolentium.

Caput V. Synopsis Historica adventus Ungarorum & Magyarorum e Fennia, seu Carjelia in Pannoniam Sæculo IX.

Caput VI. Anonymi Regis Belæ Notarij Historia Ungarica de septem primis ducibus Ungariæ authoritati, & veritati restituta.

[*Caput VII*. Constant. Porphyrogenetæ Com.]

1-28 LNG *et (minus verbose)* **m** *summariam exhibet* **J** **29** *Ex adnotatione manu, ut videtur, Patris Hell inserta in* **L** *omittunt* **NGJ**

1 et **m** und **G** omittunt **LN** | Lapponum **LNm** dieser Nation **G** **4-5** varijs moribus **m** vershiedenen Sitten **G** les mœurs ... du Pays **J** variis morbis *(sed cf. lin. 8)* **LN** **10 et 12** ante inductam religionem Christianam *(bis)* **LGN** ante quam inducti sunt Missionarij Lutherani ... ante inductionem Missionariorum **N** **15** TOMI I. **LGm** *omittit* **N** **19 LNG** continebit dissertationem Patris Sajnovics de identitate Jdiomatis Ungarici et Lapponici **m** **23** De Patria natali **LNm** von dem eigentlichen Heumath **G** **24** Ungariam incolentium **LNm** die das Königreich Hungarn bewohnen **G** **25** Synopsis Historica **LN** brevis Historia **m** kurze historische Nachricht **G** **26** in Pannoniam **LNm** nacher Hungarn **G** **29** [Caput VII. *etc.*] *adnotatio per stilum plumbatum, ni fallor, a Patre Hell, addita (cf. Sajnovics,* Demonstratio ..., *Tyrnaviae [1771], p. 130) in* **L** *omittunt* **NGm**

Chapter VII. On the transportation carriages and ways of travelling of the Lapps.

Chapter VIII. On the hunting and fishing of the Lapps.

Chapter IX. On the crafts of the Lapps.

Chapter X. On the Lappish character, the vices, virtues, and various customs of the Lapps.

Chapter XI. On the marriages, the raising of children, and various games among the Lapps.

Chapter XII. On diseases, ways of curing, and burial rituals among the Lapps.

Chapter XIII. On the gods, sacrifices, and superstitious beliefs among the Lapps before the introduction of Christianity.[1]

Chapter XIV. On the Lapps' magical arts, performed by the runic drum before the introduction of Christianity.

Chapter XV. On missionary work and Danish missionaries in the Lapland of Finnmark.

PART THREE OF VOLUME ONE.

On the language of the Lapps, on the unity of the Hungarian and Lappish language, and on the Asian language in general.

Chapter I. The origin and occasion of this investigation of the lappish language.

Chapter II. On the agreement of the Hungarian language with that of the lapps.[2]

Chapter III. On the unity of the Lappish, Hungarian, and Asian language in its entirety, with the Chinese language, and on the peoples using the same Lappish, or Asian, language.

Chapter IV. On the original native country of the Hungarians, Magyars, Jugrians, or Juhrians, that are nowadays living in Hungary.[3]

Chapter V. Historical overview of the coming of the Hungarians and Magyars from Finland, or Carjelia, to Pannonia[4] in the ninth century.

Chapter VI. The authority and truth of the Hungarian history on the first seven warlords, written by the *Anonymus*, or notarius of King Bela, is restored.

[*Chapter VII*. The account of Constantinus Porphyrogenitus.][5]

1. "before the introduction of Christianity" **L**. **N** has "before the Lutheran missionaries were introduced".
2. **m** has: "will contain the treatise of Father Sajnovics on the identity of the Hungarian and Lappish language".
3. **LNm** have "Hungary"; **G** "the Kingdom of Hungary".
4. **LNm** have "to Pannonia"; **G** "to Hungary".
5. Text in [brackets] found only in a pencil addition to **L**, almost certainly in Hell's own hand. Plans for such a chapter are confirmed by various autograph letters and manuscripts by Hell (cf. Unprinted Sources and Literature below).

TOMUS II. PHYSICUS.

Tomus II. Physicus dividetur in VI. Partes.

[TOMI II.] PARS I.

Naturalia, animalium, Herbarum, conchilium &c. Regionum borealium Finnmarchiæ[,] Nordlandiæ, & Norwegiæ.

Caput I. De Animalibus quadrupedibus.

Caput II. De Piscibus marinis, & fluviorum.

Caput III. De Amphibijs.

Caput IV. De Avibus aquaticis.

Caput V. De Avibus terrestribus.

Caput VI. De Arboribus & fruticibus.

Caput VII. De Herbis, fructibus terrestribus &c.

Caput VIII. De Algis, fucis, & Herbis marinis.

Caput IX. De Conchilibus, & testaceis.

Caput X. De Mirabilibus Oceani, & terrarum borealium.

TOMI II. PARS II.

De decremento maris Septentrionalis & incremento terrarum & insularum borealium.

Caput I. De Signis, & Argumentis decrescentiæ maris Septentrionalis.

Caput II. Dimensiones geometricæ decrementi maris, & incrementi telluris in terris Septentrionalibus.

Caput III. De Causa imminutionis maris inquisitio.

Caput IV. Consectaria Physica in natura globi terraquei e causa decrescentiæ maris necessaria.

Caput V. Consectaria politica, & œconomica e decrescentia maris Septentrionalis in Regnis borealibus necessaria.

Caput VI. Observationes aliorum antiquiores & recentiores continuam marium decrescentiam probantes.

1-29 LNGm *summariam exhibet* **J**

1 LGm *omittlt* **N** **2** Tomus II. Physicus dividetur in VI. partes **LN** Ad hunc Tomum pertinent I. naturalia: animalium, Herborum, conchilium etc: 2do: materia de decrescentia Maris septentrionalis. 3tio de luce marina: 4to de Luce borea. 5to de Meteoris, et Meteorologica. 6to observationes œconomicæ. Tomus ergo II. in VI. Partes dividendus. **m** **3** [TOMI II.] *scripsi; omittunt* **LNGm** **4** Naturalia ... &c. **LN** enthält eine Beschreibung verschiedener natürlicher Dinge, als Thiere, Kraüter, Schnecken und Muscheln &c. **G** Aget universim de Naturalibus **m** **6-15 LN** *et fere* **G** *Capita novem numerat,* de Avibus *unum caput promittens* **m** **16** TOMI II. *omittunt* **LNm** Des 2ten Bandes 2ter Theil **G** **17** De decremento **LN** De Decrescentia **m** | maris Septentrionalis *etc.* **LNm** der mitternächtigen See *(sicut etiam lin. 19-20 et 27 infra)* und gentheiligen Zuwachse der nordlichen Ländereyen und Insuln **G** **21** imminutionis **LNm** sich verliehrt oder vermindert **G** **25** borealibus **N** broealibus **L** *omittit* **m**

VOLUME TWO. PHYSICAL.

Volume two, physical, will be divided into six parts.[1]

PART ONE OF VOLUME TWO.

Life forms, [such as][2] animals, plants, shellfish, etc. in the northern regions of Finnmark, Nordland, and Norway.

Chapter I. On quadruped animals.[3]
Chapter II. On marine fishes and fishes in rivers.
Chapter III. On amphibians.
Chapter IV. On waterfowls.
Chapter V. On terrestrial birds.
Chapter VI. On trees and bushes.
Chapter VII. On terrestrial herbs, fruits, etc.
Chapter VIII. On marine algae, mosses, and herbs.
Chapter IX. On shellfish and mussels.
Chapter X. On wonders in the ocean and land of the north.

PART TWO OF VOLUME TWO.

On the decline of the sea level in the northern sea, and the increase of the continent and islands in the north.

Chapter I. On signs and arguments in favour of the decrease of the sea level in the northern sea.

Chapter II. Geometric dimensions of the decrease of the sea level, and increase of the land in the northern regions.

Chapter III. An investigation into the cause of this diminishing of the sea.

Chapter IV. Unavoidable physical consequences for the nature of the terrestrial globe as a result of this decrease of the sea level in the northern sea.

Chapter V. Unavoidable politico-economical consequences resulting from the decrease of the sea level in the northern reigns.

Chapter VI. Others' observations, former as well as recent, proving the continuous decrease of the sea waters.

1. **LNG** are in agreement here. **m** is more informative: "To this volume belong 1) Naturalia: animals, plants, shellfish, etc.; 2) documentation on the decrease of the sea level; 3) on the luminescence of the sea; 4) on the northern light; 5) on the atmosphere and meteorology; 6) economical observations. The volume will thus be divided into six parts."
2. "such as" found only in **G**.
3. This part has ten chapters in **LNG**, but only nine in **m**. The reason is that **m** promises only one chapter on birds, whereas the rest have two.

TOMI II. PARS III.

De Causa Lucis marinæ Oceani Septentrionalis.

Caput I. Phœnomena, & observationes Lucis marinæ.

Caput II. Occasio inquisitionis causæ lucis hujus marinæ.

Caput III. Experimenta facta ad explicandam Lucem marinam deservientia.

Caput IV. Descriptio insectorum marinorum Lucem marinam producentium.

Caput V. Statuitur causa vera lucis marinæ per quam Phœnomena omnia explicantur.

Caput VI. Sententiæ variorum authorum de luce marina refelluntur.

TOMI II. PARS IV.

De Luce, sive Aurora boreali. Hæc Pars ob amplitudinem materiæ in quatuor iterum Sectiones, & singulæ Sectiones in sua capita subdividi debent.

Sectio I. Continet Phœnomena, & observationes proprias in Zona frigida a Patre Hell factas & inde deductam Theoriam novam lucis borealis.

Sectio II. Continet Phœnomena, & observationes Variorum sub elevatione Poli a gradu 66. ad gradum 60. factas, earumque juxta Theoriam novam explicationes.

Sectio III. Continet Phœnomena, & observationes variorum sub Elevatione Poli a gradu 60. ad 50. factas, cum explicat[ione] e Theoria desumpta.

Sectio IV. Continet Phœnomena, & observationes Variorum a gradu Elevationis Poli 50. ad 40. factas simulque examini subjiciuntur Hypotheses aliorum, cumprimis cel. D. Mairan de Luce borea in medium hucusque productæ.

1-29 LNG *eundem sensum aliis verbis exprimit* **m** *summariam exhibet* **J**

1 TOMI II. **LG** *omittunt* **Nm** **2** Oceani Septentrionalis **LNm** die Nordsee **G** **3-12 LNG** *Capita quinque numerat,* Caput III *et* IV *unum facit* **m** **3** Phœnomena *(vel interdum* Phoenomena*) et hic et infra* **Lm** Phaenomena *et hic et infra* **N** **5** Experimenta facta **LNm** Verschiedene angestellte Experimente **G** **7-8** Descriptio *etc.* **LN** *et fere* **m** Beschreibung gewissen Seewürmer, oder Jnsekten, die eigentlich dieses Leuchten verursachen **G** **13** TOMI II. **LG** *omittunt* **Nm** **17** Phœnomena *(vel* Phaenomena*)*, & *(vel* et*)* observationes **LNm** verschiedene ... beobachtete Phänomena, und angestellte Versuche *(lin. 20 autem leguntur haec:* verschiedener Gelehrten ... angestellten Beobachtungen *et lin. 23 haec:* Eben dergleichen Beobachtungen verschiedener Gelehrter, die sie ... angestellet haben *attamen lin. 26 haec:* Phänomena und Beobachtungen verschiedener Gelehrter, die sie ... angestellet*)* **G** **23** observationes **N** observation. **L** **24** cum explicat[ione] *scripsi;* cum explicat. **LN** mit ihren ... Erklärungen **G** *omittit* **m** **28** Luce borea **L** Luce boreali **N** lucis boreæ **m**

PART THREE OF VOLUME TWO.

On the cause of the marine light in the northern ocean.[1]

Chapter I. Appearances of the marine light and observations thereof.[2]

Chapter II. The occasion of this investigation into the cause of the marine light.

Chapter III. Experiments made in order to explain the marine light.[3]

Chapter IV. Description of the marine insects[4] producing the marine light.

Chapter V. The real cause of the marine light, by which all its appearances are explained, is presented.

Chapter VI. Theories put forward by various authors concerning the marine light are refuted.

PART FOUR OF VOLUME TWO.

On the Northern Light, or Aurora borealis. This part must, because of the vastness of the material, be divided into sections, each of which in their turn shall be subdivided into chapters.

Section I. Will contain appearances, and Fathers Hell's personal observations of Northern Lights, on the basis of which a New Theory of the Northern Lights is deduced.

Section II. Will contain appearances, and observations of Northern Lights made by various others at a pole height[5] of 66 to 60 degrees, and explanations of them according to the new theory.

Section III. Will contain appearances, and observations of Northern Lights, made by various others at a pole height of 60 to 50 degrees, and the explanation of them taken from the new theory.

Section IV. Will contain appearances, and observations of Northern Lights, made by various others at a pole height of 50 to 40 degrees. At the same time, the hypotheses of others concerning the Northern Lights which have been published so far, in particular that of famous Monsieur [Jean Jacques d'Ortous de] Mairan, are examined.

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1. "northern ocean" (*mare Septentrionale*, "Nordsee") is used by Hell for the entire coast between Trondheim and Vardø.
2. The expression *phaenomena & observationes* is somewhat puzzling. It seems that *observationes* both here and below verge on "remarks", "reports". See the *apparatus criticus* for various ways this expression has been rendered in **G** (see also Hell 1776*b* for more examples).
3. "Experiments made" **LNm**. **G** has "Various experiments...". Moreover, the contents of Chapter III and IV has been included in one chapter in **m**.
4. "marine insects": Father Hell used *insecta* for various species of marine life (cf. Hansen & Aspaas 2005).
5. "Pole height" (*elevatio Poli*) = geographical latitude.

TOMI II. PARS V.

De Meteoris, & Meteorologica ad Zonam frigidam spectantia.

Caput I. De Calore & Frigore observationes Meteorologicæ.

Caput II. De gravitate aëris, & ejus variationibus per observationes barometricas exhibitis.

Caput III. De ventis, & eorum vicissitudinibus.

Caput IV. De quatuor anni tempestatibus in Zona frigida.

Caput V. De alijs meteoris aëris, uti Parhelia, Paraselene, halones, coronæ &c. Zonæ frigidæ proprijs.

Caput VI. De fluxu & refluxu maris Septentrionalis observationes, & dimensiones.

TOMI II. PARS VI.

Observationes Oeconomicæ Regionum Zonæ frigidæ Subjacentium.

Caput I. Jn causam veram inquiritur cur in Lapponia Finnmarchica Jnsulæ, pluraque alia loca herbis, fruticibus, & arboribus destituantur?

Caput II. Referuntur observationes, cur Jncolæ partium Superiorum Finnmarchiæ Jnsulas itemque oras maritimas, & littora deserta relinquant, atque adeo de migratione Lapponum continua a Septentrione in Meridiem.

Caput III. De causa imminutæ Piscationis salparum in parte orientali, & quibusdam alijs locis Finnmarchiæ.

Caput IV. De modo Lappones vagos ad Sedes stabiles, & vitam civilem perducendi observationes.

1-26 LNG *et (nisi quod lin. 11-12 omittit)* **m** *summariam exhibet* **J**

1 TOMI II. **LG** *omittunt (sicut etiam lin. 13)* **Nm** **7** Caput III. **N** Cap. III. **L** | vicissitudinibus **LN** varietate **m** Verhältnissen **G** **9-10** uti Parhelia, Paraselene, halones, coronæ **LN** uti Parhelia Paraselene, halonibus *(sic)* etc. etc. **m** als der Parhelia, Paraselene, Mondkreisen &c. **G** **11** maris Septentrionalis **LN** des Nordmeers **G** *lin. 11-12 omittit* **m** **16-17** cur in Lapponia Finnmarchica Insulæ, pluraque alia loca **LN** cur in Lapponia Finnmarchica loca pleraque **m** warum in finnmarkischen Lappland und in meisten dasigen Landen **G** **17** fruticibus **LN** Früchte *(sic)* **G** **21-22** de migratione *etc.* **LN** der daraus entstehenden Emigration der nördl. Lappländer nach den mittägigen Gegenden **G** de Migratione lapponum observata ex septentrione Meridiem versus **m** **23** salparum **m** *omittunt* **LNG** **26-27** De modo *etc.* **LN** Von einigen Mitteln die herumziehenden Lapplände *(sic)* zu einer standhaften häuslichen Niederlassung und gesitteten Lebensart zu bringen **G** De modo Lappones ad vitam civilem seu communitatem perducendi, eosque civiles reddendi, et ad loca certa inhabitanda figendi, observationes **m**

PART FIVE OF VOLUME TWO.

Remarks on atmosphere and meteorology relating to the frigid zone.

Chapter I. Meteorological observations of heat and cold.

Chapter II. On the weight of the air, and its variations as shown by barometrical observations.

Chapter III. On winds and their alternations.

Chapter IV. On the four seasons of the year in the frigid zone.

Chapter V. On other atmospheric phenomena, like parhelion, paraselene, halo, corona, etc., found in the frigid zone.

Chapter VI. Observations concerning, and measurements of the ebb and flow of the tides in the northern sea.[1]

PART SIX OF VOLUME TWO.

Economical observations concerning the regions lieing exposed to the frigid zone.

Chapter I. Investigation into the real cause why islands and most other places in the Lapland of Finnmark are devoid of herbs, bushes and trees.

Chapter II. Observations concerning why the inhabitants of the upper parts of Finnmark are leaving islands as well as coastal areas and shorelines, deserted, and also on the continuous migration[2] of the Lapps from north to south.

Chapter III. On the cause of the declining fishery of Stockfish[3] in eastern parts of Finnmark, and some other parts of Finnmark as well.

Chapter IV. Observations concerning how to bring the migratory lapps to lead a civilised life with stable dwellings.[4]

1. This chapter is missing in **m**.
2. Instead of “the continuous migration” (**LN**), **G** has “the resulting migration” and **m** has “the observed migration”. **m** appears to suggest that Hell planned to describe the migration as he and Sajnovics observed it.
3. “Stockfish”. The word *salpa* is found only in **m** (the rest simply have “declining fishery”). It is recorded as “Stockfisch” (i.e. dried fish from the sea, usually cod, *Gadus morhua*) in Bartal 1901 s.v.
4. **m** reads: “Observations concerning how to bring the Lapps to lead a civilised or communal life, render them civilised and point out fixed places for them to live sedentary lives”. **G** is nearly identical to **LN**, but has “On *various* means by which to bring ...” (my italics).

TOMUS III. MATHEMATICUS, & ASTRONOMICUS in IV. Partes dividitur.

TOMI III. PARS I.

Complectitur Astronomica.

Caput I. Descriptio Observatorij Wardœhusiani, instrumentorum &c.

Caput II. Observationes astronomicæ ad determinandam Elevationem Poli observatorij Wardœhusiani pertinentes.

Caput III. Observationes astronomicæ ad definiendam Longitudinem geographicam, seu differentiam Meridianorum observatorij Wardœhusiani spectantes.

Caput IV. Observationes Astronomicæ ad definiendam quantitatem Refractionis aëris in Zona frigida sub Elevatione Poli 70. graduum.

Caput V. Observatio transitus Veneris ante discum Solis die 3. Junij Wardœhusij obtenta.

Caput VI. Determinatio Parallaxeos Solis, seu distantiæ Telluris a Sole ex observatione transitus Veneris Wardœhusiana cum observationibus Americanis, & alibi locorum factis collata.

TOMI III. PARS II.

Observationes Astronomicæ, & Geographicæ per iter factæ ad Mapparum novarum constructionem deservientes.

Caput I. Descriptio Quadrantis astronomici ad has observationes adhibiti, & modus observandi.

Caput II. Observationes Elevationis Poli Locorum *Finnmarchiæ*.

Caput III. Observationes Elevationis Poli Locorum *Nordlandiæ*.

Caput IV. Observationes Elevationis Poli Locorum *Norwegiæ*.

Caput V. Observationes Elevationis Poli Locorum *Sueciæ*, itemque Urbis *Haffniensis*.

Caput VI. Explicantur Mappæ Finnmarchiæ[,] Nordlandiæ & Norwegiæ ex his observationibus constructæ & operi insertæ.

Caput VII. Dimensio Geometrica Jnsulæ Wardœhusianæ, & ejusdem delineatio geographica explicatur.

1-35 LNG *et (minus verbose)* **m** **1-35** *summariam exhibet* **J**

2 dividitur **LN** wird ... eingetheilet *(i.e., tempus futuri)* **G** *omittit* **m** **3** TOMI III. **LG** *omittunt (sicut etiam lin. 19)* **Nm** **5** Wardœhus *(sicut infra)* **L** Wardoehus *(sicut infra)* **Nm** Wardoehouss **G** **15** obtenta **LNm** glücklich von statten gegangen **G** **20-21** per iter factæ **LNm** die eröfter Hr. P. Hell auf der Reise angestellt **G** **21-22** deservientes **L** inservientes **N** necessariæ **m** **23-24 LNG** *hoc caput omittit* **m** **27** Observationes Elevationis Poli *(sicut infra)* **L** Observ. elevat. Poli *vel similiter et hic et infra (etsi huiusmodi abbrevatione lin. 25* **N** *non utitur)* **Nm** **30** Observationes **m** Observationis **L** Observ. **N** **34** Insulæ Wardœhusianæ **LN** Jnsulæ Wardoë **m**

VOLUME THREE. MATHEMATICAL AND ASTRONOMICAL.
is divided into four parts.

PART ONE OF VOLUME THREE.
consists of astronomical matters.

Chapter I. Description of the observatory at Vardøhus, the instruments, etc.

Chapter II. Astronomical observations pertaining to the determination of the pole heihgt of the observatory at Vardøhus.

Chapter III. Astronomical observations made in order to determine the geographical longitude, or difference in the meridian, of the observatory at Vardøhus.

Chapter IV. Astronomical observations made in order to determine the refraction in the atmosphere in the frigid zone under the latitude of 70 degrees.

Chapter V. Observation of the transit of Venus in front of the Sun's disc, [successfully][1] obtained on 3 June.

Chapter VI. Determination of the parallax of the Sun, or the distance between Earth and Sun, based upon a comparison of the Vardøhus observation with observations of the same transit of Venus made in the Americas and elsewhere.

PART TWO OF VOLUME THREE.
Astronomical and geographical observations made during the journey, serving as the basis for construction of new maps.

Chapter I. Description of the astronomical quadrant used for these observations as well as the observational method.[2]

Chapter II. Observations of the latitude of places in *Finnmark*.

Chapter III. Observations of the latitude of places in *Nordland*.

Chapter IV. Observations of the latitude of places in *Norway*.

Chapter V. Observations of the latitude of places in *Sweden* as well as the city of *Copenhagen*.

Chapter VI. Explanation of the maps of Finnmark, Nordland, and Norway, made on the basis of these observations and included in the work.

Chapter VII. Explanation of the geometrical dimension of the island of Vardøhus,[3] and the geographical delineation of this same island.

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1. Text in [brackets] found in **G** only.
2. This chapter is missing in **m**.
3. "Vardøhus": whereas **LNGm** use the form *Wardœhus* almost consistently, in this particular instance **m** has "Wardoë".

TOMI III. PARS III.

Observationes ad Theoriam Declinationis acus magneticæ pertinentes.

Caput I. Refertur apparatus Wardœhusianus ad observationes acus magneticæ adhibitus.

Caput II. Referuntur observationes Declinationis acus Magneticæ Wardœhusij noctu & interdiu singulis pæne horis factæ.

Caput III. De Causa disseritur, quæ variationem Declinationis acus magneticæ diurnam, & pæne horariam inducere videtur.

Caput IV. Refertur Methodus, factarum observationum Declinationis acus magneticæ per iter.

Caput V. Recensentur observationes Declinationis acus Magneticæ per iter arcticum sub diversis Latitudinibus, & longitudinibus factæ.

TOMI III. PARS IV.

De figura Telluris ope observationum barometricarum definiendi Methodus nova.

Caput I. Occasio Methodi hujus detectæ.

Caput II. Conferuntur invicem observationes sub diversis latitudinibus factæ.

Caput III. Quantitas compressionis ad Polos ex observationibus barometricis definitur.

Caput IV. De conditionibus ad præcisionem hujus Methodi necessarijs, & quænam præcisio Resolutionis hujus Problematis barometricarum observationum ope sperari possit.

Caput V. Examinatur Methodus hactenus a varijs Astronomis usurpata (ope dimensionis geometricæ graduum Meridiani) in quantitatem compressionis Telluris ad Polos inquirendi.

Caput VI. Dimensiones ope barometri institutas montium ad Nordcap, aliarumque celebrium Norwegiæ Alpium, itemque Declivitatum fluvij *Laangen-Elv* Norwegiam intercurrentis.

Caput ultimum. Conclusio totius operis Expeditionis litterariæ ad Polum arcticum.

1-33 LNG *summariam exhibent* **Jm**

1 TOMI III. **LG** *omittunt (sicut lin. 15)* **Nm** **2-14 LNG** observationes Declin. Acus Magneticæ // Caput I. referuntur observationes Wardoehusij factæ, et de cause disseritur // Caput II. Referuntur observationes Declinationum acus magneticæ per iter à Latit. 71° ad 54 factæ, itemque Methodus facilis has observationes exactè. instituendi **m** **7 et 9** pæne **N** pene **L** **17** nova **LNGJ** *omittit* **m** **21-22** Quantitas *etc.* **LN** Die Bestimmung der Verhältnisse der Achse der Erde gegen den Diameter der Aequators, oder die Compreßibilität der Erde bey denen Polis, die aus denen Beobachtungen gefolgert wird **G** Ex his eruitur circiter quantitas compressionis Telluris ad Polos *(vox* circiter *supra linea)* **m** **23-25 LNG** *et (supra autem leguntur hae voces erasae:* Quænam ad investigandam hanc methodum à me facta sint per distributionem fistulorum barometricorum*)* **m** **26** a variis Astronomis **LNG** *omittit* **m**

PART THREE OF VOLUME THREE.

Observations pertaining to the theory of the magnetic needle's declination.[1]

Chapter I. The instruments used for observations of the magnetic needle at Vardøhus are described.

Chapter II. Observations of the magnetic needle's declination, made at Vardøhus both day and night, at almost every hour, are laid out.

Chapter III. The reason which apparently causes the magnetic needle to show deviations dayly, almost every hour of the day, is discussed.

Chapter IV. The method used for observing the magnetic needle's declination during the journey is laid out.

Chapter V. The observations of the magnetic needle's declination made during the arctic journey, at various latitudinal and longitudinal positions, are discussed.

PART FOUR OF VOLUME THREE.

A new method[2] of determining the shape of the Earth by means of barometic observations.

Chapter I. The circumstances of the detection of this method.

Chapter II. Observations made at different latitudes are compared with each other.

Chapter III. The quantity of the [Earth's] compression by the poles is defined on the basis of barometric observations.

Chapter IV. On the conditions which are prerequisites for the precision of this method, and what degree of precision may be hoped for in resolving this problem by means of barometric observations.[3]

Chapter V. The method which has been used so far, by various astronomers, in order to investigate the quantity of the Earth's compression by the poles (that is, by measuring the dimensions of tjhe degrees of meridians).

Chapter VI. Dimensions of mountains close to Nordkapp and of other famous alps in Norway, as well as dimensions of declinations of the river Laangen-Elv [Gudbrandsdalslågen] which flows through central Norway, measured by means of the barometer.

Final Chapter. Conclusion of the entire work entitled Scientific Expedition by the North Pole.

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1. This part is phrased totally different in **m**: "Observations of the declination of the magnetic needle. // Chapter I. Gives an account of observations made in Wardoehus, and discusses the cause [i.e., of the magnetic needle's declination]. // Chapter II. Gives an account of observations of the magnetic needle made during the journey, from the 71st to the 54th latitude, as well as an easy method, by means of which these observations can be arranged."
2. "A new method" according to **LNGJ**; **m** omits "new".
3. An erased version of this sentence in **m** reads: "The measures I took to test this method by distributing barometric tubes.".

III.3 THE UNFINISHED INTRODUCTION TO THE *EXPEDITIO LITTERARIA AD POLUM ARCTICUM*

[Maximiliani Hell è S. J.
INTRODUCTIO IN
EXPEDITIONEM LITTERARIAM AD POLUM ARCTICUM
ex manuscriptis autographis edita, apparatu critico Latino, versione et notis Anglicis instructa]

[Maximilianus Hell of the Society of Jesus,
INTRODUCTION TO
THE *SCIENTIFIC EXPEDITION BY THE NORTH POLE*,
edited from autograph manuscripts and furnished with a critical apparatus in Latin and translation and commentary in English][1]

1. This title page has been added by the editor (the manuscript has no title page). As for the translation of the title as 'Scientific Expedition by the North Pole', see Section I.2.3 above. Photographic reproductions of the manuscripts **A B b C D** are found in Aspaas 2012*b*.

Pars I.

Ephemeris totius Expeditionis litterariæ ad Polum arcticum à P. Hell et Socio P. Sajnovics factæ.

Caput I.

§.I. Proponitur scopus et finis omnium Expeditionum litterariarum Anno 1769 ab Astronomis per orbem universum suscipiendarum. §.II. Recensentur Expeditiones in Russia et Suecia factæ. §.III. Expeditiones Gallicæ et Hispanicæ. §.IV. Expeditiones ab Anglis susceptæ. §.V. Expeditio litteraria Regis Daniæ per Patrem Hell et ejus Socium P. Sajnovics in Jnsulam Wardœhus *suscepta, refertur apparatus itineris et discessus Viennâ 1768 die 28 Aprilis.*

§. I.

Proponitur scopus et finis omnium Expeditionum litterariarum Anno 1769 ab Astronomis per universum orbem suscipiendarum.

Tres non amplius supererant anni ad longe expectatissimum, exoptatissimumque Annum 1769, quo die 3 Junij celebre rarissimumque Phœnomenon *Transitus Veneris ante discum Solis* sese Astronomis spectandum, observandumque præberet. Docuerat jam olim Lumen illud Angliæ immortalis *Hallejus* Astronomus Regius (a.) summi fore momenti, utilitatis summæ, fructûs verò in utramque Rempublicam litterariam, et civilem omne pretium superantis isthoc Phœnomenon Transitûs, è cujus accuratis observationibus penderet quam maxime præcisa, et ab orbe condito hucusque desiderata definitio *Parallaxeos Solis* seu *veræ Solis à Tellure Distantiæ Quantitas.*

(a.) Vide Transactiones Philos. N. CCCXLVIII. pag. 454.

1-17 BCD *summariam exhibet* **b** *omittit (pro titulo* J.N.D. *[scil.* Jn Nomine Dei*] exhibet)* **A** **18-29 ABCD**

5-13 CD Quæ Causa Expeditionis hujus Litterariæ inter Augustissimum Regem Daniæ, Aulam Cæsareo-Regiam, et Patrem Hell 1767 Viennæ acta sunt, Expeditionis Scopus, Jtineris ad Polum arcticum *(*ad Polum arcticum *omittit* **b***)* suscipiendi comparatio, et Discessus Viennâ 1768 die 28 Aprilis **b** *et (cum commentario* hic titulus mutandus *in margine)* **B** **15-17 CD** *fere eaedem voces in margine* **B** Regum atque imperantium Principum munificentia causa observandi Transitus Veneris in itinera et Jnstrumenta virorum Astronomorum liberaliter decreta **b** **16** per universum orbem **B** per orbem universum **CD** **19** -mumque Annum **BCD** -mumque Astronomis Annum **A** **21** -mis spectandum **BCD** -mis iterum spectandum *(*iterum *supra linea)* **A** **22** Astronomus Regius. **BCD** *omittit* **A** **26** hucusque **ACD** usque *(litteris* huc *erasis)* **B**

Part One

A diary of the entire Scientific Expedition by the North Pole that was carried out by Father Hell and his companion, Father Sajnovics.

Chapter One

§.I. A presentation of the aims and scope of all scientific expeditions to be conducted world wide by astronomers in the year 1769. §.II. A survey of expeditions carried out in Russia and Sweden. §.III. French and Spanish expeditions. §.IV. Expeditions carried out by Englishmen. §.V. The scientific expedition of the King of Denmark, carried out by Father Hell and his companion Father Sajnovics, to the island of Vardø, including a description of the preparations for their journey and their departure from Vienna on 28 April 1768.

§. I.

A presentation of the aims and scope of all scientific expeditions to be conducted world wide by astronomers in the year 1769.

No more than three years[1] were left until that much longed for and highly promising year 1769, during which, on the third day of June, that famous and most rare phenomenon — a *transit of Venus in front of the disc of the Sun* — was to offer itself to the scrutinising observation of astronomers. A long time had passed since that beacon of England, the immortal Astronomer Royal, *[Edmond] Halley* (a.), had explained the utmost importance, the extreme utility, and the fruitfulness exceeding every possible profit to be obtained for each of the two communities — the Republic of Letters as well as Civil Society — from accurate observations of this phenomenon, upon which the most accurate, and since the creation of the world up to this day so sorely missed, definition of *the solar parallax*, or: *the true quantity of the Sun's distance from the Earth*, depended.

(a.) See Philosophical Transactions no. 348, p. 454 [Halley 1717].

1. Hell uses inclusive reckoning. The reference is to the year 1767.

Ergo ardentia causa boni publici Astronomorum pectora calculis primùm oportunas maxime huic obtinendo fini indagare per orbem universum Stationes (a.), hisque repertis longinqua meditari itinera; Regibus, Summisque Principibus maxima in Rempublicam utramque ex observationibus hujus Phœnomeni promanatura emolumenta per amantes Scientiarum, bonique civilis Ministros proponere, Eorumque opem, Liberalitatem, Munificentiam exorare; Viros dein in Re astronomica et egregie exercitatos, et Vitæ suæ causa boni publici prodigos in laborum, itinerumque Societatem evocare, verbo: nihil intentatum relinquere, quo minus finem hunc orbi universo tam exoptatum ausis felicibus consequerentur.

Nec sine DEJ dispositione factum esse arbitrandum est, ut maximè oportunæ ad finem hunc consequendum Astronomorum *Stationes* ijs in Regnis repertæ fuerint, quorum Dominos et Principes ætas nostra Scientiarum, bonique publici *Patres* et summa cum admiratione suspicit, et devotione maxima veneratur. Etenim cum definitio subtilissimi hujus Problematis à duobus momentis in Transitu Veneris ante Discum Solis maxima cum accuratione observatis pendeat, à momento scilicet *ingressus totalis Veneris in Discum Solis*, et in Egressu, *à contactu interiore limbi Veneris cum Limbo Solis* in binis Telluris locis maximum Parallaxeos Veneris à Sole effectum exhibentibus, prævijs repertum est calculis, (b.) loca Telluris nostræ *Durationem* totius Transitus ab uno contactu interiore ad alterum *maximam* exhibentibus sita esse in parte boreali Sueciæ, Norwegiæ, Finnmarchiæ, itemque Laponiæ Jmperio Russiæ parentis; Loca contra *Durationem* Transitus hujus *brevissimam, minimamque* habentia esse Jnsulas quasdam maris meridionalis Americæ, quod pacificum dicunt; inter has verò Durationes maximam scilicet, et

(a.) Celeb. *De La Lande*. Explication de la figure du Passage de Venus sur le Disque Du Soleil, qui s'observera le 3 Juin 1769, avec les Résultats du Passage observé [en] 1761, à Paris 1764.

(b.) Cel. D. *Pingré*. [Mémoire sur le choix et l'état des lieux Où le passage de Vénus du 3. Juin 1769 pourra être observé avec le plus d'avantage; et principalement sur la position géographique des isles de la mer du sud, à Paris 1767.]

1-29 ABCD 29-31 BCD *signum adnotationis solum exhibet* **A 32** *nomen auctoris* **ABCD 32-35** *titulum dissertationis addidi*

5 ex ... Phœnomeni **A** *omittunt* **BCD 7** egregie **ACD** egregiæ **B 13** Astronomorum **CD** *in margine* **B** *omittit* **A 14** repertae fuerint, quorum **BCD** repertae fuerint ab Astronomis, quorum *(*ab Astronomis *in margine)* **A 16** maxime **ACD** maxima **B 17** definitio **BCD** solutio **A 18** ante Discum Solis **BCD** *omittit* **A** | maxima cum accuratione **BCD** maxima, qua fieri potest, accuratione **A 23** ab uno contactu interiore ad alterum **A** *omittunt* **BCD 24** boreali **BCD** borealiore **A 24-25** Norwegiæ **A** Norvegiæ **BCD 27-28** quod pacificum dicunt **BCD** sive Maris Pacifici **A 30** Soleil *scripsi* soliel **BCD 31** Resultats du Passage observé 1761 **B** Resultats des Passage observè 1761 **CD 32** Cel. D. Pingrè. *(vel* Pingré*)* **BCD** vide dissertationem cel. Pingre. ... . **A**

Accordingly, the minds of astronomers eager to serve the common good at first devoted themselves to the task of making calculations in search for such sites all over the world as would best serve the purpose of attaining this goal (a.). Having found these, they began contemplating far-reaching journeys and, through the aid of ministers caring for the sciences and the common good, they furnished kings and rulers with explanations of the great profits to be gained for both communities, begging for their help and gracious support. Their next step was to search for men skilled in the subject of astronomy and willing to risk their lives for the sake of the common good, and invite these to undertake strenuous journeys. In brief, they left nothing unattempted in their pursuit of a successful attainment of their goal, so longed for by the entire world.

There should be little doubt that God's disposition was at work when it turned out that the sites of observation found to be best serving the purpose of attaining this goal, lay in exactly those realms whose lords and rulers in this age of ours are subject to the greatest admiration and devotion as patrons of the sciences and the common good. For it is so that the solution to this extremely subtle problem depends on two moments in a transit of Venus in front of the disc of the Sun, namely the moment of *total ingress of Venus on the Sun's disc* and in egress, that of *interior contact of the limb of Venus with the limb of the Sun*, which must be observed with the utmost accuracy from two places on Earth providing the highest possible effect of parallax of Venus when seen on the Sun. Accordingly, as it emerged from preparatory calculations (b.), the places on our Earth supplying the *longest duration* of the whole transit were placed in the northern parts of Sweden, Norway and Finnmark, as well as in the parts of Lapland belonging to the Russian Empire.[1] Conversely, the places providing the *shortest duration* were certain islands in the southern sea of America, known as the Pacific. Between these two

(a.) The famous Monsieur de Lalande, *Explication de la figure du Passage de Venus sur le Disque Du Soleil, qui s'observera le 3 Juin 1769, avec les Résultats du Passage observé en 1761* ['*Explanation of the illustration of the transit of Venus in front of the disc of the Sun that is to be observed on 3 June 1769, with the results of the transit that was observed in 1761*'], Paris 1764.

(b.) The famous Monsieur Pingré, *Mémoire sur le choix et l'état des lieux Où le passage de Vénus du 3. Juin 1769 pourra être observé avec le plus d'avantage; et principalement sur la position géographique des isles de la mer du sud* ['*Memoir concerning the choice and nature of places where the transit of Venus on the 3 June 1769 may be most fruitfully observed; especially concerning the geographical positions of the islands of the Pacific*'], Paris 1767.

1. "Sweden" includes present-day Finland. "Norway" here refers to the modern counties Nordland and Troms, whereas Finnmark is treated as a separate entity. Russian Lapland signifies the Kola Peninsula and its adjacent islands.

minimam, medias nonnullas observandas fore in *California*, alias item in America boreali; harum autem Telluris nostræ partium Dominos, Principes, Reges, Jmperatores esse ætate nostra Scientiarum, bonique publici Patres, nemo ignorat.

§. II.

Recensentur Expeditiones in Russia et Suecia factæ.

Et verò Posterorum memoriæ cumprimis comendari venit Summa inter cæteros liberalitas, ac munificentia Augustissimæ Jmperatricis Russiæ *Catharinæ II.* Studio, consilio, et cura Jllustrissimi, ac Excellentissimi Comitis *Volodimerij ab Orlow* Academiæ Jmperialis Scientiarum Petropolitanæ Directoris longe dignissimi procurata et impetrata (a.).

(a.) In præfatione novorum Comentariorum Academiæ Scientiarum Jmperialis Petropolitanæ ad Annum 1770 Tomi XIV Parte I. hæc leguntur "Quum annus 1769 maximè inclytus esset duobus cœlestibus uno die Phœnomenis Transitu Veneris per Solem, et deliquio Solari, indulgentissimæ Rossiarum omnium Dominæ Jmperatrici Catharinæ II visum est ad sustinendos horum Phœnomenorum causa susceptos labores, atque peregrinationes erogare de fisco suo sumptus necessarios ----- et quamvis ad sustinendas Expeditionis Astronomicæ impensas jam undecim millia rubellorum gratificata fuerat Augusta, tamen ne quid deesset, Expeditioni rerum naturalium causa institutæ ad priorem summam decem millia rubellorum adjici jussit clementissima Jmperatrix, omnibusque cum Præfectis, tum Administris harum Expeditionum præberi Stipendium duplex, et mercedem Veredarijs debitam dissolvi ex ærario, atque ne quid moræ intercederet Provinciarum Præsidibus missa sunt edicta Jmperatoria manu signata, quibus jussi erant Academicos humaniter excipere, atque ijs de omnibus, quæ ad Expeditionem pertinerent, benigne gratificari; denique singulis Expeditionum Præfectis data sunt ab amplissimo ordine Diplomata Præsidibus Provinciarum et Procuratoribus exhibenda.". Quo apparatu Astronomi, quibusve cum Socijs ab Augustissima Jmperatrice Russiæ expediti fuêre, quove successu laudati Astronomi finem Expeditionis suæ consecuti fuerint, videre licet in opere Collectionis Petropolitanæ omnium observati[on]um, quæ occasione Transitus Veneris per Solem Anno 1769 Jussu Augustæ per Jmperium Russicum Jnstitutæ fuêre, item in eodem Tomo XIV Parte II Novorum Comentariorum Academiæ Petropolitanæ, atque in Dissertatione cel. D. *de la Lande* Memoire sur le Passage de Venus. Parisijs 1772, itemque in mearum Ephemeridum Appendicibus ad annum 1773 et 1774.

1-4 ABCD 5-6 C2D *omittunt* **BC1 7-12 ABCD 13-30 BCD** *omittit* **A 30-33** Quo apparatu ... videre licet **ACD** *notam* <u>NB vide adjectam schedam</u> *exhibet* **B 33-35** in opere ... fuêre, **A** *omittunt* **BCD 35-38** item ... 1772 **ACD** *omittit* **B 38-39** itemque *etc.* **CD** *omittunt* **AB**

4 nemo ignorat. **BCD** quis quæso ignorat? *et in margine:* hic recensendæ dispositiones et itinera, facta a varijs Potentijs et Astron. **A 31** ab ... Russiæ **CD** *omittit* **A 35-36** in ... Academiæ **CD** in Tomo XIV Actorum Jllustris Academiæ **A 38** Parisijs 1772 **A** anno 1772 conscriptæ **CD**

extremes in the duration — in other words, between the shortest and the longest one — there would be several durations in-between to be obtained from observations in California and other places in northern America. That precisely these parts of the Earth in our age are belonging to lords, princes, kings and emperors that are patrons of the sciences and the common good, is well known to every one.

§. II.

A survey of expeditions carried out in Russia and Sweden.

In this respect, the extremely lavish and gracious funding afforded by the Supreme Empress of Russia, *Catherine II.*, commends itself to the memory of posterity more than any other. It was thanks to eager advice and management from the highly illustrious and most competent director of the Imperial Academy of Sciences in Saint Petersburg, His Excellency Count *Vladimir of Orlov*, that this came about (a.).

(a.) In the preface to the *Novi Commentarii* of the Imperial Academy of Sciences in Saint Petersburg for the Year 1770, vol. XIV part I [Anonymous 1770*b*], one reads: “Since the year 1769 was the object of celebrity due to two celestial phenomena to be observed on a single day — a transit of Venus and an eclipse of the Sun — the supremely gracious Ruler of all Russian territories, Empress Catherine II., decided that the necessary funding for support of activities and expeditions pertaining to the observation of these phenomena was to be paid from her personal Treasury, [...] and although a sum of eleven thousand rubles had already been bestowed by Her Highness for the purpose of astronomical expeditions, the Empress in her clemency nonetheless added a further ten thousand rubels to the previous grant in order to support expeditions devoted to natural history. Furthermore, she ordered double wages to be offered to all leaders and assistants in these expeditions, and that payment for postal correspondence should be disbursed from her Treasury. Moreover, so that no delay should hamper the expeditions, edicts signed by Imperial hand were sent to the provincial governors, containing instructions that the academicians be met with hospitality and offered any kind of help they should be in need of for their expeditions’ sake. Finally, to the leaders of each expedition were given Imperial letters of recommendation that they were to show to the governors and magistrates of the provinces”. What instruments and assistants were entrusted to the astronomers by Her Imperial Highness of Russia, and what success they had in their undertakings, can be read in the work ‘Collection of all the observations that were undertaken in conjunction with the transit of Venus in front of the Sun in the Russian Empire in 1769, upon order from the Empress’ [Anonymous 1770*a*], in part II of the same volume of the *Novi Commentarii* of the Petersburg Academy as well as in the treatise by the famous Monsieur *de Lalande*, ‘Mémoir on the transit of Venus’, Paris 1772 [cf. Lalande 1772], and also in the appendices to my *Ephemerides* for the years 1773 and 1774 [Hell 1772 & 1773].

Jntellexerat nempe ab Jllustrissima Scientiarum Academia oportunissimas observando huic Phœnomeni *Stationes* in parte maxime boreali Jmperij Russici sitas esse, quæ cum *Stationibus* americanis australioribus collatæ basim præberent maximam, eaque de causa definiendæ Parallaxeos Solis maximè oportunam.

Jtaque eximia Augustissimæ Jmperatricis munificentia donati Academici Petropolitani, in id primum incubuêre, ut *Stationes* per Jmperium Russiæ assequendo huic fini quam maximè oportunas designarent, tum ut observatores exquisitis donarentur Jnstrumentis, ac denique, ut Astronomos et in observando exercitatissimos et Theoriæ peritissimos unde unde in laborum Societatem evocarent. Fuêre autem *Stationes* delectæ omnino octo, has inter quatuor, in quibus uterque contactus observaretur, erant *Kola*, *Ponoj*, et *Ombay* in Laponia Superiore Russiæ, atque *Jakutsk* in parte maxime orientali, et septentrionali Tartariæ sita; Quatuor aliæ in quibus egressus tantum videretur fuêre: *Petropolis*, *Orenburg*, *Orsk*, *Guriew*. Et quidem *Kolam* urbeculam Laponiæ Russicæ ad fluvium ejusdem nominis sitam, *stationem* sibi legit ipsusmet Academiæ Petropolitanæ Astronomus cel. D. *Rumowskj*; altera Laponiæ statio *Ponoj* dicta, occupata est à cel. D. *Mallet* Astronomo Genevensi, tertiam in *Ombay* fixit sedem cel. D. *Pictet* Genevâ item evocatus Astronomus; *stationem* autem *Jakutsk* sibi occupandam elegit claris. *Jsleniew*.

Stationem *Orenburgensem* cel. *Kraft*, et *Orskensem* cel. D. *Euler* filius Jllustris Leonardi Euleri, ambo Academici Petropolitani, *Guriewensem* autem cel. D. *Lowitz* sedem observationum sibi delegêre, *Petropoli* denique egressum veneris observaturi una cum Astronomis Petropolitanis cel. Domino *Lexell*, cel. *Eulero* filio, et cel. D. *Kotelnicow* Professore, fuêre cel. R. D. *Christianus Mayer* Astronomus Principis Electoris Palatini cum Socio R. D. *Stahl* sumptibus

1-17 ABCD 17-18 Kolam ... sitam **BCD** *omittit* **A 18-22 ABCD 22-23** stationem ... Jsleniew. **A** *omittunt* **BCD 24-27 ABCD 27-29** una cum ... Lexell ... Eulero filio ... Kotelnicow Professore **BCD** *omittit* **A 29-30 ABCD**

2 parte maxime boreali Jmperij **BCD** parte Boreali amplissimi Jmperij **A 5** oportunam **BCD** accomodam **A 6** Jtaque Eximia **DC2** Eximia **BC1** Hac ergo **A 7-8** per ... assequendo **A** *omittunt* **BCD 9** tum ut **A** et **BCD 13** uterque contactus *(*conctatus **B***)* **BCD** contactus omnes totius transitus **A 14-15** in parte maxime orientali et septentrionali Tartariæ sita **BC1** *et (vocem* sita *omittit)* **A** (Locus in parte maxima orientali et septentrionali Tartariæ situs) **C2D 17** Et quidem *etc.* **BCD** his itaque stationibus Primi ex ordine delecti fuêre Astronomi; **A 18** ejusdem nominis **DC2** cognominem **BC1 20** occupata est à *etc.* **BCD** oblata cel. D. Mallet Astronomo Genevensi ab Jllustrissima Acad. Petrop. evocando **A 21-22** tertiam ... Geneva ... Astronomus **BCD** Tertia quæ Ombay dicitur Astronomum habuit cel. D. Pictet Genevâ item cum Dno Mallet invitatum **A 22** Jakutsk *scripsi* Jaktustk **A 25** Euler **ACD** *sine emphasi* **B** | Jllustris Leonardi Euleri **A** *omittunt* **BCD 26-27** sedem ... sibi delegêre **BCD** stationes ... designatæ erant *id quod casum dativum adicit nominibus observatorum* **A 29-30** Astronomus Prinicipis Electoris Palatini **BCD** Astronomus Palatinus **A**

For he[1] had been made to understand by the highly illustrious Academy of Sciences that the most convenient stations were situated in the northernmost parts of the Russian Empire. Collated with stations in the southern Americas,[2] these sites would provide observations of the largest mathematical basis, and thereby also of the highest aptitude for deducing the parallax of the Sun.

Enriched by such extreme munificence from the part of Her Highness the Empress, the Saint Petersburg academians first embarked upon the task of pointing out stations thorughout the Russian Empire that would best serve their purpose in this project. Next, they began equipping their observers with precious instruments and finally, to invite from far and near astronomers well versed in both the practical task of observing and the theory of astronomy to take part in their efforts. In total, eight sites of observation were chosen. Four of these lay within the zone where both contacts were observable — *Kola*, *Ponoi* and *Umba* in the upper part of Russia's Lapland, along with *Iakutsk*, a place in the northeasternmost part of Tartaria. The remaining four, from where only the egress would be visible, were *Saint Petersburg*, *Orenburg*, *Orsk* and *Gur'ev*. The small town *Kola* in Russian Lapland, situated on the banks of a river of the same name, was chosen by none other than the famous astronomer of the Saint Petersburg Academy, Mister *Rumovskii*, as his site observation; the second site in Lapland, by the name *Ponoi*, was manned by the famous Monsieur *Mallet*, an astronomer from Geneva; and in the third place — *Umba* — the famous Monsieur *Pictet*, likewise an astronomer called for from Geneva, settled to make his observations. The able *Islen'ev*, however, chose *Iakutsk* as his station.

The famous *Krafft* chose *Orenburg* to be the site for his endeavours, whereas famous Mister *Euler* the younger, son of the illustrious Leonard Euler, chose *Orsk*. Both were members of the Saint Petersburg Academy. In *Saint Petersburg* itself, for observations of the egress of Venus only, were stationed the famous Honourable Mister *Christianus Mayer*, astronomer of the Elector Palatine, and his companion, Honourable Mister *Stahl*.[3] They had been sent from Mannheim in the Palatinate with funding from that greatly esteemed Prince, and were to participate in the observations along with Saint Petersburg's astronomers

1. "For he.. [scil. Orlov]" or perhaps "For she.. [scil. the Empress]".
2. "Southern Americas" here includes the Pacific.
3. One notices the use of *R. D.* (i.e. *Reverendus Dominus*, "Honourable Mister") instead of *R. P.* (*Reverendus Pater*, "Honourable Father") to characterise the Jesuit astronomer Christianus Mayer and his assistant. Hell and Sajnovics are, however, characterised as *Pater*, "Father" throughout the text.

ejusdem serenissimi Principis Manheimio è Palatinatu Petropolim ablegati.

Non minore Zelo, et conatu celeberrimi Sueciæ Astronomi Jllustrium Academiarum *Stokholmiensis* et *Upsalensis* præclara Academiæ Petropolitanæ studia æmulati ternas ad septentrionem totius Transitus peroportunas observandi stationes fixerunt, *Torneam*, et *Pello* bina jam olim à laboribus cel. D. *Maupertuis* celebria loca, atque *Cajaneburgum* Cajaniæ Provinciæ Metropolim, his occupandis delecti eximij in Astronomia observatoria Astronomi; *Torneam* cel. D. *Hellant*, *Pello* cel. D. *Mallet*, et *Cajaneburgum* cel. D. *Planman* idem, qui eadem in Urbe Veneris Transitum Anno 1761 felici cum Successu observaverat; cæteri Sueciæ Astronomi *Stokholmiam*, *Upsalam*, *Aboam*, *Lundam* (a.), atque etiam Jnsulam *Huenam* à laboribus immortalis Tychonis longè celeberrimam selectas sibi voluêre stationes (b.).

§. III.

Expeditiones Gallicæ et Hispanicæ.

Hæc dum in Septentrione magnis aguntur studijs, celeberrimi Angliæ et Galliæ Astronomi ingenti Æmulationis spiritu excitati partem orbis alteram laborum suorum Theatrum voluêre, Americam scilicet utramque, atque etiam remotissimas Jndiarum Jnsulas, probe gnari

(a.) *Stokholmiæ* Transitum Veneris observarunt cel. D.D. *Wargentin*, *Ferner*, et *Wilke*, *Upsaliæ* cel. D.D. *Melander*, *Prosperin*, *Bergman*, et *Salenius*. *Lundæ* cel. D.D. *Schenmark* et *Nenzelius*.

(b.) Ex meo itinere arctico Hafniam redux, *Huenam* Jnsulam cum Jllustri, ac cel. D. *Horrebow* Astronomo Regio, atque cel. D. *Niebuhr*, et socio meo P. *Sajnovics* invisens, Extemporaneum observatorium ligneum ab Astronomis Sueciæ pro observando Transitu Veneris constructum haud procul à ruderibus celeberrimi Uranoburgi Tychonici situm reperi; ab incolis hujus Jnsulæ intellexi binos ex universitate Lundensi Astronomos hoc loco Transitum Veneris observaturos per nubes observatione privatos fuisse.

1-15 ABCD 16 BCD *omittit* **A 17 CD** *omittunt* **AB 18-21 ABCD 22-24 BCD** *omittit* **A 25-32 ABCD**

1 Manheimio è Palatinatu **BCD** ex ordine nostro **A 3** Zelo, et **A** *omittunt* **BCD** | *in margine:* De suecia. **A** *omittunt* **BCD 6** peroportunas **B** per oportunas **CD** quam maxime oportunas **A 7** Maupertuis **AB** Maupertius **CD 8** atque **A** et **BCD 11** idem, qui **BCD** idem exercitatus Astron. qui **A 16** §. III. **CD** §. II. **B 26-27** et ... Sajnovics **BCD** *omittit* **A 27-28** Extemporaneum observatorium ligneum ab Astronomis Sueciæ **BCD** Observatorium Astronomorum Sueciæ **A 28** pro observando Transitu Veneris constructum **BCD** pro observando ingressu Veneris in hac insula erectum **A 29** celeberrimi **A** *omittunt* **BCD 31** hoc loco **A** in hac insula **BCD**

famous Mister *Lexell*, a[nother] son of famous *Euler*, and famous Mister Professor *Kotelnitsov*.

No less dedicated in their efforts were the highly famous astronomers of the illustrious Swedish academies in *Stockholm* and *Uppsala*, who in emulation of the tremendous zeal of the Saint Petersburg Academy settled for three sites in the North that would be well suited for observations of the whole transit. These three were *Torneå* and *Pello* — both places having long since acquired fame through the works of the famous Monsieur *Maupertuis* — and *Kajaneborg*, the capital of the province of Cajania.[1] To occupy these sites were chosen astronomers of exquisite skills in observational astronomy. Thus, famous Mister *Hellant* was to be stationed in Torneå, famous Mister *Mallet* in Pello, and in Kajaneborg, famous Mister *Planman* — the very same man who had successfully observed the transit of Venus of the year 1761 from the same city. The rest of the Swedish astronomers opted for *Stockholm*, *Uppsala*, *Åbo*, *Lund* (a.), and even the island of *Hven*, so famous for the labours of immortal *Tycho [Brahe]*, as their sites of observation (b.).[2]

§. III.

French and Spanish expeditions.

As these grand scale preparations were taking place in the North, the famous astronomers of England and France, set ablaze with a spirit of the utmost competitiveness, opted for the other part of the world to become the arena of their activities — that is, both of the Americas[3] as well as the remotest of islands in the Indies — fully

(a.) In *Stockholm* the transit of Venus was observed by the famous Misters *Wargentin*, *Ferner* and *Wilke*; in *Uppsala* by the famous Misters *Melander*, *Prosperin*, *Bergman*, and *Salenius*; in *Lund* by the famous Misters *Schenmark* and *Nenzelius*.

(b.) Having returned to Copenhagen from my arctic journey I paid a visit to the Island *Hven* together with the illustrious and famous Astronomer Royal, Mister *Horrebow*, the famous Mister *Niebuhr* and my companion Father *Sajnovics*. There, I found the provisional wooden observatory that the Swedish astronomers had constructed close to the ruins of the Tychonian Uraniburg Observatory. From people living on this island I learned that two astronomers from the University in Lund had stationed themselves on this island with the intention of observing the transit of Venus, but that they had been deprived of this observation due to clouds.

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1. Torneå (Swedish) = Tornio (Finnish); Kajaneborg (S) = Kajaani (F); Cajania (Latin) = Kajanaland (S), Kainuu (F).
2. Åbo (Swedish) = Turku (Finnish); Hven or Hveen (Danish) = Ven (modern Swedish).
3. "both of the Americas" refers to North and South America (included in the latter was even the Pacific, see above).

Stationes in novo hoc orbe figendas cum *Stationibus* Europæis et Asiaticis bases daturas maximas definiendæ Parallaxeos solis oportunissimas. Astronomi equidem Galliæ remotissimas et nondum cognitas Maris pacifici Americæ meditantes Jnsulas, jam anno 1767 cel. Dominum *Veron* observatorem non inexercitatum, et instrumentis astronomicis instructissimum navi eadem, qua cel. D. *Bougainville* circum orbem universum navigaturus vehebatur, expeditum causa observationis Transitus Veneris Anni 1769 in Jnsula quadam Maris pacifici obtinendæ ablegarunt (a.). Easdem petendi incognitas Maris pacifici Jnsulas ardentissimo animo flagrabat cel. D. *Chappe d'Auteroche* ab Expeditione litteraria *Tobolskenski* anni 1761 celeberrimus, venia attamen ab Aula hispanica non obtenta, mutata mente *Californiam* navi hispana in Societate celebrium Virorum D.D. *Vincent* et *Salvador* petere coactus, *stationem* suam in loco, cuj à S. *Josepho* nomen, sibi infelicissimam fixit (b.). Tertius Galliæ Astronomus Longè celeberrimus D. *Le Gentil* Academiæ Regiæ Scientiarum Parisiensis socius, ab anno 1761, quo primum Transitum Veneris observaturus Jndias petierat, fixa in Jndijs statione per ipsos octo annos Transitum Veneris Anni 1769 præstolari

(a.) Expeditio hujus Astronomi fausto successu caruit, dudum enim ante observationis diem Jnsulas Maris pacifici prætervectus, dum ex Jnsula *Franciæ* ad *Pondicheri* veheretur, quo loco observationem Transitus obtinendam sperabat, ipsa observationis die 3 Junij alto in mari versans, observatione privatus, vita quoque in Jndijs functus est.

(b.) Celeberrimus hic Astronomus Galliæ (cujus amicitia hic Viennæ, dum in Siberiam anno 1761 mense Januario proficisceretur, gavisus sum) jam ante et sub ipsa observatione gravi laborans morbo observationem Transitus Veneris obtinuit quidem, at paucos post dies eodem in loco contagione inter Socios grassante, victima Astronomiæ, magno Reipublicæ Astron[omicæ] damno cecidit.

1-24 ABCD 25-30 BCD *summariam exhibet, relationem de amicitia omittens* **A**

1-3 Stationes ... oportunissimas **BCD** pro maxime oportunis basim scilicet maximam exh[ibentibus?] decertabant stationibus **A** **3-4** nondum **BCD** minime **A** **4** Jnsulas jam **BCD** Jnsulas, quæ cum stationibus Laponiæ maxime Borealibus basim observationum præberent maximam, jam *(cf. lin. 1-3)* **A** **7-8** expeditum **A** *omittunt* **BCD** **10** ardentissimo animo flagrabat **C2D** ardentissimo animo versabat **BC1** mente versabat **A** **11-12** ab Expeditione ... celeberrimus **BCD** celeberrimus Galliæ Astronomus **A** **13** mutata mente **BCD** *omittit* **A** **15-17** Tertius ... Le Gentil ... socius **BCD** cel. Le Gentil **A** **18-19** Transitum ... præstolari **BC** *et fere* **A** Transitum Veneris Anni 1769 præstolari *(verbis cunctis inter* Transitum Veneris *lin. 18 et* Anni 1769 *lin. 19 omissis)* **D** **20** Expeditio ... caruit **BCD** Zeloso huic observatori infelix prorsus hæc accidit Expeditio **A** **21-24 BCD** *eundem sensum aliis verbis exhibet* **A** **30** Astron. damno **C2D** Astron. cum damno **BC1** magno Astronomiæ detrimento **A**

aware that the sites of observation to be set up in this New World would be providing the most suited basis for calculations of the solar parallax when collated with the sites in Europe and Asia. The astronomers of France, having in mind some extremely remote and as yet unknown islands in the Pacific Ocean of America, had already in the year 1767 dispatched a highly experienced observer, the famous Monsieur *Veron*, well equipped with astronomical instruments, for the sake of obtaining an observation of the transit of Venus from one of the islands of the Pacific Ocean in the year 1769. He was carried by the very same ship as famous Monsieur *Bougainville*, when he set sails to circumnavigate the entire globe (a.). Enflamed by an unrestrained desire to reach those same unexplored islands of the Pacific Ocean was [also] the famous Monsieur *Chappe d'Auteroche*, who had received much fame for his scientific expedition to Tobolsk in the year 1761. However, since he failed to obtain permission from the Spanish Crown, he was forced to change his mind. Instead, he travelled in a Spanish ship to *California* along with two famous men, Señores *Vincent* and *Salvador*, and stationed himself at a site named after *Saint Joseph*,[1] a place that was to lead to his own ruin (b.). A third, highly famous astronomer of France and a member of the Académie Royale des Sciences in Paris, Monsieur *Le Gentil*, having set up a site of observation in the Indies already in 1761, in which year he had set forth with the aim of observing the first transit of Venus, had made up his mind to stay in the Indies for the coming eight years in waiting for the transit of Venus of the year

(a.) The expedition of this astronomer became no success, since he, having traveled past some islands in the Pacific Ocean long before the day of the observation, found himself in the middle of the deep sea on the observational day of 3 June, on his way from the *Isle de France* towards *Pondicherry*, the site where he had hoped to observe the transit.[2] He was thereby deprived of the observation, and even lost his life in the Indies.

(b.) This famous French astronomer (whom I had the pleasure of befriending in January of the year 1769, when he passed through Vienna on his way to Siberia) was already ill from a serious disease before and during the observation itself. He did, however, succeed in observing the transit of Venus, but only few days later, as the disease took hold of more and more of his travel companions in the same place, he succumbed to it, a victim of Astronomy and a great loss for the astronomical republic.

1. "The place name after Saint Joseph" = San José in Baja California.
2. Isle de France = Mauritius.

decrevit (a.). Nemo tamen omnium celeberrimorum Galliæ Astronomorum tanto ardebat desiderio observandi hujus Transitus Veneris, atque Reverendus D. *Pingré* ab Expeditione astronomica anni 1761 in Jnsulam *Roderici* toti orbi litterato celebratissimus; Prælegerat is Jllustrissimæ Academiæ Scientiarum Parisinæ die 23 Decembris Anni 1766 celebrem illam Dissertationem suam Anno 1767 Typis datam, de selectu locorum, in quibus Transitus Veneris Anni 1769 observationes faciendæ ad præcisam Parallaxeos Solis definitionem conferent plurimùm, nihilque optabat magis atque ex designatis animo Jnsulis incognitis Maris pacifici quampiam magnis ausibus quærendam, aut saltem quasdam Americæ tenere oras; nec spe sua frustratus principio Mensis Februarij anni 1769 conscensa navi Gallica in Jnsulam S. *Dominici* vela faciens, eandem laborum suorum astronomicorum *stationem* consecutus, et observatione ingressus Veneris in discum solis felici successu beatus, in Galliam redijt.

§. IV.

Expeditiones ab Anglis susceptæ.

Magna equidem erant *Moschoviæ*, *Sueciæ*, *Galliæ*, causa felicis observationis hujus consequendi successus suscepta molimina, sed longe his superiora, aut certè paria erant summorum Angliæ Astronomorum studia, et conatus. Etenim cum Definitio Problematis hujus subtilissimi (ut jam commemini) è binis penderet *stationibus*, quarum observationes totius Transitus Veneris *differentiam* moræ Veneris ante discum solis transeuntis obtentæ præberent quam maximam, harum autem *stationum* altera, quæ moram exhiberet

(a.) Fine attamen suo causa nubium frustratus, diuturna decem annorum Expeditione egregiè functus magno rerum Variarum ad scientias illustrandas, augendasque spectantium apparatu, et collectione ditatus anno demum 1771 Galliam totamque Europam suo recreavit adventu.

1-15 ABCD 16 BCD *omittit* **A 17 CD** *omittunt* **AB 18-25 ABCD 26-29 BCD** *summariam exhibet* **A**

2 desiderio **BCD** Zelo **A 3** Reverendus **CD** *et (voce* celeberrimus *erasa)* **B** doctissimus *(voce* celeberrimus *erasa)* **A |** Pingré *scripsi* Pingrè *vel* Pingrè **ABCD 4** toto orbi litterato **BCD** longe **A 6-7** Typis datam **BCD** Typis editam **A 9-11** atque ex Jnsulis ... quampiam ... quærendam **BCD** *eundem sensum aliis verbis* **A 11** nec **BCD** ne **A 13** in Jnsulam S. Dominici **BCD** Jnsulam S. Domini versus **A 13-15** laborum ... astronomicorum ... consecutus, et ... felici successu ... redijt. **CD** *et (vocibus* consecutus est *in* consecutus, et *mutatis, designatione adnotationis erasa)* **B** stationem laborum fixit (a.) *cum adnotatione marginali:* (a.) quo loco observatione ingressus Veneris felici successu beatus est. **A 16** §. IV. **C2D** §. III. **BC1 21** studia, et conatus **BCD** molimina **A |** Definitio *(vel* definitio*)* **BCD** Solutio **A 24** ante discum ... obtentæ **BCD** in disco solis spectatæ **A 27** egregiè functus **BCD** *omittit* **A 28-29** illustrandas, augendasque spectantium **BCD** pertinentium **A |** et collectione **BCD** *omittit* **A 23** anno ... adventu. **BCD** Galliam tenuit 1771. **A**

1769 (a.). However, among the highly famous astronomers of France there was no one yearning with such a flagrant desire to observe this transit of Venus as the Honourable Monsieur *Pingré*, a celebrity to the entire world of learning since his astronomical expedition to the island of *Rodrigues* in the year 1761. This Pingré had on 23 December of the year 1766 read to the highly illustrious Académie des Sciences of Paris his famous memoir on the choice of places for observation of the transit of Venus in the year 1769. Printed in the year 1767, this memoir explained what places would contribute the most to a precise calculation of the solar parallax, and there was nothing its author wished more than to be given the daunting task of searching for one or other among those unknown islands of the Pacific Ocean that he intuitively supposed to exist, or at least to be sent to some place on the shores of the Americas. His hopes were not in vain, and in the beginning of February of the year 1769 he embarked on a French ship sailing for the island of *Santo Domingo*,[1] which was to the site for his astronomical tasks. He arrived at his destination, was bestowed the luck of a successful observation of the ingress of Venus upon the disc of the Sun, and returned to France.

§. IV.

Expeditions carried out by Englishmen.

Great indeed were the strenuous contributions of *Muscovy*, *Sweden* and *France* for the sake of a successful outcome of this enterprise. Much superior, however, or at least at the same level, were the dedicated endeavours offered by the eminent astronomers of England. As already explained, the solution to this extremely subtle phenomenon depended upon two sites of observation offering the largest possible difference in the time spent by Venus in crossing the disc of the Sun. Of these two, the site providing the longest duration of

(a.) Although he failed to obtain his goal because of clouds, he did accomplish a ten-year, uninterrupted expedition until he finally returned — to the joy and relief of France as well as entire Europe — in the year 1771, with a rich and diverse collection of items that he had assembled, mindful as he was of the elucidation and advancement of the sciences.

1. The site was in today's Haiti.

longissimo tempore duraturam, haberetur in Zona frigida arctica; altera, in qua mora Transitus brevissimo tempore contineretur, in Jnsulis meridionalibus Americæ Maris pacifici at incognitis usque, sita foret, utrasque has *stationes* sibi occupandas delegêre, eo nimirum fine, ut si observatores *stationis utriusque* cœlo bearentur sereno, solis Angliæ Astronomis Arbitris (in dissensu aliorum Astronomorum) Definitione Parallaxeos solis ab Angliæ Astronomis facta standum foret. Eum in finem in remotissimas, easque incognitas Maris pacifici Americæ detegendas Jnsulas magno apparatu instructa, ablegatur navis, Navarcho cel. Domino *Cook*, Viris doctis comitantibus, Astronomo cel. Domino *Green*, et D. *Solander* upsalensis Academiæ rerum naturalium Viro peritissimo, Bothanices cumprimis cognitione clarissimo (a.). Navis altera cum celeberrimis Astronomis Angliæ *Dymont* et *Walles* in sinum *Hudsonis* vela faciens, munitum Anglorum Locum, quem *Prince of Walles fort* dicunt, stationem suarum observationum figere jussa (b.). Tertia denique in Finnmarchiam, Regi Daniæ subditam Regionem Zonæ frigidæ longe difficillimam, delectis celeberrimis Astronomis D.D. *Bayly* et

(a.) Navis isthæc, quam totum circum orbem vela fecisse novimus, paulo ante diem Transitus Veneris ad oras Jnsulæ majoris Maris Pacifici, quam indigenæ *Otahite*, Angli, Jnsulam *Regis Georgij*, Galli autem *Taïti* dicunt, adpellens, anchoras jecit. Ea igitur in *statione* oportunissima cel. D. *Green* Astronomus Angliæ cum Jllustri Navarcho *Cook*, et D. *Solander* die 3 Junij 1769 cœlo sereno beati completissimam obtinuêre observationem, quam in Appendice Ephem[eridum] mearum Vindob[onensium] ad Annum 1773 retuli; magno tamen damno hæc stetit observatio Angliæ Astronomis, cujus causa præstantissimo privati fuêre Astronomo cel. Domino *Green* ipso in reditu in Batavia Americæ (ut in California cel. D. *Chappe d'Auteroche*) vita functo.

(b.) Observationem in sinu Hudsonis feliciter obtentam recensui in Appendice mearum Ephem[eridum] Vindob[onensium] ad annum 1773.

1-29 ABCD 30-31 BCD *omittit* **A**

2 in qua mora ... contineretur **BCD** quæ maxime contractam **A** **3-4** at incognitis usque, sita foret, utrasque **BCD** incognitis, utrasque **A** **6** solis **BCD** *omittit* **A** **7-8** Definitione parallaxeos ... standum foret. **BCD** definitioni *(voce* sententiæ *erasa)* standum foret. **A** **9** detegendas **BCD** *omittit* **A** **10-11** Viris doctis comitantibus **BCD** *omittit* **A** **11-13** et D. Solander ... peritissimo ... clarissimo **BCD** atque rerum naturalium peritissimo Viro D. Solander Sueciæ Bothanico longe clarissimo **A** **13** (a.) **CDA** *designationem adnotationis omittit* **B** **15** dicunt **BCD** appellant **A** **17** Finnmarchiam **CDA** Finmarchiam **B** | Regi Daniæ subditam **BCD** *omittit* **A** **18** Bayly **BCD** Bailiy **A** **22** dicunt **BCD** appellant **A** | adpellens **BCD** *omittit* **A** **24** observationem **C2DA** *omittunt* **BC1** **26** magno tamen damno hæc stetit **BCD** caro tamen hæc venit **A** **28-29** (ut ... Chappe d'Auteroche) **BCD** *omittit* **A**

the transit would be located in the frigid zone of the Arctic, and the site providing the shortest duration, among the still undiscovered islands of the Pacific Ocean of South America. Accordingly, they decided to man sites in each of the two regions. Their aim was evidently nothing less than to bring about that, if clear skies were to be bestowed upon observers at each of these sites, the determination of the parallax of the Sun (in case other astronomers failed to arrive at a consensus) could be defined by England's astronomers, with astronomers from England as sole witnesses. To this end, one ship was dispatched with a mission to search for some extremely remote, even undiscovered, islands of the Pacific Ocean of America. Aboard this well equipped ship was the famous Mister Captain *Cook*, accompanied by learned men, the famous astronomer Mister *Green* as well as Mister *Solander* of the Uppsala Academy, a man with a keen knowledge of natural history and botany in particular (a.). Another ship with the highly famous English astronomers *Dymond* and *Wales* set sail for *Hudson Bay*, upon orders to establish the site for their observations at the fort of the Englishmen called *Prince of Wales Fort* (b.). Finally, a third ship was being made ready for an expedition to Finnmark, a region belonging to the King of Denmark and located in the frigid zone, so extremely complicated to visit; the highly famous astronomers Mister *Bayly* and Mister

(a.) This ship, which is known to have circumnavigated the entire globe, reached the shores of a major island of the Pacific Ocean shortly before the day of the transit of Venus, and cast anchor there. This island is called *Otahite* by the indigenous population, *King George's Island* by the English, and *Tahiti* by the French. At this highly convenient site, the famous English astronomer Mister Green, along with the illustrious Captain Cook and Mister Solander, were granted an unclouded sky on the third day of June 1769, allowing them to make a complete observation [of the transit]. An account of their observation is found in the appendix to my Viennese *Ephemerides* for the year 1773. However, this observation came at a huge cost in the damaging blow it afflicted on the astronomers of England, for they were deprived of one of their most outstanding astronomers, the famous Mister Green, who — just like famous Monsieur Chappe d'Auteroche in California — lost his life in Batavia in America,[1] on his way back from this expedition.

(b.) I have treated the successful observation obtained in Hudson Bay in the appendix to my Ephemerides for the year 1773.

1. "Batavia in America": now better known as Jakarta in Indonesia. Green actually died at sea 29 January 1771, having left Batavia.

Dixon ableganda parabatur (a.).

Neque tamen his tribus, quamvis maximo apparatu, et sumptu susceptis Expeditionibus ardentia Anglorum vota arctabantur; delecta fuêre et alia loca Americæ septentrionalis, in quibus, etsi egressus Veneris è disco solis videri haud potuerit, momenta tamen ingressus Veneris totalis observarentur accuratissime; hæc inter in nova Anglia erat *Cantabriga* statio cel. Domini *Winthrop* Matheseos Professoris. *Norritonij* in comitatu Philadelphiæ Provinciæ Pensylvaniæ *stationem* habuêre viri cel. D.D. *Smith*, *Lukens*, et *Rittenhouse*; Locus *Lewestown* in Promontorio *Hinlopen* observatores nactus est cel. D.D. *Biddle*, et alterius *Bayly*. Statio *Philadelphiæ* fuit cel. D.D. *Erwing*, et *Prior* (b.). sed et ad oras Jndiæ pro solo Egressu Veneris è disco Solis observando Angliæ Astronomus vela facere jussus; Ex hoc magno numero, et situ locorum facile perspicitur, si observatores omnes cœlo sereno beati fuissent, è Solis Anglorum observationibus Quantitatem *Parallaxeos Solis* quam maxime præcisam definiendam fuisse, eventus attamen docuit, omnes hasce etsi sapientissimè cogitatas, quas jam recensui Regum, Principum,

(a.) Expeditio hæc Anglorum ad Polum arcticum in Finnmarchiam facta est ipso observationis anno 1769 Mense Aprili, quum ego jam à die 11 octobris 1768 cum socio meo P. *Sajnovics* in Jnsula Finnmarchiæ, *Wardœhus* dicta, versarer. Fixêre autem bini hi observatores suas stationes ab invicem plus 40 milliaribus germanicis distantes; celeberrimus quidem *Bayly* in monte supra portum *Kielwig* paulo infra *Nord-Cap*, sub Elevatione Poli 71°. 0'. 47". et longit[udine] à Meridano Parisino 1 h. 34. m. 50. s. orient[em] versus. Cel. autem *Dixon* in monte portus *Hammerfest* sub Latitudine 70°. 38'. 22". et Merid[iano] dist[ante] à Paris[ino] 1 h. 35'. 39". Utraque hæc *statio* causa nubium fine suo obtinendæ observationis Transitus Veneris privata est.

(b.) Harum omnium stationum observationes recensitæ habentur in Ephem[eridibus] meis Vindobone[n]s[ibus] ad annum 1773.

1 ABCD 2-6 BCD *summariam exhibet* **A 7-20 ABCD 20-23** quum ... distantes; **BCD** *omittit* **A 23-31 ABCD**

1 ableganda **BCD** ablegenda **A 6** accuratissime *scripsi* accuratissima **CD** *ultima littera vix legibilis* **B** *omittit* **A 8-9** Norritonij ... stationem habuêre viri cel. D.D. **BCD** Norriton ... statio celeberrimorum DD. **A 9** Lukens, et **D** Lukeus, et **A** Lukeus et **BC 10-11** Locus Lewestown ... observatores nactus est cel. D.D. **BCD** Lewestown ... statio cel. D:D: **A 11** Bayly **BCD** Bayley **A 12** solo **BCD** *omittit* **A 13** Angliæ **BCD** ex parte Anglorum **A 14** Ex hoc magno numero, et situ locorum **BCD** quorum sapientissimo delectu Locorum **A 16** Quantitatem **CD** *et (voce* definitionem *erasa)* **B** definitionem *(voce* solutionem *erasa)* **A 17** definiendam fuisse **BCD** obtineri potuisset **A 17-18** omnes hasce etsi **BCD** providas has omnes, atque **A 20** Aprili, quum *etc.* **BCD** Aprili, in cujus fine stationes suas appulere **A 21** 1768 **C2D** *omittunt* **BC1 24** Bayly **BCD** Bayley **A** | in monte **BCD** in montibus *(sicut lin. 26)* **A 28** fine suo obtinendæ observationis **BCD** observatione **A**

Dixon were chosen for this mission (a.).

But the enthusiastic zeal of the English was not restricted to these three expeditions only, however well equipped and sumptuous they were. More places in northern America were chosen; places where, although the egress of Venus from the Sun's disc would not be visible, it would at least be possible to discern the moments of total ingress with all possible accuracy. Among these was a site in *Cambridge*, New England, where the Professor of Mathematics, famous Mister *Winthrop* was to be stationed. Furthermore, *Norristown* in the County of Philadelphia in the Pennsylvanian Province was occupied by the famous men Mister *Smith*, Mister *Lukens* and Mister *Rittenhouse*. And the place *Lewes Town* at the Cape of Hinlopen[1] received the famous observers Mister *Biddle* and another Mister *Bayl[e]y*. Finally, the site of *Philadelphia* was occupied by the famous Misters *Erwing* and *Prior* (b.). Even to the shores of India an astronomer of England was ordered to sail, to make observations limited to the egress of Venus from the disc of the Sun. Taking into account the large number and the geographical distribution of these sites of observation, it is easy to see that if the luck of a clear sky had been bestowed upon all the observers mentioned, the exact quantity of the parallax of the Sun would have been possible to define through observations made by Englishmen alone. The outcome proved otherwise, however. It turned out that, notwithstanding all the wise and careful planning of kings, princes

(a.) This expedition of Englishmen to [the County of] Finnmark by the North Pole was made in the month of April 1769, the year of the observation itself, at a time when I, along with my companion Father Sajnovics, had been staying at the island in Finnmark by the name *Vardøhus*, ever since the 11th of October 1768. The two observers mentioned stationed themselves more 40 German miles apart from each other. The highly famous *Bayly* observed from a mountain above the port of *Kjelvik*, just below the North Cape, at a Pole height of 71º.00'.47" and a longitude 1 hour 34 minutes 50 seconds East of the Parisian meridian. The famous *Dixon*, for his part, observed from a mountain by the port of *Hammerfest*, at a latitude of 70º.38'.22", and a meridian 1 h 35 m 39 s East of Paris.[2] Each of the two sites were deprived of their goal of observing the transit of Venus because of clouds.

(b.) The observations from all these stations have been treated in my Viennese *Ephemerides* for the year 1773.

1. Now known as City of Lewes, near the Cape of Henlopen.
2. The site of Bayly was at or near the present site of Honningsvåg airport, whereas Dixon observed from Rypeklubben just south of Hammerfest.

Astronomorumque dispositiones, divina ita ordinante Providentia haud sufficientes omnino futuras fuisse ad decidendam sine dubio, et cum certitudine, aut saltem maxima cum probabilitate Quæstionem *præcisæ Quantitatis* Parallaxeos solis si suasu et consilio sapientissimorum Daniæ Ministrorum Augustissimus Rex *CHRISTIANUS VII* in societatem summi hujus negotij, præter opinionem omnium aliarum Academiarum non venisset sumptibus quam maximis ad finem hunc consequendum liberalissimè profusis, ideoque omnium hucusque recensitarum à summis Principibus factarum Expeditionum veluti Coronidem impositurus.

§. V.

Expeditio litteraria Regis Daniæ per Patrem Hell et ejus socium P. Sajnovics in Jnsulam Wardœhus *suscepta, refertur apparatus itineris et discessus Viennâ 1768 die 28 Aprilis.*

Dania ergo erat, cujus solius Dispositioni *Divina Providentia* inter decem ad Polum arcticum stationes, quam maxime completam dare decreverat observationem hujus Transitus Veneris, sola et una maris glacialis Jnsula, solum nempe *Wardœhusium* ea erat in extremo septentrione *statio*, quam solam (ut eventus docuit) cum remotissima Maris pacifici Americæ Jnsula *Otahite* Numen delegerat divinum, è quarum binarum laboribus quæstio subtilissima *Parallaxeos solis* à condito orbe hucusque desideratæ cum præcisione maxima definita haberetur. Felix hic eventus Completæ observationis Transitus in Supremo septentrione non stationibus Jmperij Russiæ *Kola*, *Ponoy*, *Ombay*, et *Jakutsk*. Non Sueciæ locis *Tornea*, *Pello*, et *Cajaneburg*. Non etiam Finnmarchiæ stationibus Anglorum *Kielwig* et *Hammerfest* à divino Numine decretus,

1-4 ABCD 4-10 si *etc.* **BCD** *summariam exhibet* **A 11 BCD** *omittit* **A 12-15 CD** *omittunt* **AB 16-19 ABCD 19-28** solum nempe *etc.* **AB** *omittunt* **CD** *(vox* Jnsula *lin. 19 in medio paginae reperta* **A** *paginam explicit* **B** *manuscripta explicit* **CD***)*

2 haud sufficientes omnino **BCD** insufficientes **A 2-3** sine dubio, et **BCD** *omittit* **A 4** præcisæ **BCD** *omittit* **A 4-10** si ... CHRISTIANUS VII ... non venisset ... impositurus. **BCD** si non Dania Jn Societatem summi hujus negotij, præter opinionem omnium aliarum Academiarum sponte velut sua Harum omnium dispositionum coronidem impositura venisset, **A 11** §. V. **C2D** §. IV. **BC1** *post* impositurus, *lin. 10 textum lin. 16 sine spatio intermisso continuat* **A 17** ad Polum arcticum **CD** *et (vocibus* ad Arctos *erasis)* **B** ad Arctos **A 17-18** quam maxime completam dare **BCD** completam in septentrione *(cf. lin. 19-20)* dare **A 18** hujus Transitus Veneris **BCD** *omittit* **A 19** Wardœhusium **B** Wardhusium **A 19-20** in extremo septentrione **B** in septentrione *supra linea* **A 20** (ut eventus docuit) **B** *omittit* **A 24** definita **B** decisa **A 24-25** Completæ ... septentrione **B** *omittit* **A 26** locis **B** *omittit* **A 27** Anglorum **B** *omittit (vocibus* ab Astronomis Angliæ *erasis)* **A 28** à divino Numine **B** *omittit* **A**

and astronomers recounted so far, divine providence would have rendered all their efforts entirely insufficient for the attainment of their goal. A precise definition of the Sun's parallax, that is, a definition beyond any doubt, associated with all certitude or at least with the highest possible degree of probability, would not have been possible if it were not for the Supreme King CHRISTIAN the SEVENTH, who followed the advice of Denmark's highest ministers and entered among the participants in this extremely important entreprise. To the surprise of all other academies, His Highness donated the highest possible sums for the attainment of this goal as if to snatch the crown of all the expeditions launched by the mightiest princes so far reviewed.

§. V.

The scientific expedition of the King of Denmark, carried out by Father Hell and his companion, Father Sajnovics, to the island of Vardøhus, including a description of the preparations for their journey and their departure from Vienna on 28 April 1768.

Denmark it was, then, whose dispositions — alone among the ten sites by the North Pole — were chosen by Divine Providence to be granted the completest possible observation of this transit of Venus. For solely and uniquely this island by the Arctic Sea, *Vardøhus*, turned out to be the one and only site in the High North that the Divinity had chosen to become, along with the extremely remote island of *Otahite* in the Pacific Ocean of America, the sole contributors to the resolution of that extremely delicate question of the parallax of the Sun, a question whose resolution has been longed for since the creation of the world up to this very day, but which was now finally resolved with the highest possible degree of accuracy. The success of a complete observation from the farthest North was neither bestowed upon the stations of the Russian Empire, *Kola*, *Ponoi*, *Umba* or *Iakutsk*; nor upon the Swedish locations *Torneå*, *Pello* or *Kajaneborg*; or upon the English stations in Finnmark, *Kjelvik* or *Hammerfest*.[1]

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1. One notices that Hell never in this text mentions the official expedition of Peder Horrebow the Younger to Dønnes (Tromsø wss planned to be the site) nor the private expedition of Kratzenstein to Trondheim.

quum omnes hæ stationes, DEo ita ordinante, cœlo per nubes obducto completa observatione privatas jam novimus (a.), solum *Wardœhusium*, ea erat Daniæ subjecta Jmperio Maris glacialis Jnsula, quam cœlo sereno pro utroque contactu exacte observando DEus optimus maximus beaverat (b.).

Annus erat 1767, quo sapientissimi, scientiarum, atque boni publici amantes *Christiani VII* Daniæ et Norwegiæ Regis Ministri, intellectis vicinarum Daniæ Aularum *Russiæ* scilicet et *Sueciæ* causa Transitus Veneris diei 3 Junij 1769, decretis Expeditionibus, atque unà perspecto Jnsulæ *Wardœhusianæ* Regi Daniæ subjectæ situ, huic consequendo fini perquam commodissimo, Consilio inito

(a.) *Kolæ* quidem cel. *Rumowskj* observationes contactuum protulit, sed trans nubes spectatas, certitudine necessaria carentes, et *Cajaneburgi* cel. D. *Planman* ob solem ad horizontem vaporibus immersum, nubesque supervenientes minus quoque certas habere potuit contactuum observationes, et in Egressu quidem solum contactum externum, cum interior per nubes videndus impediebatur, eumque prorsus dubium retulit. Quis igitur adeo manifestam DEJ dispositionem in hoc eventu non admiretur, qui novit, è *decem* stationibus ingenti adeo à se intervallo dissitis, ut quædam plus centum milliaribus à se invicem distarent, *novem* harum eodem fere tempore cœlum habuisse nubilum? Si igitur Jnsula Wardœhusiana observatore caruisset, cuj soli cœlum pro observatione contactuum serenum à divino Numine decretum erat, fructu certè præcipuo etiam aliorum Principum Expeditiones in partem Americæ australem privatæ fuissent, quum Definitio hujus Problematis ab observationibus septentrionalibus Europæis cum Australibus Americæ collatis penderet, ut Astronomis notum est.

(b.) Mirabilem DEJ dispositionem Sub ipsum observationis tempus nubium cursum ita dirigentem, ut uterque Contactus cœlo serenissimo à me obtentus fuerit, fusius retuli, in observatione Transitus Veneris *Wardœhusij* à me facta, quæ primùm *Hafniæ*, dein Viennæ in Ephem[eridibus ad annum] 1771, ac demum Lipsiæ in Actis eruditis typis exscripta habetur.

1-11 AB 12-33 Bb *omittit* **A**

1-2 quum ... solum **B** qvas omnes stationes ita ordinante DEo fine caruisse suo jam novimus, solum **A** **3** Maris glacialis **B** *omittit* **A** **4-5** quam ... beaverat **B** quam dono hoc cœlesti divina beare decreverat clementiâ *(sic)* **A** **6-7** atque boni publici **B** *omittit* **A** **7** Ministri **B** ministeri **A** **7-8** intellectis **B** cognitis **A** **9** diei ... 1769 **B** *omittit* **A** **9-10** atque unà **A** *omittit* **B** **10** perspecto **B** cognita *(sic)* **A** **11** consequendo **B** *omittit* **A** | commodissimo **B** opportunissimo **A** **12** Kolæ quidem **B** stationes in septentrione supra recensitæ die 3 Junij tempore Transitus Veneris causa cœli nubibus obducti, observatione contactuum privatæ fuêre omnes, Kolæ equidem **b** **12-13** observationes ... carentes **B** trans nubes dubios obtinuit contactus **b** **13** et **b** *omittit* **B** **14** Planman **B** Planmann **b** **14-15** nubesque supervenientes **B** *omittit* **b** **26** Europæis *in margine* **B** *omittit* **b** | Americæ **B** *omittit* **b** **26-27** ut Astronomis notum est **B** ut optime nôrunt Astronomi **b** **30** in observatione **B** in Typis edita observatione **b** **31** à me facta, quæ **b** facta, et **B** **32** ac demum **B** itemque **b**

For as it later emerged, the Divine Will of God arranged matters so that all the stations mentioned were deprived of a complete observation due to a clouded sky (a.). Indeed, *Vardøhus* alone it was, that island sited by the Arctic Sea and belonging to the Danish Empire, which was granted by God Allmighty the blessing of a clear sky so that each of the contacts could be accurately observed (b.).

It was in the year 1767 that the highly wise ministers of King *Christian VII* of Denmark and Norway learnt of the decisions that had been taken by the neighbouring courts — namely, the Russian and the Swedish — to make expeditions in order to observe the transit of Venus on 3rd June 1769. At the same time, these supporters of the sciences and the common good had perceived that the Vardøhus island belonging to the King of Denmark enjoyed a geographical position that rendered it highly suitable for the attainment of this goal. Having discussed the issue with each other,

(a.) In *Kola* the famous *Rumovskii* did indeed obtain observations of the contacts, but through a layer of clouds and lacking in the exactitude required; likewise, at *Kajaneborg* the famous Mister *Planman* failed to obtain accurate observations because the Sun was immersed in vapours close to the horizon, with clouds passing in front of it. During egress, because observation of the inner contact was hindered by clouds, Planman was only able to record the external contact, but his report on this point is very dubious. What person, I ask, is not struck with awe at God's manifest dispositioning in this outcome, when he learns that out of *ten* sites of observation, distributed with such an enormous space between each other (some of them even at a distance of more than a hundred miles apart), no less than *nine* of these experienced a clouded sky at almost exactly the same moments? In other words, if on that day no observer had been present at the island of Vardøhus, the site that was unique in being granted, by the Divine Will, a clear sky facilitating observation of the contacts, then even the results from expeditions of other sovereigns to the southern part of America would have been deprived of their value as well. For, as is well known to the astronomers, the resolution of this problem depended upon a collation of northern observations from Europe with southern observations from America.

(b.) A detailed account of God's extraordinary dispositioning during the crucial moment of observation, when He directed the course of the clouds in such a way that I was able to observe each of the contacts through a perfectly cloudless sky, is found in my work *Observatio Transitus Veneris ... Wardoëhusii ... facta* ['*Observation of the transit of Venus, made in Vardøhus*'], printed for the first time in Copenhagen [Hell 1770*a*1], then in Vienna (in the *Ephemerides* for the year 1771) [Hell 1770*a*4], and finally in the *[Nova] Acta Eruditorum* in Leipzig [Hell 1770*a*2].

Expeditionem quoque litterariam ad Polum arcticum in Jnsulam *Wardœhus* Regi Clementissimo proponendam, impetrandamque decrevêre. Erant autem id temporis Summi Consilij Regij intimi Ministri Comes Jmmortalis nominis Excell[entissimus] *Bernstorfius* negotiorum, ut appellant, exterorum Præses et Caput, Excellentissimus Comes *Otto de Thott* omni scientiarum genere ornatissimus et Regnorum Regi Daniæ Subjectorum supremus Minister, atque Excellentissimus Comes de *Moltke* Commercij, Artiumque omnium supremus Præses.

Decretam hanc communi consilio Expeditionem litterariam in Jnsulam *Wardœhus* Sub Auspicijs Regis clementissimi faciendam, ut à Rege Augustissimo, in scientijs etiam mathematicis Regiam dignitatem ornantibus excultissimo, ratam, Suoque benignissimo annutu firmatam habuêre summi hi Triumviri ad Aulam regiam Ministri, occulto, et planè miro divinæ Providentiæ instinctu communibus (ut subinde mihi innotuit) votis, voluntate quoque Regia accedente, Expeditionem hanc Auspicio Regio à me Consiliorum votorumque horum omnium prorsus ignarissimo, suscipiendam, perficiendamque exoptavêre.

Datis ergo Augusto Mense 1767 ad Excellentissimum Comitem de *Bachof* ad Aulam Cæsareo-Regiam Vindobonensem Regis Daniæ Legatum, ab Excellentissimo Comite de *Bernsdorf* Primo, ut dixi, Aulæ Regiæ Hafniensis Ministro litteris, Consilia à Rege Daniæ causa Expeditionis hujus Litterariæ suscepta et mecum per Excellentissimum Comitem de Bachof communicanda complectentibus, die 5 Septembris, mihi nihil hujusmodi opinanti, ad se accersito, mentem, votaque Clementissimæ Suæ Aulæ aperit, *Wardœhusium* Jnsulam Finnmarchiæ in mari glaciali sitam, *stationem* laborum

1-28 AB

1 litterariam **B** *et (voce* Astronomicam *supra linea)* **A** **1-2** ad Polum ... Wardœhus **B** in finnmarchiam **A** **2** Regi Clementissimo proponendam, impetrandam *(*-que *scripsi; cf. e.g. lin. 19-20)* **B** à Rege clementissimo impetrandam **A** **4** Jmmortalis nominis Excell. *supra linea* **A** *omittit* **B** | Bernstorfius **B** Bernsdorfius **A** **5** Caput, **A** *post* Caput *designationem adnotationis habet* **B** **6** et **A** *omittit* **B** **7** Regi **A** *omittit* **B** **9** Præses. **A** *post* Præses *legitur adnotationis designatio, licet erasa (cf. ad lin. 5)* **B** **11** Jnsulam Wardœhus **B** Finnmarchiam *(cf. lin. 1-2)* **A** **12-13** in scientijs ... excultissimo **A** *omittit* **B** **13** benignissimo **A** *omittit* **B** **14** hi Triumviri **B** *omittit* **A** **15** planè **B** *omittit* **A** **16-17** voluntate quoque Regia accedente *in margine* **A** *omittit* **B** **17** Auspicio Regio **B** *omittit* **A** **17-18** consiliorum ... ignarissimo, *in margine* **A** Consiliorum horum votorumque prorsus ignarissimo *in margine* **B** **18-19** suscipiendam, perficiendamque *scripsi;* suscipiendam perfectamque *(voce* suscipiendam *in margine addita;* -que *ad vocem* perfectam *addita)* **B** susceptam perfectamque **A** **19** optavêre; **A** *post* exoptavêre *designationem adnotationis habet* **B** **21** Cæsareo-Regiam **B** Cæsaream **A** **22** Bernsdorf **B** Bernstorf **A** **22-23** ut dixi **B** *omittit* **A** **23** Regiæ **A** *omittit* **B** **23-24** consilia à Rege Daniæ Causa **B** Consilia ab Aula Hafniensi causa **A** **24** et **B** *omittit* **A** **26** nihil hujusmodi opinanti *(post* opinanti *voces* sibique ignotissimo, *licet erasae, in margine leguntur)* **B** *omittit* **A** **27** Wardoehusium **B** Wardaehusium **A** **28** Jnsulam ... sitam **B** *omittit* **A**

they decided to suggest to, and indeed convince the supremely gracious King that he too should facilitate a scientific expedition by the North Pole, with Vardøhus island the destination. In those days, the highest ministers closest to the King's table were His Excellency Count *Bernstorff*, that immortally famed head and administrator of foreign affairs, along with His Excellency Count *Otto von Thott*, a man well versed in all branches of the sciences and Supreme Minister of the realms belonging to the King of Denmark, as well as His Excellency Count *von Moltke*, the highest administrator of finances and all the arts.[1]

This triumvirate of ministers at the King's court, then, decided among themselves that a scientific expedition ought to be sent to the island of Vardøhus under the auspices of their supremely gracious King. And as soon as they obtained the consent of the Supreme King — who is Himself well versed in the mathematical sciences, as befits His Royal Dignity[2] — and had their proposal confirmed through His most benign approval, they all (as I learned later), thanks to some hidden and downright miraculous instinct of Divine Providence, all voted unanimously that the one to undertake this expedition under the auspices of the King, was to be me. The will of the King supported the proposal, whereas I for my part did not have the faintest idea that any such deliberations and casting of votes took place.

Thus, in the month of August 1767 a letter was sent from His Excellency Count *von Bernstorff*, the Prime Minister (as I explained above) at the Royal court in Copenhagen, addressed to His Excellency Count *von Bachoff*, the Danish King's ambassador at the Imperial and Royal court in Vienna. The letter contained the deliberations of the King of Denmark concerning this scientific expedition, to be presented to me by His Excellency von Bachoff. Accordingly, on the 5th of September I, who did not have the slightest idea that anything of this sort was going to happen, was invited to the place of von Bachoff, and upon my arrival the ambassador revealed to me the ideas and wishes of his supremely gracious court, making me understand that the highest ministry had singled out Vardøhus in Finnmark, an island

1. Count Johann Hartwig Ernst von Bernstorff (1712-1772), Minister of Foreign Affairs from 1754 to 1770. Count Otto von Thott (1703-1785), Interior Minister from 1763 to 1770. Count Adam Gottlob Moltke (1710-1792), Privy Councillor and administrator of the King's treasury from 1747 to 1766 and again Privy Councillor as well as head of the "Overskattedirektion" from 1768 to 1770.
2. "who is Himself ... Royal Dignity": this phrase is found only in **A**.

meorum à summo Ministerio delectam refert, sumptus regios, Jnstrumenta, commodaque omnia difficillimi hujus itineris à Ministerio Regio ad vota mea ampliter, atque liberaliter procuranda recenset, negotium denique sibi demandatum esse, mentem, animumque meum suscipiendæ hujus Expeditionis ex me intelligeret enarrat, rogatque, mentem meam, ut sibi candide aperirem, num animus mihi foret hanc ab Aula sua Augustissima exoptatam Expeditionem Suscipiendi? Hic (dum hæc Excell[entissi]mus legatus longiore prosequeretur oratione) ego, qui causa debiliorum mei corporis virium, binas jam antehac Suscipiendæ hujus modi Expeditionis factas invitationes deprecatus fueram, hisce Excellentissimi Comitis de Bachof non prævisis propositionibus perculsus, divinam quamdam, eamque occultam circa me Dispositionem, et Providentiam mente versabar, utpote, qui non modo cum nemine per *Daniam* ullum usque habebam commercium litterarium, sed ne nomen quidem meum in *Dania*, et multo verò minùs *Hafniæ*, minime verò summis Aulæ Regis Ministris notum fuisse arbitrabar, maximè autem quod *Dania* me Virum de societate JESV evocaret, quæ in Regionibus hisce septentrionalibus ferè ignota haberetur, et eo cumprimis tempore, quo societas per Regna Catholica gravissimis laborabat persecutionibus, toto orbe notissimis, dein quod à Clementissimo Rege Daniæ invitarer, cujus votis satisfacere celeberrimus quisquis Galliæ, aut Angliæ Astronomus summo, immortalique sibi duxisset honori, quod, inquam *Christianus VII*, ejusque sapientissimum Ministerium, à me Viro, id temporis de Societate JESV, hujusmodi ne cogitante quidem, promissis amplissimis, atque liberalissime impendendis sumptibus Expeditionem hanc Susceptam vellet.

1-27 AB 18-21 quæ ... notissimis **b**

1-2 Jnstrumenta **B** *omittit* **A 2** commodaque **A** commoda **B 2-3** omnia ... ad vota mea **B** omnia mihi ad vota mea **A 4** negotium ... sibi demandatum esse **B** sibi negotium ab Aula sua clem[entissima] commissum esse **A 5** enarrat *scripsi;* ennarrat **A** *omittit* **B 6** sibi **B** *omittit* **A** | num **B** an **A 7** Augustissima **B** clem. **A 8-9** (dum ... oratione) *in margine; secundum indicationem Patris Hell inter* ego *et* qui *ponenda* **B** *omittit* **A 9** debiliorum mei corporis virium **B** debiliorum potissimum mei corporis virium **A 10-11** binas ... suscipiendæ ... Expeditionis ... invitationes deprecatus fueram **B** binis ... suscipiendi ... itineris ... renunciaveram ... invitationibus **A 11-12** hisce ... non prævisis propositionibus **B** ad hasce ... non prævisas propositiones **A 12** perculsus **B** admodum perculsus **A 13-14** eamque occultam ... mente versabar **B** dispositionem mihi occultam admirans **A 14-15** ullum usque (usque *in margine)* **B** *omittit* **A 16-17** et ... minùs <u>Hafniæ</u>, minime ... Ministris **B** *omittit* **A 17** fuisse **B** esse **A 17-18** maximè ... Virum **B** et maxime abad me Virum **A 18** evocaret **B** *omittit* **A 19** hisce **Bb** *omittit* **A** | haberetur **BA** habetur **b** | cumprimis **Bb** imprimis **A 20** societas **Bb** ordo meus **A** | per Regna Catholica **B** in Regnis Catholicis **b** *omittit* **A 20-21** gravissimis laborabat persecutionibus **Bb** maximis laboraret persecutionibus **A 22** invitarer **B** *omittit* **A 22-23** celeberrimus ... Astronomus ... duxisset **A** celeberrimi Galliæ, et Angliæ Astronomi summo, immortalique sibi ducerent **B 24-27** quod ... vellet. **B** quod inqvam à me de Societate JESV, et quidem suis ampliter promissis sumptibus Expeditionem hanc Susceptam vellet, **A**

sited by the Arctic sea, to become the site of my endeavours. The expenses (worthy of a King), the instruments and all sorts of supplies needed for this extremely challenging journey were to be generously provided by the Royal ministry according to my wishes; the task of von Bachoff was to learn from me whether I would be willing to undertake this expedition. Accordingly, he asked me to share my thoughts on the matter openly, and to tell him whether I found it tempting to accept the invitation to make this expedition, so hoped for by his splendid court. As I listened to the detailed explanations of His Excellency the ambassador, I, who because of my failing bodily strength twice already had rejected invitations to make a similar expedition, found myself overwhelmed by the unexpected proposal presented by His Excellency Count von Bachoff. Confused, I began suspecting that some hidden plan of Divine Providence was behind this experience of mine. For not only had I so far never had any scientific correspondence with anyone in Denmark; nor did I have an idea that my very name should be known in that country, especially not in Copenhagen, and even less so among the highest ministers at the King's court! And even more surprising I found the fact that Denmark had chosen to invite me, a member of the Society of Jesus, which in these northern regions was almost completely unknown, and that even at a time when the Society endured the severest of persecutions in Catholic kingdoms, as is well known all over the world. And why did the supremely gracious King of Denmark invite me, when each and every famous astronomer of France or Britain would have found it eternally honorific to satisfy the King's wishes? In short, why had *Christian VII* and his highly sagacious Ministry chosen to ask me, at that time[1] a member of the Society of Jesus and not even considering any task of this sort, to undertake this expedition in the prospect of a promise of grand and lavish support?

1. "at that time" (*id temporis*) is lacking in **A**, which indicates that that part of the draft may have been written before the suppression of the Society of Jesus.

Præter hæc, alia non nulla fortassis hac in Evocatione latentia, mihique occulta Divinæ Providentiæ consilia, mente revolvens, quidnam ad propositam invitationem reponerem dubius, animo tandem in divinam providentiam fixo, firmiter statui, mentem meam ita declarandam, ut totius negotij consecutio, non à mea, sed à divina penderet voluntate; reposui itaque Excellentissimo Comiti de Bachof, perhonorificas mihi equidem esse Regis sui clementissimi propositiones, Meritis etiam meis longe superiores, me autem non esse mei juris, sed esse Astronomum Cæsareo-Regium Augustissimorum nostrorum, proin me totum ab Eorum clementissimo arbitrio pendere, ideoque sine annutu, et venia Augustissimorum me Expeditionem hanc acceptare non posse; -- ad hæc Excellentissimus Legatus, animum duntaxat meum, ut aperirem suscipiendæ Expeditionis, id solum se nunc in Commissis habere, cætera curanda deinceps; animum, quod meum spectaret, eum dixi me habere promptum vota Regis clem[entissimi] implendi, me tamen nequaquam veniæ peregrinandi ab Augustissimis nostris impetrandæ actorem futurum; intellecta hac mea mente Excellentissimus Legatus Comes de *Bachof* finem denique Colloquij faciens, certum me reddidit, declaratam mentem meam se ad clementissimum Regem Suum relaturum Hafniam, ejusque responsum mecum communicaturum. Hæc sub finem Augusti Mensis mecum acta Summo interea premebam silentio, dum quid Rex Clementissimus Daniæ porro decerneret, intelligerem.

Mensis Septembris die 22, secundò ad Excellentissimum Comitem *de Bachof* evocatus, intelligo, responsum meum benigno acceptum fuisse animo ab Augustissimo Rege Daniæ, sibique in mandatis datum, nomine Regis sui clementissimi pro me veniam

1-28 AB

1 Præter hæc, alia non nulla **B** hæc, et præterea non nulla *(eaedem voces erasae leguntur in* **B***)* alia **A** | fortassis **B** *omittit* **A** **2** mihique oculta **A** *omittit* **B** | mente revolvens **B** menti meæ volvens **A** **3-4** tandem **B** *omittit* **A** **4-6** mentem meam ita declarandam, ut ... penderet voluntate **B** mentem meam neutram in partem declarandam **A** **7** equidem **B** *omittit* **A** | sui **B** *omittit* **A** **8** Meritis etiam meis longe superiores *in margine* **B** *omittit* **A** **9** sed esse Astronomum **B** quippe Astronomum esse **A** **9-11** Augustissimorum ... arbitrio pendere **B** Augustissimæ Aulæ nostræ, me totum in ejus clementissimo arbitrio esse **A** **11** ideoque **B** quapropter **A** | venia Augustissimorum **B** indulgentia Augustissimorum nostrorum **A** **12** acceptare non posse **B** nullo modo acceptare posse **A** **13** Legatus **B** Comes de Bachof **A** **15** eum dixi me habere **B** eum esse **A** **16** clem. **A** *omittit* **B** **16-18** me ... nequaquam ... actorem futurum **B** sed sine Aulæ Augustissimæ annutu me nihil omnino suscepturum, nec me de hoc annutu impetrando quidquam apud Augustissimam Jmperatricem nostram acturum **A** **18** Legatus **B** *omittit* **A** **20-21** clementissimum Regem Suum **B** Regem suum Augustissimum **A** **22-23** Hæc ... silentio **B** Hæc meum *[sic]* Mense Augusto acta fuêre, quæ ego summo premebam silentio **A** **25** secundò **B** *omittit* **A** **27** Ab ... Daniæ *(*Augustissimo *in margine)* **B** à Rege suo Clem. **A** **28** datum *(voce* esse *erasa)* **B** datum esse **A** | Regis sui clementissimi **B** Regis Daniæ **A**

As I rolled over in my mind these and whatever additional dispositions from the part of Divine Providence that may be at work in this summoning, I was overcome with doubt concerning what I should answer. At last, however, focusing all my concentration on Divine Providence, I decided to declare my thoughts in such a way that all further development in this matter would be depending on the Will of God, not on myself. Hence, my answer to His Excellency Count von Bachoff was as follows: the proposal of his supremely gracious King honoured me greatly, and went far beyond my merits; however, I was not a man with the power to decide for myself, since the office of Imperial and Royal Astronomer of our Highnesses meant that all decisions concerning my person were up to their supremely gracious judgement; therefore, I could not accept the task of undertaking this expedition without the assenting permission of my sovereigns. To this His Excellency the ambassador responded that his only mission at this stage was to make me express my own point of view regarding this expedition; all the rest would be taken care of later. I then declared that as for my part, I was indeed willing to fulfill His gracious Majesty's wishes, but in no way was I prepared to be the one to negotiate for permission to travel abroad from our Highnesses.[1] His Excellency the ambassador Count von Bachoff, having learned my opinion in this matter, told me, as he ended our conversation, that he would send message back to his supremely gracious King in Copenhagen about my point of view, and promised to inform me of the King's response when it arrived. These discussions, in which I was involved towards the end of August,[2] I kept secret with the utmost degree of silence, while waiting for information on the decision of His supremely gracious King of Denmark.

Then, on the 22nd day of September, I was called to His Excellency Count von Bachoff for the second time, and learned that my answer had been generously accepted by His Highness the King of Denmark, and that it now was his task to formulate, in the name of his supremely gracious King a petition on my behalf

1. "from our Highnesses" (*ab Augustissimis nostris*) is the text of **B**. **A** has *apud Augustissimam Jmperatricem nostram*, referring to Empress Maria Theresa alone.
2. Curiously, the correct date 7 September 1767 (stated above) is here changed to "towards the end of August".

suscipiendæ Expeditionis hujus litterariæ Sumptibus Regijs perficiendam, ab Augustissima Jmperatrice petendam esse; ad hæc ego, me itaque impense orare, sive de obtenta, sive negata venia quamprimum certiorem me reddere vellet, ut scilicet rebus providerem meis. Et verò paucos post dies, de venia peregrinandi, per summum Aulæ Cæsareo-Regiæ Ministrum Principem *de Kaunitz* ab Augustissima Jmperatrice jam benevolentissimè concessa edocet, quam se ad Regem Suum illico relaturum, et mandata de suppeditandis mihi in iter Sumptibus postulaturum edixit; facilem hunc promptumque (me nihil agente) ab Augustissima nostra Jmperatrice impetratum assensum dum intelligerem, illico meæ obversabatur menti singularis divinæ circa me Providentiæ dispositio, quæ adeo animum in spem vivam successus felicis totius Expeditionis hujus difficillimæ erigebat, ut metu omni subeundorum quantumvis gravissimorum vitæ, et valetudinis periculorum liber, non nisi prospera omnia, ac felicia mente versarer mea, quippe plenissime persuasus evocationem isthanc adeo mirabilem, me necquidquam agente factam, opus omnino solius divinæ Providentiæ esse. Hæc eò dicta velim, ut qui Expeditionem hanc, nescio quibus vijs et occultis artibus procuratam suspicati sunt, intelligerent, mea opera nihil omnino actum esse, sed Principùm, media, et finem totius Expeditionis DEJ solius Providentiæ, et Dispositioni tribuenda (a.).

De Expeditione hac litteraria à me suscipienda jam certus ea agere cœpi, quæ tanto negotio feliciter perficiendo necessaria arbitratus sum. Primum itaque de socio itineris à me deligendo

(a.) num Expeditio hæc litteraria opus omninò fuerit solius divinæ Providentiæ, elucescet opinor ex eventibus profecto mirabilibus tum in periculissimo itinere, tum in loco commorationis Jnsulæ *Wardœhus*, tum sub ipsum tempus observationis Transitus Veneris, qui ad *Majorem solius DEJ gloriam* candidissime à me in hoc referentur opere.

1-18 AB 18-22 Hæc eò dicta velim *etc.* **B** *omittit* **A 23-25 AB 26-30 B** *omittit* **A**

1-2 suscipiendæ Expeditionis Sumptibus Regijs perficiendam, **B** sumptibus sui Regis suscipiendæ Expeditionis hujus litterariæ **A 3** impense **B** *omittit* **A** | sive de obtenta, sive negata venia **B** ut Excell[entissi]mus Comes, de obtenta Venia **A 4** me **B** *omittit* **A** | scilicet **B** *omittit* **A 5-7** de venia ... concessa edocet **B** certiorem me reddit, Veniam ... concessam esse **A 5-6** per summum Aulæ Cæsareo-Regiæ Ministrum **B** per serenissimum ... primum Aulæ nostræ Minstrum **A 7** jam *supra linea* **A** *omittit* **B 7-8** quam se ad Regem Suum relaturum **B** seque hunc Augustissimæ nostræ annutum ad Regem suum illico relaturum **A 8-9** et mandata de suppeditandis mihi in iter Sumptibus **B** mandata suppeditandorum sumptuum in iter Viennâ Hafniam usque faciendorum **A 9** postulaturum edixit **B** *omittit* **A 10-11** ab ... Jmperatrice ... assensum **B** Augustissimæ Nostræ Jmperatricis ... annutum **A 11** meæ **B** *omittit* **A 12** animum **B** animum meum **A 14** *et* omni *et* quantumvis *supra linea* **B** *omittit* **A 15** gravissimorum **B** *omittit* **A 15-16** ac felicia **B** *omittit* **A 17** adeo ... factam **B** *omittit* **A 18** omnino **B** *omittit* **A 24-25** arbitratus sum **B** censebam **A 25** itaque **B** *omittit* **A**

to Her Highness the Empress, asking for my permission to undertake this scientific expedition financed by the King. My answer to this message was to earnestly bid him do me the favour of informing me about the outcome of this petition, whether positive or negative, as soon as possible, so that I could be prepared for my future business. And then, only a few days later von Bachoff did indeed inform me that the permission to go abroad, through the influence of the supreme minister at the Imperial and Royal court, *von Kaunitz*, had already been most benevolently granted by Her Highness the Empress. The ambassador was now going to inform his King of this, and at the same time ask for the mandate to procure all the expenses of my journey. As I heard of this assent, which so easily and readily had been obtained from Her Highness our Empress (without any effort from my part), I at once started pondering this strange and exceptional plan of Providence, which caused my spirit to be lifted with a lively hope of a complete success in this highly strenuous expedition. Hence, free from all fear associated with being exposed to the utmost dangers to my life and health, I found myself expecting nothing but luck and success in every respect; so completely convinced was I that this invitation, which had come about in such a strange manner and without any interference of my own, was altogehter the work of Divine Providence. I should like to stress this,[1] in order that those who have nurtured suspicions that this expedition was made to happen through a hidden and not very honourable scheming of some sort, should realise that nothing whatsoever came about as a result of any actions from my part. The Rulers were the protagonists, whereas the means and end of this whole expedition is to be attributed solely to GOD's Providence and planning (a.).

Now that it had become evident that I was going to undertake this scientific expedition, I began making the preparations that I considered necessary for a successful outcome of this challenging project. First of all I started pondering what travel companion

(a.) That this scientific expedition was the work of none other than Divine Providence, will be made apparent, I should think, through the utterly wonderous events that unfolded themselves both during the highly dangerous journey and at our place of abode on Vardøhus Island, as well as during the observation of the transit itself, all of which will be explained in full later in this work, *to the greater glory of GOD alone*.[2]

1. The entire period from "I should like to stress this" to "GOD's Providence and planning" (*Hæc eò dicta velim ... DEJ solius Providentiæ, et Dispositioni tribuenda*), as well as its accompanying footnote, is found only in **B**.
2. "To the greater glory of GOD" (*ad majorem DEJ gloriam*) was the motto of the Jesuit order.

consilium mecum ipso ineo, quem eum volebam, qui et Genio arrideret meo, et de societate JESV esset, et viribus corporis valeret firmis, atque periculorum subeundorum, commodorumque Contemptor foret fortissimus, essetque unà in Astronomia utraque versatus adeo, ut si ipse per infirmiorem valetudinem, aut alium Casum infeliciorem à facienda observatione prohiberer, ipsus mei loco scopum, ac finem Expeditionis hujus consequeretur; quibus naturæ, et scientiæ donis quum R. Patrem *Joannem Sajnovics* id temporis de Societate JESV virum clarissimum, meumque olim per binos annos in Specula Cæsareo-Regia Universitatis Vindobonensis socium charissimum, atque hoc ipso anno 1767 Adjunctum Astronomi Tyrnaviensis cel. Patris *Weiss*, præditum esse scirem, litteris ad eum datis, animum, mentemque suscipiendæ mecum Expeditionis hujus litterariæ rogabam, qui nihil hæsitans, si per superiores steterit, promptissimo animo socium se meum acturum spopondit.

Alterum erat, ut speculæ Cæsareo-Regiæ Universitatis de exercitato Astronomo mei sub tempus Expeditionis vices gerente providerem, qui unà, si in itinere hoc versans casu infelici vita fungerer, officium Astronomi Cæsareo-Regij sustinere posset; at nihil hac in parte deliberandum erat; quem enim alium Augustissimæ nostræ Jmperatrici mei loco proponere poteram, quam R. Patrem *Antonium Pilgram* id temporis quoque de societate JESV virum in Astronomia utraque exercitatissimum, per annos ipsos septem socium meum mihi admodum charum dilectumque, et speculæ Cæsareo-Regiæ per id ipsum tempus incolam, atque per labores suos tum Ephemeridum nostrarum communi studio calculatarum, tum Causa observationum in hoc Cæsareo-Regio observatorio ab ipso factarum, et typis per Ephemerides nostras datarum per orbem astro-

1-28 AB

1 ipso **B** *omittit* **A** | quem eum volebam *in margine* **A** *omittit* **B** **2** et de societate JESV esset *in margine* **B** *omittit* **A** **3** atque **A** et **B** **4** fortissimus **B** *supra linea (voce* magnanimus *in margine addita)* **A** | unà **B** *omittit* **A** **5** infirmiorem **B** infirmam **A** **8-13** quibus ... donis ... quum R. Patrem ... Sajnovics *(etc. accusativo casu)* ... præditum esse scirem **B** quæ dona ... quum in R. Patre ... Sajonovis *[sic] (etc. ablativo casu)* ... haberi scirem **A** **9** clarissimum **B** *omittit* **A** **10** Universitatis Vindobonensis **B** *omittit* **A** **11-12** Tyrnaviensis **B** Tyrnavienensis **A** **12** Patris **B** *omittit* **A** **13** mentemque Suscipiendæ **B** mentemque illius suscipiendæ **A** **13-14** hujus litterariæ **A** *omittit* **B** **14** si ... steterit **B** si ... licuerit **A** **15-16** spopondit. // Alterum erat *sic distinxi;* spopondit. -- Alterum erat **BA** **17** sub tempus Expeditionis **B** *omittit* **A** **18** unà *supra linea* **B** *omittit* **A** | casu infelici **A** casu infelice **B** **19-20** at nihil hac in parte deliberandum erat **B** nulla hac in parte deliberatio mihi facienda erat **A** **21** Jmperatrici **B** *omittit* **A** **24** charum dilectumque **B** dilectum **A** **25** per id ipsum tempus **B** *omittit* **A** **26** Causa **B** *omittit* **A** **27** hoc **B** *omittit* **A** | ab ipso **B** *omittit* **A** **28** et typis per Ephemerides nostras datarum **B** *omittit* **A**

I should choose; this needed to be someone whose personality fitted my own, he needed to be a member of the Society of Jesus,[1] be of strong bodily constitution and be daring and unrelenting when faced with hardships and danger. At the same time, he needed to be so well versed in both branches of astronomy[2] that, if I should happen to be prevented from making the observation myself due to failing health or some even worse stroke of bad luck, he would be capable of accomplishing the aim of this expedition all by himself. I knew that these gifts of nature and erudition were characteristics of Honourable Father *Joannes Sajnovics*, at that time a famous member of the Society of JESUS[3] and formerly a cherished assistant at my Imperial and Royal Observatory at the University of Vienna, but in that very year — 1767 — an adjunct of the Tyrnavian astronomer, famous Father *Weiss*. Accordingly, I asked him by way of a letter what he thought of the idea of undertaking this scientific expedition along with me. He answered without any reluctance whatsoever that he was more than willing to be my travel companion, providing that his superiors would permit this.

My second task was to make sure that an experienced astronomer was in place as a substitute of mine at the Imperial and Royal Observatory of the University, someone capable of filling the role of an Imperial and Royal Astronomer in case something should befall me and bereave me of my life during my journey. In this respect there was no need for deliberation, for I could not possibly propose to our Highness the Empress anyone else as a substitute than Honourable Father *Antonius Pilgram*. He too a member of the Society of JESUS at the time, Pilgram was well versed in both branches of astronomy. He was for seven years my cherished and beloved assistant at the Imperial and Royal Observatory, where he lived during that same period. Thanks to his contributions in the mutual task of calculating our *Ephemerides*[4] and as a result of the observations he had made in this Imperial and Royal Observatory and shared with the community of astronomers through our printed *Ephemerides*,

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1. "he needed to be a member of the Society of Jesus" is found only in a marginal addition to **B**.
2. "Both branches of astronomy" refers to practical and theoretical astronomy.
3. "at that time [...] of the Society of Jesus" (*id temporis de Societate JESV*) is here found in both **A** and **B**, indicating that this part of **A** has been written after the suppression of the Society of Jesus.
4. "our *Ephemerides*": The *Ephemerides Astronomicae ad Meridianum Vindobonensem*.

nomicum jam celebrem, notissimumque (a.). Quam meam propositionem Augustissima Jmperatrix etiam benignissime ratam, gratamque habuit.

Jtineris socio R. Patre *Joanne Sajnovics* beatus, substituto autem meo R. P. *Antonio Pilgram* per Decretum Cæsareum jam firmato, in id unum mihi incumbendum erat, ut de rebus omnibus ad Expeditionem hanc litterariam quoquo modo spectantibus providâ Curâ maturandis, perficiendisque agerem; fixum quippe, firmumque erat propositum mihi, ita maturandum, accelerandumque iter, ut Anno 1768 sub finem Mensis Augusti *Wardœhusij* anchoras jacerem, stationemque mihi designatam tenerem, quod ipsum necessarium quoque erat, nisi Expeditionem anno 1769 fine suo frustratam vellem; in numeris quidem habebam scopum hunc me facile consecuturum, si sub finem Mensis Aprilis 1768 iter ingressus, illud terra, marique per Menses quatuor continuos prosequerer; res tamen aliter accidit, atque animo conceperam, cujus quidem et causam, rationesque referam dum de commoratione Hafniensi paulo amplius acturus sum;

(a.) clarissimus hic Vir altero à meo reditu anno, post quam annos ipsos undecim socium meum, atque vices meas per binos annos et menses quatuor maxima cum laude egisset, graviore correptus morbo pectoris, consilio medicorum observatorio Cæsareo-Regio valedicere coactus, post societatis JESV dissolutionem anno 1773 promulgatam, ad suam Jllustrem familiam redux, sublevato mor[bo] nunc dum hæc scribo hortum suburbanum familiæ suæ incolit, in quo eleganter à se exstructam speculam astronomicam domesticam instrumentis ex Anglia suo ære procuratis instructam habet, observationibusque et alijs laboribus mathematicis tempus utilissimè impendit.

NB. inserenda ea, quæ Jll[ustrissi]mus Ep[isco]pus de Gondola Vicarius Apost[olicus] per septentrionem causa hujus Expeditionis mecum egerat.

1 ... notissimumque **AB** **1-18** Quam meam *etc.* **A** *omittit* **B** **19-28 B** *omittit* **A** **29-31** *in margine* **A** *omittit* **B**

3 *post* habuit *voces erasae* exhibito eidem decreto eidem subinde *leguntur* **A** **8-11** fixum ... tenerem *legitur etiam altera, sed erasa, harum linearum versio, sensum exhibens fere eundem* **A** **13** *post* vellem; *voces* Jtaque conceperat *leguntur, licet erasae* **A** **13-14** consecuturum ... ingressus *supra linea (verbis* consequi posse *et* ingrederer *erasis)* **A** **16** atque ... conceperam *vocibus* quam ... fixeram *erasis* **A** **16-17** causam, rationesque *an* rationemque *legenda?* **A** **17-18** de ... acturus sum *vocibus* Moram Hafniensem descripturus *erasis* **A** **18** *post* acturus sum *leguntur voces erasae* Jnterea de suppelectile viatica dum itaque in compara[?] vestitu scrutari, mihi socioque cum Jnstrumenta[?] **A** **20** *ante* per binos annos *leguntur* sub Expeditione *erasae* **B** **24** mor[bo] *conieci; litterae* mor *in ipso margine paginae leguntur* **B** **29-31 A** *hanc notam, quae in margine paulo superius legitur, huc transposui.*

he was already a famous and well known figure (a.).[1] My proposal was deemed reasonable also by her Highness the Empress, who graciously gave her consent.

Having received Honourable Father Joannes Sajnovics as my travel companion, and having had Honourable Father Antonius Pilgram confirmed as my substitute by Imperial decree, there was only one issue left for me to focus on, namely to make sure that every issue that in some way or other pertained to the accomplishment of this scientific expedition was dealt with with haste and determination. It was my indivertible persuasion that both the preparations and the travel itself ought to be made swiftly, so that I could cast anchor at Vardøhus and reach my site of observation towards the end of August of the year 1768. This choice was necessary if I was to avoid missing the aim of the expedition in the year 1769. According to my calculations, I should be able reach this destination with ease, if I set forth towards the end of April of the year 1768, and continued restlessly across sea and land for four consecutive months. However, this is not what came to pass. Things did not turn out quite as I had planned, as I will explain below when I will treat the stay in Copenhagen in some more detail.[2]

(a.) This highly famous man fell ill from a serious ailment in his chest in the year after my return from Vardøhus, after he had served as my assistant for eleven years, and as my substitute for two years and four months, all this to great praise. Following his doctors' advice, he was forced to take leave from the Imperial and Royal Observatory, and after the dissolution of the Society of JESUS, which was put in effect in the year 1773, he returned to his illustrious family. He lives, at the time of my writing this, again in good health in the suburban garden of his family, where he has built himself a splendid private astronomical observatory which he has furnished with instruments acquired from England at his own cost. His time is spent most usefully, on observations and other mathematical activities.

Note: Here the exchanges that I had concerning this expedition with the highly illustrious Bishop von Gondola, Vicar Apostolic of Nordic Missions, will be included.[3]

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1. "a famous and well known figure (a.)": with these words, and its accompanying footnote, manuscript **B** ends. **A** omits the footnote, which may be taken as another indication that it was - at least in part - written before the suppression of the Society of Jesus.
2. At this point, the text of **A** breaks off.
3. A marginal note to **A**. Franz Joseph von Gondola (1711-1774) was appointed *Vicarius Apostolicus* for the northern missions of the Catholic church in 1761. His negotiations with Father Hell prior to the expedition have not been found.

SUMMARY AND REFERENCES

SUMMARY

In the years 1761 and 1769, the planet Venus passed in front of the Sun as seen from Earth. In that century of Enlightenment, these events – known as transits of Venus – attracted massive interest from the entire world of learning. The thesis *Maximilianus Hell (1720-1792) and the Eighteenth-Century Transits of Venus. A Study of Jesuit Science in Nordic and Central-European Contexts* is a source-based, historical case study that aims to explore and contextualise Venus transit activities in the Nordic countries and Central Europe. It traces the scientific career of an individual, Maximilianus Hell, and analyses *en route* the conditions for astronomical research in areas presently known as Slovakia, Austria, Romania, Hungary, Denmark, Norway, Sweden, Finland and Russia. It presents numerous primary sources and also has a separate part with editions of Latin texts.

Part I consists of an Introduction and a Biographical Essay. The *Introduction (Chapter I.1)* outlines the aims and scope, analytical approach and present state of knowledge in the fields covered by the thesis. First, it is argued that although a fair amount of scholarly work has been devoted to scientific endeavours occasioned by transits of Venus in the past, the predominant historiography has so far been too narrowly focused on the roles of British and French agents. An overarching aim of the thesis is therefore to adjust the prevailing impression of the Venus transit projects of the eighteenth century, by highlighting activity in Nordic and Central parts of Europe. Second, the introduction underscores that sources in the Latin language, not just French and English, ought to be taken into account when studies of international relations in early-modern science are undertaken. Latin sources can be important to our understanding of cutting-edge science in eighteenth-century Europe. Third, the thesis aims to contribute to the growing field of historical studies of Jesuit science by focusing on a hitherto underexplored theme: the degree of integration of Jesuits in the international Venus transit enterprise.

The *Biographical Essay (Chapter I.2)* recounts the career of Maximilianus Hell through the following stages: childhood in the Kingdom of Hungary and education and teaching at various Jesuit institutions in Central Europe (1720-1755); Imperial and Royal Astronomer of Maria Theresa (appointed 1755); the expedition to observe the 1769 transit of Venus from Vardø in Norway and its immediate aftermath (1768-1773); and his situation as an ex-Jesuit in the decades following the suppression of the Jesuit order (1773-1792). Hell’s scientific career was neatly bound up with both Habsburg politics and Jesuit strategies of science. Natural sciences

received increasing support in Central Europe during the 1740s and 1750s, as a result of the import of ideas from more westerly *philosophes*. However, in Austria this interest in natural sciences was not yet blended with secularism and liberalism; that came later. Thus, Father Hell's research interests were initially in tune with both a pro-Catholic court and a 'pro-scientific' Society of Jesus. Institutionalised astronomy saw a rapid development, with foundation of new observatories throughout the 'Austrian Province' of the Jesuits around the mid eighteenth century. However, when the Pope in the summer of 1773 dissolved the Society of Jesus, this entailed a reorganisation of the infrastructure for teaching and research in the region. Hell kept his position as court astronomer, but became a man of conflicting loyalties and strategies. Particularly during Joseph II's reign (1780-1790), he came under fierce attack from freemasons and other representatives of the radical Enlightenment. In this situation, he did what he could to retain the Jesuit heritage. He cooperated closely with the conservative bishop of Agria (Eger, Erlau) in establishing a new observatory there; he lobbied for the preservation of observatories that once had been run by the Jesuits; he argued fiercely against the state-imposed use of German, instead of Latin, for teaching and research in the Habsburg lands. The biographical essay not only discusses this political framework, it also presents a survey of astronomical observatories and agents within the entire 'Austrian Province' of the Society of Jesus, before and after the watershed of 1773. It further presents information on the various branches of research that Father Hell engaged in beyond his core subject of astronomy. 'Mesmerism' constitutes one such branch, studies of the Magyar nation's language and history, another.

Part II, The Eighteenth-Century Transits of Venus and the Role of Maximilianus Hell: Nordic and Central-European Contexts, is divided into three chapters. *Chapter II.1* on *The 1761 Transit of Venus and the Role of Father Hell* is devoted to an explanation of the phenomenon and its use in efforts to determine the scale of the solar system. It further demonstrates how Hell, mainly thanks to his Jesuit network, was capable to deliver an important contribution to the Venus transit project of 1761, during which year he stayed in Vienna. *Chapter II.2* on *The Nordic Countries and the Transits of Venus, 1761 and 1769* provides a survey of the history of astronomy in eighteenth-century Sweden, Russia and Denmark-Norway. The participation of these entities in the international Venus transit projects of the 1760s are a recurring theme. By way of a comparative perspective, contrasts between the three states are singled out. Sweden is seen to have been firmly integrated in the international project in both 1761 and 1769, in no small measure due to the talents of Pehr

Wargentin as a networker and a culture of openness towards integrating amateurs in scientific endeavours. Denmark-Norway's Astronomer Royal, Christian Horrebow was incapable or reluctant to establish a nation-wide program. Instead, his attention appears to have been directed towards the Rundetårn Observatory in the capital of Copenhagen alone. In Russia, efforts to include amateurs were half-hearted at best, and the first round in 1761 appears to have been hampered by internal conflict within the Imperial Academy in St. Petersburg. By contrast, in 1769 even Catherine the Great involved herself in the project and ensured that this opportunity to integrate Russian science in an elite project of international dimensions was used. *Chapter II.3, The Role of Father Hell in the Venus Transit Project of 1769*, first goes into details concerning the determination of the coordinates of the Vardø observatory and on the observation of the transit itself. It then proceeds to examine the reasons why Father Hell's report from Vardø arrived so late and the suspicions entailed by this lateness. The fierce controversy over the solar parallax involving the likes of Lalande and Pingré (Paris), Planman (Åbo), Lexell (St. Petersburg) and Hell (Vienna) is recounted in some detail. For all their disagreements, however, Hell's contemporaries were not openly accusing him of being a liar because he was Jesuit; such religious prejudices did not surface in the serious, astronomical literature until the nineteenth century.

Part III, Editions of Primary Sources, presents two central texts in Hell's own hand, with an introduction, translation, critical apparatus and limited commentary. The texts in question are (*Chapter III.2*) the call for subscriptions to the *Expeditio litteraria ad Polum arcticum*, a planned three-volume work that was meant to cover the history of the Vardø expedition and its various scientific results, and (*Chapter III.3*) Hell's unpublished draft for the introductory chapter of that work. These texts are key sources to the self representation of the Jesuit Father shortly after his return from Danish-Norwegian soil. In the present editions, linguistic aspects are not emphasised. However, it is argued that the punctuation and lay-out of the autograph should be retained. Typographical aspects are formative for our interpretation of texts, and it is no good service to students of Neo-Latin to make early-modern texts look like a Teubner or Oxford edition of Cicero.

The letters and manuscripts of Hell and his assistant Joannes Sajnovics that have been used in this study are presented in the section on *Unprinted Sources and Literature*. It is followed by listings of Printed Sources and Literature. The first part of *Printed Sources and Literature* lists items published before the year 1800; the second, publications dating from the year 1800 or later.

Summa summarum, the present thesis is the first full-scale, contextualised study of the Jesuit Father Maximilianus Hell in the English language. New sources, not only on Father Hell, but also on the institutional history of astronomy in Central and Nordic regions of Europe are presented. The thesis is also pioneering in the sense that it covers areas that have until now been neglected or at least ill-understood in the Anglo- and Francophone historiography on the eighteenth-century transits of Venus. By 'breaking down national barriers' and employing a comparative perspective, it offers new insight into the different conditions for astronomical research in each country or region covered. Examination of archival sources and literature in various languages – primarily in Latin, Swedish, Danish, Russian, French and German – has been vital here. Hopefully, this study may prove helpful to the formation of a fuller and more nuanced understanding of the Venus transit projects of the eighteenth century, seen as an international enterprise.

Those who take pleasure in numbers will be pleased to learn that the number of successful, properly published Venus transit observations from the eighteenth century has been increased since Harry Woolf's seminal study from 1959. Instead of Woolf's 120 individual observations in 1761 and 151 in 1769, we now have evidence for 130 in 1761 and 154 in 1769. Investigation of Latin periodicals that were widely read in their age, but rarely visited by modern historians of science, has helped adjust those figures. Readers with a special interest in Sajnovics and the discovery of Finno-Ugrian, will find new sources illuminating his relationship with Father Hell in Section I.2.3.

This thesis has no index, but by way of a PDF freely available on the internet (accessible at http://munin.uit.no), it should be possible to search for what ever character, place or topic that may be of interest.

UNPRINTED SOURCES AND LITERATURE

Maximilianus Hell and Joannes Sajnovics corresponded frequently with numerous persons both inside and outside the circles of Jesuit learning. Especially Father Hell evidently had a wide network of correspondents, although his epistolary output cannot be compared to that of famous contemporaries like Albrecht von Haller (17,000 surviving letters), Johann Heinrich Samuel Formey (18,000), Johann Caspar Lavater (20,000) or François Voltaire (21,000).[1] Sections 1*a*, 1*b* and 2*a* provide tabular overviews of all unprinted letters that have been available for this study, either adressed to, or written by Hell or Sajnovics. These lists are merely meant to document sources that have been available for the present work, and cannot provide anything more than a patchy and fragmentary impression of what their correspondence must have been like.

The number of archives used for this study is limited. Of the archives that have been visited, it is only the collections of the *Wiener Universitätssternwarte* (Vienna University Observatory) that has been studied in depth. If concerted efforts were made to search for surviving parts of Hell's correspondence in for example France, Italy or in places once belonging to the Habsburg Empire, it is likely that many more documents would surface.[2] Furthermore, none of the numerous letters that were *printed* in the lifetime of Hell and Sajnovics are included in the present tables; witness the heading "unprinted sources". Left out, therefore, is a considerable amount of letters that are either referred to, quoted from or printed in full by Father Hell in his *Ephemerides Astronomicae*,[3] by Sajnovics in the *Demonstratio*[4] or by other contemporaries in various books,[5] newspapers and journals.[6] Nor have I attempted to

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[1] These figures are from Stuber 2005, pp. 314-315.

[2] Several previously unprinted letters have been referred to in the present work already. See also Toth 2003 on a report of Hell concerning the profusion of almanacs in the Austrian empire, dating from 1774; Smolka and Šolc 2008 on expert opinions of Hell concerning the observatory of Prague, dated Vienna 7 & 14 April 1787; Aspaas 2010 on Lalande's and Hell's correspondence; etc.

[3] Some examples: extracts of various letters addressed to Hell are printed in his report on the 1761 transit of Venus, cf. Hell 1761, pp. 39-40, 42-45, 47-49, 62-67, etc; several letters exchanged between Hell and Lalande, Wargentin, Lexell, and others are referred to or quoted in the *Ephemerides*, among which the long letter of Lexell in Hell 1773, pp. 15-67 merits particular mention; a series of letters from Fixlmillner to Hell were likewise published in their entirety in the *Ephemerides*, cf. Rabenalt 1986, pp. 180-203.

[4] See Section I.2.3 above.

[5] See for example Chr. Mayer 1769*b*, p. 317; Lexell 1772, pp. 116-131; Bernoulli 1772, p. 15, 1777*c*, pp. 44-56, 1778, p. 15; etc. I have not had access to Joseph Stepling, *Litterarum commercium eruditi cumprimis argumenti*, Wratislavae 1782, which – according to Smolka and Šolc 2008 – contains six letters from Hell to Stepling in Prague, dated Vienna 9 February & 5 July 1757, 15 August & 9 September 1758, 4 January 1760, 8 January 1762, and 23 July 1777, and one letter from Stepling to Hell in Vienna, dated Prague 30 August 1758.

reconstruct lost parts of their correspondence by means of letters referring to other letters, or references in manuscript sources like Sajnovics' travel diary. I have, however, included in the tables letters published by historians and others after the year 1800, in the sense that these remained unprinted throughout Hell's and Sajnovics' lifetime.[7]

The lists of other manuscript sources, 1*c* and 2*c*, give an equally limited and fragmentary impression of the two Jesuits' *œuvre*. For the major part of their printed works, the manuscripts are either lost or still waiting to be disclosed. In the case of Father Hell, many more texts exist than those that are included here, especially in the collections of the Vienna University Observatory. Given the scope of this study, however, I have only studied – and listed in the tables – such works that I found to have some sort of relevance to the Vardø expedition or to the Venus transit projects in general. Finally, no attempt has been made to give a survey of letters or other texts in which contemporaries of Hell and Sajnovics comment upon their activities, refer to meetings with them, etc.

A bibliography of printed sources of relevance to the study of Hell and Sajnovics has been compiled by Sándor Hadobás at the Ore and Mineral Mining Museum in Rudabánya, Hungary.[8] To the best of my knowledge, no analogous list of archival sources has been compiled either by Hadobás or others. For all their limitations, then, the listings presented here may perhaps serve as a modest start for others to expand upon. I am greatly indebted to the former archivarian at the Konkoly Observatory in Budapest, Mrs Magda Vargha, who has shared with me a great number of photocopies from her private collections of eighteenth-century documents. For some of these documents, she could no longer remember which archive she had copied them from. They are, however, true and genuine eighteenth-century texts, and several of them are even autographs of Maximilianus Hell.

Furthermore, according to the web pages of the Universitätsbibliothek Basel ('University Library of Basel') several letters from Hell to Johann Ignaz von Felbiger, Johann Heinrich Lambert and Jean Bernoulli III were translated from Latin and printed in various works of Lambert and Bernoulli; search for "Hell, Maximilian" at the *Handschriftenbestände und Nachlässe IDS Basel Bern* at http://aleph.unibas.ch/ (accessed 10 September 2008). I have not used those letters during my work on this thesis.

[6] For example "Sur le Passage de Vénus que l'on attend en 1769.", *Journal des Sçavans* Mars 1769, pp. 190-191; "En Skrivelse fra Pater Hell, dat. Wardehuus den 15 Januarii h.a.", *Kiøbenhavns Kongelig allene privilegerede Adresse-Contoirs Med Posten forsendende Efterretninger* Mandagen den 3die Julii 1769; "Adskilligt Nyt", *K[ongelig] allene privileg[erede] Tronhiems Adresse-Cont[oirs] Efterretning* 1769. No. 31. Fredagen den 4 Aug.; "En bekiendt Fransk Lærd Tidende […]", *Nordske Jntelligenz-Sedler* No. 1, Onsdagen den 3. Januari 1770; etc.

[7] I have not had access to the following publication: Joseph Friedrich Freyherrn von Retzer (ed.), *Michael's Denis Literarischer Nachlass*, 2. Theil, Wien 1802, which – according to Sommervogel 1893, p. 257 – contains a letter from Hell to Michael Denis SJ, dated 8 March 1773.

[8] Hadobás 1996 and 2006.

ABBREVIATIONS

Lang.	the language in which the text is preserved (written)

D = Danish
F = French
G = German
G,L = Text partly in German, partly in Latin
L = Latin
L+F = The entire text is extant in both Latin and French

Source	what copy I have had access to

AkadWien	= Österreichische Akademie der Wissenschaften, Vienna, "Nachlass Littrow"
EL Budap	= Eötvös Lorand University Library, Budapest
Holov.	= letter printed in Holovics 1972 (e.g. Holov.,500 = page 500)
KB Copen	= Kongelige Bibliotek, Copenhagen, "Ny Kgl. S. 4^{o} 287. I-II"
Kragm	= letter printed in Kragemo 1960 (e.g. Kragm,103 = page 103)
MagAkad	= Magyar Tudományos Akadémia Könyvtára, Hungary, "irodalmi levelezés 2-r, 13. sz."
Mencsik	= letter printed in Mencsik 1905
NB Helski	= Nationalbiblioteket, Helsingfors/Helsinki, "Manuskriptsamlingarna, Personarkiven, Katalog nr.180"
Pannonhalma	= Pannonhalmi Főapátság, Hungary
Pinzg.	= letter at least partly printed in Pinzger 1920-1927 (e.g. II,3 = vol. II, p. 3)
RA Copen	= Rigsarkivet, Copenhagen, "Privatarkiv nr. 1846. Andreas Schumacher"
RA Oslo	= Riksarkivet, Oslo, "Danske Kancelli […] Saker vedr. prof. Maximilian Hells reise til Vardøhus for å iaktta Venus […] Pakke DK E36. Hyllenr. 4A 115 62"
Rabn.	= letter printed in Rabenalt 1986 (e.g. Rabn.,113 = page 113)
RAN Pbg	= Rossiiskaia Akademiia Nauk, St. Petersburg
SA Tø	= Statsarkivet, Tromsø, "Vardøhus Festning Nr. 80: Skrivelser og regnskaper 1767-1769"
UB Basel	= Universitätsbibliothek Basel
UB Göttin	= Niedersächsische Staats- und Universitätsbibliothek, Göttingen
VA Stockh	= Centrum för Vetenskapshistoria vid Kungliga Vetenskapsakademien, Stockholm
Varg.	= letter at least partly printed in Vargha 1990-1992 (e.g. I,50 = vol. I, p. 50)
Varg.priv.	= Magda Vargha's private collection of photocopies of 18th century documents
Vatican	= Archivio Segreto Vaticano, Vatican See, "Archivio della Nunziatura Apostolica in Vienna, vol.136, fol.45r"
WUS	= Wiener Universitätssternwarte, Vienna, "Manuscripte von Hell, Chr. 90. Mappe 1-4"

UNPRINTED SOURCES AND LITERATURE, 1*a*: LETTERS WRITTEN BY HELL

The contents of the columns are as follows:

Place Date	indicates where and when the letter is dated
TO (Place)	TO WHOM (and where) the letter is addressed
Lang.	the language in which the letter is preserved (written)
Source	the archive or modern publication in which the letter is found
Autograph?	
copy rec.	= manuscript copy of the letter as received by the recipient
draft	= draft in Hell's own hand
rec.	= the original in the writer's own hand, as received by the recipient
secr. copy	= copy in the hand of Hell's secretary
transcr.	= printed transcript

Place Date	TO (Place)	Lang.	Source	Autograph?
Vienna Nov 1758	WEISS (Tyrnavia)	L	WUS	secr. copy
Vienna 14 June '59	HATVANI (Debrecinum)	L	WUS	draft
Vienna 22 June '59	LACAILLE (Paris)	L	WUS	draft
Vienna 27 Nov '59	LACAILLE (Paris)	L	WUS	secr. copy
Vienna 27 Nov '59	HUBERTI (Würzburg)	L	WUS	secr. copy
Vienna 12 Dec 1759	DELISLE (Paris)	L	WUS	secr. copy
Vienna 31 Jan 1761	LACAILLE (Paris)	L	WUS	secr. copy
Vienna 31 Jan 1761	DELISLE (Paris)	L	WUS	secr. copy
Vienna 31 Jan 1761	PEZENAS (Marseille)	L	WUS	secr. copy
Vienna 31 Jan 1761	MESSIER (Paris)	L	WUS	secr. copy
Vienna 1 July 1761	LACAILLE (Paris)	F+L	WUS	copy
Vienna 6 Feb 1761	RIEGER (Madrid)	L	WUS	secr. copy
Vienna 8 Feb 1761	BRAUN (St. Petersburg)	L	WUS	secr. copy
Vienna 8 Feb 1761	CHAPPE (Tobolsk)	L	WUS	secr. copy
Vienna 9 Feb 1761	CHR MAYER (Heidelb.)	L	WUS	secr. copy
Vienna 10 Feb 1761	BOVIUS and GERRA (Milan)	L	WUS	secr. copy
Vienna 12 Feb 1761	MESSIER (Paris)	L	WUS	secr. copy
Vienna 12 Feb 1761	LACAILLE (Paris)	L	WUS	secr. copy
Vienna 14 Feb 1761	STEPLING (Prague)	L	WUS	secr. copy
Vienna 18 Feb 1761	XIMENEZ (Florence)	L	WUS	secr. copy
Vienna 19 Feb 1761	TAUFFERER (Labacum)	L	WUS	secr. copy
Vienna 2 Mar 1761	VON CONDIE (*ubi*?)	G	WUS	secr. copy
Vienna 4 Mar 1761	STEPLING (Prague)	L	WUS	secr. copy
Vienna 12 Mar '61	CHR MAYER (Heidelb.)	L	WUS	secr. copy
Vienna 13 Mar '61	WEISS (Tyrnavia)	L	WUS	secr. copy
Vienna 16 Mar '61	CHR MAYER (Heidelb.)	L	WUS	secr. copy
Vienna 18 Mar '61	Journ. des Sçavans (Paris)	L	WUS	secr. copy
Vienna 20 Mar '61	LACAILLE (Paris)	L	WUS	secr. copy
Vienna 20 Mar '61	DELISLE (Paris)	L	WUS	secr. copy
Vienna 20 Mar '61	MESSIER (Paris)	L	WUS	secr. copy
Vienna 20 Mar '61	BRAUN (St. Petersburg)	L	WUS	secr. copy

Vienna 21 Mar '61	WEISS (Tyrnavia)	L	WUS	secr. copy
Vienna 21 Mar '61	CHAPPE (Tobolsk)	L	WUS	secr. copy
Vienna 21 Mar '61	PEZENAS (Marseille)	L	WUS	secr. copy
Vienna 1 Apr 1761	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,187)[9]
Vienna 8 Apr 1761	POLENIUS (Padua)	L	WUS	secr. copy
Vienna 8 Apr 1761	TAUFFERER (Labacum)	L	WUS	secr. copy
Vienna 10 Apr 1761	BRAUN (St. Petersburg)	L	WUS	secr. copy
Vienna 10 Apr 1761	CHR MAYER (Heidelb.)	L	WUS	secr. copy
Vienna 12 Apr 1761	ZANOTTI (Bologna)	L	WUS	secr. copy
Vienna 12 Apr 1761	BOVIUS (Milan)	L	WUS	secr. copy
Vienna 12 Apr 1761	XIMENEZ (Florence)	L	WUS	secr. copy
Vienna 17 Apr 1761	CHR MAYER (Heidelb.)	L	WUS	secr. copy
Vienna 27 Apr 1761	LACAILLE (Paris)	L	WUS	secr. copy
Vienna 4 May 1761	RIEGER (Madrid)	L	WUS	secr. copy
Vienna 5 May 1761	BRAUN (St. Petersburg)	L	WUS	secr. copy
Vienna 10 Jun 1761	CASSINI DE THURY (Baden)	L	WUS	secr. copy
Vienna 12 Jun 1761	LACAILLE (Paris)	L	WUS	secr. copy
Vienna 12 Jun 1761	LALANDE (Paris)	L	WUS	secr. copy[10]
Vienna 6 Aug 1762	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 21 Sep 1762	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 24 Oct 1762	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
[Vienna] 29 Dec '63	WEISS (Tyrnavia)	L	Varg.I,50	transcr. rec.
Vienna 12 May '64	WARGENTIN (Stockholm)	L	VA Stockh	rec.
Vienna 20 Dec '64	WARGENTIN (Stockh.)	L	VA Stockh	rec.
Vienna 7 May 1765	WEISS (Tyrnavia)	L	UL Budap.	rec. (Pinzg.II,198)
Vienna 10 Aug '65	WARGENTIN (Stockh.)	L	VA Stockh	rec.
Vienna 18 Aug '66	WEISS (Tyrnavia)	L	WUS	draft
Vienna 27 Aug '66	WARGENTIN (Stockh.)	L	VA Stockh	rec. (WUS draft)
Vienna 5 Oct 1766	BUGGE (Copenhagen)	L	Pinzg.II,3	transcr. rec. (KB Copen)
Vienna 5 Mar 1768	The Pope (Vatican)	L	Vatican	copy rec.
Vienna 14 Apr 1768	BUGGE (Copenhagen)	L	Pinzg.II,5	transcr. rec. (KB Copen)
Copen. [June 1768]	[SCHUMACHER (Copen.)]	G	RA Copen	copy rec.
Copen. 30 Jun 1768	WARGENTIN (Stockh.)	L	VA Stockh	rec.
[Varberg] 6 July '68	WARGENTIN (Stockh.)	L	VA Stockh	copy rec.
Trondheim [Aug '68]	KRATZENSTEIN (Copen.)	L	WUS	draft[11]
Vardø 12 Oct 1768	ECKLEFF (Vardø)	D	Kragm,103	transcr. copy rec.
Vardø 12 Nov 1768	PILGRAM (Vienna)	G	WUS	draft (Pinzg.II,7)
Vardø 12 Nov 1768	GRAMBOW (Trondh.)	G	RA Oslo	rec.(Pinzg.II,20)(WUSdraft)
Vardø 12 Nov 1768	GUNNERUS (Trondh.)	G	WUS	draft (Pinzg.II,24)
Vardø 12 Nov 1768	HAGERUP (Talvik)	G	WUS	draft (Pinzg.II,27)
Vardø 12 Nov 1768	HORREBOW (Copenh.)	G	WUS	draft (Pinzg.II,29)
Vardø 12 Nov 1768	MERCIER (Copenhagen)	G	WUS	draft
Vardø 13 Nov 1768	THOTT (Copenhagen)	G	RA Oslo	rec.(Pinzg.II,35)(WUSdraft)
Vardø 28 Nov 1768	ECKLEFF (Vardø)	D	SA Tø	rec., Borchgrevink's hand
Vardø 27 Dec 1768	HAGERUP (Talvik)	G	WUS	draft (Pinzg.II,39)
Vardø 12 Jan 1768	SCHÖLLER (Trondh.)	G	WUS	draft (Pinzg.II,41)
Vardø 15 Jan 1769	Pater Generalis SJ (Rome)	L	WUS	draft (Pinzg.II,43)

9 Secr. copy of the same letter is also preserved (WUS).
10 Facsimile in Aspaas 2010.
11 Facsimile in Hansen & Aspaas 2005.

Vardø 15 Jan 1769	MERCIER (Copenhagen)	G	WUS	draft (Pinzg.II,49)
Vardø 15 Jan 1769	PILGRAM (Vienna)	G	WUS	draft (Pinzg.II,50)
Vardø 15 Jan 1769	HORREBOW (Copenh.)	G,L	WUS	draft (Pinzg.II,56)
Vardø 15 Jan 1769	HÖLLER (Vienna)	L	WUS	draft (Pinzg.II,57)
Vardø 15 Jan 1769	GUNNERUS (Trondh.)	G	WUS	draft (Pinzg.II,59)
Vardø 15 Jan 1769	VON OSTEN (Trondh.)	G	WUS	draft
Vardø 16 Jan 1769	VON NORDAL (Trondh.)	G	WUS	draft
Vardø 16 Jan 1769	HAGERUP (Talvik)	G	WUS	draft (Pinzg.II,62)
Vardø 5 April 1769	PILGRAM (Vardø)	G	WUS	draft (Pinzg.II,63)
Vardø 6 April 1769	BACHOFF (Vienna)	G	WUS	draft
Vardø 6 April 1769	MERCIER (Copenhagen)	G	WUS	draft (Pinzg.II,70)
Vardø 6 April 1769	Pater Generalis SJ (Rome)	L	WUS	draft (Pinzg.II,74)
Vardø 6 April 1769	GONDOLA (Hamb./Lübeck)	G	WUS	draft (Pinzg.II,76)
Vardø 6 April 1769	GUNNERUS (Trondh.)	G	WUS	draft (Pinzg.II,83)
Vardø 6 April 1769	NIEBUHR (Copenhagen)	G	WUS	draft (Pinzg.II,86)
Vardø 6 April 1769	HÖLLER (Vienna)	L	WUS	draft (Pinzg.II,91)
Vardø 6 April 1769	VON OËTTEL (Vienna)	G	WUS	draft
Vardø 6 April 1769	OËDER (Copenhagen)	L	WUS	draft
Vardø 6 April 1769	SCHÖLLER (Trondh.)	G	WUS	draft
Vardø 6 April 1769	HAGERUP (Talvik)	G	WUS	draft
Vardø 6 April 1769	[BREDAL/PAUS] (Talvik)	L	WUS	draft
Vardø 30 Apr 1769	PILGRAM (Vienna)	L	WUS	draft (Pinzg.II,93)
Vardø 30 Apr 1769	THOTT (Copenhagen)	G	RA Oslo	rec.(Pinzg.II,95)(WUSdraft)
Vardø 30 Apr 1769	GRAMBOW (Trondh.)	G	WUS	draft
Vardø 30 Apr 1769	HORREBOW (Copenh.)	L	WUS	draft
Vardø 5 June 1769	THOTT (Copenhagen)	G	RA Oslo	rec. (Pinzg.II,102)
Copenh. 7 Nov ’69	WARGENTIN (Stockh.)	L	VA Stockh	rec.
Copenh. 14 Apr ’70	PRAY (Posonium)	L	EL Budap	rec. (Pinzg.II,202)
Vienna 28 Nov ’70	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,204)
Vienna 4 Jan 1771	PRAY (Posonium)	L	EL Budap	rec. (Pinzg.II,206)
Vienna 10 Jan 1771	PRAY (Posonium)	L	EL Budap	rec.
Vienna 30 Jan 1771	PRAY (Posonium)	l	EL Budap	rec.
Vienna 29 Mar ’71	PRAY (Posonium)	L	EL Budap	rec.
Vienna 23 Apr 1771	FIXLMILLNER (Cremifanum)	L	Rabn.,113	transcr.rec. (Pinzg.II,158)
Vienna 24 May ’71	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,104)
Vienna 31 May ’71	PRAY (Posonium)	L	EL Budap	rec.
Vienna 13 June ’71	PRAY (Posonium)	L	EL Budap	rec.
Vienna 15 June ’71	WARGENTIN (Stockh.)	L	VA Stockh	rec.
Vienna 5 Oct 1771	FIXLMILLNER (Cremif.)	L	Rabn.,115	transcr. rec. (Pinzg.II,160)
Vienna 20 Dec ’71	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna 26 Dec ’71	WEISS (Tyrnavia)	L	UL Budap.	rec. (Pinzg.II,107)
Vienna 27 Dec ’71	FIXLMILLNER (Cremif.)	L	Rabn.,117	transcr. rec.
Vienna 1 Jan 1772	WARGENTIN (Stockh.)	L	VA Stockh	rec.
Vienna 24 Jan 1772	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,110)
Vienna 28 Jan 1772	KAPRINAI (Tyrnavia)	L	EL Budap	rec.
Vienna 5 Feb 1772	KAPRINAI (Tyrnavia)	L	EL Budap	rec.
Vienna 18 Feb 1772	KAPRINAI (Tyrnavia)	L	EL Budap	rec.
Vienna 19 June ’72	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,111)
Vienna 15 July ’72	WARGENTIN (Stockh.)	L	VA Stockh	rec.
Vienna 17 July ’72	FIXLMILLNER (Cremif.)	L	Rabn.,118	transcr. rec.

Vienna 20 July ’72	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna [c. 1772]	ANONYMOUS (*ubi*?)	G	WUS	draft
Vienna [c. 1772]	J:E: NILSON (*ubi*?)	G	WUS	draft
Vienna 9 Nov ’72	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna 26 Nov ’72	WARGENTIN (Stockh.)	L	VA Stockh	rec.
Vienna 24 Feb 1773	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna 5 Mar ’73	WEISS (Tyrnavia)	L	EL Budap	rec.
Vienna 6 April ’73	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,114)
Vienna 26 Jan 1774	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna 9 Feb 1774	WARGENTIN (Stockholm)	L	VA Stockh	rec.
Vienna 9 Feb 1774	PLANMAN (Åbo/Turku)	L	NB Helski	rec.
Vienna 11 July ’74	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna 25 Nov ’74	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 27 Jan 1775	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,117)
Vienna 1 March ’75	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna 27 May ’75	WARGENTIN (Stockholm)	L	VA Stockh	rec.
Vienna 22 Aug ’75	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 23 Apr ’76	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 9 May 1776	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna 1 July 1776	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 31 Aug ’76	FIXLMILLNER (Cremif.)	L	Rabn.,119	transcr. rec. (Pinzg.II,161)
Vienna 26 Nov ’76	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 27 Nov ’76	FIXLMILLNER (Cremif.)	L	Rabn.,121	transcr. rec. (Pinzg.II,163)
Vienna 30 Nov ’76	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna 12 Dec ’76	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 15 Feb 1777	FIXLMILLNER (Cremif.)	L	Rabn.,123	transcr. rec. (Pinzg.II,164)
Vienna 15 Feb 1777	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna 15 Feb 1777	LAMBERT (Berlin)	L	UB Basel	rec.
Vienna 21 Feb 1777	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 8 Apr 1777	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 20 June ’77	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna 12 July ’77	BUGGE (Copenhagen)	L	Pinzg.II,127	transcr. rec.
Vienna 14 July ’77	WARGENTIN (Stockh.)	L	VA Stockh	rec.
Vienna 8 Sep 1777	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 31 Oct 1777	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 4 Nov 1777	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 17 Feb 1778	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 29 July ’78	WARGENTIN (Stockh.)	L	VA Stockh	rec.
Vienna 2 Oct 1778	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 30 Oct 1778	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 1 Jan 1779	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 16 Feb ’79	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,128)
Vienna 19 Mar ’79	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 5 Apr 1779	FIXLMILLNER (Cremif.)	L	Rabn.,127	transcr. rec.
Vienna 9 April 1779	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 14 April ’79	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,130)
Vienna 17 April ’79	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,131)
Vienna 19 April ’79	FIXLMILLNER (Cremif.)	L	Rabn.,128	transcr. rec.
Vienna 15 Oct 1779	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 24 Jan 1780	ESZTERHAZY (Agria)	L	Varg.priv.	rec.

Vienna 25 Mar ’80	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna 9 June 1780	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,133)
Vienna 26 Jan 1781	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 29 Jan 1781	FIXLMILLNER (Cremif.)	L	Rabn.,129	transcr. rec.
Vienna 10 Apr 1781	PRAY (Buda)	L	EL Budap	rec.
Vienna 20 Apr 1781	PRAY (Buda)	L	EL Budap	rec.
Vienna 3 May 1781	PRAY (Buda)	L	EL Budap	rec.
Vienna 11 May ’81	CETTO (*ubi*?)	L	Varg.II,159	transcr. rec.
Vienna 12 May ’81	PRAY (Buda)	L	EL Budap	rec.
Vienna 13 May ’81	PRAY (Buda)	L	EL Budap	rec.
Vienna 23 May ’81	PRAY (Buda)	L	EL Budap	rec.
Vienna 20 July ’81	PRAY (Buda)	L	EL Budap	rec.
Vienna July 1781	Kaiserliche Hofkammer (Vienna)	G	AkadWien	rec.
Vienna 3 Aug 1781	PRAY (Buda)	L	EL Budap	rec.
Vienna 5 Aug 1781	PRAY (Buda)	L	EL Budap	rec.
Vienna 22 Aug ’81	PRAY (Buda)	L	EL Budap	rec.
Vienna 13 Sep 1781	PRAY (Buda)	L	EL Budap	rec.
Vienna 18 Oct 1781	PRAY (Buda)	L	EL Budap	rec.
Vienna 1 Nov 1781	PRAY (Buda)	L	EL Budap	rec.
Vienna 12 Dec ’81	PRAY (Buda)	L	EL Budap	rec.
Vienna 28 Dec ’81	PRAY (Buda)	L	EL Budap	rec.
Vienna 2 Jan 1782	PRAY (Buda)	L	EL Budap	rec.
Vienna 16 Jan 1782	PRAY (Buda)	L	EL Budap	rec.
Vienna 24 Jan 1782	PRAY (Buda)	L	EL Budap	rec.
Vienna 3 Feb 1782	PRAY (Buda)	L	EL Budap	rec.
Vienna 6 Feb 1782	PRAY (Buda)	L	EL Budap	rec.
Vienna 8 Feb 1782	FIXLMILLNER (Cremif.)	L	Rabn.,131	transcr. rec. (Pinzg.II,166)
Vienna 9 Feb 1782	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,134)
Vienna 8 Mar 1782	PRAY (Buda)	L	EL Budap	rec.
Vienna 27 June ’82	PRAY (Buda)	L	EL Budap	rec.
Vienna 16 Oct 1782	PRAY (Buda)	L	EL Budap	rec.
Vienna 21 Dec [’82]	PRAY (Buda)	L	EL Budap	rec.
Vienna 23 Dec ’82	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna 10 Jan 1783	FIXLMILLNER (Cremif.)	L	Rabn.,132	transcr. rec. (Pinzg.II,167)
Vienna 11 Jan 1783	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,135)
Vienna 9 Aug 1783	FIXLMILLNER (Cremif.)	L	Rabn.,136	transcr. rec. (Pinzg.II,169)
Vienna 12 Nov ’83	WEISS (Tyrnavia)	L	EL Budap	rec. (Pinzg.II,137)
Vienna 26 Dec 1783	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 6 Mar 1785	KAESTNER (Göttingen)	L	UB Göttin	rec.
Vienna 12 Nov ’85	FIXLMILLNER (Cremif.)	L	Rabn.,138	transcr. rec. (Pinzg.II,171)
Vienna 15 Dec ’85	FIXLMILLNER (Cremif.)	L	Rabn.,144	transcr. rec. (Pinzg.II,172)
Vienna 31 Dec ’85	FIXLMILLNER (Cremif.)	L	Rabn.,150	transcr. rec.
Vienna 1 Feb 1786	FIXLMILLNER (Cremif.)	L	Rabn.,158	transcr. rec. (Pinzg.II,174)
Vienna 25 Aug ’86	ESZTERHAZY (Agria)	L	Varg.priv.	rec.
Vienna 20 Jan 1787	FIXLMILLNER (Cremif.)	L	Rabn.,160	transcr. rec. (Pinzg.II,175)
Vienna 5 Mar 1787	FIXLMILLNER (Cremif.)	L	Rabn.,171	transcr. rec.
Vienna 12 Apr ’87	FIXLMILLNER (Cremif.)	L	Rabn.,173	transcr. rec. (Pinzg.II,177)
Vienna 11 Aug ’87	J. BERNOULLI (Berlin)	L	UB Basel	rec.
Vienna 16 Dec ’87	FIXLMILLNER (Cremif.)	L	Rabn.,182	transcr. rec.
Vienna 61 Jan 1788	KAESTNER (Göttingen)	L	UB Göttin	rec.

Vienna 5 Mar 1788	BUGGE (Copenhagen)	L	Pinzg.II,138 transcr. rec.
Vienna 2 May 1788	BUGGE (Copenhagen)	L	Pinzg.II,146 transcr. rec.
Vienna 4 Feb 1789	FIXLMILLNER (Cremif.)	L	Rabn.,197 transcr. rec. (Pinzg.II,179)
Vienna 9 Feb 1789	J. BERNOULLI (Berlin)	L	UB Basel rec.
Vienna 21 Feb '89	BUGGE (Copenhagen)	L	Pinzg.II,147 transcr. rec.
Vienna 22 Mar '89	BUGGE (Copenhagen)	L	Pinzg.II,149 transcr. rec.
Vienna 27 Mar '89	J. BERNOULLI (Berlin)	L	UB Basel rec.
Vienna 24 July '89	BUGGE (Copenhagen)	L	Pinzg.II,151 transcr. rec.
Vienna 2 Feb 1790	FIXLMILLNER (Cremif.)	L	Rabn.,207 transcr. rec. (Pinzg.II,180)
Vienna 30 Oct 1790	ESZTERHAZY (Agria)	L	Varg.priv. rec.
Vienna 5 Mar 1791	SZVORÉNYI (*ubi*?)	L	Pinzg.II,155 transcr. rec.
Vienna 30 Sep 1791	ESZTERHAZY (Agria)	L	Varg.priv. rec.
Vienna 1 Nov 1791	ESZTERHAZY (Agria)	L	Varg.priv. rec.
Vienna 11 Nov '91	ESZTERHAZY (Agria)	L	Varg.priv. rec.

UNPRINTED SOURCES AND LITERATURE, 1*b*: LETTERS WRITTEN TO HELL

From	Place Date	Lang.	Source	Autograph?
STEPLING	Prague 30 Jan 1757	L	WUS	secr. copy
HUBERTI	Würzburg 2 Mar 1757	L	WUS	secr. copy
HUBERTI	Würzburg 27 Mar 1757	L	WUS	secr. copy
STEPLING	Prague 28 July 1757	L	WUS	secr. copy
WEISS	Tyrnavia 20 Aug 1757	L	WUS	secr. copy
WEISS	Tyrnavia 23 Aug 1757	L	WUS	secr. copy
HUBERTI	Paris 3 Oct 1757	L	WUS	secr. copy
WEISS	Tyrnavia 8 Oct 1757	L	WUS	secr. copy
JOSEPHUS MAYR	Graecium 13 Oct 1757	L	WUS	secr. copy
XIMENEZ	Florence 15 Oct 1757	L	WUS	secr. copy
WEISS	Tyrnavia 22 Oct 1757	L	WUS	secr. copy
WEISS	Tyrnavia 13 Jan 1758	L	WUS	secr. copy
XIMENEZ	Florence 4 Feb 1758	L	WUS	secr. copy
XIMENEZ	Florence 23 Feb 1758	L	WUS	secr. copy
HUBERTI	Würzburg 18 Mar 1758	L	WUS	secr. copy
WEISS	Tyrnavia 18 Mar 1758	L	WUS	secr. copy
HUBERTI	Würzburg 25 Mar 1758	L	WUS	secr. copy
WEISS	Tyrnavia 28 Mar 1758	L	WUS	rec. (WUS secr. copy)
HUBERTI	Würzburg 26 Apr 1758	L	WUS	secr. copy
HUBERTI	Würzburg 1 July 1758	L	WUS	secr. copy
HUBERTI	Würzburg July 1758	L	WUS	secr. copy
HUBERTI	Würzburg 12 Aug 1758	L	WUS	secr. copy
HUBERTI	Würzburg 2 Sep 1758	L	WUS	secr. copy
WEISS	[Tyrnavia] 14 Nov 1758	L	WUS	secr. copy
HUBERTI	Würzburg 20 Dec 1758	L	WUS	secr. copy
WEISS	Tyrnavia 23 Dec 1758	L	WUS	secr. copy
WEISS	[Tyrnavia] 30 Dec 1758	L	WUS	secr. copy
RITTER	Passau 17 Jan 1759	L	WUS	secr. copy
WEISS	Tyrnavia 27 Jan 1759	L	WUS	secr. copy
HERTL	Quinque Ecclesiae 23 Feb ’59	L	WUS	secr. copy
SENDZIMIR	Premislia 27 Feb 1759	L	WUS	secr. copy
SCHUMACHER	Posonium Mar 1759	G	WUS	secr. copy
HERTL	Quinque Eccles. 26 Mar 1759	L	WUS	secr. copy
WEISS	Tyrnavia 27 Mar 1759	L	WUS	secr. copy
HERTL	Quinque Eccles. 8 Apr ’59	L	WUS	secr. copy
WEISS	Tyrnavia 1 May 1759	L	WUS	secr. copy
SCHUMACHER	Posonium 1 May 1759	G	WUS	secr. copy
HATVANI	Debrecinum 29 May 1759	L	WUS	secr. copy
HUBERTI	Würzburg 23 May 1759	L	WUS	secr. copy
WEISS	Tyrnavia 26 May 1759	L	WUS	secr. copy
LACAILLE	Paris 3 June 1759	L	WUS	secr. copy
WEISS	Tyrnavia 4 June 1759	L	WUS	secr. copy
DELISLE	Paris 8 July 1759	F	WUS	rec.
LACAILLE	Paris 7 July 1759	L	WUS	secr. copy

HATVANI	Debrecinum 7 July 1759	L	WUS	secr. copy
HUBERTI	Würzburg 20 Oct 1759	L	WUS	secr. copy
BODA	Graecium 11 Nov 1759	L	WUS	secr. copy
WEISS	Tyrnavia 12 Dec 1759	L	WUS	secr. copy
KRATZ	Ingolstadt 15 Dec 1759	L	WUS	secr. copy
STEPLING	Prague 28 Dec 1759	L	WUS	secr. copy
LACAILLE	Paris 29 Dec 1759	L	WUS	secr. copy
KRATZ	Ingolstadt 2 Apr 1760	L	WUS	rec.
STEPLING	Prague 4 Mar 1761	L	WUS	secr. copy
XIMENEZ	Florence 15 Mar 1761	L	WUS	secr. copy
WEISS	Tyrnavia 24 Mar 1761	L	WUS	secr. copy
CHR. MAYER	Heidelberg 2 Apr 1761	L	WUS	secr. copy
BODA	Graecium 2 Apr 1761	L	WUS	secr. copy
WEISS	Tyrnavia 7 Apr 1761	L	WUS	secr. copy
CHR. MAYER	Heidelberg 17 Apr 1761	L	WUS	secr. copy
LACAILLE	Paris 18 Apr 1761	L	WUS	secr. copy
MESSIER	Paris 20 Apr 1761	F	WUS	secr. copy
RIEGER	Madrid 30 Apr 1761	L	WUS	secr. copy
BRAUN	St. Petersb. 5 May 1761	L	WUS	secr. copy
ZUM SCHLUG	Wetzlas 8 May 1761	G	WUS	secr. copy
LALANDE	Paris 10 May 1761	F	WUS	secr. copy[12]
WEISS	Tyrnavia 19 May 1761	L	WUS	secr. copy
ZECH	Ingolstadt 13 May 1761	L	WUS	secr. copy
POLENI	Padua 25 May 1761	L	WUS	secr. copy
CHR. MAYER	Schwetzingen 26 May 1761	L	WUS	secr. copy
MÜLLER	St. Petersburg 6 June 1761	L	RAN Pbg	draft (WUS secr. copy)
DE LUYNES	Sens 6 June 1761	F	WUS	secr. copy
CASSINI DE THURY	Baden 11 June 1761	F	WUS	secr.copy
MESSIER	[*France*] May 1761	F	WUS	secr.copy
KRATZ	Ingolstadt 25 Nov 1763	L	WUS	rec.
LALANDE	[*France*] 29 Dec 1763	F	Pinzg.II,190	copy rec.
BAUDOUIN	[*France*] [Nov/Dec 1763]	F	Pinzg.II,191	copy rec.
CHAPPE	[*France*] [Nov/Dec 1763]	F	Pinzg.II,192	copy rec.
DE LUYNES	Versailles 14 Dec 1763	F	Pinzg.II,195	copy rec.
CLAIRAUT	[*France*] 3 Jan 1764	F	Pinzg.II,193	copy rec.
WEINHART	Innsbruck 24 Nov 1766	L	WUS	rec.
WEINHART	Innsbruck 16 Dec 1766	L	WUS	rec.
WEINHART	Innsbruck 18 Dec 1766	L	WUS	rec.
DE LUYNES	Paris 23 June 1770	F	WUS	copy in Hell's hand
HALLERSTEIN	Beijing 5 Sep 1770	L	UB Basel	J. Bernoulli's copy
TREBUCHET	Auxerre 16 Dec 1770	F	WUS	rec.
KAPRENAI	Tyrnavia 15 Feb 1771	L	WUS	rec.
FIXLMILLNER	Cremifanum 14 Nov 1771	L	Rabn.,116	draft
FIXLMILLNER	Cremif. 23 Feb 1771	L	Rabn.,124	draft
SCHLÖZER	Göttingen 29 Feb 1772	L	Mencsik	draft?
J. BERNOULLI	Berlin [after Jan 1774]	F	UB Basel	draft
KATONA	Tyrnavia 2 Nov 1776	L	WUS	rec.
FIXLMILLNER	Cremif. [Feb 1781]	L	Rabn.,129	draft

[12] Facsimile in Aspaas 2010.

FIXLMILLNER	Cremif. [Mar-July 1783]	L	Rabn.,134	draft
BUGGE	Copenhagen 15 Jan 1784	L	KB Copen	draft
FIXLMILLNER	Cremif. 26 Nov 1785	L	Rabn.,139	draft
FIXLMILLNER	Cremif. 22 Dec 1785	L	Rabn.,146	draft
FIXLMILLNER	Cremif. 12 Jan 1786	L	Rabn.,151	draft
FIXLMILLNER	Cremif. 22 Jan 1786	L	Rabn.,155	draft
FIXLMILLNER	Cremif. 8 Feb 1787	L	Rabn.,163	draft
BUGGE	Copenhagen 18 Apr 1788	L	KB Copen	draft
BUGGE	Copenhagen 4 Aug 1788	L	KB Copen	draft
FIXLMILLNER	Cremif. [c. Feb 1790]	L	Rabn.,211	draft
BUGGE	Copenhagen 30 Nov ’90	L	KB Copen	draft
FIXLMILLNER	Cremif. 2 Dec 1790	L	Rabn.,214	draft (*Eph.Astr. Anni 1792*)

UNPRINTED SOURCES AND LITERATURE, 1*c*: MANUSCRIPTS, REPORTS AND OTHER DOCUMENTS WRITTEN BY, OR AT LEAST SIGNED BY HELL

Type

Ill. = illustration (sketch)
MS = manuscript
PM = *pro memoria* (i.e. "Gutachten", 'expert opinion')

Date

[in brackets] signifies estimated date, otherwise date as stated by Hell

Lang.

See above, 1*a* for abbreviations

Source

See above, 1*a* for abbreviations

Type	Title/opening words (brief description of contents)	Date	Lang.	Source
MS, 24 pp.	"Theoria Phœnomeni Ascensus, et Descensus Mercurij in Barometris" (unfinished treatise for *Académie Royale des Sciences* in Paris)	[c. 1761]	L	WUS
MS, 7 pp.	"Demonstratio qua Vera idea, proponitur temporis tum Accellerationis fixarum diurnæ præ motu medio Telluris, tum ipsiusmet Temporis medij mensura" (unfinished treatise for *Académie Royale des Sciences* in Paris)	[c. 1765]	L	WUS
MS, 28 pp.	"Observationes Astronomicæ et Cæteræ Jn Jtinere litterario Viennâ Wardoëhusium usque factæ 1768. A. M. Hell" (diary of scientific activities, Oslo 17 July 1768 – Vardø 18 June 1769)	1768-69	L	WUS
MS, 7 pp.	"Observationes Declinationum acûs Magneticæ Jn Observatorio Wardoëhusiano 1769." (magnetic declinations observed in Vardø, 27 April – 18 June 1769 [facsimile in Hansen & Aspaas 2005])	1769	L	WUS
MS, 21 pp.	[no heading] "Jn Parte Jnsulæ occidentali ..." (survey of the Vardø island, with calculations, May 1769)	1769	L	WUS
MS, 3 pp.	[no heading] "NB De Horologijs", "Comparatio Quadrantis Haffniensis cum D. Niebuhr", "Wardo[e]husij maximus æstus habetur...", "Ex relatione Militis hujatis..." (notes on astronomical clocks, quadrants, the ebb and flow of the tides and the decreasing sea level in Vardø, c. May 1769)	1769	L	WUS
MS, 27 pp.	"Methodus observandi Declinationes acus magneticæ per iter litterarium ad Polum boreum"	1769-70	L	WUS

	(measurements of the magnetic declination, geodetic observations, measurements of the decreasing sea level, sketches of animals, etc. Hamningberg 29 June 1769 – Copenhagen 15 February 1770 [facsimile, nearly complete, in Hansen & Aspaas 2005. See also Aspaas 2008*c*])			
MS, 17 pp.	"Conjunctiones [Solis] et [Lunæ] Veræ..." (calculations of the longitude of Vardø, later published in the Venus-transit report [Hell 1770*a*])	[1769]	L	WUS
MS, 47 pp.	"Observatio Transitus Veneris ante discum Solis die 3 Junij Anno 1769 Wardoehusji Sumptibus Clementissimi ac Potentissimi Regis Daniæ, et Norwegiæ Christiani VII facta, à R. P. Maximiliano Hell è S. J. Astronomo Cæsareo-Regio Universitatis Vindobonensis, Societatis Regiæ Scienti arum Haffniensis, et Academiæ Regiæ Scientiarum Nidrosiensis Membro, atque Academiæ Regiæ Scientiarum Parisinæ Correspondente" (partly draft, partly proofread text for the Venus-transit report from Vardø [Hell 1770*a*])	[1769]	L	WUS
MS, 4 pp.	"Determinationes Elevationum Poli Nordlandiæ ex meis observationibus Astronom. itemque ex mappa D. Rami manuscripta juxta milliaria Norwegica et acum magneticam constructa, atque Secundum meas observationes Astron. Reducta"	c. 1770	L	WUS
MS, 1 p.	"De Mappa Geographica Manuscripta quæ adservatur in Archivo Exc. Comitis De Thott"	c. 1770	L	WUS
Ill., 1 p.	"Parhelion singulare Visum Haffniæ 1770 die 30 Martij mane hora 9 m. 16. à P. Hell, et P. Sajnovics" (coloured drawing, with comments)	1770	L	WUS
MS, 67 pp.	"Lucis Boreæ Theoria nova à Maximiliano Hell S.J. Pars I^ma^. Societati Regiæ Scientiarum Haffniensi per quinque Sessiones. hoc est, die 2^da^, 9, 16, 23 et 30 Martij 1770 prælecta" (published as *Auroræ Borealis Theoria Nova* [Hell 1776])	1770	L	WUS
MS, 40 pp.	"Latitudines Geographicæ Locorum Finmarchiæ, Nordlandiæ, Norwegiæ et Sueciæ Observationibus à Maximiliano Hell et Societati Regiæ Scientiarum Hafniensi Oblatæ die 18 May 1770" (the Latin original for the Danish publication [Hell 1770*b*])	1770	L	RA Oslo
MS, 7 pp.	"Oeconomia sive Partitio Totius operis Expeditionis Litterariæ ad Polum Arcticum" (draft for the call for subscriptions [Hell 1770*c*])	[1770]	L	WUS
MS, 4 pp.	"De Primis Ungarorum sedibus seu Natali solo Ungarorum. §. I. occasio inquirendi in natalem Ungarorum Patriam"	[c. 1771]	L	WUS
MS, 6 pp.	"Quædam philologica ad Jllustrandum Anonymum" (unfinished)	[c. 1771]	L	WUS
MS, 1 p.	"Notitia Regni Ungariæ Anno 886. ante adventum Ungarorum"	[c. 1771]	L	WUS

MS, 2 pp.	"Synopsis Chronologico-Geographico-Historica Adventûs Ungarorum in Pannoniam Seculo IX. Ex Anonymo Regis Belæ Notario, et Constantino Porphyrogenetæ de Administrando Jmperio"	[c. 1771]	L	WUS
MS, 2 pp.	"Disquisitio Critica De Cumanis Anonymi Belæ Regis Notarij"	[c. 1771]	L	WUS
MS, 1 p.	"De Comanis sive Komanis ex Historia Annæ Comnenæ Auth. Possino S.J. Ex Tomo X Historiæ Byzantinæ"	[c. 1771]	L	WUS
MS, 2 pp.	"Nomina Hunus, chunus, Cunus, et seculo XII cumanus, seu Cunmanus idem significare, hoc est, *Equites*, seu *Populum in equis pugnantem*, aut populum equestrem, demonstratur"	[c. 1771]	L	WUS
MS, 2 pp.	"Pro R. P. Kaprinaj è S. J." (prob. notes for a letter)	[c. 1771]	L	WUS
MS, 4 pp.	"Excerpta ex Cedreno. Spectantia ad terminos chronologicos de morte Leonis Jmper. de Nativitate, ætate, et annis Jmperij. Constantini Jmperatoris. de anno exautorationis Romani senioris, et de anno Coronationis Romani Junioris filij Constantini"	[c. 1771]	L	WUS
MS, 1 p.	"Lingua Asiatica seu orientalis ... Lingua Europea seu occidentalis"	[c. 1771]	L	WUS
MS, 2 pp.	"Pro Dissertatione de Ungaris qua demonstrabitur Jnclytam Nationem Ungaricam, quæ seipsam appellat *Magyar*; originis esse Finnicæ; et quidem è Provincia Finnlandiæ *Carelia* in Pannoniam deductam, atque ab hac Regnum Ungariæ appellationem suam accepisse"	[c. 1771]	L	WUS
MS, 1 p.	"De Primis Ungarorum sedibus, seu de Prima Ungarorum Patria Dissertatio qua Demonstratur notissimam Ungarorum Gentem esse nationis Finnicæ, seu Fennicæ" (chapter headings)	[c. 1771]	L	WUS
MS, 3 pp.	"Jn adlocutione ad Soctem Regiam" (additions for the 2nd edn. of Sajnovics' *Demonstratio* [1771])	[c. 1771]	L	WUS
MS 1 p.	"Descriptio Karjeliæ ex Blau Geographiæ volumine II. pag. 35. et 36. 1660"	[c. 1771]	L	WUS
MS, 1 p.	"Ex Mappa Nicolaj Joannidis Piscatoris Speciæ et Norwegiæ, dicata Regi Gustavo Adolpho"	[c. 1771]	L	WUS
MS, 3 pp.	"Demonstratur Tempore Constantini Porphyrogenetæ chersonem Peninsulam, seu hodiernam Crimeam, non fuisse dictam Chazariam"	[c. 1771]	L	WUS
MS, 4 pp.	"Vox Magyar probatur esse eadem, quæ megyer vel Megjer"	[c. 1771]	L	WUS
MS, 2 pp.	"Jn eo autem opere ..." (additions for the 2nd edn. of Sajnovics' *Demonstratio* [1771])	[c. 1771]	L	WUS
MS, 2 pp.	"Ex Annalibus fuldentibus"	[c. 1771]	L	WUS

MS, 1 p.	Excerpts from the works “Saxonia” and “Vandalia” by “Albertus Krantzius”	[c. 1771]	L	WUS
MS, 2 pp.	Excerpts “Ex Voyage Cel. Dñi Le Brün par la Moscovie En Perse Tom I. edit. 1718” and “Ex Witichindo Corbejenti De Ungaris Annalium lib. I.”	[c. 1771]	L,F	WUS
MS, 1 p.	Excerpts “Ex Analectis cl. Kollarij Tom. I. Pag. 547.” and “Jn Novalibus Hamburgensium ad An. 1771 31 stuk. 22 febr.”	[c. 1771]	L,G	WUS
MS, 1 p.	“Distantiæ Tribuum chazarorum Porphyrogenetæ”	[c. 1771]	L	WUS
MS, 1 p.	“Mappa Scandinaviæ complectens Sueciæ Daniæ, et Norvegiæ Regna ex Tabulis Joan. Propt. Homanni”	[c. 1771]	L	WUS
MS, 1 p.	Excerpts “Ex bibliotheca Suecica D. Netteb. pars I. pag 96” and from “Saxo grammaticus”	[c. 1771]	L	WUS
MS, 1 p.	“Nota ad caput 37 Porphyrogenetæ de sedibus Patzinacitarum ante eorum egressum”	[c. 1771]	L	WUS
MS, 1 p.	Excerpts “Jntra Pontum Euxinum et Mare Caspium ex mappa Vischeri Asiæ, et Europæ Seuteri”, “Ex mappa Antiqua Jmperium Turcicum Anonymo Authore”, “Ex mappa Europæ Homanni”, and “Jn mappa Vit *Persiæ*”	[c. 1771]	L	WUS
MS, 2 pp.	“Synopsis brevissima de adventu Ungarorum seculo 9no ex Anonymo, et Porphyrogeneta”	[c. 1771]	L	WUS
MS, 1 p.	“Caput III. Part. III. Tomi I. De Unitate idiomatis Lapponici Ungarici, et Universim Asiatici cim idiomate sinico, et de populis idem Jdioma Lapponicum seu Asiaticum habentibus” (plans for the *Exp. litt.*)	[c. 1771]	L	WUS
MS, 2 pp.	“Titulus Mappæ Ungariæ Majoris” (plans for maps for the *Exp.litt.*)	[c. 1771]	L	WUS
Ill., 1 p.	(Map showing travel route from Helsingborg to Gothenburg [facsimile in Sajnovics 1990])	[c. 1771]	L	WUS
Ill., 1 p.	[no title] “Hæc delineatio nihil valet” (Sketch of a Sámi camp, with Hell’s comments [facsimile in Aspaas & Voje Johansen 2004*a*])	[c. 1771]	L	WUS
MS, 2 pp.	“Regulæ Generales. Secundum qvas argumento infallibili conseqvatur octo Gentes Chazarorum Porphyrogenetæ fuisse Fennos et Carjelios, et Accolas Lacuum Ladoga et Onega”	[c. 1771]	L	WUS
MS, 4 pp.	“De Lapponibus” (synopsis of the first volume of the *Exp. litt.*)	[c. 1771]	L,G	WUS
MS, pp.	“De Parallaxi Solis” (manuscript for the treatise printed in *Eph.Astr. Anni 1773* [Hell 1772])	[1772]	L	WUS
MS, 3 pp.	“opera à P. Hell. S.J. edita” (autobibliography, dated 9 June 1773)	1773	L	Pannonhalma
MS, 7 pp.	“J. N. D.” (first draft for the introductory chapter of the *Exp.litt.* = MS *A* in Section III.3)	[around July 1773]	L	WUS
MS, 7 pp.	“Pars I. Ephemeris totius Expeditionis litterariæ ad Polum arcticum à P. Hell et socio P. Sajnovics	[after July 1773]	L	WUS

	factæ. Caput I” (second draft for the introductory chapter of the *Exp.litt.* = MS *B* in Section III.3)			
MS, 2 pp.	[no heading] “Quæ causa Expeditionis hujus...” (additions to the introductory chapter of the *Exp. litt.* = MS *b* in Section III.3)	[after July 1773]	L	WUS
MS, 6 pp.	“*Pars I.* Ephemeris totius Expeditionis litterariæ ad Polum arcticum à P. Hell et socio P. Sajnovics factæ. *Caput I*” (third draft for the introductory chapter of the *Exp.litt.* = MS *C* in Section III.3)	[after July 1773]	L	WUS
MS, 8 pp.	“*Pars I.* Ephemeris totius Expeditionis litterariæ ad Polum arcticum à P. Hell et Socio P. Sajnovics factæ. *Caput I*” (fourth version of the introductory chapter of the *Exp.litt.* = MS *D* in Section III.3)	[after July 1773]	L	WUS
MS, 8 pp. + 1 Ill.	“De æquatione Temporis à Patre Maximiliano Hell S.J.” (for the Academy of Göttingen, in response to an article of Kästner)	[c. 1774]	L	UB Basel
PM	“Aller unterthänigster unparteiischer Bericht, über die unmassgeblichen Gedanken den damahligen Zustand der K.K. Gesandtschafts Capelle zu Copenhagen, und wie solche zu verbessern, auch einige Ordnung darin einzuführen wäre”	1776	G	Pinzg.II,120
MS, 2 pp.	“Ad clar. Praÿum Hellius”, “Ad clar. Praÿum Regelspergerus!”, “Praÿo Hellius” (poems)	n.d.	L,G	WUS
MS, 1 p.	“Pag. 1ª confirmat cl. Author iterum errorem ...” (polemics against Benedictus Cetto)	[c. 1781]	L	WUS
MS, 2 pp.	“Observationes Eclipsium satellitum [Jovis] factæ Drontheimij à D. Holm 1761...” (calculations for the longitude of Trondheim)	[c. 1790]	L	WUS
MS, 4 pp.	“Latitudines Geographicæ Locorum Finnmarchiæ, Nordlandiæ, Norwegiæ et Seuciæ observationibus Astronomicis definitæ à Maximiliano Hell et Societati Regiæ Scientiarum Haffniensi oblatæ die 18 Maij 1770” (part of the introduction of the report printed in *Eph.Astr. Anni 1791* [Hell 1790])	[c. 1790]	L	WUS
MS, 4 pp.	“Observationes Astronomicæ Latitudinum ...” (part of the introduction of the report printed in *Eph.Astr. Anni 1791* [Hell 1790])	[c. 1790]	L	WUS
MS, 4 pp.	“Elenchus operum editorum à P. Maximiliano Hell” (autobibliography, dated 1791)	1791	L	Pannonhalma

UNPRINTED SOURCES AND LITERATURE, 2*a*: LETTERS WRITTEN BY SAJNOVICS

Place Date	TO (Place)	Lang.	Source	Autograph?
Vienna 16 Apr 1768	SPLENYI (Tyrnavia)	L	MagAkad	copy rec.
Prague 5 May 1768	SPLENYI (Tyrnavia)	L	MagAkad	copy rec.
Leipzig 15 May ’68	SPLENYI (Tyrnavia)	L	MagAkad	copy rec.
Lübeck 5 Jun 1768	SPLENYI (Tyrnavia)	L	MagAkad	copy rec.
Copenh. 21 Jun ’68	SPLENYI (Tyrnavia)	L	MagAkad	copy rec.
Trondh. [?] Aug ’68	SPLENYI (Tyrnavia)	L	MagAkad	copy rec.
Vardø 14 Nov 1768	SPLENYI (Tyrnavia)	L	MagAkad	copy rec.
Vardø 5 April 1769	SPLENYI (Tyrnavia)	L	MagAkad	copy rec(Varg.priv.copy)[13]
Vardø 6 June 1769	SPLENYI (Tyrnavia)	L	MagAkad	copy rec(Varg.priv.copyrec)
Trondh. 2 Sep 1769	SPLENYI (Tyrnavia)	L	MagAkad	copy rec.
Copenh. 10 Feb ’70	SPLENYI (Tyrnavia)	L	MagAkad	copy rec.
Tyrnavia 12 May ’71	NAGY (*ubi*?)	L	Holov.,500	transcr.rec.

[13] The letters dated 5 April and 6 June 1769 are extant in another copy, made by a certain “M[a]g[ister] Ambrus” and signed by “Nic[olaus] Benkő” in Buda, 5 September 1769. Cf. the article of Vass 1857.

UNPRINTED SOURCES AND LITERATURE, 2*b*: MANUSCRIPTS, REPORTS AND OTHER DOCUMENTS WRITTEN BY, OR AT LEAST SIGNED BY SAJNOVICS

Type	Title/opening words (brief description of contents)	Place, Date	Lang.	Source
MS, 2 pp.	[no heading] "die 2da Octobris..." (tables showing travel costs, Oslo 2 October – Helsingør 16 Oct. 1769 and Vienna 27th April – Hamburg 25 May 1768)	1768-69	L,G	WUS
MS, 6 pp.	"Moneta Danica", "Moneta Suecica", "Die 27. Junij. accepi a R.P. H. ...", "Reise Route. Von Coppenhagen durch Schweden biß Tronhiem", "Ex Novellis Altonæ editis ad diem 14. Julij. 1768", "Res quæpiam, quæ raritatis causa in nostras terras deferre possemus" (notes on exchange rates, money spent, distances between places, a newspaper excerpt, and a list of books and items to bring back home)	[1768]	L,G	WUS
MS, 2 pp.	"Von Christiania biß Trondheim" (brief description of the roads and landscapes from Oslo to Trondheim)	[1768]	L	WUS
MS, 51 pp.	"Diarium Haffniâ Trondheimium", "Diarium in Jnsula Wardoë" (travel diary, first draft, from Departure Copenhagen 2 July 1768 – departure Vardø 27 June 1769)	1768-69	L	WUS
MS, 82 pp.	"Jter Maritimum e Wardoe *Wils Gott* Trondheimium!" (travel diary, first draft, from deparTure Vardø 27 June 1769 – arrival Vienna 12 August 1770)	1769-70	L	WUS
MS, 2 pp.	"Marsch Routte" (brief descriptions of the roads and landscapes from Trondheim to Oslo)	[1769]	L	WUS
MS, 2 pp.	"Jter Christianiâ Havniam" (brief descriptions of the roads and landscapes from Oslo to Copenhagen)	[1769]	L	WUS
MS, 1 p.	"De Rangiferis, seu Rhenonibus. Tarandis. Sueci: Rhen"	[c. 1769]	L	WUS
MS, 3 pp.	"Suplementa Diarij" (various notes on everyday life etc. in Norway)	[c. 1769]	L	WUS
MS, 1 p.	"Expensæ P. Hell", "Desiderium D. Luxdorff" (brief notes)	[c. 1769]	L	WUS
MS, 1 p.	"Observatio Transitus Veneris facta Greenwichij. die 3 Junij 1769"	[c. 1769]	L	WUS
MS, 6 pp.	[no heading] "Ex novellis Altonensibus ..." (various observations of the 1769 transit of Venus, culled from newspapers etc.)	[c. 1769-70]	G,L	WUS
MS, 27 pp.	"Jter Viennâ Pragam, Dresdam, Lipsiam, Hamburgum & Lybekam" (travel diary, revised version, 27 April – 1 June 1768)	[c. 1770]	L	WUS

MS, 20 pp.	[no heading] “Acceptis recentibus 10. equis ...” (travel diary, revised version, departure Copenhagen 4 July – departure Trondheim 22 Aug. 1768)	[c. 1770]	L	WUS
MS, 4 pp.	“Nomina Lapponica Ex Lemij Lapponia Finnmarchica excerpta” (table, with comments for Hell)	[c. 1771]	L	WUS

PRINTED SOURCES AND LITERATURE, PART 1 – BEFORE 1800

Abbreviations:

Akad.Berlin Digitisation service of Berlin-Brandenburgische Akademie der Wissenschaften: http://bibliothek.bbaw.de/bibliothek-digital/digitalequellen/schriften

BIBSYS Xerox copy provided by the Norwegian Library System, BIBSYS

Bodleian Copy from Bodleian Library, Oxford University

CVH Copy from Centrum för Vetenskapshistoria vid Kungl. Vetenskapsakademien, Stockholm

Diglib Bologna Digitisation service of Università di Bologna: http://diglib.cib.unibo.it/

KUB Nord Copy from Det Natur- og Sundhedsvidenskabelige Fakultetsbibliotek, Copenhagen

Eph.Astr. *Ephemerides Astronomicae ad Meridianum Vindobonensem*. Vienna

EZB Digitisation service of Universitätsbibliothek Bielefeld: http://www.ub.uni-bielefeld.de/diglib/aufklaerung/zeitschriften.htm

ECCO Digitisations provided by Gale Group's *Eighteenth Century Collections Online*: http://galenet.galegroup.com/servlet/ECCO

ECHO Digitisation service of European Cultural Heritage Online: http://echo.mpiwg-berlin.mpg.de/home

Gallica Digitisation service of Bibliothèque nationale de France: http://gallica.bnf.fr

Google Books Digitisation service of Google: http://books.google.com/

Göttinger DigZentrum Digitisation service of Niedersächsische Staats- und Universitäts-bibliothek, Göttingen: http://gdz.sub.uni-goettingen.de/de/index.html

ThULB Digitisation service of Thüringer Universitäts- und Landesbibliothek Jena: http://zs.thulb.uni-jena.de/

Handl.Stockh. *Kungliga Vetenskaps Academiens Handlingar*. Stockholm

HARS *Histoire de l'Académie Royale des Sciences avec les Mémoires de mathématique et de physique tirés des registres de cette Académie*. Paris

HARS, Mem. Mémoires-section of HARS

Inst. Astr. Wien Copy from Institut für Astronomie der Universität Wien, Vienna

JdS *Journal des Sçavans*. Paris

JSTOR Digitisation service of the JSTOR organisation: www.jstor.org

Les rendez-vous de Vénus CD digitised document on CD Rom issued by the Observatoire de Paris, 2004, edited by Jean-Eudes Arlot, Delphine Mousset, Michel Toulmonde, Patrick Rocher, Gilles Bessou & Audrey Delsanti.

Mus.Hist.Sc., Oxf. Copy from Museum of the History of Science, Oxford

Phil.Tr. *Philosophical Transactions of the Royal Society of London, giving some Account of the Present Undertakings, Studies, and Labours, of the Ingenious, in many Considerable Parts of the World*. London

Nov.Comm. *Novi Commentarii Academiae Scientiarum Imperialis Petropolitanae*. St. Petersburg

Schwed.Abh. *Der Königl. Schwedischen Akademie der Wissenschaften Abhandlungen aus der Naturlehre, Haushaltungskunst und Mechanik [...] Aus dem Schwedischen übersetzt*. Hamburg and Leipzig

Skrifter Kiøb. *Skrifter, som udi det Kiøbenhavnske Selskab af Lærdoms og Videnskabers Elskere ere fremlagte og oplæste*. Copenhagen

Stockh. UB Copy from Stockholms Universitetsbibliotek, Stockholm

UBO Copy from Universitetsbiblioteket i Oslo, Oslo

UBTØ Copy from Universitetsbiblioteket i Tromsø, Tromsø

[Anonymous]
1767: "Transitus Veneris per Solem a Iesuitis Tranquebariae in India orientali observatus", *Nov.Comm.* pro Anno MDCCLXV (1767), p. 569. BIBSYS
[Anonymous]
[1769]: *A Copper Plate and Discourse of the Transit of Venus, On the 3d of June 1769. Most humbly inscribed to His Royal Highness George Prince of Wales*, [no place, no publisher] 16 pp. ECCO
[Anonymous] (ed.)
1770*a*: *Collectio omnium observationum quae occasione transitus Veneris per Solem a. MDCCLXIX. iussu Augustae per Imperium Russicum institutae fuerunt una cum theoria indeque deductis conclusionibus*, Petropoli: Typis Academiae Scientiarum. 607 pp. Les rendez-vous de Vénus CD
1770*b*: "Praefatio", *Nov.Comm.* pro Anno MDCCLIX, vol. XIV pars prior (1770*b*), pp. [i]-[iv]. BIBSYS
[Anonymous] (ed.)
1779: *Der Zucker, ein neues Präservativmittel wider den Scorbut (Scharbock) von Herrn* Abt Hell, *Kaiserl. Königl. Hofastronom in Wien, Nebst einer Zuschrift, darinn des Scharbocks Ursachen etc. und auch des Zuckers Eigenschaften gründlicher erwogen und widerlegt werden von Herrn* von Albertiz, *der Arzneygelartheit Doktor*, Vienna / Leipzig: bey Johann Friedrich Jahn. 48 pp. UBO
[Anonymous]
1797: *Authentic Memoirs of the Life and Reign of Catherine II. Empress of all the Russians. Collected from Authentic MSs. Translations, &c.* […], London: Printed for the Author, And sold by B. Crosby. 307 pp. ECCO
Austria. Catalogi Breves 1763-1765 (photocopies of printed catalogues). Institutum Historicum Societatis Iesu, Rome
Austria. Catalogi Breves 1766-1769 (photocopies of printed catalogues). Institutum Historicum Societatis Iesu, Rome
Bayly, William (Bayley)
1770: "Astronomical Observations made at the *North Cape*, for the Royal Society", *Phil.Tr.* For the Year 1769, vol. LXIX, pp. 262-272. JSTOR
Bergman, Thorbern Olof
1762: "An Account of the Observations made on the same Transit at Upsal in Sweden: In a Letter to Mr. Benjamin Wilson […] from Mr. Thorbern Bergman […] Read Nov. 19, 1761", *Phil.Tr.* For the Year 1761, vol. LII, part I, pp. 227-230. JSTOR
Bernoulli, Jean (Johann) III
1771*a*-1772-1776*a*: *Recueil pour les Astronomes*, Berlin, Chez l'Auteur. 3 vols., I: x+284 pp., II: 362 pp., III: xii+340 pp. Bodleian
1771*b*: *Lettres Astronomiques où l'on donne une idée de l'état actuel de l'astronomie pratique dans plusieurs villes de l'Europe*, Berlin: Chez l'Auteur. 175 pp. Bodleian
1776*b*-1777*a*-1777*b*-1778-1779*a*-1779*b*: *Nouvelles Littéraires de divers pays. Avec des supplemens pour la liste et le nécrologe des Astronomes*, Berlin: chés l'Auteur & chés Hande & Spencer. 6 vols., I: iv+48+64 pp., II: 64 pp., III: 78 pp., IV: 71 pp., V: 68 pp., VI: 88 pp. KUB Nord
1777*c*: *Lettres sur différens sujets, écrites pendant le cours d'un voyage par l'Allemagne, la Suisse, la France méridionale et l'Italie; en 1774. et 1775. avec des additions & des notes plus nouvelles, concernant l'histoire naturelle, les beaux arts, l'Astronomie, & d'autres matières*, vol. I, Berlin: Chés G. J. Decker. vii+275 pp. Gallica

1784: *Sammlung kurzer Reisebeschreibungen und anderer zur Erweiterung der Länder- und Menschenkenntniß dienender Nachrichten*, Vierter Band, Berlin: bey dem Herausgeber / Altenburg: bey C. E. Richter. 432 pp. Kongelige Bibliotek, Copenhagen

1785: *Archiv zur neuern Geschichte, Geographie, Natur- und Menschenkenntniß. Mit Kupfern*, Zweiter Theil, Berlin: bey dem Herausgeber / Altenburg: bey C. E. Richter. 428 pp. Kongelige Bibliotek, Copenhagen

[Born, Ignatius a]

1783: *Joannis Physiophili Specimen Monachologiæ Methodo Linnæana tabulis tribus æneis illustratum, cum adnexis thesibus e Pansophia P.P.P. Fast* […] *quas præside A.R.P. Capistrano a Mulo Antonii* […] *XXVI. May hora IV. post prandium in vestibulo refectorii conventus defendendent P. Tiburtius a Vulnere Theresiæ et P. Theodatus a Stigmatibus Francisci* […], Augustæ Vindelicorum: Sumtibus P. Aloysii Merz. [48] pp. Google Books

1786: "Lectori Salutem", *Staats-Anzeigen gesammelt und zum Druck befördert von August Ludwig Schlözer* Neunter Band, Heft 33-36, pp. 228-231. EZB

Bredal, Niels Krog

1761: "Amicis summo honore suscipiendis scientiæ astronomicæ peritis Dominis Bugge et Aaskov, ad Nidrosiam Veneris Solem transeuntis videndæ gratia iter facientibus per iniuriam nebulosæ athmosphæræ ut plurimum spe frustratis inter otia has lineolas posuit", *Kiøbenhavnske Nye Tidender om lærde Sager* 18de Jun. 1761, pp. 203-204. BIBSYS

Büsching, Anton Friedrich

1764: *Neue Erdbeschreibung, Teil I: Welcher Dänemark, Norwegen, Schweden, das ganze rußische Reich, Preussen, Polen, Hungarn und die europäische Türkey, mit denen dazu gehörigen und einverleibten Ländern, enthält*, 2 vols., Hamburg: Bey Johann Carl Bohn. I: pp. 1-908, II: pp. 910-1439. Nasjonalbiblioteket, Oslo

Cassini de Thury, César-François

1762: "Remarques sur la conjonction de Vénus avec le Soleil, Qui doit arriver le 6 Juin de l'année prochaine 1761.", *HARS* Année M.DCCLVII., *Mém.*, pp. 326-335. Gallica

1763: "Observation du passage de Vénus sur le Soleil, Faite à Vienne en Autriche", *HARS* Année M.DCCLXI., *Mém.*, pp. 409-412. Gallica

Cassini, Jean-Dominique (Cassini fils)

1772: "Histoire abrégée de la parallaxe du soleil", in Cassini (ed.), *Voyage en Californie pour l'observation du passage de Vénus sur le disque du soleil, Le 3 Juin 1769; Contenant les observations de ce phénomene, & la description historique de la route de l'Auteur à travers le Mexique, Par feu Chappe d'Auteroche* […], pp. 113-170. Paris: Chez Charles-Antoine Jombert. Les rendez-vous de Vénus CD

Chappe d'Auteroche, Jean-Baptiste (l'Abbé)

[1762]: *Memoire du passage de Venus sur le Soleil; Contenant aussi quelques autres Observations sur l'Astronomie, et la Declinaison de la Boussole, faites à Tobolsk en Siberie l'Année 1761, Lû à l'Academie Impériale de St. Petersbourg le 8 Janviuer 1762*, St. Petersbourg: l'Imprimerie de l'Academie Impériale des Sciences. 22 pp. Göttinger DigZentrum

1763: "Extrait du voyage fait en Sibérie, Pour l'Observation de Vénus sur le disque du Soleil, faite à Tobolsk le 6 Juin 1761.", *HARS* Année M.DCCLXI., *Mem.*, pp. 337-377. Gallica

1768: *Voyage en Sibérie, fait par ordre du Roi en 1761; contenant Les Mœurs, les Usages des Russes, et l'Etat actuel de cette Puissance; la Description géographique & le Nivellement de la route de Paris à Tobolsk; l'Histoire naturelle de la même route, des Observations astronomiques, & des Expériences sur l'Electricité naturelle; Enrichi de Cartes géographiques, de Plans, de Profils du terrein; de Gravures qui représentent les usages des Russes, leurs mœurs, leurs habillements, les Divinités des Calmouks, & plusieurs morceaux d'histoire naturelle.*, Tome Premier, Paris: Chez Debure, pere Librair, quai des Augustins, à Saint Paul. xxx+677 pp. Göttinger DigZentrum

Cook, James

1772: "Observations made, by appointment of the Royal Society, at *King Georg's Island* in the *South Sea;* by Mr. *Charles Green* […] and Lieut. *James Cook*, of his Majesty's Ship the Endeavour. Read November 21, 1771", *Phil.Tr.* For the Year 1771, vol. LXI, part I, pp. 397-421. JSTOR

Daval, Peter

1764: "An Account of the *Sun's* Distance from the Earth, deduced from Mr. *Short's* Observations relating to the horizontal Parallax of the Sun: In a Letter from *Peter Daval* […] to *James Barrow* […] Read Jan. 13, 1763", *Phil.Tr.* For the Year 1763, vol. LIII, pp. 1-2. JSTOR

Dixon, Jeremiah

1770: "Observations made on the Island of *Hammerfost*, for the Royal Society", *Phil.Tr.* For the Year 1769, vol. LXIX, pp. 253-261. JSTOR

Dunn, Samuel

1762: "Some Observations of the Planet *Venus*, on the Disk of the Sun, *June 6*th, 1761; with a preceding Account of the Method taken for verifying the Time of that Phænomenon; and certain Reasons for an Atmosphere about *Venus* […] Read Nov. 5, 1761", *Phil.Tr.* For the Year 1761, vol LII, part I., pp. 184-195. JSTOR

Dusejour, Dionis

1784: "Nouvelles méthodes analytiques pour résoudre différentes questions astronomiques. Seizième mémoire, Dans lequel on applique à la détermination de la parallaxe du Soleil, les Formules analytiques démontrées dans les Mémoires précédens", *HARS* Année M.DCCLXI., *Mem.*, pp. 297-336. Gallica

Euler, [Johann Albrecht]

1772: "A Deduction of the Quantity of the Sun's Parallax from the Comparison of the several Observations of the late Transit of *Venus*, made in *Europe*, with those made in *George Island* in the *South Seas* […] in a Letter to *Charles Morton* […] Read March 5, 1772", *Phil.Tr.* vol. LXII, pp. 69-76. JSTOR

Ferguson, James

1764: "A Delineation of the Transit of *Venus* expected in the Year *1769* […], Read Feb. 10, 1763", *Phil.Tr.* For the Year 1763, vol. LIII, p. 30. JSTOR

Ferner, Bengt

1762: "An Account of the Observations on the same Transit made in and near Paris: In a Letter from Mr. Benedict Ferner […] to the Rev. Thomas Birch […] Translated from the French. Read Nov. 19, 1761." *Phil.Tr.* For the Year 1761, vol. LII, part I, pp. 221-225. JSTOR

Frantz [Franz], Josephus

1744: "Observationes *Cometæ*, a R.P. *Frantz* Soc. *Jes.* Factæ, mense *Februario* anni *MDCCXLIII. Viennæ Austriæ*. Ex Epistola Rev. *Petri Isaaci Carnabè*, ad *Isaacum Lawson*, M.D. Read April 21, 1743", *Phil.Tr.* For the Years 1742. and 1743., vol. XLII, no. 470, pp. 457-358. JSTOR

Gadolin, Jacob

1769: "Observationer på Veneris Inträde i Solen, d. 3 Jun. 1769, anstälde vid Åbo", *Handl.Stockh.* vol. 31, pp. 173-175. CVH

Gassendi, Pierre

1658: *Petri Gassendi Diniensis Ecclesiæ Præpositi, et in Academia Parisiensi Matheseos Regii Professoris ASTRONOMICA, uidelicet I. Institutio Astronomica cum Oratione Inaugurali. II. Obseruationes Cælestes. III. Mercurius in Sole visus & Venus inuisa. IV. Nouem Stellæ circa Iouem visæ. V. Solstitialis altitudo Massiliensis. TOMVS QVARTVS. cum indicibus necessariis*, Lygduni: Sumptibus Laurentii Anisson & Ioannis Baptistæ Devenet. 536 pp. Gallica

Ghelen, Jacques Antoine noble de

[1770]: *Monsieur! [...] Vienne, le 4. Avril 1771* (printed letter apparently meant to accompany copies of Hell 1770*a*1 & 1770*a*2), [no place: no publisher]. 1 p. Inst. Astr. Wien

Gissler, Nils

1769: "Veneris Inträde på Solen, den 3 Jun. 1769, observeradt i Hernosand", *Handl.Stock.* vol. 31, pp. 225-226. BIBSYS

Göttingische Anzeigen von Gelehrten Sachen unter der Aufsicht der Königl. Gesellschaft der Wissenschaften, Göttingen. Göttinger DigZentrum

Gregory, James

1663: *Optica Promota, Seu Abdita radiorum reflexorum & refractorum Mysteria, Geometrice Enucleata; Cui subnectitur Appendix, Subtilissimorum Astronomiæ Problematωn resolutionem exhibens. Authore Jacobo Gregorio* […], Londini: Excudebat J. Hayes, pro S. Thomson. 134 pp. Gallica

Grischow, A. N.

1761: "Investigatio Parallaxeos Lunae, observationibus aliquot 1752 et in Promontorio bonae spei ex compacto habitis, innixa", *Nov.Comm.* ad Annum MDCCLVI. et MDCCLVII, vol. VI, pp. 412-444. BIBSYS

Halley, Edmund

1717: "Methodus singularis quâ *Solis* Parallaxis sive distantia à *Terra*, ope *Veneris* intra *Solem* conspiciendæ, tuto determinari poterit: proposita coram *Regia Societate*", *Phil.Tr.* For the Years 1714, 1715, 1716, vol. XXIX, Number 348, pp. 454-464. JSTOR

Heinsius, Gottfried

1761: "De Refractionibus in Oris Septentrionalibus", *Nov.Comm.* pro Annis MDCCLVIII. et MDCCLIX., vol. VII, pp. 412-444. BIBSYS

Hell, Maximilianus (Maximilian)

[1760]*a*: *Transitus Veneris per discum Solis Anni 1761. Die Astronom. 5. Junii calculis definitus et methodis observandi illustratus*, Vindobonae: Typis et sumtibus Joannis Thomae Trattner. 20 pp. Les rendez-vous de Vénus CD

1760*b*: *Adjumentum Memoriæ Manuale, seu Tabulæ succinctæ historico-chronologico-genealogicæ*, editio quarta, emendatior et auctior, Ingolstadii: Typis Mariæ Ann. Schleigin, Typogr. Academ. Viduæ. 283 pp. Google Books

[1761]*a*: "Observatio Transitus Veneris ante discum Solis die 5ta Junii 1761. Una cum observationibus satellitum Jovis, in Observatorio Caes. Reg. Publ. Universitatis habitis. Adjectis Observationibus ejusdem Transitus Veneris factis à variis per Europam Viris in observando exercitatis, cum Appendice aliarum nonnullarum Observationum", *Eph.Astr.* Anni 1762, 123 pp. Inst. Astr. Wien

1761*b*: *Elementa Arithmeticæ Numericæ, et Literalis seu Algebræ ad præfixam in scholis nostris normam concinnata*, editio tertia, Vienna: Typis et sumptibus Joannis Thomæ Trattner. 230+51 pp. Google Books

1762: *Anleitung zum Nutzlichen Gebrauch der künstlichen Stahl-Magneten*, Vienna: gedruckt mit von Ghelischen Schriften. [ii]+50 pp. Inst. Astr. Wien

[1763]: "Observationes Astronomicæ anni 1761. & 1762. Viennæ, et aliis locis factæ", *Eph.Astr.* Anni Bissexti 1764, pp. 208-225. Inst. Astr. Wien

[1764]*a*: "De Differentia Meridianorum inter Observatorium Regium Parisinum, & Cæsareo-Regium Universitatis Vindobonensis", *Eph.Astr.* Anni 1765, pp. 228-254. Google Books

[1764]*b*: "Observationes Astronomicæ Anni 1763, et 1764. Viennæ et aliis locis factæ", *Eph.Astr.* Anni 1765, pp. 308-364. Inst. Astr. Wien

[1764]*c*: "Observatio Litteraria", *Eph.Astr.* Anni 1765, pp. 364-368. Inst. Astr. Wien

1765*a*1: *De Satellite Veneris*, Vindobonae: Typis et sumtibus Joannis Thomae Trattner. 91 pp. KUB Nord

1765*a*2: "De Satellite Veneris", *Eph.Astr.* Anni 1766. 91 pp. Inst. Astr. Wien

1767*a*: "Extrait d'une lettre du R. P. Hell Astronome Impérial & Royal à Vienne en Autriche, sur le passage de Vénus observé en 1761.", *JdS*, Aoust 1767, pp. 624-626. Stockh. UB

1767*b*: "Observationes Astronomicæ Anni 1766. Viennæ & aliis locis ab exercitatis Observatoribus factæ", *Eph.Astr.* Anni 1768, pp. 234-281. Inst. Astr. Wien

1768: "De Satellite Veneris: Auctore Maximiliano Hell e S.I. Astronomo Caesareo-Regio Universitatis Vindobonensis", *Nova Acta Eruditorum* Anno MDCCLXVIII., pp. 49-126. Gallica

1770*a*1: *Observatio Transitus Veneris ante discum Solis die 3. Junii Anno 1769. Wardoëhusii, auspiciis potentissimi ac clementissimi Regis Daniæ et Norvegiæ, CHRISTIANI VII. facta, et Societati Regiæ Scientiarum Hafniensi prælecta à R.P. Maximiliano Hell, è S.J. Astronomo Cæsareo-Regio Universitatis Vindobonensis, Societatis Regiæ Scientiarum Hafniensis, et Nidrosiensis Membro, atque Academiæ Regiæ Scientiarum Parisinæ Membro Correspondente*, Hafniæ: Typis Orphanotrophii Regii, excudit Gerhard Giese Salicath. vii+82 pp. KUB NORD

1770*a*2: "Observatio Transitus Veneris ante discum Solis die 3. Iunii Anno 1769. Wardoëhusii, Auspiciis Potentissimi ac Clementissimi Regis Daniae et Norvegiae, Christiani VII. facta, et Societati Regiae Scientiarum Hafniensi praelecta, a R.P. MAXIMILIANO HELL, e S.I. Astronomo Caesareo-Regio Universitatis Vindobonensis, Societatis regiae Scientiarum Hafniensis, et Nidrosiensis Membro, atque Academiae regiae Scientiarum Parisinae Membro correspondente", *Nova Acta Eruditorum* Anno MDCCLXX., pp. 1-102. Gallica

1770*a*3: "Observation over Veneris Gang forbi Soelens Skive den 3 Junii 1769. anstillet i Wardøhuus efter den Stormægtigste og Allernaadigste Konge til Dannemark og Norge &c. &c. Kong Christian den Syvendes Befalning, og forelæst det Kongelige Videnskabernes Selskab i Kiøbenhavn den 24 November 1769. af Maximilian Hell. Oversat af det Latinske i det Danske Sprog af Henrich Hövinghoff", *Skrifter Kiøb.* i Aarene 1765. 1766. 1767. 1768. og 1769., vol. 10, 1770, pp. 537-618. BIBSYS

1770*a*4: "Observatio Transitus Veneris ante discum Solis die 3 Junii Anno 1769. Wardoëhusii facta, et Societati Reg. Scientiarum Hafniensi die 24 Novembris 1769. prælecta. Exemplari Hafniæ typis dato conformis", *Eph.Astr.* Anni 1771, 96 pp. Inst. Astr. Wien

1770*b*: “Nogle Steders Geographiske Breder i Finmarken, Nordlandene, Norge og Sverrige bestemmede ved astronomiske Observationer [...] og overgivet det Kongelige Videnskabernes Selskab i Kiøbenhavn den 18 May 1770. af det Latinske Sprog oversat paa Dansk af Henrich Hövinghoff”, *Skrifter Kiøb.* i Aarene 1765. 1766. 1767. 1768. og 1769., vol. 10, 1770, pp. 619-652. BIBSYS

1770*c*: “Expeditio litteraria ad Polum arcticum, in tres divisa Tomos, quorum primus Historicus, secundus Physicus, tertius Mathematicus et Astronomicus”, *Nova Acta Eruditorum* Anno MDCCLXX., pp. 427-432. Gallica

[1771]*a*1: *Expeditio litteraria ad Polum arcticum in tres divisa tomos, quorum primus Historicus, secundus Physicus, tertius Mathematicus, & Astronomicus* (call for subscriptions, in Latin), [no place: no publisher]. 4 pp. Inst. Astr. Wien

1771*a*2: *Nachricht [...] Wien den 2. März 1771* (call for subscriptions, in German), [no place: no publisher]. 4 pp. Inst. Astr. Wien

1771*a*3: “*Expeditio Litteraria ad polum arcticum in tres divisa tomos; quorum primus historicus, secundus Physicus, tertius Mathematicus & Astronomicus [...]* (summary of call for subscriptions, in French)” *Journal des Sçavans,* Juillet 1771, pp. 499-500. Gallica

1772: “De parallaxi Solis ex observationibus Transitus Veneris Anni 1769.”, *Eph.Astr.* Anni 1773, 116 pp. Inst. Astr. Wien

1773: “Supplementum dissertationis de Parallaxi Solis”, *Eph.Astr.* Anni 1774, 162 pp. Inst. Astr. Wien

1774*a*: “Methodus astronomica Sine usu Quadrantis, vel Sectoris, aut alterius cujusvis instrumenti, in gradus Circuli divisi, item sine notitia refractionis, ope solius tubi instructi micrometro filari, singula secunda indicante, et in apto ad hunc usum fulcro mobili applicati, elevationem Poli cujusvis loci, in continente siti, accuratissimam definire”, *Eph.Astr.* Anni 1775, pp. 3-41. Inst. Astr. Wien

1774*b*: *Adjumentum Memoriae Manuale chronologico-genealogico-historicum a P. Maximiliano Hell, S. J. anno 1750. concinnatum nunc ad annum 1773. continuatum, et novis ab eodem auctore capitibus auctum*, editio quinta, Viennae: Ex officina a Gheleniana. 360 pp. Google Books

1776*a*: “Observationes Astronomicæ Latitudinum Geographicarum, sive Elevationum Poli, Locorum quorumdam Ungariæ, factæ 1776.” *Eph.Astr.* Anni 1777, pp. 273-289. UBTØ

1776*b*: “Aurorae Borealis Theoria Nova … Anno 1770. Mense Martio Illustrissimae Academiae Regiae Scientiarum Hafniensi Praelecta Pars I.”, *Eph.Astr.* Anni 1777, Appendix. 119 pp. UBTØ

1779: “Der Zucker, ein neues Präservativmittel wider den Scorbut (Scharbock)”, in Anonymous (ed.), pp. [5]-12.

1790: “Observationes Astronomicae Latitudinum, & Longitudinum Locorum Borealium Daniae, Sueciae, Norwegiae, & Finnmarchiae Lapponicae per iter arcticum Annis 1768, 1769, & 1770 factae”, *Eph.Astr.* Anni 1791, pp. 300-386. Inst. Astr. Wien

1792: “Observationes Meteorologicae factae Wardoehusii Annis 1768, & 1769”, *Eph.Astr.* Anni 1793, pp. 352-393. Inst. Astr. Wien

1793: “Beobachtung des Durchganges der Venus durch die Sonnenscheibe den 3 Junius 1769. zu Wardoehus angestellet und in der Sitzung der königl. Gesellschaft der Wissenschaften zu Kopenhagen vorgelesen den 24 November 1769”, in L.A. Jungnitz (translator), *Beyträge zur Praktischen Astronomie, in verschiedenen Beobachtungen, Abhandlungen, Methoden aus den astronomischen Ephemeriden der Herrn Abbe’ Maximilian Hell … Aus dem Lateinischen* *übersetzt*, Dritter Band, pp. 171-306, Breslau / Hirschberg: bey Johann Friedrich Korn, dem Aeltern. http://www.univie.ac.at/hwastro/

Hell, Maximilianus & Ignatius Weinhart

1768: *Elogium Rustici Tyrolensis Celeberrimi Petri Anich Oberperfussensis Coloni, Tornatoris, Chalcographi, Mechanicarum Artium Magistri, Geodetæ, Geographi, et Astrophili ad Prodigium Excellentis* […], revised edition, Oeniponti: typis Jo. Thom. nob. de Trattnern. 38 pp. Digitised by Bayerische Staatsbibliothek

Hellant, Anders

1761: "Venus i Solen, Observerad i Torne Den 6 Junii 1761.", *Handl.Stockh.* vol. 23, pp. 180-184. CVH

1764: "Venus in der Sonne, zu Torne, den 6ten Junii 1761.", *Schwed.Abh.* vol. 23, pp. 179-183. Göttinger DigZentrum

Hevelius, Johannes

1662: *MERCURIUS In Sole visus Gedani, Anno Christiano M DC LXI, d. III Maji, St. n. Cum aliis quibusdam rerum Cœlestium observationibus, rarisq; phænomenis. Cui annexa est, VENUS In Sole pariter visa, Anno 1639, d. 24 Nov. St. V. Liverpoliæ, a Jeremia Horroxio: nunc primum edita, notisque illustrata. Quibus accedit succincta HISTORIOLA, Novæ illius, ac miræ Stellæ in collo Ceti, certis anni temporibus clarè admodùm affulgentis, rursùs omninò evanescentis. Nec non GENUINA DELINEATIO, Paraselenarum, & Pareliorum quorundam rarissimorum*, Gedani: Autoris Typis, et Sumptibus, imprimebat Simon Reiniger. Pp. 111-181. Inst. Astr. Wien

Horanyi, Alexius

1776: *Memoria Hvngarorvm et provincialivm scriptis editis notorum, qvam excitat Alexius Horányi, Hung. Budendsis, de CC. RR. scholarum piarvm, Pars II*, Viennae, Impensis Antonii Loewii. Bibliopolæ Posoniensis. Digitised copies of selected pages provided by Módly Zoltán

Hornsby, Thomas

1764: "A Discourse on the Parallax of the *Sun* […]. Read Dec. 23, 1763.", *Phil.Tr.* For the Year 1763, vol. LIII, pp. 467-495. JSTOR

1766: "On the Transit of *Venus* in *1769*. […] Read Feb. 13, 1766.", *Phil.Tr.* For the Year 1765, vol. LV, pp. 326-344. JSTOR

1767: "Von dem Durchgange der Venus durch die Sonne, im Jahr 1769. von Thomas Hornsby (Philosophis. Transactionen 55. V. No XXXIV.)", *Neues Hamburg-isches Magazin, oder Fortsetzung gesammleter Schriften, aus der Natur-forschung, der allgemeinen Stadt- und Land-Oekonomie, und den angenehmen Wissenschaften überhaupt*, Dreyzehntes Stück, vol. 3, pp. 291-314. EZB

1772: "The Quantity of the Sun's Parallax, as deduced from the Observations of the Transit of *Venus*, on *June 3, 1769* […] Read Dec. 19, 1771.", *Phil.Tr.* For the Year 1771, vol LXI, part I, pp. 574-579. JSTOR

Horrebow, Christian

1761*a*: *Dissertatio de semita, qvam in Sole descripsit Venus per eundem transeundo Die 6 Junii Ao. 1761, cujus particulam priorem … pro supremis in philosophia honoribus obtinendis defendent clarissimi et doctissimi laureæ supremæ philosophicæ candidati in aud. Sup. Die 28 Julii anno 1761*, Hafniæ: Typis Directoris S. R. M. & Universitatis Typogr. Nicolai Christiani Höpffneri. 24 pp. KUB Nord

1761*b*: *Dissertatio de semita, qvam in Sole descripsit Venus per eundem transeundo Die 6 Junii Ao. 1761, cujus particulam posteriorem … pro primis in philosophia honoribus obtinendis defendent præstantissimi et lectissimi laureæ primæ* *philosophicæ candidati in aud. sup. die 29 Julii anno 1761*, Hafniæ: Typis Directoris S. R. M. & Universitatis Typogr. Nicolai Christiani Höpffneri. 23 pp. KUB Nord

1765*a*: "Tidens Bestemmelse i Henseende til de Observationer, som skeede i Solen og Venere, da Venus Anno 1761. den 6te Junii passerede igiennem Solen", *Skrifter Kiøb.* i Aarene 1760. 1761. 1762. 1763. og 1764., vol. 9, pp. 373-388. UBTØ

1765*b*: "Reflexioner, anlangende Veneris Drabant", *Skrifter Kiøb.* i Aarene 1760. 1761. 1762. 1763. og 1764., vol. 9, pp. 396-399. UBTØ

1765*c*: "Videre Fortsættelse af Observationerne giorte paa Veneris Drabant", *Skrifter Kiøb.* i Aarene 1760. 1761. 1762. 1763. og 1764., vol. 9, pp. 400-406. UBTØ

Horrebow, Peder (the Younger)

1761: *Dissertatio de transitu Veneris per discum Solis, quam publico opponentium examini sumittet Mag. Petrus Horrebow [...], defendente [...] Olao Andreæ Borrebye [...] in auditorio superiori. Ad Diem 4. Jun. 1761*, Hafniæ: Typis Directoris S. Reg. Majestatis & Universitatis Typogr. Nicolai Christiani Höpffneri. 35 pp. KUB Nord

Islen'ev, Ivan (Islenief)

1769: *Nabliudeniia po sluchaiu prokhozhdeniia venery po solntsu v Iakucke uchinennyia*, St. Petersburg: Imperatorskaia akademiia nauk. 43 pp. National Library, St. Petersburg

[1770]: *Extrait du journal d'observations faites à l'occasion du passage de Venus devant le disque du soleil a Yakoutsk*, St. Petersbourg: l'Imprimerie de l'Academie Impériale des Sciences. 19 pp. KUB Nord

Jenaische Zeitungen von Gelehrten Sachen, Jena. ThULB

Journal encyclopédique, Paris. Copy provided by Alexander Moutchnik

Kepler, Johannes (Joannes Kepplerus)

1630: *Admonitio ad Astronomos, rerumqve coelestium studiosos, De raris mirisq; Anni 1631. Phænomenis, Veneris puta et Mercurii in Solem incursu: Excerpta Ex Ephemeride Anni 1631. & certo Authoris consilio huic præmissa, iterumq; edita à Jacobo Bartschio [...]*, Francofurti: Apud Godefridum Tampachium. 14 pp. KUB NORD

Kirsch, Adam Friedrich

1774: *Abundantissimum Cornu Copiae Linguae Latinae Et Germanicae Selectum : Quo Continentur Vocabula Latina omnis aevi, antiqui, medii ac novi, pariter ac Graeca Latinitate donata, nec non formulae dicendi elegantiores et Constructiones Verborum; praeterea Deorum, Dearum, Gentium, Regnorum, Regionum, Urbium, Marium, Fluviorum, Insularum, Montium, Animalium, Arborum, Herbarum, Florum et Mineralium Nomina; nec non Theologorum, Iure Consultorum, Medicorum, Philosophorum, Philologorum, Poetarum, ac Mythicorum, Artibus liberalibus, aliisque disciplinis, Rei quoque Militari ac Monetariae verba propria, eorumque Significationes et Explicationes, Syllabarum longitudine vel brevitate signis expressa [...], Appendix Regionum, Urbium, Montium Et Fluviorum [...]*, Editio Novissima, A mendis non paucis studiose repurgata, Parte utraque aucta, in ordinem redacta [...], Lipsiae : Sumtu Engelharti Beniaminis Svikertii. http://www.uni-mannheim.de/mateo/camenaref/kirsch.html

Kiøbenhavns Kongelig allene privilegerede Adresse-Contoirs Med Posten forsendende Efterretninger, Copenhagen. Various libraries and archives in Denmark and Norway

K[ongelig] allene privileg[erede] Tronhiems Adresse-Cont[oirs] Efterretning, Trondheim. http://www.nb.no/avis/adresseavisen

Kratzenstein, Christian Gottlieb

1765: "Afhandling Om Veneris Gang igiennem Solen Aar 1761. med En Beskrivelse af nye og bequæmme Maader at betragte samme", *Skrifter Kiøb.* i Aarene 1760. 1761. 1762. 1763. og 1764., vol. 9. pp. 520-540. UBTØ

Krünitz, J. G.

1769: "Verzeichniß der vornehmsten Schriften von der Venus und dem Merkur, und dem Durchgange dieser Planeten durch die Sonnenscheibe", *Neues Hamburgisches Magazin, oder Fortsetzung gesammleter Schriften, aus der Naturforschung, der allgemeinen Stadt- und Land-Oekonomie, und den angenehmen Wissenschaften überhaupt*, Ein und dreyzigstes Stück, Band 6., pp. 114-156. EZB

Lagrange, Joseph Louis Comte de (la Grange)

1768: "Mémoire sur le passage de Vénus du 3 Juin 1769", *Histoire de l'Académie Royale des Sciences et des Belles-Lettres de Berlin* Année MDCCLXVI., pp. 265-301. Akad.Berlin

Lalande, Joseph Jérôme Lefrançais de [Hieronymus De la Lande]

1762: "Observationes *Veneris* sub *Sole* visæ, habitæ *Parisiis*, die *6[a] Junii 1761*, in palatio *Luxemburgi*, quas Regiæ Societati *Londinensi*, venerationis suæ obsequium, offert *Hieronymus De la Lande*, Acad. Reg. Scient. *Parisinæ* Socius, Regiusque Matheseos Professor. Read Nov. 19, 1761.", *Phil.Tr.* Vol. LII. Part I. For the Year 1761., pp. 216-220. JSTOR

1763: "Remarques sur les Observations du Passage de Vénus, Faites à Copenhague & à Drontheim en Norwège, par ordre du Roi de Dannemarck", *HARS* Année M.DCCLXI., *Mém.*, pp. 113-114. Gallica

[1764*a*:] *Figure du Passage de Venus sur le Disque du Soleil qu'on Observera le 3. juin 1769. Sur laquelle on voit les momens de l'Entrée et de la Sortie de Venus pour tous les Païs de la Terre réduits au Méridien de Paris. Avec l'effet des Parallaxes, et le choix des Païs de la Terre ou ce Passage devra être observé pour en conclure la Distance du Soleil et de toutes les Planettes a la Terre*, Paris: chés Lattré, (map). Gallica

1764*b*: *Explication de la Figure du Passage de Venus sur le Disque du Soleil, Qui s'observera le 3 Juin 1769; Avec les Résultats du Passage observé en 1761*, Paris: de l'Imprimerie de Jean-Thomas Herissant. 26 pp. Les rendez-vous de Vénus CD

1764*c*: "Livre Onzième: Des Passages de Vénus et de Mercure sur le Soleil", in *Astronomie*, 1st edition, Paris: chez Desaint & Saillant, pp. 753-804. Les rendez-vous de Vénus CD

1769*a*: "Lettre sur le passage de Vénus; adressée à Messieurs les Auteurs du Journal des Sçavans", *JdS*, Septembre 1769, pp. 644-645. Gallica

1771: "Lettre sur le passage de Vénus; adressée à Messieurs les Auteurs du Journal des Sçavans", *JdS*, Décembre 1769, pp. 825-826. Gallica

1772: "Mémoire sur le Passage de Vénus devant le disque du Soleil, observé le 3 Juin 1769, pour servir de suite à l'explication de la Carte publiée en 1764 [Paris: chez Lattré. 44 pp.]", resumé in *JdS*, Septembre 1772, pp. 613-623. Gallica

1773: "Lettre sur les calculs de M. Lexell et du P. Hell, adressé à Messieurs les Auteurs du Journal des Sçavans", *JdS*, Février 1773, pp. 90-93. Gallica

1774: "Mémoire sur la parallaxe du soleil, Déduite des Observations faites dans la mer du Sud, dans le royaume d'Astracan, & à la Chine", *HARS* Année M.DCCLXXI., *Mém.*, pp. 776-799.

1792: *Astronomie*, 3rd edition, Paris: chez la Veuve Desaint, de l'imprimerie de P. Didot l'Aîné. 3 vols.: I: lxvi+478 pp., II: 727 pp., III: 737 pp. Mus.Hist.Sc., Oxf.

Lambert, Johann Heinrich
1775: "Essai d'une théorie du Satellite de Vénus", *Nouveaux Mémoires de l'Académie Royale des Sciences et Belles-Lettres* (Berlin) Année MDCCLXXIII., pp. 222-250. Akad.Berlin
1782: *Joh. Heinrich Lamberts […] deutscher gelehrter Briefwechsel*, herausgegeben von Joh. Bernoulli […], Zweyter Band. Berlin: bey dem Herausgeber / Dessau: in der Buchhandlung der Gelehrten. xliv+513 pp. Google Books

Lexell, Anders Johan (Andreas Iohannes)
1770: "Determinatio accuratior verae Parallaxis Solis et reliquorum elementorum", in Anonymous (ed.), pp. 533-574. Les rendez-vous de Vénus CD
1771*a*: "Uträkning, öfver Solens Parallaxis, i anledning af Observationer, som blifvit gjorde öfver Veneris gång genom Solen, År 1769.", *Handl.Stockh.* vol. 33, pp. 220-234. CVH
1771*b*: "Uträkning Öfver Solens Parallax, i anledning af de uppå King Georg Eyland gjorde Observationer öfver Veneris gång genom Solen, år 1769", *Handl.Stockh.* vol. 33, pp. 301-310. CVH
1772: Disqvisitio de investiganda vera qvantitate Parallaxeos Solis, ex Transitu Veneris ante discum Solis Anno 1769. cui accedunt animadversiones in tractatum Rev. Pat. Hell de Parallaxi Solis, Petropolis: Typis Academiae Imperialis Scientiarum. 131 pp. KUB Nord

Luca, Ignaz de
1776: *Das gelehrte Österreich. Ein Versuch*, Des ersten Bandes erstes Stück, Vienna: von Ghelen. 373 pp. Google Books

Maire, Christophorus & Rogerius Josephus Boscovich
1755: *De Litteraria Expeditione per Pontificiam Ditionem ad dimetiendos duos meridiani gradus et corrigendam mappam geographicam jussu, et auspiciis Benedicti XIV. Pont. Max. suscepta a Patribus Societ. Jesu Christophoro Maire et Rogerio Josepho Boscovich.*, Rome: In Typographio Palladis. xxi+516 pp. Google Books
1770: *Voyage Astronomique et Géographique, dans l'Etat de l'Eglise, entrepris par l'ordre et sous les auspices du Pape Benoit XIV, Pour mesurer deux dégrés du méridien, & corriger la Carte de l'Etat ecclésiastique, Par les PP. Maire & Boscovich de la Compagnie de Jesus, Traduit du Latin, Augmenté de Notes & d'extraits de nouvelles mesures de dégrés faites en Italie, en Allemagne, en Hongrie & en Amérique. Avec une nouvelle Carte des Etats du Pape levée géométriquement.*, Paris: Chez N. M. Tilliard. xvi+526 pp. Google Books

Mallet, Fredric
1769: "Berättelse Om det som kunnat observeras uti Pello, vid Veneris gång förbi Solen, den 3 och 4 Junii 1769", *Handl.Stockh.* vol. 31, pp. 218-223. CVH

Martin, Benjamin
1761: *Venus in the Sun: being an Explanation of the Rationale of that great Phænomenon; of the Several Methods used by Astronomers for Computing the Quantity and Phases thereof; And of the Manner of applying a Transit of Venus over the Solar Disk, For the Discovery of the Parallax of the Sun, settling the Theory of that Planet's Motion, and Ascertaining the Dimensions of the Solar System*, London: W. Owen. xi + 48 pp. Mus.Hist.Sc., Oxf.

Maskelyne, Nevil
1762: "An Account of the Observations made on the Transit of *Venus, June 6, 1761*, in the Island of *St. Helena*: In a Letter to […] *George* Earl of *Macclesfield*, President of the Royal Society, from the Rev. *Nevil Maskelyne* […]. Read Nov. 5, 1761" *Phil.Tr.* Vol II. Part I. For the Year 1761., pp.196-201. JSTOR
1768: *Instructions Relative to the Observation of the Ensuing Transit of Venus over the Sun's Disk, on the 3rd of June 1769*, London: Printed by W. Richardson and S. Clark. 48 pp. Mus.Hist.Sc., Oxf.
Mayer, Andreas
1762: *Observationes Veneris Gryphiswaldenses qvibus adiecta est M. Lamb. Henr. Röhlii [...] Observationis suae de Transitu Veneris per Solem Expositio*, Gryphiswaldae: Imprimebat A. F. Röse. 26+[ii]+12 pp. Stockh. UB
Mayer, Christianus
1769*a*: "Expositio utriusque observationis et Veneris et Eclipsis Solaris factae Petropoli in Specula Astronomica", *Nov.Comm.* pro Anno MDCCLXVIII., vol. XIII., pp. 541-560. BIBSYS
1769*b*: *Ad Augustissimam Russiarum omnium Catharinam II. Alexiewnam Imperatricem Expositio de transitu Veneris ante discum Solis d. 23 Maii, 1769, iussu illustrissimi et excellentissimi Domini D. Comitis Wolodimeri ab Orlow, illustr. Academiae Scientiarum Directoris suscepta, ubi Agitur de fine huius obseruationis, 1) cognoscendi veram parallaxin horizontalem solis, 2) determinandi veram distantiam solis a tellure, 3) ceterorumque planetarum et cometarum ordinem et distantiam, 4) deque commodis inde natis pro Geographia, Re nautica, Physica, etc., adductis vbique obseruationibus, earumque calculis ac methodis, ipsaque parallaxi hinc deducta*, Petropoli: Typis Academiae Scientiarum. 354 pp. UBO
Melander, Daniel
1769: "Uttydning på de Phænomener, hvilka åtfölja Planeten Veneris Passage genom Solen", *Handl.Stockh.* vol 31, pp. 161-173. CVH
Nordische Miscellaneen, Riga. EZB
Nordske Jntelligenz-Sedler, Christiania. http://www.nb.no/avis/intelligenssedler/
Pilgram, Anton
1788: *Untersuchungen über das Wahrscheinliche der Wetterkunde. Durch Vieljährige Beobachtungen*, Vienna: bey Joseph Edlen von Kurzbeck. [ix]+608 pp. Digitised by the Bayerische Staatsbibliothek
Pingré, Alexandre Guy
1763: "Observations Astronomiques pour la détermination de la parallaxe du soleil, Faites en l'Isle Rodrigue", *HARS* Année M.DCCLXI., *Mem.*, pp. 413-486. Gallica
1767: *Mémoire sur le choix et l'état des lieux Où le passage de Vénus du 3. Juin 1769 pourra être observé avec le plus d'avantage; et principalement sur la position géographique des isles de la mer du Sud […] Lu à l'Académie des Sciences, le 23 Décembre 1766 & en Janvier & Février 1767 […]*, Paris: Chez P. G. Cavelier. 91 pp. Les rendez-vous de Vénus CD
1768: "Nouvelle Recherche Sur la détermination de la Parallaxe du Soleil par le Passage de Vénus du 6 Juin 1761.", *HARS* Année M.DCCLXV., *Mem.*, pp. 1-34. Gallica
1769: "Recherches sur la longitude de plusieurs villes, Accompagnées de quelques Réflexions sur les nouvelles déterminations de la parallaxe horizontale du Soleil", *HARS* Année M.DCCLXIX., *Mem.*, pp. 17-69. Gallica

1775: “Mémoire sur la parallaxe du Soleil, Déduite des meilleurs Observations de la durée du passage de Vénus sur son disque le 3 Juin 1769.” *HARS* Année M.DCCLXXII. Première Partie, *Mem.*, pp. 398-420. Gallica

Planman, Anders (Andreas, Andrew Planmann)

[1763*a*]: *Dissertatio de Venere in Sole visa die 6 Junii anni 1761, quam Venia Ampliss. Philos. in Reg. Acad. Aboënsi publice examinandam sistunt auctor Andreas Planman [...] et respondens Johannes Carström [...] die XXIII. Februarii Anno MDCCLXIII.*, Aboæ: Impressit Joh. Christoph. Frenckell. 26 pp. Stockh. UB

1763*b*: “Solens Parallaxis Uträknad”, *Handl.Stockh.* vol. 25, pp. 118-134. CVH

[1764*a*]: *Observationes in calculum Dni De La Lande, Hujus anni Ephemer. Gallic. p. 206 contentum, quas Suffrag. Ampl. Fac. Phil. in Reg. ad Auram Academia, præside Mag. Andrea Planman, [...] Publice ventilandas sistit Isaac Utter [...] in Audit. Maj. die V. Junii, MDCCLXIV.*, Aboæ: Joh. Christoph. Frenckell. 16 pp. Stockh. UB

1764*b*: “Ytterligare uträkningar på *Solens Parallaxis*, i anledning af Observationerna på Veneris gång genom Solen, d. 6 Junii 1761”, *Handl.Stockh.* vol. 26, pp. 139-142. CVH

[1766]:*Investigatio Parallaxeos Solis ex observationibus novissimi transitus Veneris per discum Solarem, Pekini & alibi peractis, quam, Consensu Ampliss. Fac. Philos. in Reg. Acad. Aboënsi, præside Mag. Andrea Planman, [...] Ventilandum sistit Abrahamus Fabricius [...] In Audit. Maj. d. XXI. Junii Anni MDCCLXVI.*, Aboæ: Joh. Christoph. Frenckell. 12 pp. Stockh. UB

1769*a*: “A Determination of the Solar Parallax attempted, by a peculiar Method, from the Observations of the last Transit of Venus: By *Andrew Planman* […]; together with a Letter from him to Mr. *James Short* […] Read March 24, 1768.”, *Phil.Tr.* For the Year 1768, vol. LVIII, pp. 107-127. JSTOR

1769*b*: “Venus i Solen, den 3 Junii 1769, Observerad i Cajaneborg”, *Handl.Stockh.* vol. 31, pp. 214-218. CVH

[1770]:*Expositio observationum Transitus Veneris per Solem, Cajaneburgi A:o 1769, D. 3 Junii factarum, quam Cons. Ampliss. Fac. Philos. in Reg. Acad. Aboënsi, præside Mag. Andrea Planman [...] Publice ventilandum sistit Carolus Gebhard. Widqvist [...] In Audit. Maj. Die 26. Maji An. MDCCLXX.*, Aboæ: Impressit Joh. Christopher. Frenckell. 10 pp. Stockh. UB

1771*a*: “Formuler, At Uträkna Parallaxens verkan för observerade in- och utgångs momenter, vid en Planets gång under Solen”, *Handl.Stockh.* vol. 33, pp. 66-74. CVH

[1771*b*]: *Dissertatio, demonstrationem Formularum, quæ in Actis Stockholmiensibus hujus anni pag. 67 et seqq. comparent, exhibens, quam Consens. Ampliss. Facult. Philosoph. In Reg. Acad. Aboënsi, præside Mag. Andrea Planman [...] Publice ventilandam sistit Gustavus Nicol. Idman [...] In auditorio majori Die VII Decembris, Anni MDCCLXXI.*, Aboæ: Impressit Johannes Christophorus Frenckell. 22 pp. Stockh. UB

1772*a*: “Om Solens Parallaxis, i anledning af Observationer öfver Venus i Solen, år 1769”, *Handl.Stockh.* vol. 34, pp. 183-191. CVH

[1772*b*]: *Animadversiones subitaneæ in Appendicem Hellianam ad Ephemerides Anni MDCCLXXIII, de Parallaxi Solis, quas Consensu Ampliss. Facult. Philosoph. in Reg. Acad. Aboënsi, præside Mag. Andrea Planman [...] Publice defendet Johannes Kreander [...] In auditorio majori Die XXVIII. Novembris An. MDCCLXXII.*, Aboæ: Typis Johannis Christophori Frenckell. 12 pp. Stockh. UB

1772*c*: “Anmärkningar Vid Afhandlingen om Solens Parallaxis, som anföres uti detta års Handlingar, p. 183 seq.”, *Handl.Stockh.* vol. 34, pp. 358-361. CVH

1774: "Förklaring På de Formler, at uträkna Parallaxens verkan, för observerade in- och utgångs-momenter vid en Planets gång under Solen, som anfördes uit Handlingarne för år 1771", *Handl.Stockh.* vol. 36, pp. 306-319. CVH

Poda, Nicolaus

1771: *Kurzgefaßte Beschreibung der, bey dem Bergbau zu Schemnitz in Nieder-Hungarn, errichteten Maschinen, nebst XXII. Tafeln zu derselben Berechnung; zum Gebrauch der, bey der Schemnitzer Bergschule, errichteten mechanischer Vorlesungen, verfasset von Nicolaus Poda [...] herausgegen von Ignata Edlen von Born [...] Mit 35 Vignetten*, Prag: in der Waltherischen Buchhandlung. xix + 84 pp. Digitised by Dresdner Digitalisierungszentrum

Pontoppidan, Erich

1753-54: *Versuch einer natürlichen Historie von Norwegen, worinnen die Luft, Grund und Boden, Gewässer, Gewächse, Metalle, Mineralien, Steinarten, Thiere, Vögel, Fische und endlich das Naturel, wie auch die Gewohnheiten und Lebensarten der Einwohner dieses Königreichs beschrieben werden*, aus dem Dänischen übersetzt von Johann Adolph Scheiben, two vols., Kopenhagen: Franz Christian Mumme. I: 367 pp. II: 536 pp. UBTØ

Prosperin, Eric

1769: "Utdrag af Observationerna på Veneris Inträde i Solen, d. 3 Jun. 1769, som blifvit gjorda på Observatorium i Upsala", *Handl.Stockh.* vol. 31, pp. 158-161. CVH

Röhl, Lambert Heinrich

1762: "Observatio Astronomica Transitus Veneris sub Disco Solis Gryphiæ anno 1761. d. 5 Jun. habita", 12 pp., in Andreas Mayer 1762.

1768: *Merkwürdigkeiten von den Durchgängen der Venus durch die Sonne*, Greifswald: gedruck und verlegt von A. F. Röse. [ix]+164 pp. Stockh. UB

Rumovskii, Stepan (Stephanus Rumovsky)

1767*a*: "Brevis expositio observationum occasione transitus Veneris per Solem in urbe Selenginsk an. 1761. institutarum", *Nov.Comm.* pro Anno MDCCLXV, vol. XI, pp. 443-486. BIBSYS

1767*b*: "Investigatio parallaxeos Solis ex observatione transitus Veneris per discum solis Selenginski habita, collata cum observationibus alibi institutis", *Nov.Comm.* pro Anno MDCCLXV, vol. XI, pp. 487-538. BIBSYS

1768: "Animadversiones in supplementum Cel. *Pingre* ad dissertationem eius de Parallaxi Solis", *Nov.Comm.* pro Annis MDCCLXVI et MDCCLXVII, vol. XII, pp. 575-586. BIBSYS

1771: *Nabliudeniia iavleniia venery v solntse v rossiiskoi imperii v 1769 godu uchinennyia s istoricheskim preduvedomleniem*, St. Petersburg: Imperatorskaia akademiia nauk, 165 pp. National Library, St. Petersburg

Rødkier, Peder

1765: "Beretning om een den 3 og 4 Martii 1764. giort Jagttagelse, angaaende Veneris Drabant", *Skrifter Kiøb.* i Aarene 1760. 1761. 1762. 1763. og 1764., vol. 9, pp. 394-395. UBTØ

Sajnovics, Johannes (Joannes Sainovics)

[1770]*a*1: *Demonstratio. Idioma Ungarorum et Lapponum idem esse. Regiae Scientiarum Societati Danicae praelecta Hafniae mense Januario Anno MDCCLXX*, Hafniae: Typis Orphanotrophii Regii, excudit Gerhard Giese Salicath. 83 pp. UBO

1770*a*2: "Beviis, at Ungarernes og Lappernes Sprog er det samme. Oversat af det Latinske ved M. R. Fleischer", *Skrifter Kiøb.* i Aarene 1765. 1766. 1767. 1768. og 1769., vol. 10, 1770, pp. 653-732. BIBSYS

[1771]: *Demonstratio. Idioma Ungarorum et Lapponum idem esse. Regiae Scientiarum Societati Danicae praelecta, et Typis excusa Hafniae Anno MDCCLXX. Recusa*, Tyrnaviae: Typis Collegii Academici Societatis Jesu. 132 pp. UBTØ

Schenmark, Nils

1769: "Observationer på Veneris Immersion i Solen, d. 3 Junii, samt på Sol-Förmörkelsen d. 4 Jun. detta år, gjorda i Lund", *Handl.Stockh.* vol. 31, pp. 223-225. CVH

Schefferus, Joannes

1673: *LAPPONIA Id est, regionis lapponum et gentis nova et verissima descriptio. In qua multa De origine, superstitione, sacris magicis, victu, cultu, negotiis Lapponum, item Animalium, metallorumque indole, quæ in terris eorum proveniunt, hactenus incognita Produntur, & eiconibus adjectis cum cura illustrantur*, Francofurti: Ex Officina Christiani Wolffii, Typis Joannis Andreæ. 378 pp. UBTØ

Scherffer, Carolus

1752: *Institutionum Physicæ Pars Prima, seu Physica Generalis, conscripta in usum suorum D.D. auditorum*, [Viennae]: Typis Joannis Thomæ Trattner. 491 pp. ECHO

1753: *Institutionum Physicæ Pars Secunda, seu Physica Particularis, conscripta in usum suorum D.D. auditorum*, [Viennae]: Typis Joannis Thomæ Trattner. 557 pp. ECHO

1777: *Institutiones Astronomiæ Theoreticæ, conscriptæ in usum tironum*, Vindobonæ: Typis Ioannis Thomæ nob. de Trattnern. 394 pp. ECHO

[Scherffer, Karl et al.]

1775: *Beyträge zu verschiedenen Wissenschaften von einigen Oesterreichischen Gelehrten*, Wien: verlegts Augustin Bernardi. 448 pp. Google Books

Schlichtegroll, Friedrich (ed.)

1793: "Den 14. April. Maximilian Hell", in *Nekrolog auf das Jahr 1792. Enthaltend Nachrichten von dem Leben merkwürdiger in diesem Jahre verstorbener Personen*, Dritter Jahrgang, Erster Band, Gotha: bey Justus Perthes, pp. 282-303. Photocopy provided by Alexander Moutchnik

Schlözer, August Ludwig

1771: *Allgemeine Nordische Geschichte. Aus den neuesten und besten Nordischen Schriftstellern und nach eigenen Untersuchungen beschrieben, und als eine Geographische und Historische Einleitung zur richtigern Kenntniß aller Skandinavischen, Finnischen, Slavischen, Lettischen, und Sibirischen Völker, besonders in alten und mittleren Zeiten*, Halle: bey Johann Justinus Sebauer. 8+636 pp. UBTØ

Short, James

1763: "The Observations of the internal Contact of *Venus* with the *Sun's* Limb, in the late Transit, made in different Places of *Europe*, compared with the Time of the same Contact observed at the *Cape of Good Hope*, and the Parallax of the *Sun* from thence determined […]. Read Dec. 9, 1762", *Phil.Tr.* For the Year 1762, vol. LII, part II, pp. 611-628. JSTOR

1764: "Second Paper concerning the Parallax of the *Sun* determined from the Observations of the late Transit of *Venus*, in which this Subject is treated of more at length, and the Quantity of the Parallax more fully ascertained […]. Read Dec. 8, 1763", *Phil.Tr.* For the Year 1763, vol. LIII, pp. 300-345. JSTOR

Trebuchet, Claude-Étienne

1766: "Lettre à Messieurs les auteurs du Journal des Sçavans sur les passages du Vénus, & sur l'Eclipse de Soleil arrivée en 1764 [...] À Auxerre le 24 Mai 1766", *JdS*, Octobre 1766, pp. 644-657. Gallica

1770: *Lettre à Messieurs les auteurs du Journal des Savans. Sur le passage de Vénus*, à Bouillon: Aux dépens de la Société Typographique, 27 pp. Inst. Astr. Wien

Wargentin, Pehr Wilhelm

1761*a*: "Observationer På Planeten Veneris gång genom Solens Discus, d. 6 Junii 1761", *Handl.Stockh.* vol. 23, pp. 143-166. CVH

1761*b*: "Anmärkningar öfver Planeten Veneris gång genom Solens Discus", *Handl.Stockh.* vol. 23, pp. 167-179. CVH

1762: "Observations on the same Transit; and on an Eclipse of the Moon, *May 8, 1761*; and of the Sun, on the 3d of *June 1761*: In a Letter to the Rev. *Thomas Birch* […] Read Nov. 12, 1761.", *Phil.Tr.* For the Year 1762, vol. LII, part II, pp. 208-213. JSTOR

1764*a*: "Beobachtungen des Durchganges der Venus durch die Sonne, den 6 Jun. 1761.", *Schwed.Abh.* vol. 23, pp. 142-164. Göttinger DigZentrum

1764*b*: "Anmerkungen über den Durchgang der Venus durch die Sonnenscheibe", *Schwed.Abh.* vol. 23, pp. 167-178. Göttinger DigZentrum

1769: "Berättelse, om de anstalter, som varit gjorde i Sverige, at observera Planeten Venus i Solen, den 3 Junii 1769, och huru de lyckats; med observationer därpå i Stockholm", *Handl.Stockh.* vol. 31, pp. 146-158. CVH

1770*a*: "Observationer på Solens Förmörkelse, d. 4. Junii 1769, gjorda på Observatorium i Stockholm", *Handl.Stockh.* vol. 32, pp. 35-41. CVH

1770*b*: "Observationes Transitus *Veneris* per Discum *Solis*, Die *3 Junii, 1769*, habitæ in *Suecia*, et *Societati Regiæ Londinensi* communicatæ […] Communicated by […] John Ellicott […] Read Dec. 16, 1769", *Phil.Tr.* For the Year 1769, vol. LIX., pp. 327-332. JSTOR

1784: "Nogle Norske Stæders Geographiske Beliggenhed, bestemt i Anledning af afg. Danske Astronoms og Professors Hr. G. Holms Observationer", *Nye Samling af det Kongelige Norske Videnskabers Selskabs Skrifter* Første Bind, pp. 413-430. http://www.ntnu.no/ojs/index.php/DKNVS_skrifter

Weidler, Johann Friedrich

1727: *De Praesenti Specularum Astronomicarum Statu Dissertatio*, Wittembergae: Apud Viduam Bergesiam. 24 pp. Mus.Hist.Sc., Oxf.

Zanotti, Eustachio

1757: "Observationes astronomicae, in Bononiensi specula habitae annis 1751, 1752, ad investigandas Lunae, Martis, et Veneris parallaxes", *De Bononiensi Scientiarum et Artium instituto atque academia commentarii* vol. IV, pp. 311-324. Diglib Bologna

[1761]: *De Veneris ac Solis congressu Observatio habita in Astronomica Specula Bononiensis Scientiarum Instituti Die 5 Junii MDCCLXI*, Bononiae: Typis Laelii a Vulpe Instituti Scientiarum Typographi. 12 pp. http://www.bo.astro.it/~biblio/sma/page/pubblicazione/venere_05_06_1761.html

1767: "De Veneris ac Solis congressu. Observatio habita in Astronomica Specula Bononiensis Scientiarum Instituti die 5 Junii 1761", *De Bononiensi Scientiarum et Artium Instituto atque Academia Commentarii* vol. V, part I, 1767, pp. 126-140. http://www.bo.astro.it/~biblio/sma/page/pubblicazione/venere_05_06_1761.html

PRINTED SOURCES AND LITERATURE, PART 2 – AFTER 1800

Acker, Agnes & Carlos Jaschek
1985: *Astronomical Methods and Calculations*, translated by Chris Kitchin (French orig. 1981), Chichester: John Wiley and Sons.

Aldea, Quintin
1970: "Spanien und Portugal bis 1815", in Jedin (ed.), pp. 180-193.

Alnæs, Karsten
2004: *Historien om Europa*, Bind 2: *1600-1800*, Oslo: Gyldendal.

Andersen, Håkon With, Brita Brenna, Magne Njåstad & Astrid Wale
2009: *Aemula Lauri: The Royal Norwegian Society of Sciences and Letters, 1760-2010*, Sagamore Beach, Mass.: Science History Publications.

Anderson, Benedict
2006: *Imagined Communities* (reprint of revised 1991 edition), London: Verso.

[Anonymous]
1881: *Scriptores ordinis S. Benedicti qui 1750-1880 fuerunt in Imperio Austriaco-Hungarico*, Vindobona: In aedibus Leon. Woerl.

[Anonymous]
1990: "Hammerfest på 1700-tallet: 'En gammel Hammerfestborgers efterladte Optegnelser'", *Årbok '90: Hammerfest-Sørøysund* No. 1/1990, pp. 7-9.

Anonymus
2010: *Anonymus and Master Roger: Anonymi Bele Regis Notarii* Gesta Hungarorum / *Anonymus, Notary of King Béla* The Deeds of the Hungarians. Edited, translated and annotated by Martyn Rady & László Veszprémy. *Magistri Rogerii* Epistola in Miserabile Carmen super Destructione Regni Hungarie per Tartaros Facta / *Master Roger's* Epistle to the Sorrowful Lament upon the Destruction of the Kingdom of Hungary by the Tatars, Translated and annotated by János M. Bak & Martyn Rady, Central European Medieval Texts Vol. 5, Budapest/New York: Central European University Press.

Arlot, Jean Eudes & Jean-Pierre Luminet
2004: *Le passage de Vénus*, Les Ulis: EDP Sciences Editions.

Ashbrook, Joseph
1984: *The Astronomical Scrapbook: Skywatchers, Pioneers, and Seekers in Astronomy*, edited by Leif J. Robinson, New York / Cambridge, Mass.: Cambridge University Press and Sky Publishing Corporation.

Aspaas, Per Pippin
2008*a*: Review of Kastner-Masilko 2005, in Dick & Hamel (eds.), pp. 269-273.
2008*b*: Review of Moutchnik 2006, in Dick & Hamel (eds.), pp. 286-291.
2008*c*: "Maximilian Hell og Johannes Sajnovics om folkeliv og natur i Øst-Finnmark anno 1769", in Balsvik & Nielsen (eds.), pp. 61-72.
2008*d*: "Maximilian Hell's invitation to Norway", Firneis & Kerschbaum (eds.), pp. 10-20.
2008*e*: "From the Expeditio Litteraria of Maximilian Hell (1768-1770) to La Recherche of Paul Gaimard (1838-1840): Northernmost Fennoscandia in the Encyclopædic Tradition of Science", paper presented at The First Annual Conference for the History of Science in Norway, Oslo May 2008, retrievable at: http://munin.uit.no/handle/10037/1899
2010: "Le Père Jésuite Maximilien Hell et ses relations avec Lalande", in Boistel et al. (eds.), pp. 129-148.

2011*a*: “Nordiske amatørastronomers bidrag i forbindelse med venuspassasjene 1761 og 1769”, in Federhofer & Hodacs (eds.), pp. 103-127.
2011*b*: Review of “Hugo Grotius, *Mare liberum – det frie hav: En avhandling om retten nederlenderne har til å drive handel i Ostindia*, redigert, oversatt og med noter av Andreas Harald Aure, Oslo: Vidarforlaget, 2009”, *Klassisk forum* (Oslo) No. 1/2011, pp. 118-124.
2012*a*: “Maximilianus Hell’s call for subscriptions to the work *Expeditio litteraria ad Polum arcticum*” (reproduction of source materials), retrievable at: http://hdl.handle.net/10037/3800
2012*b*: “Maximilianus Hell’s unfinished introduction to the work *Expeditio litteraria ad Polum arcticum*” (reproduction of source materials), retrievable at: http://hdl.handle.net/10037/3799
In press: “Maximilian Hellin ja Johannes Sajnovicsin ‘Expeditio litteraria ad Polum arcticum’ ja suomalais-ugrilaisen kielentutkimuksen synty”, in Osmo Pekonen & Johan Stén (eds.), *Lapin tuhat tarinaa*, Ranua: Mäntykustannus, pp. 65-86.

Aspaas, Per Pippin & Truls Lynne Hansen
2007: “Geomagnetism by the North Pole, anno 1769: The Magnetic Observations of Maximilian Hell during his Venus Transit Expedition”, *Centaurus: An International Journal of the History of Science and its Cultural Aspects* vol. 49, pp. 138-164.

Aspaas, Per Pippin & Nils Voje Johansen
2004*a*: “Astronomen Maximilian Hell: Fra Wien til Vardø for å se Venus”, *Ottar: Populærvitenskapelig tidsskrift fra Tromsø Museum* no. 249, 1/2004, pp. 3-11.
2004*b*: “Venus møter sola: 8. juni 2004 i historisk lys”, *Ottar: Populærvitenskapelig tidsskrift fra Tromsø Museum* no. 249, 1/2004, pp. 12-20.

Aspaas, Per Pippin, Thomas Posch, Isolde Müller & Akos Bazso
In preparation: “Astronomische Observatorien der Jesuiten in der ‘Provincia Austriae’ im 18. Jahrhundert”, forthcoming in *Acta Historica Astronomiae*.

Aubin, David (ed.)
2007: *L’événement astronomique du siècle? Histoire sociale des passages de Vénus, 1874-1882*, Cahiers François Viète Numéro 11-12 (2006), Nantes: Cahiers François Viète.

Aubin, David, Charlotte Bigg & H. Otto Sibum (eds.)
2010: *The Heavens on Earth: Observatories and Astronomy in Nineteenth-Century Science and Culture*, Durham & London: Duke University Press.

Aughton, Peter
1999: *Endeavour: The story of Captain Cook’s first great epic voyage*, Moreton-in-Marsh: Windrush.
2004: *The Transit of Venus: The Brief, Brilliant Life of Jeremiah Horrocks, Father of British Astronomy*, London: Windrush.

Auroux, Sylvain, E.F.K. Koerner, Hans-Josef Niederehe & Kees Versteegh (eds.)
2001: *History of the Language Sciences / Geschichte der Sprachwissenschaften / Histoire des sciences du langage* vol. II, Berlin / New York: Walter de Gruyter.

Bach, Thomas
2007: “Dilettantismus und Wissenschaftsgenese. Prolegomena zu einer wissenschaftshistorischen Einordnung des naturwissenschaftlichen Dilettantismus im 18. Jahrhundert”, in Blechschmidt & Heinz (eds.), pp. 339-352.

Bahlcke, Joachim
2005: *Ungarischer Episkopat und österreichische Monarchie: von einer Partnerschaft zur Konfrontation (1686-1790)*, Stuttgart: Franz Steiner Verlag.

Balázs, Lajos G., Peter Brosche, Hilmar Duerbeck & Endre Zsoldos (eds.)
2005: *The European Scientist : Symposium on the era and work of Franz Xaver von Zach (1754-1832)*, Acta Historica Astronomiae vol. 24, Frankfurt am Main: Verlag Harri Deutsch.

Balázs, Éva H.
1997: *Hungary and the Habsburgs, 1765-1800: An Experiment in Enlightened Despotism*, translated by Tim Wilkinson, Budapest: Central European University Press.

Bálint, Emese
2010: "Levels of Group Loyalty at the Turn of the Seventeenth and Eighteenth Centuries: Kolosvár in the Rákóczi War of Independence", in Jaroslav Miller & László Kontler (eds.), *Friars, Nobles and Burghers – Sermons, Images and Prints: Studies of Culture and Society in Early-Modern Europe In Memoriam István György Tóth*, Budapest: Central European University Press, pp. 281-296.

Balsvik, Randi Rønning
1992: "Pomorbyen Vardø og Russland" (with a Russian summary), in Einar Niemi (ed.), *Pomor: Nord-Norge og Nord-Russland gjennom tusen år*, Oslo: Gyldendal, pp. 99-116.

Balsvik, Randi Rønning & Jens Petter Nielsen (eds.)
2008: *Forpost mot øst: Fra Vardø og Finnmarks historie 1307-2007*, Rapport fra det XXXII nordnorske historieseminar Vardø 21.-23. september 2007, Stamsund: Orkana forlag.

Bartal, Antonius
1901: *Glossarium Mediæ et Infimæ Latinitatis Regni Hungariæ*, jussu et auxiliis Academiæ Litterarum Hungaricæ, Lipsiæ: Teubner / Bupapestini: Societas Franklinia.

Bartha, Lajos
1983: "Sajnovics János, Hell Miksa és a 'magyar őstörténet'", *Különlenyomat a Nyelvtudományi Közlemények* vol. 85, pp. 297-304.
2004*a*: "Magyar Tudósok Mágneses Megfigyelései a Sarkkörön túl, 1769-ben", *Földrajzi Múzeumi Tanulmányok* [Érd, Hungary] vol. 13, pp. 49-55.
2004*b*: "Hell Miksa légkörtani munkássága", *Légkör* vol. XLIX, No. 4, pp. 20-25
2006: "A Nagyszombati egyetem csillagvizsgálójának kezdetei", in Petrovay (ed.), pp. 7-38.

Bartók, István (ed., main author),
2005: (with Barnabás Guitman, Farkas Gábor Kiss, László Havas, Éva Knapp, László Takács & Gábor Tüskés) *Companion to the History of the Neo-Latin Studies in Hungary*, translated by György Földes, Budapest: Universitas Publishing House.

Battlori, Miquel
1985: "Les universités et les collèges jésuites du XVIe au XVIIIe siècle", *CRE-Information* vol. 72, pp. 61-73.

Beauvois, Daniel
1976: "Les Jésuites dans l'Empire Russe 1772-1820", *Dix-huitième siècle* vol. 8, pp. 257-272.

Beckman, Jenny
2011: "Amatörer, dilettanter och botanisk arbetsfördelning", in Federhofer & Hodacs (eds.), pp. 309-325.

Bedini, Silvio A.
1997: "The Transit in the Tower: English Astronomical Instruments in Colonial America", *Annals of Science* vol. 54, pp. 161-196.

Bennett, Jim
2002: "The travels and trials of Mr Harrison's timekeeper", in Marie-Noëlle Bourgouet, Christian Licoppe and H. Otto Sibum (eds.), *Instruments, Travel and Science: Itineraries of precision from the seventeenth to the twentieth century*, London / New York: Routledge, pp. 75-95.
Berger, Stefan & Chris Lorenz (eds.)
2008: *The Contested Nation: Ethnicity, Class, Religion and Gender in National Histories*, Basingstoke: Palgrave Macmillian.
Bieńkowska, Barbara
1972: "From Negation to Acceptance: The Reception of the Heliocentric Theory in Polish Schools in the 17th and 18th centuries", in Jerzy Dobrzycki (ed.), *The Reception of Copernicus' Heliocentric Theory*, Dordrecht: Reidel, pp. 79-116.
Bireley, Robert
2003: *The Jesuits and the Thirty Years War: Kings, Courts, and Confessors*, Cambridge: Cambridge University Press.
Birkeland, B. J.
1935: "Ältere meteorologische Beobachtungen in Vardö", *Geofysiske publikasjoner* utgitt av Det norske videnskabs-akademi i Oslo vol. X, No. 9, pp. 1-52.
Bjerring-Hansen, Jens
2010: "Fraktur eller antikva? Om tekstens materialitet, typografisk usikkerhed i 1700-tallet og skriftstriden omkring 1800", *Lychnos: Årsbok för idé- och lärdoms-historia* 2010, pp. 163-177.
Blechschmidt, Stefan
2007: "Eigen-Sinn und Dilettantismus. Bezüge in Goethes Schriftenreihen *Zur Natur-wissenschaft überhaupt, besonders zur Morphologie*", in Blechschmidt & Heinz (eds.), pp. 307-322.
Blechschmidt, Stefan & Andrea Heinz (eds.)
2007: *Dilettantismus um 1800*, Heidelberg: Universitätsverlag Winter.
Brosche, Peter
1977: "Zur Deutung der Sternfarben im 18. Jahrhundert (C. G. Lichtenberg und M. Hell)", *Südhoffs Archiv* vol. 61, pp. 248-257.
2001: "A footnote on the prehistory of interpretation of stellar colours", in Christiaan Steerken & John B. Hearnshaw (eds.), *Homage to Miklos Konkoly Thege (1842-1916): 100 Years of Observational Astronomy and Astrophysics*, Bruxelles: Verlag Vrije Universiteit Brussel, pp. 255-258.
2009*a*: *Der Astronom der Herzogin: Leben und Werk von Franz Xaver von Zach (1754-1832)*, 2nd edn., Acta Historica Astronomiae vol. 12, Frankfurt am Main: Verlag Harri Deutsch.
2009*b*: "Korrespondierende Beobachtungen", in Ingrid Kästner (ed.), *Wissenschafts-kommunikation in Europa im 18. und 19. Jahrhundert. Beiträge der Tagung vom 5. und 6. Dezember 2008 an der Akademie gemeinnütziger Wissenschaften zu Erfurt*, Aachen: Shaker Verlag, pp. 95-99.
2010: "Lichtenbergs Breiten", *Lichtenberg Jahrbuch* 2010, pp. 27-52.
Brosche, Peter & Klaralinda Ma-Kircher
2010: "Elisabeth von Matt (1762-1814), an Enlightened Practitioner of Astronomy in Vienna", *Journal of Astronomical History and Heritage* vol. 13, pp. 187-193.
Brosche, Peter & Magda Vargha (eds.)
1984: *Briefe Franz Xaver von Zachs in sein Vaterland*, Publications of the Astronomical Department of L. Eötvös University vol. 7, Budapest: L. Eötvös University.

Brotóns, Víctor Navarro
2006: "Science and Enlightenment in Eighteenth-Century Spain: The Contribution of the Jesuits before and after the Expulsion", in O'Malley et al. (eds.), 390-404.
Boedecker, Hans Erich
2002: "'Sehen, hören, sammeln und schreiben': Gelehrte Reisen im Kommunikationssystem der Gelehrtenrepublik", *Paedagogica Historica: International Journal of the History of Education* vol. 38, pp. 504-532.
Boistel, Guy
2004: "Nicole-Reine Lepaute et l'*Hortensia*", *Cahiers Clairaut* No. 108, pp. 13-17.
Boistel, Guy, Jérôme Lamy & Colette LeLay (eds.),
2010: *Jérôme Lalande (1732-1807): Une trajectoire scientifique*, Rennes: Presses universitaires de Rennes.
Botez, Elvira
2004: "Maximilian Hell and the Northernmost Transit of Venus Expedition of 1769", in Christiaan Sterken & Hilmar W. Duerbeck (eds.), *Astronomical Heritages: Astronomical Archives and Historic Transits of Venus*, Journal of Astronomical Data vol. 10, Bruxelles: C. Sterken, Vrije Universiteit Brussel, pp. 165-174.
Bots, Hans & Françoise Waquet
1997: *La République des Lettres*, Paris: Éditions Belin.
Brahde, Rolf
1972: "Beregning av Merkurs dråpeform på solskiven", *Astronomisk Tidsskrift* vol. 5, pp. 79-82.
Bray, R. J.
1980: "Australia and the Transits of Venus", *Proceedings of the Astronomical Society of Australia* vol. 4, pp. 114-120.
Brenna, Brita
2011: "Dilettantisme og disiplin: Det lærde miljø rundt opprettelsen av Det Kongelige Norske Videnskabers Selskab", in Federhofer & Hodacs (eds.), pp. 33-60.
Brosche, Peter, Wolfgang R. Dick, Oliver Schwarz, & Roland Wielen (eds.)
1998: *The Message of the Angles – Astrometry from 1798 to 1998*, Acta Historica Astronomiae vol. 3, Frankfurt am Main: Verlag Harri Deutsch.
Bruckner, Joseph
1919: *La Compagnie de Jésus: Esquisse de son institut et de son histoire*, Paris: Gabriel Beauchesne.
Bryson, Bill
2004: *A Short History of Nearly Everything* (orig. published 2003), London: Black Swan.
Burke, Peter
2004: *Languages and Communities in Early Modern Europe*, Cambridge: Cambridge University Press.
Burkhardt, Johannes & Christine Werkstetter (eds.)
2005: *Kommunikation und Medien in der frühen Neuzeit*. Historische Zeitschrift, Beihefte (Neue Folge), Herausgegeben von Lothar Gall, Band 41, München: R. Oldenbourg Verlag.
Burns, Willam E.
2011: *Knowledge and Power: Science in World History*, Connections: Key Themes in World History, series editor Alfred J. Andrea, New Jersey: Pearson Education.

Bursill-Hall, Piers (ed.)
1993: *R. J. Boscovich: Vita e Attività Scientifica / His Life and Scientific Work*, Atti del Convegno Roma, 23-27 maggio 1988, Rome: Isituto della Enciclopedia Italiana fondata da Giovanni Treccani.

Butler, C. John
2005: "Observations of planetary transits made in Ireland in the 18th Century and the development of astronomy in Ireland", in Kurtz (ed.), pp. 87-99.

Bønes, Jostein
1972: "Dråpeforma til Merkur og Venus ved passasjar", *Astronomisk Tidsskrift* vol. 5, pp. 74-78.

Candaux, Jean-Daniel
2005: "Jacques-André Mallet, Jean-Louis Pictet: deux vocations pour un même voyage", in Pictet & Mallet 2005, pp. 3-8.

Carter, William E. & Merri Sue Carter
2009: "Simon Newcomb, America's first great astronomer", *Physics Today* vol. 62, pp. 46-51.

Chapman, Allan
1998: "The transits of Venus", *Endeavour* vol. 22, pp. 148-151.
2005: "Jeremiah Horrocks, William Crabtree, and the Lancashire observations of the transit of Venus of 1639", in Kurtz (ed.), pp. 3-26.

Chappe d'Auteroche, Jean
2004: *Voyage en Sibérie fait par ordre du Roi en 1761*, 2 vols., I: *Introduction et apparat critique*, by Michel Mervaud and *Le Prince et les dessinateurs et graveurs du 'Voyage en Sibérie'*, by Madeleine Pinault Sørensen, II: *Édition critique*, by Michel Mervaud, Studies on Voltaire and the Eighteenth Century 2004:03 & 2004:04, Oxford: Voltaire Foundation.

Charlet, Jean-Louis
2006: "Problèmes de méthode et normes éditoriales dans les différents types d'édition de textes néo-latins", in Schnur et al. (eds.), pp. 231-237.

Chartier, Roger
1995: "Princely Patronage and the Economy of Dedication", in *Forms and Meanings: Texts, Performances, and Audiences from Codex to Computer*, Philadelphia: University of Pennsylvania Press, pp. 25-42.

Clark, William
2003: "The pursuit of the prosopography of science", in Roy Porter (ed.), *The Cambridge History of Science* vol. 4: *Eighteenth-Century Science*, Cambridge: Cambridge University Press, pp. 211-237.
2006: *Academic Charisma and the Origins of the Research University*, Chicago / London : University of Chicago Press.

Cognet, Louis
1970: "Der Jansenismus im Frankreich des 18. Jahrhundert", in Jedin (ed.), pp. 409-461.

Cohen, I. Bernard
1959: "George Sarton", *ISIS: An International Review devoted to the History of Science and its Cultural Influences* vol. 48, pp. 286-300.

Comtet, Roger
2001: "L'étude des langues slaves en Russie: M. L. Lomonosov", in Auroux et al. (eds.), pp. 1136-1143.

Constantine VII Porphyrogenitus
1962-1967: *De administrando imperio* vol. I-II, Greek text edited by Gy. Moravcsik, English translation by R. J. H. Jenkins, Commentary by F. Dvornik, Corpus fontium historiae Byzantinae consilio Societatis internationalis studiis Byzantinis provehendis destinatae editum 11, Washington / London: Dumbarton Oaks / Athlone Press.
Daae, Ludvig [Kristensen]
1895: "Hells og Sainovics's reise i Norden", *[Norsk] Historisk Tidsskrift* 3. Række, 3. bind, pp. 114-146.
Dahl, Ove
1891-1911: *Biskop Gunnerus's virksomhed fornemmelig som botaniker, tilligemed en oversigt over botanikens tilstand i Danmark og Norge indtil hans død* (series of offprints from *Det Kgl. Norske Videnskabers Selkskabs Skrifter*), Trondheim: Aktietrykkeriet.
Darnton, Robert
1968: *Mesmerism and the End of Enlightenment in France*, Cambridge, Mass.: Harvard University Press.
Daston, Lorraine
1991: "The Ideal and Reality of the Republic of Letters in the Enlightenment", *Science in Context* vol. 4, pp. 367-386.
Davis, A.E.L.
2005: "Kepler's Angular Measure of Uniformity: how it provided a potential proof of his Third Law", in Friederike Boockmann, Daniel A. Di Liscia & Hella Kothmann (eds.), *Miscellanea Kepleriana: Festschrift für Volker Bialas zum 65. Geburtstag*, Algorismus: Studien zur Geschichte der Mathematik und der Naturwissenschaften herausgegeben von Menso Folkerts Heft 47, Augsburg: Dr. Erwin Rauner Verlag, pp. 157-173.
Débarbat, Suzanne
2005: "Venus transits – A French view", in Kurtz (ed.), pp. 41-51.
Décsy, Gyula & Wolfgang Veenker
1972: "Nachwort der Herausgeber", in Sajnovics 1972, pp. 159-163.
Deitz, Luc
1998: "Editing Sixteenth-Century Latin Prose Texts: a Case Study and a Few General Observations", in Most (ed.), pp. 141-164.
Dick, Wolfgang R. & Jürgen Hamel (eds.)
2008: *Beiträge zur Astronomiegeschichte* Band 9, Acta Historica Astronomiae vol. 36, Frankfurt am Main: Verlag Harri Deutsch.
Diderichsen, Paul
1974: "The Foundation of Comparative Linguistics: Revolution or Continuation", in Hymes (ed.), pp. 277-306.
Ditchfield, Simon
2007: "Of Missions and Models: The Jesuit Enterprise (1540-1773) Reassessed in Recent Literature", *The Catholic Historical Review* vol. 93, pp. 325-343.
Donnert, Erich
1986: *Russia in the Age of Enlightenment*, translated from the German by Alison & Alistair Wightman (1st German edn. 1983), Leipzig: Edition Leipzig.
Duerbeck, Hilmar W.
2005: "Zach, Gotha and the Venus transits of the 18th and 19th centuries", in Balázs et al. (eds.), pp. 53-63.

Duhr, Bernhard
1892: *Jesuiten-Fabeln: Ein Beitrag zur Culturgeschichte*, Freiburg: Herder.
1928*a*-b: *Geschichte der Jesuiten in den Ländern deutscher Zunge*, Vierter Band, 1.-2. Theil, München & Regensburg: Verlagsanstalt vorm. G. J. Manz.
Duin, Johs. J.
1984: "Astronomer som sjelesørgere: 1768-69", in *Streiftog i norsk kirkehistorie 1450-1880: En samling artikler*, Oslo: St. Olav Forlag.
Dulac, Georges
2000: "La vie académique à Saint-Pétersbourg vers 1770, d'après la correspondance entre J.A. Euler et Formey", in Hurel & Laudin (eds.), pp. 221-263.
Dumont, Simone
2007: *Un astronome des Lumières: Jérôme Lalande*, with a foreword by Jean-Claude Pecker, Paris: Vuibert / Observatoire de Paris.
Dumont, Simone & Suzanne Débarbat
1996: "Delisle – Cassini III: Deux pèlerins de la cartographie scientifique en Europe centrale et orientale", *Revue XYZ* vol. 18, No. 67, pp. 70-76.
Dumont, Simone & Jean-Claude Pecker (eds.),
In preparation: *Lalandiana II: Jerôme Lalande et ses amis de Berlin*, (publisher pending).
Éder, Zoltán
1977: "Die Aufnahme der 'Demonstratio' von Sajnovics in Ungarn: Neue Aspekte zur Geschichte der Frage", *Acta Linguistica Academiae Scientiarum Hungariae* vol. 26, pp. 305-323.
Elvestrand, Vegard
2004: *Generalkonduktør Christopher Hammer (1720-1804) og hans manuskript-samling: registratur, biografi, slektshistorie*, Trondheim: Tapir.
Encke, Johann Franz
1822: *Der Venusdurchgang von 1769 als Fortsetzung der Abhandlung über die Entfernung der Sonne von der Erde*, Gotha: Becker.
1837: "Über den Venusdurchgang von 1769", *Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin* Aus dem Jahre 1835, *Abhandlungen: Mathematische Klasse*, pp. 295-309.
Enebakk, Vidar
2008: *Vitenskapsstudier: historie, teori, kritikk*, Oslo: Unipub.
2009: "Darwinjubileet 2009 – en bro mellom de to kulturer", *Arr: Idéhistorisk Tidsskrift* Nr. 3-4/2009, pp. 115-130.
Engstrand, Iris H. W.
2004: "The Transit of Venus in 1769: Launching Pad for European Exploration in the Pacific during the Late Eighteenth Century", *Boletin: Journal of the California Mission Studies Association* vol. 21, pp. 36-48.
Erdődi, Jozsef
1970: "Sajnovics, der Mensch und der Gelehrte", *Acta Linguistica Academiae Scientiarum Hungaricae* vol. 20, pp. 291-322.
Eskildsen, Kasper Risbjerg
2005: "How Germany Left the Republic of Letters", *Journal of the History of Ideas* vol. 66, pp. 421-432.
Evans, Robert John Weston
2006: *Austria, Hungary, and the Habsburgs: Essays on Central Europe, c. 1683-1867*, Oxford: Oxford University Press.

Fauque, Danielle M. E.
2010: “La correspondence Jérôme Lalande et Nevil Maskelyne: un exemple de collaboration internationale au XVIII^{e} siècle”, in Boistel et al. (eds.), pp. 109-128.
Fazekas, Tiborc
2001*a*: “Die Entdeckung der Verwandtschaft der finnougrischen Sprachen”, in Auroux et al. (eds.), pp. 1144-1155.
2001*b*: “Finno-ugrische Philologie und vergleichende Grammatik”, in Auroux et al. (eds.), pp. 1305-1311.
Faye, [Hervé Auguste Étienne Albans]
1869*a*-1869*b*: “Sur les passages de Vénus et la parallaxe du Soleil” [Parts I-II], *Comptes rendus hebdomadaires des séances de l’Académie des Sciences* vol. 68, pp. 42-50 & 69-73.
1869*c*: “Examen critique des idées et des observations du P. Hell sur le passage de Venus de 1769”, *Comptes rendus hebdomadaires des séances de l’Académie des Sciences* vol. 68, pp. 282-290.
Federhofer, Marie-Theres
2001: “*Moi simple amateur”: Johann Heinrich Merck und der naturwissenschaftliche Dilettantismus im 18. Jahrhundert,* Hannover: Wehrhahn.
2007: “Dilettantenkultur. Alexander von Humboldts Kosmos-Vorlesungen”, in Blechschmidt & Heinz (eds.), pp. 323-338.
2011: “Dilettantismens potensial”, in Federhofer & Hodacs (eds.), pp. 11-29.
Federhofer, Marie-Theres & Hanna Hodacs (eds.)
2011: *Mellom pasjon og profesjonalisme: Dilettantkulturer i skandinavisk kunst og vitenskap,* Trondheim: Tapir Forlag.
Feil, Joseph
1861: “Versuche zur Gründung einer Akademie der Wissenschaften unter Maria Theresia”, *Jahrbuch für vaterländische Geschichte* vol. 1, pp. 319-407.
Feingold, Mordechai (ed.)
2003: *Jesuit Science and the Republic of Letters*, Cambridge, Mass. / London: The MIT Press.
Ferencová, Elena
1995: *Maximilián Hell: významná osobnost’ slovenskej vedy a techniky,* Bratislava: Asklepios.
Ferrari d’Occhieppo, Konradin
1957: “Maximilian Hell und Placidus Fixlmillner: Die Begründer der neueren Astronomie in Österreich”, in Fritz Knoll (ed.), *Österreichische Naturforscher, Ärzte und Techniker,* Vienna: Verlag der Gesellschaft für Natur und Technik, pp. 27-31.
1973: “Maximilian Hell”, in Walter Pollak (ed.), *Tausend Jahre Österreich,* vol. I, Vienna: Jugend und Volk, pp. 349-352.
Ferrner, Bengt (Ferner)
1956: *Resa i Europa: En astronom, industrispion och teaterhabitué genom Danmark, Tyskland, Holland, England, Frankrike och Italien 1758-1760 (Cod. Holm. M 239),* udgiven med inledning och register av Sten G. Lindberg, Lychnos-Bibliotek vol. 14, Uppsala: Almqvist & Wiksells Boktrykkeri.
Firnes, Maria G.
1993: “Johann Tobias Bürg (1766-1834): Littrows Gegenspieler in Wien”, *Die Sterne* vol. 69, pp. 148-153.

Firneis, Maria G. & Franz Kerschbaum (eds.)
2008: *Konferenzbeiträge/Proceedings: Festkolloquium und Fachtagung 250 Jahre Universitätssternwarte Wien*, Communications in Asteroseismology vol. 149, Vienna: Austrian Academy of Science Press.
Fischer, Karl Adolf Franz
1978: "Jesuiten-Mathematiker in der Deutschen Assistenz bis 1773", *Archivum historicum Societatis Iesu* vol. 47, pp. 159-224.
1983: "Jesuiten-Mathematiker in der Französischen und Italienischen Assistenz bis 1773", *Archivum historicum Societatis Iesu* vol. 52, pp. 52-92.
1984: "Die Jesuiten-Mathematiker des Nordostdeutschen Kulturgebietes", *Archives internationales d'histoire des sciences* vol. 34, pp. 124-162.
Forbes, Eric G. & Jacques Gapaillard
1996: "La correspondance astronomique entre l'abbé Nicolas-Louis de Lacaille et Tobias Mayer", *Revue d'histoire des sciences* vol. 49, pp. 483-541.
Fox, Robert
2006: "Fashioning the Discipline: History of Science in the European Intellectual Tradition", *Minerva: a review of science, learning and policy* vol. 44, pp. 410-432.
Frank, Peter R. & Johannes Frimmel
2008: *Buchwesen in Wien 1750-1850: Kommentiertes Verzeichnis der Buchdrucker, Buchhändler und Verleger*, Buchforchung: Beiträge zum Buchwesen in Österreich herausgegeben von Peter R. Frank und Murray G. Hall Band 4, Wiesbaden: Harrassowitz Verlag.
Friis, Aage (ed.)
1904-1907-1913: *Bernstorffske Papirer: Udvalgte Breve og Optegnelser vedrørende Familien Bernstorff i Tiden fra 1732 til 1835*, vol. I-III, Copenhagen / Kristiania: Gyldendalske Boghandel.
Frijhoff, Willem
1996: "Patterns", in Walter Rüegg (general editor), *A History of the University in Europe* vol. II: *Universities in Early Modern Europe*, ed. by Hilde de Ridder Symoens, Oxford: Oxford University Press, pp. 43-110.
Frimmel, Johannes
2011: "History of Books", in Wallnig et al. (eds.), pp. 227-244.
Frängsmyr, Tore (ed.)
1989: *Science in Sweden: The Royal Academy of Sciences 1739-1989*, Canton, MA: Science History Publications.
Frängsmyr, Tore, J.L. Heilbron & Robin E. Rider (eds.)
1990: *The Quantifying Spirit in the Eighteenth Century*, Berkeley / Los Angeles / Oxford: University of California Press.
Genette, Gérard
1987: *Paratexts: Thresholds of interpretation*, translated by Jane E. Lewin, with a foreword by Richard Macksey (French orig. 1987), Cambridge: Cambridge University Press.
Gheno, Danilo
1975: "Sajnovics e la *Demonstratio*. Problemi e caratteri dell'edizione di Trnava", *Atti e memorie, Accademia Patavina di scienze lettere ed arti* vol. 87, pp. 45-59.
Gilje, Nils & Tarald Rasmussen
[2002:] *Tankeliv i den lutherske stat*, Trond Berg Eriksen & Øystein Sørensen (eds.), *Norsk Idéhistorie* vol. II, Oslo: Aschehoug.

Gillispie, Charles Coulston

1970-1981: *Dictionary of Scientific Biography*, 16 vols, New York: Charles Scribner's Sons.

Glaβner, Gottfried & Christine Preiner

2009: "'…Physica autem sine omni experimento sicca sit et sterilis': Warum im Jahr 1771 trotz guter Argumente der Plan, in Melk eine Sternwarte zu errichten, nicht zur Ausführung kam", in Gottfried Glaβner (ed.), *" ... und das Firmament kündet vom Werk Seiner Hände" (Ps. 19,2): Faszination Astronomie – eine Spurensuche in der Melker Stiftsbibliothek*, Thesaurus Mellicensis I, Melk: Stift Melk, pp. 123-131.

Graesse, J. G. Th.

1909: *Orbis Latinus: oder Verzeichnis der wichtigsten lateinischen Orts- und Länder-namen*, 2nd edn. by Friedrich Benedict, Breslau.

Grafton, Anthony

2009: *Worlds Made by Words: Scholarship and Community in the Modern West*, Cambridge, Mass.: Harvard University Press.

Grau, Conrad, Sergueï Karp & Jürgen Voss (eds.)

1997: *Deutsch-Russische Beziehungen im 18. Jahrhundert: Kultur, Wissenschaft und Diplomatie* (with Russian summaries), Wiesbaden: Harrassowitz.

Grillo, Alessandra

In press: *Au pays des vendeurs de vent. Voyages et voyageurs en Laponie et Finlande du XVe au XIXe siècle*, Collection Imago Mundi dirigée par François Moureau, Paris: Presses Universitaires de Paris Sorbonne.

Haberzettl, Hermann

1973: *Die Stellung der Exjesuiten in Politik und Kulturleben Österreichs zu Ende des 18. Jahrhunderts*, Dissertationen der Universität Wien 94, Vienna: Verband der wissenschaftlichen Gesellschaften Österreichs.

Hádobas, Sándor

1996: *Hell Miksa és Sajnovics János bibliográfiája*, A bevezető tanulmányt írta: Bartha Lajos, Szakmailag ellenőrizte: Dr. Szíj Enikő [és] Bartha Lajos, Rudabánya.

2006: *Bibliography of Maximilian Hell and János Sajnovics / Hell Miksa és Sajnovics János bibliográfiája*, Compiled by / Összeállította: Hadobás Sándor, Rudabánya (CDrom).

2008: *Hell Miksa és Sajnovics János bibliográfiája*, A bevezető tanulmányt írta: Bartha Lajos, A bibliográfiát lektorálta: Dr. Szíj Enikő […], Bartha Lajos tudomány-történész, Rudabánya: Érc- és Ásványbányászati Múzeum Alapítvány http://mek.oszk.hu/06200/06237/06237.pdf

Hagen, Johann Georg

1917: "Karl Littrow als Geschichtsforscher", *Stimmen der Zeit* vol. 93, pp. 108-114.

Hagen, Rune Blix

2008: "Vardøhus som sentrum for dansknorsk statsmakt i nord 1550-1738", in Balsvik & Nielsen (eds.), pp. 45-60.

Hamel, Jürgen, Isolde Müller & Thomas Posch (eds.),

2010: *Die Geschichte der Universitätssternwarte Wien. Dargestellt anhand ihrer historischen Instrumente und eines Typoskripts von Johann Steinmayr*, Acta Historica Astronomiae Vol. 38, Frankfurt am Main: Verlag Harri Deutsch.

Hansen, Truls Lynne & Per Pippin Aspaas

2005: *Maximilian Hell's geomagnetic observations in Norway 1769*. Tromsø Geophysical Observatory Reports No. 2. Tromsø: University of Tromsø. (Also retrievable online at: http://munin.uit.no/munin/handle/10037/2392)

Harbsmeier, Michael
2003: "Indledning", in Niebuhr 2003, pp. 9-32.
Harbsmeier, Michael & Morten Petersen
2005: "Introduktion", in Hviid 2005, pp. 9-16.
Harris, Steven J.
1993: "Boscovich, the 'Boscovich Circle' and the Revival of the Jesuit Science", in Bursill-Hall (ed.), pp. 527-548.
1996: "Confession-Building, Long-Distance Networks, and the Organization of Jesuit Science", *Early Science and Medicine* vol. 1, pp. 287-318.
1999: "Mapping Jesuit Science: The Role of Travel in the Geography of Knowledge", in O'Malley *et al.* (eds.), pp. 212-240.
2005: "Jesuit Scientific Activity in the Overseas Missions, 1540-1773", *ISIS* vol. 96, pp. 71-79.
Heilbron, J. L.
1979: *Electricity in the 17th and 18th centuries: A Study in Early Modern Physics*, New York: Dover.
1989: "Science in the Church", *Science in Context* vol. 3, pp. 9-28.
Helander, Hans
2001: (with comments by J. H. Gaisser, Y. Haskell, H. Hofmann, G. Huber-Rebenich, M. Skafte Jensen, C. Kallendorf, W. Ludwig, A. Moss, K. Skovgaard-Petersen & F. Tateo) "Neo-Latin Studies: Significance and Prospects", *Symbolae Osloenses* vol. 76, pp. 5-102.
2004: *Neo-Latin Literature in Sweden in the Period 1620-1720: Stylistics, Vocabulary and Characteristic Ideas*, Acta Universitatis Upsaliensis, Studia Latina Upsaliensia 29, Uppsala: Uppsala Universitet.
Hellyer, Marcus
1999: "Jesuit Physics in Eighteenth-Century Germany: Some Important Continuities", in O'Malley et al. (eds.), pp. 538-554.
2005: *Catholic Physics: Jesuit Natural Philosophy in Early Modern Germany*, Notre Dame, Indiana: University of Notre Dame Press.
Henriksen, Carol
2011: "Sprogpatrioternes vej til videnskab: Om de danske sprogvidenskabelige dilettanter fra begyndelsen af 1700-tallet", in Federhofer & Hodacs (eds.), pp. 155-173.
Henze, Dietmar
1968: "Carsten Niebuhr und sein Beitrag zur Erforschung des Orients", in Niebuhr 1968, vol. I, pp. iii-xxii.
Herrmann, Dieter B.
1984: *The History of Astronomy from Herschel to Hertzsprung*, 3rd edn., translated and revised by Kevin Krisciunas (1st German edn. 1975), Cambridge: Cambridge University Press.
Hill, Elizabeth
1961: "Roger Boscovich: a biographical essay", in Whyte (ed.), pp. 16-101.
Hockey, Thomas (main editor)
2007: *Biographical Encyclopedia of Astronomers*, 2 vols., New York: Springer.
Hodacs, Hanna
2011: "Att utbilda en 'älskare' – naturalhistorisk skolning i Linnés anda", in Federhofer & Hodacs (eds.), pp. 61-90.

Hoffmann, Hermann
1969: *Friedrich II. von Preussen und die Aufhebung der Gesellschaft Jesu*, Bibliotheca Instituti Historici S.I., Rome: Institutum Historicum Societatis Iesu.
Holm, Edvard
1902: *Danmark-Norges Historie under Kristian VII (1766-1808)*, Første Binds Første Afdeling (1766-15 September 1770), Kjøbenhavn: Universitetsboghandler G.E.C. Gad.
Holmberg, Peter
2008: "Anders Planman och Solens parallax", *Arkhimedes* no. 5/2008, pp. 15-21.
Holovics, Flórián
1972: "Sajnovics János a Demonstratióról", *Magyar Nyelv* LXVIII, pp. 432-501.
Holzapfel, Helmut
1979: *Pater Maximilian Hell S.J. i Danmark. Et bidrag til Kirkens historie i Danmark i sidste halvdel af 18. århundrede.* Würzburg.
Horn d'Arturo, Guido
1922: "Il fenomeno della 'goccia nera' e l'astigmatismo", *Pubblicazioni dell'Osservatorio astronomico della R. Università di Bologna* vol. I, no. 3, pp. 25-57.
Horský, Zdeněk
1970: "Vedecké dielo Maximiliána Hella / Das Wissenschaftliche Werk von Maximilian Hell", in Novák (ed.), pp. 71-101.
Hovdhaugen, Even, Fred Karlsson, Carol Henriksen & Bengt Sigurd
2000: *The History of Linguistics in the Nordic Countries*, Helsinki: Societas Scientiarum Fennica.
Home, R. W.
1973: "Science as a Career in Eighteenth-Century Russia: The Case of F.U.T. Aepinus", *Slavonic and East European Review* vol. 51, pp. 75-94.
Howse, Derek
1986: *The Greenwich List of Observatories: A World List of Astronomical Observatories, Instruments and Clocks, 1670-1850*, Journal for the History of Astronomy vol. 17 Part 4.
1994: "The Greenwich List of Observatories: A World List of Astronomical Instruments and Clocks, 1670-1850. Amendment List No. 1", *Journal for the History of Astronomy* vol. 25, pp. 207-235.
Howse, Derek & Andrew Murray
1997: "Lieutenant Cook and the transit of Venus, 1769", *Astronomy & Geophysics* vol. 38, pp. 27-30.
Hsia, Florence
1999: "Jesuits, Jupiter's Satellites, and the Académie Royale des Sciences", in O'Malley *et al.* (eds.), pp. 241-257.
Hudon, Daniel
2004: "A (Not So) Brief History of the Transits of Venus", *The Journal of the Royal Astronomical Society of Canada / Le Journal de la Société royal d'astronomie du Canada* vol. 98, pp. 6-20.
Hughes, David W.
2005*a*: "Why did other European astronomers not see the December 1639 transit of Venus?", in Kurtz (ed.), pp. 146-152.
2005*b*: "Transit of Venus: The Scientific Event that Led Captain Cook to Australia, by Nick Lomb, (Powerhouse Publishing, Haymarket, NSW), 2004", *The Observatory: A Review of Astronomy* vol. 125, p. 45.

Hundrup, F. E.
1854: *Biographiske efterretninger om dem, der ved Kjøbenhavns Universitet have erholdt de høieste akademiske værdigheder*, Roeskilde: D. Hansons Bogtrykkeri.
Hurel, Daniel-Odon & Gérard Laudin (eds.)
2000: *Académies et sociétés savantes en Europe (1650-1800)*, Paris / Genève: Honoré Champion Éditeur / Editions Slatkine.
Hviid, Andreas Christian
[2005]: *Andreas Christian Hviids Europa: Udtog af en Dagbog holden i Aarene 1777-1780 paa en Reise igennem Tyskland, Italien, Frankrige og Holland* ([first edn. 1788, author's name then spelled Hwiid], edited, with foreword and commentary by Michael Harbsmeier, Claus Mechlenborg & Morten Petersen), Copenhagen: Forlaget Vandkunsten.
Hymes, Dell (ed.)
1974: *Studies in the History of Lingustics: Traditions and Paradigms*, Bloomington / London: Indiana University Press.
Iggers, Georg G. & Q. Edward Wang (with the assistance of Supriya Mukherjee)
2008: *A Global History of Modern Historiography*, Harlow: Pearson Education Ltd.
IJsewijn, Jozef
1990: *Companion to Neo-Latin Studies*, Part I: *History and Diffusion of Neo-Latin Literature*, 2nd edn., Supplementa Humanistica Lovaniensia V, Leuven: Leuwen University Press.
Jami, Catherine
2004: "Légitimité dynastique et reconstruction des sciences Mei Wending (1633-1721)", *Annales. Histoire, Sciences Sociales* vol. 59, pp. 701-727.
Janota, Dušan
1970: "Život Maiximiliána Hella / Das Leben Maximilian Hells", in Novák (ed.), pp. 45-69.
Jászó, Anna A.
1983: "Deux études sur János Sajnovics", *Études Finno-Ougriennes* XVI, pp. 255-261.
Jedin, Hubert (ed.)
1970: *Handbuch der Kirchengeschichte*, Band V: *Die Kirche im Zeitalter des Absolutismus und der Aufklärung*, Freiburg / Basel / Wien: Herder.
Jensen, Ola W.
2011: "Mellan dilettantism och professionalism: Om konstruktionen av vetenskapliga självbilder inom 1800-talets svenska minnesvård och arkeologi", in Federhofer & Hodacs (eds.), pp. 255-286.
Jørgensen, Per Magnus (ed., main author)
2007: *Botanikkens historie i Norge*, [Bergen]: Fagbokforlaget.
Kafka, Richard
[2003:] *Bridges to the North: From the history of Slovak – Norwegian cooperation in the area of science and technology*, [Ziar nad Hronom]: Slovalco.
Kalkar, Otto
1881-1907: *Ordbog til det Ældre Danske Sprog (1300-1700)*, vol. 1-4, Copenhagen: facsimile edition online: http://www.hist.uib.no/kalkar/
Kamusella, Tomasz
2009: *The Politics of Language and Nationalism in Modern Central Europe*, Basingstoke: Palgrave Macmillan.
Kargon, Robert
2003: "Harry Woolf, 1923-2003", *ISIS* vol. 94, pp. 492-493.

Kastner-Masilko, Horst
2005: *Franciscus de Paula Triesnecker: Astronom, Mathematiker und Landvermesser aus Mallon bei Kirchberg am Wagram*, Gösing/Wagram: Edition Weinviertel.
Katona, Stephano
1809: *Historia Critica Regum Hungariae Stirpis Austriacae, ex fide domesticorum et externorum scriptorum concinnata*, Tomulus XX. Ordine XXXIX.: *Ab anno Christi MDCCXL. Ad annum usque MDCCLXXX.*, Buda: Typis et Sumptibus Regiae Universitatis Pestanae.
Király, Béla K.
1969: *Hungary in the Late Eighteenth Century: The Decline of Enlightened Despotism*, New York & London: Columbia University Press.
Kisbán, Emil
1943: *Johann Sajnovics. Leben und Werk eines ungarischen Bahnbrechers und Gelehrten* (Hungarian orig. 1942), Publicationes ad historiam S.J. in Hungaria illustrandam: Lucubrationes vol. 34, Budapest: Hungária.
Kjeldstadli, Knut
1988: "Metodekommentar: Nytten av å sammenlikne", *Tidsskrift for samfunns-forskning* vol. 5, pp. 435-447.
2009: "En saga blott? Kan vi skrive norgeshistorie i globaliseringens tid?", in Tjelmeland et al. (eds.), pp. 57-76.
Kliemann, Hendriette
2005: "Nordens koordinater: Vetenskapliga konstruktioner av en europeisk region 1770-1850", *Lychnos* 2005, pp. 43-62.
Klingenstein, Grete
1997: "The meanings of 'Austria' and 'Austrian' in the eighteenth century", in Robert Oresko, G. C. Gibbs & H. M. Scott (eds.), *Royal and Republican Sovereignty in Early Modern Europe*, pp. 423-478, Cambridge: Cambridge University Press.
Koltai, András
2005: "The Piarist order and the scientific way of thinking in Hungary (The Piarists and Johann Franz Zach)", in Balázs et al. (eds.), pp. 21-33.
Kohns, Oliver
2007: "Der Enzyklopädist als Anfänger. Novalis' Project einer progressiven Enzyklo-pädistik", in Blechschmidt & Heinz (eds.), pp. 279-288.
Kókay, György
1990: *Geschichte des Buchhandels in Ungarn*, Wiesbaden: Harrassowitz.
Kontler, László
2009: *A History of Hungary*, 2nd edn., Budapest: Atlantisz Publishing House.
2011: "The Lappon, the Scythian and the Hungarian, or our (former) selves as 'others'. Philosophical history in eighteenth-century Hungary", in Guido Abbattista (ed.), *Encountering Otherness. Diversities and Transcultural Experiences in Early Modern European Culture*, Trieste: EUT Edizioni Università di Trieste, pp. 131-145.
In press: "Distances celestial and terrestrial. Maximilian Hell's Arctic expedition of 1768-1769: contexts and responses", in André Holenstein, Hubert Steinke & Martin Stuber (eds.), *The Practice of Knowledge and the Figure of the Savant in the 18th Century*, Leiden: Brill.
Köhler, Helga
1998: "Auf dem Weg zum modernen Lesetext?", in Most (ed.), pp. 165-189.

Kragemo, Helge (Bergh)

1933: "Pater Hell's observasjoner i Vardøhus 1769", in *Norvegica. Minneskrift til femti-årsdagen for opprettelsen av Universitetsbibliotekets norske avdeling 1883. 1. januar. 1933,* Oslo: Grøndahl & Søn, pp. 220-226.

1960: "Pater Hells Vardøhusekspedisjon. Belyst ved Pater Sainovič's dagbok 1768-1769", in Willoch (ed.), pp. 92-125.

1968: "Pater Hells ufullendte", in *Festskrift til Harald L. Tveterås,* pp. 121-133, Oslo: Tanum.

Kraggerud, Egil

2001: Review of Östlund 2000, *Eranos* vol. 99, pp. 54-62.

Kragh, Helge

1987: *An Introduction to the Historiography of Science*, Cambridge: Cambridge University Press.

2005: *Dansk Naturvidenskabs Historie* Bind 2 (with contributions from Frank Allan Rasmussen, Anja Skaar Andersen, Henrik Kragh Sørensen and Michael Sterll): *Natur, Nytte og Ånd 1730-1850,* Århus: Aarhus Universitetsforlag.

2008: *The Moon That Wasn't: The Saga of Venus' Spurious Satellite* (with the collaboration of Kurt Møller Pedersen), Science Networks. Historical Studies vol. 37, Basel: Birkhäuser.

Lomonosov, Mikhail Vasil'evich

1955*a*-1955*b*: S. I. Vavilov (main editor), *M. V. Lomonosov: Polnoe sobranie sochinenii*, vol. IV: T. P. Kravets & V. L. Chenakal (eds.), *Trudy po fizike, astronomii i priborostroeniiu, 1744-1765 gg.*, vol. IX: T. P. Kravets & V. L. Chenakal (eds.), *Sluzhebnye dokumenty, 1742-1765 gg.*, Moscow / Leningrad: Izdatel'stvo Akademii Nauk SSSR.

Krefting, Ellen (ed.)

2010: *Louis Sébastien Mercier: Tablå over Paris*, Oslo: Unipub.

Kronick, David A.

1990: "Notes on the Printing History of the Early *Philosophical Transactions*", *Libraries and Culture* Vol. 25, pp. 243-268.

Kröll, Helmut

1971: "Die Auswirkungen der Aufhebung des Jesuitenordens in Wien und Niederösterreich: Ein Beitrag zur Geschichte des Josephinismus in Österreich", *Zeitschrift für Bayerische Landesgeschichte* Vol. 34, pp. 547-617.

Kurtz, Don W. (ed.)

2005: *Proceedings of the International Astronomical Union, Volume 2004, June 2004: Transits of Venus: New Views on the Solar System and Galaxy,* Proceedings IAU Colloquium No. 196, 2004. Online version published by Cambridge University Press, May 2005.

Lackner, Karin, Isolde Müller, Franz Kerschbaum, Roland Ottensamer & Thomas Posch

2006: *Der historische Buchbestand der Universitätssternwarte Wien: Ein illustrierter Katalog*, Teil 2: *18. Jahrhundert*, Frankfurt am Main: Peter Lang Europäischer Verlag der Wissenschaften.

Lakó, György

1970: "J. Sajnovics und seine Demonstratio", *Acta Linguistica Academiae Scientiarum Hungaricae* vol. 20, pp. 269-289.

Lalande, Joseph Jérôme de (La Lande)

1803: *Bibliographie astronomique; avec l'histoire de l'astronomie depuis 1781 jusqu'à 1802,* Paris: Imprimérie de la République.

Langen, Ulrik
2008: *Den afmægtige – en biografi om Christian 7.*, Århus: Jyllands-postens forlag.
Leem, Knud (Canutus)
1975: *Beskrivelse over Finmarkens Lapper 1767*, Efterord af Asbjørn Nesheim (facsimile edition of *Knud Leems, Professor i det Lappiske Sprog, Beskrivelse over Finmarkens Lapper, deres Tungemaal, Levemaade og forrige Afgudsdyrkelse, oplyst ved mange Kaaberstykker: med J. E. Gunneri [...] Anmærkninger; og E. J. Jessen-S. [...] Afhandling om de Norske Finners og Lappers Hedenske Religion* / *Canuti Leemii, Professoris Lingvæ Lapponicæ, De Lapponibus Finmarchiæ, Eorumqve Lingva, Vita et Religione Pristina Commentatio, multis tabulis æneis illustrata: una cum J. E. Gunneri [...] Notis; & E. J. Jessen-S. [...] Tractatu Singulari de Finnorum Lapponumqve Norvegic. religione pagana* ([xi] + 544 + 82 pp.)], Copenhagen: Rosenkilde og Bagger International Boghandel og Forlag.
Levine, Philippa
1986: *The Amateur and the Professional: Antiquarians, Historians and Archæologists in Victorian England 1838-1886*, Cambridge: Cambridge University Press.
Lewis, Charlton T. & Charles Short
1879: *A Latin Dictionary*, founded on Andrews' edition of Freund's Latin dictionary, revised, enlarged and in great part rewritten, Oxford: Oxford University Press.
Lindberg, Bo
1984: *De lärdes modersmål: Latin, humanism och vetenskap i 1700-talets Sverige*, Göteborg: Acta Universitatis Gothoburgensis.
Lindroth, Sten
1967: *Kungl. Svenska Vetenskapsakademiens Historia 1739-1818*, Vols. I.1, I.2, II, Uppsala: Almquist & Wiksells Boktryckeri.
1978: *Svensk lärdomshistoria*, bind II: *Frihetstiden*, Stockholm: P.A. Norstedt.
Littrow, Carl Ludwig
1835: *P. Hell's Reise nach Wardoe bei Lappland und seine Beobachtung des Venus-Durchganges im Jahre 1769. Aus den aufgefundenen Tagebüchern geschöpft und mit Erläuterungen begleitet*, Wien: Im Verlage bei Carl Gerold.
1977: *Cesta Maximiliána Hella do Vardö pri Laponsku a jeho pozorovanie prechodu Venuše v roku 1769* (Slovak translation by František Hattala, prologue by Ján Tibenský), Bratislava: Tatran.
Lomholt, Asgeir
1942-1950-1960-1961-1973: *Det Kongelige Danske Videnskabernes Selskab 1742-1942: Samlinger til Selskabets Historie*, 5 vols., I: *[no title]*, II: *[no title]*, III: *[no title]*, IV: *Landmaaling og Fremstilling av Kort under Bestyrelse af Det Kongelige Danske Videnskabernes Selskab 1761-1843*, V: *Manuskripter og Tegninger i Selskabets Arkiv*, Copenhagen: Munksgaard.
Lynne Hansen, Truls
2011: "En prest om nordlyset – Jens Spidbergs skrift fra 1724", in Federhofer & Hodacs (eds.), pp. 93-102.
Ludewig, Johann
1992: *Der gelehrte Bauer. Mit D. Christian Gotthold Hoffmanns Vorbericht nebst Kupffern*, Nachdruck der ersten Ausgabe Dresden 1756. Mit einem Nachwort von Holger Böning, Volksaufklärung: Ausgewählte Schriften Band 3, Stuttgart: Fromann-Holzboog.

Ludwig, Walther
1997: “Die neuzeitliche lateinische Literatur seit der Renaissance”, in Fritz Graf (ed.), *Einleitung in die lateinische Philologie*, Stuttgart/Leipzig: Teubner, pp. 323-356.
Madariaga, Isabel de
1998: *Politics and Culture in Eighteenth-Century Russia*, London / New York: Longman.
Marlot, Christophe
2004: *Les passages de Vénus. Histoire et observation d’un phénomène astronomique*, Paris: Vuibert.
Marov, Mikhail Ya.
2005: “Mikhail Lomonosov and the discovery of the atmosphere of Venus during the 1761 transit”, in Kurtz (ed.), pp. 209-219.
Marton, József
2007: “The History of Roman Catholic Theological Education in Transylvania”, *Studia Universitatis Babes-Bolyai, Theologia Catholica Latina*, No. 1/2007, pp. 15-23.
2009: “Toleranţa şi intoleranţa religioasă în Transilvania după Reforma religioasă”, *Annales Universitatis Apulensis, Series Historica* 2009, pp. 195-210.
Maor, Eli
2000: *June 8, 2004: Venus in Transit*, Princeton: Princeton University Press.
Meadows, A.J.
1966: “The discovery of an atmosphere on Venus”, *Annals of Science* vol. 22, pp. 117-127.
Meillet, Antoine et al.
1924: “Le problème de l’orthographe latine”, *Revue des études latines* vol. 2, pp. 28-34.
Mejer, Nils
2004: “Venuspassagerna på 1760-talet – en startpunkt för internationellt vetenskapligt samarbete”, *Populär Astronomi* vol. 5, no. 1, pp. 42-45.
Mencsik, Ferdinánd
1905: “Schlözer Ágoston Lajos levelei Hell Miksához, 1772. febr. 29.”, *Történelmi Tár* vol. 6, pp. 143-147.
Mervaud, Michel
2004: “Introduction: Jean Chappe d’Auteroche, savant et voyageur au siècle des Lumières”, in Chappe d’Auteroche, vol. I, pp. 1-122.
Metz, Don
2007: “William Wales and the 1769 transit of Venus: puzzle solving and the determination of the astronomical unit”, *Science & Education* vol. 18, pp. 581-592.
Molvig, Ole
2010: “The Berlin Urania, Humboldtian Cosmology, and the Public”, in Aubin et al. (eds.), pp. 325-343.
Mortensøn, Ole
2004: “Kanetur”, *Skalk. Nyt om gammelt* Nr. 1/2004, pp. 29-32.
Morovics, Miroslav Tibor & Šperka, Andrej
2006: “The beginnings of scientific interests in electrical phenomena in Hungarian Kingdom”, in M. Kokowski (ed.), *The Global and the Local: The History of Science and the Cultural Integration of Europe, Proceedings of the 2nd ICESHS (Cracow, Poland, September 6-9, 2006)*, pp. 926-933. Retrieved at: http://www.2iceshs.cyfronet.pl/2ICESHS_Proceedings/Chapter_29/R-Varia_II_Morovics_Sperka.pdf (Accessed 18 January 2011)

Most, Glenn W.
1998: *Editing Texts / Texte edieren*, Aporemata: Kritische Studien zur Philologiegeschichte Band 2, Göttingen: Vandenhoeck & Ruprecht.

Moutchnik, Alexander
2006: *Forschung und Lehre in der zweiten Hälfte des 18. Jahrhunderts: Der Naturwissenschaftler und Universitätsprofessor Christian Mayer SJ (1719-1783),* Algorismus: Studien zur Geschichte der Mathematik und der Naturwissenschaften herausgegeben von Menso Folkerts Heft 54, Augsburg: Dr. Erwin Rauner Verlag.

Müller, Winfried
1993: "Der Jesuitenorden und die Aufklärung im süddeutsch-österreichischen Raum", in Harm Klueting (ed.), *Katholische Aufklärung – Aufklärung im katholischen Deutschland*, Studien zum achtzehnten Jahrhundert, herausgegeben von der Deutschen Gesellschaft für die Erforschung des achtzehnten Jahrhunderts Band XV, pp. 225-245.

Münter, Frederik (Friederich)
1837: *Frederik Münter: Et mindeskrift* II: *Aus den Tagebüchern Friedrich Münters: Wander- und Lehrjahre eines Dänischen Gelehrten*, herausgegeben von Øjvind Andersen, Erster Teil: 1772-85, Copenhagen / Leipzig: P. Haase & Søn / Otto Harrassowitz.

Myklebost, Kari
2009: "Norge i verden. Norsk-russiske historiske relasjoner som bakteppe for grunnlovsjubileet", in Tjelmeland et al. (eds.), pp. 47-56.

Newcomb, Simon
1883: "On Hell's alleged Falsification of his Observations of the Transit of Venus in 1769", *Monthly Notices of the Royal Astronomical Society* vol. 43, May 1883, pp. 372-381.
1890: "Discussion of Observations of the Transits of Venus in 1761 and 1769", *United States Nautical Almanac, Astronomical Papers* vol. II.5, pp. 259-405.
2006: *The Reminiscences of an Astronomer*, (orig. published 1903), Teddington: The Echo Library.

Niebuhr, Carsten
1968: *Reisebeschreibung nach Arabien und den umliegenden Ländern*, Um ein Vorwort vermehrter Nachdruck der bei Nicolaus Möller, Kopenhagen 1774-78 und bei Friedrich Perthes, Hamburg 1837 erschienenen Ausgabe [facsimile, with a foreword by Dietmar Henze], 3 vols., Graz: Akademische Druck- und Verlagsanstalt.
2003: *Rejsebeskrivelse fra Arabien og andre omkringliggende lande* vol. I, med indledning af Michael Harbsmeier, oversat fra tysk af Hans Christian Fink, Copenhagen: Forlaget Vandkunsten.

Niehl, Rüdiger
2006: "Editionsprojekt CAMENA, Heidelberg: De editionibus Neolatinis in rete electronico instituendis", in Schnur et al. (eds.), pp. 639-643.

Nielsen, Axel V.
1957*a*: "Christian Horrebows observationer af Venuspassagen i 1761", *Nordisk Astronomisk Tidsskrift* [Copenhagen], pp. 47-50.
1957*b*: "Pater Hell og Venuspassagen 1769", *Nordisk Astronomisk Tidsskrift* [Copenhagen], pp. 77-97.

Nordenmark, N. V. E.
1939: *Pehr Wilhelm Wargentin: Kungl. Vetenskapsakademiens Sekreterare och Astronom 1749-1783 […]. Avec un résumé français*, Uppsala: Kungl. Svenska Vetenskapsakademien.
1959: *Astronomiens Historia i Sverige intill År 1800*, Uppsala & Stockholm: Almqvist & Wiksell.
Nouzille, Jean
1998: "Les Jésuites en Transylvanie aux XVII[e] et XVIII[e] siècles", *XVIIe siècle. Revue trimestrielle* vol. 50, pp. 315-328.
Novák, Ján (ed.)
1970: *Maximilián Hell 1720-1792: Zborník prednášok z konferencie o živote a diele Maximiliána Hella*, Bratislava: ÚRD pre Slovenske banské múzeum v. Ban. Štiavnici.
Nunis Jr., Doyce B. (ed.)
1982: *The 1769 transit of Venus: the Baja California observations of Jean-Baptiste Chappe d'Auteroche, Vicente de Doz, and Joaquín Velázquez Cárdenas de León*, introduced & edited by Doyce B. Nunis, Jr., translations by James Donahue, Maynard J. Geiger, & Iris Wilson Engstrand, *Baja California travels series* 46, Los Angeles: Natural History Museum of Los Angeles County.
O'Malley, John W.
1999: "The Historiography of the Society of Jesus: Where Does It Stand Today?", in O'Malley *et al.* (eds.), pp. 3-37.
O'Malley, John W., Gauvin Alexander Bailey, Steven J. Harris & T. Frank Kennedy (eds.)
1999: *The Jesuits: Cultures, Sciences, and the Arts, 1540-1773*, Toronto: University of Toronto Press.
2006: *The Jesuits II: Cultures, Sciences, and the Arts, 1540-1773*, Toronto: University of Toronto Press.
O'Neill, Charles Edwards & Joaquín María Domínguez (eds.)
2001: *Diccionario histórico de la Compañía de Jesús: biográfico-temático*, 4 vols., Rome: Institutum historicum S. I. / Madrid: Universidad Pontificia Comillas.
Orchiston, Wayne
2005: "James Cook's 1769 transit of Venus expedition to Tahiti", in Kurtz (ed.), pp. 52-66.
Ordbok över svenska språket (Svenska Akademins Ordbok)
1898-: Vol. 1-, utgiven av Svenska Akademin, Lund: Gleerup.
Oxford English Dictionary
2004: 2nd edn. (printed in 20 vols., 1989), online version provided by Oxford: Oxford University Press.
Oxford Latin Dictionary
1968-1982: Vol. 1-8, edited by P. G. W. Glare, Oxford: Oxford University Press.
Oscarsson, Ingemar
2011: "En revolution i offentligheten: om lärda tidskrifter i Europa under tidigmodern tid och om hur svensk vetenskap representerades i dem", *Sjuttonhundratal: Nordic Yearbook for Eighteenth-Century Studies* vol. [8] 2011, pp. 93-115.
Oseen, C. W.
1939: *Johan Carl Wilcke: Experimental-Fysiker*, Uppsala: Kungl. Svenska Vetenskapsakademien.
Pagani, Catherine
2006: "Clockwork and the Jesuit Mission in China", in O'Malley *et al.* (eds.), pp. 658-677.

Pasachoff, Jay M., Glenn Schneider, & Leon Golub
2005: "The black-drop effect explained", in Kurtz (ed.), pp. 242-253.
Pasachoff, Jay M. & Naomi Pasachoff
2010: Review of Kragh 2008, *Physics in Perspective* vol. 12, pp. 105-108.
Passeron, Irène
2008: "La République des Sciences: Réseaux des correspondances, des académiens et des livres scientifiques", in Passeron, Siegfried Bodenmann & René Sigrist (eds.), *La République des Sciences*, Dix-Huitième Siècle No. 40, Numéro spécial, Paris: la Société française d'étude du 18e siècle.
Pecker, Jean-Claude
1985: "L'œuvre scientifique de Joseph-Jérôme Lefrançois de Lalande (1732-1807)", *Les nouvelles annales de l'ain*, 1985, pp. 1-31.
1998: "Jérôme de Lalande and international cooperation", in Brosche *et al.* (eds.), pp. 52-62.
2007: "Préface", in Dumont 2007, pp. 1-7.
Pedersen, Olaf
1992: *Lovers of Learning: A History of the Royal Danish Academy of Sciences and Letters, 1742-1992*, Copenhagen: Munksgaard.
Perkmann, R.
1866: *Die Jesuiten und die Wiener Universität*, Zweite Ausgabe, Leipzig: Verlag von Otto Wigand.
Persson, Mathias
2009: *Det nära främmande: Svensk lärdom och politik i en tysk tidning 1753-1792*, Acta Universitatis Upsaliensis, Uppsala Studies in History of Ideas 40, Uppsala: Uppsala Universitet.
Petrovay, Kristóf (ed.)
2006: *A csillagászati tanszék negyed évezrede: Évfordulós kötet* / *A Quarter Millennium of the Depatment of Astronomy: An Anniversary Volume*, PADEU: Publications of the Astronomy Department of Eötvös University vol. 16, Budapest: ELTE Csillagászati Tanszéke.
Pfeiffer, Rudolphus
1949: *Callimachus*, vol. I: *Fragmenta*, Oxonii: E typographeo Clarendiano.
Pictet, Jean-Louis & Jacques-André Mallet
2005: *Deux astronomes genevois dans la Russie de Catherine II: Journaux de voyage en Laponie russe […] pour observer le passage de Vénus devant le disque solaire 1768-1769*, publiés d'après les manuscrits originaux, avec introductions et notes de Jean-Daniel Candaux, Sophie Capdeville, Michel Grenon, René Sigrist et Vladimir Somov, Ferney-Voltaire: Centre international d'étude du XVIIIe siècle.
Pigatto, Luisa
2005: "The 1761 transit of Venus dispute between Audiffredi and Pingré", in Kurtz (ed.), pp. 74-86.
Pihlaja, Päivi Maria
2005*a*: "Sweden and l'Académie des Sciences: Scientific Elites in 18th-century Europe", *Scandinavian Journal of History* vol. 30, pp. 271-285.
2005*b*: "The study of the North in the 18th Century: Knowledge of Lapland in Europe, and its Significance for Foreign Scholars", in Maria Lähteenmäki & Päivi Maria Pihlaja (eds.), *The North Calotte: Perspectives on the Histories and Cultures of Northernmost Europe*, Helsingin yliopiston historian laitoksen julkaisuja 18, Inari: Puntsi, pp. 25-37.

2006: "Sverige, vetenskapen och Paris i slutet av frihetstiden: Synpunkter på de lärdas kontakter, deras vistelser i Paris och Nordens roll i de vetenskapliga förbindelserna", *Historisk Tidskrift för Finland* vol. 91, pp. 2-34.

2009: *Tiedettä pohjantähden alla: pohjoisen tutkimus ja Ruotsin tiedeseurojen suhteet Ranskaan 1700-luvulla*, Bidrag till kännedom av Finlands natur och folk 181, Helsinki: Suomen tiedeseura.

Pinsker, Anton

1971: "Der Astronom Pater Max Hell SJ", *Freinberger Stimmen* [Linz] vol. 41, pp. 99-111.

Pinzger, Ferenc

1920-1927: *Hell Miksa Emlékezete: Születésének kétszázadik évfordulójára különös tekintettel Vardői útjára*, I. Rész: *Hell élete és működése*, II. Rész: *Hell levelezése, három függelékkel [...] Mit einem deutschen Auszuge aus dem Werke: Erinnerung an Maximilian Hell*, Budapest: Kiadja a Magyar Tudományos Akadémia.

Pontoppidan, Erik

1977: *Norges Naturlige Historie 1752-53* (facsimile edition of *Det første Forsøg paa Norges Naturlige Historie, forestillende Dette Kongeriges Luft, Grund, Fielde, Vande, Væxter, Metaller, Mineralier, Steen-Arter, Dyr, Fugle, Fiske og omsider Indbyggernes Naturel, samt Sædvaner og Levemaade*), two vols., København: Rosenkilde og Bagger.

Posch, Thomas & Franz Kerschbaum

2005: "Kepler, Horrocks, Hevelius und der Venustransit von 1631", in Gudrun Wolfschmidt & Martin Šolc (eds.), *Astronomy in and around Prague: Colloquium of the Working Group of the History of Astronomy, Prague, September 20, 2004*, Acta Universitatis Carolinae Mathematica et Physica vol. 46, Supplementum, Prague: Univerzita Karlova v Praze – Nakladatelství Karolinum, pp. 89-100.

Posch, Thomas & Karin Lackner

2008: "Anton Pilgram – Mitbegründer neuzeitlicher wissenschaftlicher Meteorologie?", in Firneis & Kerschbaum (eds.), pp. 55-69.

Powalky, C. R.

1864: *Neue Untersuchung des Venusdurchganges von 1769 zur Bestimmung der Sonnenparallaxe* (also with a title page in Latin: *De transitu stellae Veneris ante discum Solis anno 1769 peracto ad Solis parallaxin accuratius determinandam novae disquisitiones [...] quam [...] scripsit Carolus Rudolphus Powalky*), Kiel: C.F. Mohr.

Prevost, Pierre:

1805: *Notice de la vie et des écrits de George-Louis Le Sage de Genève [...], rédigée d'après ses notes [...]*, Genève: Chez J. J. Paschoud.

Pärr, Nora

2001: *Wiener Astronomen – Ihre Tätigkeit an Privatobservatorien und Universitätssternwarten*, Diplomarbeit, Wien: Geisteswissenschaftliche Fakultät der Universität Wien.

Pörtner, Regina

2005: "Die Kunst der Lügens: Ketzerverfolgung und geheimprotestantische Überlebensstrategien im theresianischen Österreich", in Burkhardt & Werkstetter (eds.), pp. 385-408.

Rabbie, Edwin
1996: "Editing Neo-Latin Texts", *Editio: Internationales Jahrbuch für Editionswissenschaft* vol. 10, pp. 25-48.
Rabenalt, Ansgar
1986: "Astronomische Forschung im 18. Jahrhundert in Kremsmünster. Zu den ersten Berechnungen der Bahn des Uranus nach dem Briefwechsel zwichen Flacidus Fixlmillner O.S.B. und Maximilian Hell S.J. (1771-1790)", *Mitteilungen des Oberösterreichischen Landesarchivs* Band 15, pp. 93-216.
Ramminger, Johann
2006: "The orthography of machine-readable Neolatin texts: a plaidoyer for minimal intervention" (preprint dated 5 October 2006), http://www.lrz.de/~ramminger/orthography/neolatin_orthography.pdf (accessed 12 September 2011).
Rasmussen, Stig T. (ed.)
[1990]: *Den Arabiske Rejse 1761-1767: En dansk ekspedition set i videnskabshistorisk perspektiv*, [Copenhagen:] Munksgaard.
Ratcliff, Jessica
2008: *The Transit of Venus Enterprise in Victorian Britain*, Science and Culture in the Nineteenth Century Number 3, London: Pickering & Chatto.
Rem, Tore
2005: "Mesenat, marked og litteratur", *Nytt Norsk Tidsskrift* vol. 22, pp. 115-126.
Réthly, A. & Z. Berkes
1963: *Nordlichtbeobachtungen in Ungarn (1523-1960)*, übersetzt von L. Aujeszky, Budapest: Akadémiai Kiadó.
Robertson, Ritchie
2009: "Curiosity in the Austrian Enlightenment", *Oxford German Studies* vol. 38, pp. 129-142.
Robin, Nicolas
2007: "Amateure der Botanik und Botanik für Amateure. Bilder der botanischen Tätigkeiten in Weimar-Jena", in Blechschmidt & Heinz (eds.), pp. 353-368.
Roggen, Vibeke
2002: *Intellectual Play – Word and Picture: A study of Nils Thomassøn's Latin Rebus Book* Cestus Sapphicus. *With edition, translation and a corpus of sources*, vol. I, Acta Humaniora nr. 98, Oslo: University of Oslo.
Romano, Antonella
2000: "Entre Collèges et Académies: Esquisse de la place des Jésuites dans les réseaux européens de la production scientifique (XVII^e^-XVIII^e^ siècle)", in Hurel & Laudin (eds.), pp. 387-407.
2005: "Les Jésuites entre apostolat missionaire et activité scientifique (XVI^e^-XVIII^e^ siècles)", *Archivum historicum Societatis Iesu* vol. 74, pp. 213-236.
Ruiu, Adina
2007: *Les récits de voyage aux pais froids au XVII^e^ siècle: De l'expérience du voyageur à l'expérimentation scientifique*, Montréal: Université du Quebec à Montreal.
Ryymin, Teemu & Per Pippin Aspaas
2009*a*: "Kvenbegrepet hos Henrik Gabriel Porthan", *Arina : Nordisk tidskrift for kvensk forskning / Pohjoismainen kveenitutkimuksen aikakausjulkaisu* vol. 7, pp. 45-72.
2009*b*: "Henrik Gabriel Porthanin kveeni-käsite", *Arina* vol. 7, pp. 15-44. [Finnish translation of the above article]

Sajnovics, Johannes (Joannes, Johann, János)
1968: *Demonstratio Idioma Ungarorum et Lapponum idem esse*, [facsimile edition of Sajnovics (1771)] with an introduction by Thomas A. Sebeok, Indiana University Publications: Uralic and Altaic Series vol. 91, The Hague: Indiana University, Bloomington.
1972: *Beweis, daß die Sprache der Ungarn und Lappen dieselbe ist* (Aus dem Lateinischen übertragen von Monika Ehlers), mit Anmerkungen und Nachwort herausgegeben von Gyula Décsy und Wolfgang Veenker, Veröffentlichungen der Societas Uralo-Altaica vol. 5, Wiesbaden: In Kommission bei Otto Harrassowitz.
1990: *Naplója 1768-1769-1770*. A Bécsben őrsött latin nyelvű eredetiből fordította Deák András. Függelékként 1. Sajnovics János 11 úti levele. Magyarul közzétette Herman Ottó (1893). 2. Bollik Zsolt: Csillagászok nyomában. A Hell-Sajnovics emlékexpedíció-1989 […] Az előszót írta, a jegyzeteket, a jegyzékeket összeállította, szerkesztette Szíj Enikő, Bibliotheca Regulyana vol. I, Bupadest: ELTE Finnugor Nyelvtudományi Tanszék.
1993: *Sajnovics János Idea Astronomia*. A csillagászat alapvető ismertetése. Fordította: id. Nagy Rezső. Konzultáns: Nagy Rezső. Lektorálta: Hudoba György [facsimile edition of *Idea Astronomiæ. Honoribus Regiæ Universitatis Budensis dicata. A Joa. Nep. Sajnovics, AA. LL. & Philosophiæ Doctore; SS. Theologiæ Baccalaureo; Regiarum Societatum Scientiarum, quæ Hafniæ, & Nidrosiæ florent, Membro; Astronomi Regii Universitatis Budensis p.t. Adjuncto*, Budæ: Typis Catharinæ Landerer Viduæ (1778, 86 pp.), with introduction and translation in Hungarian], Székesfehérvár.
1994: *Demonstratio Sajnovics János […] Bizonyítása a magyar és a lapp nyelv azonos […]*, a Nagyszombati kiadást latinból magyarra fordította Constantinovitsné Vladár Zsuzsa, szerkesztette Szíj Enikő, Bibliotheca Regulyana vol. II, Bupadest: ELTE Finnugor Nyelvtudományi Tanszék.
Sammallahti, Pekka
1996: “History of Finno-Ugric Linguistics in the Nordic Countries”, in Carol Henriksen, Even Hovdhaugen, Fred Karlsson & Bengt Sigurd (eds.), *Studies in the Development of Linguistics in Denmark, Finland, Iceland, Norway and Sweden*, Oslo: Novus Forlag, pp. 297-323.
Sarton, George
1944: “Vindication of Father Hell”, *ISIS* vol. 35, pp. 97-105.
Schaefer, Bradley E.
2001: “The transit of Venus and the notorious black drop effect”, *Journal for the History of Astronomy* vol. 32, part 4, no. 109, pp. 325-336.
Schaffer, Simon
2010: “The astrological roots of mesmerism”, *Studies in History and Philosophy of Biological and Biomedical Sciences* vol. 41, pp. 158-168.
Schlafly Jr., Daniel L.
2006: “The Post-Suppression Society of Jesus in the United States and Russia: Two Unlikely Settings”, in O’Malley *et al.* (eds.), pp. 772-783.
Schmidt, Michael
2005: “Zwischen Dilettantismus und Trivialisierung: Experiment, Experimentmetapher und Experimentalwissenschaft im 18. und frühen 19. Jahrhundert”, in Marie-Theres Federhofer (ed.), *Experiment und Experimentieren im 18. Jahrhundert*, Cardanus: Jahrbuch für Wissenschaftsgeschichte vol. 5, Heidelberg: Palatina Verlag, pp. 63-87.

Schneider, Burkhart
1970: "Clemens XIII. und Clemens XIV.", in Jedin (ed.), pp. 626-636.
Schnur, Rhoda et al. (eds.)
2006: *Acta Conventus Neo-Latini Bonnensis: Proceedings of the Twelfth International Congress of Neo-Latin Studies, Bonn 3-9 August 2003*, Medieval and Renaissance Texts and Studies vol. 315, Tempe, Arizona: Arizona Center for Medieval and Renaissance Studies.
Schörg, Cornelia Maria
2009: *Die Präsenz der Wiener Universitätssternwarte und ihrer Forschungen in den deutschsprachigen astronomischen Jahrbüchern und Fachzeitschriften 1755-1830: Von Hells "Ephemerides astronomicae [ad meridianum Vindobonensem]" zu Littrows "Annalen der k. k. Sternwarte in Wien"*, Diplomarbeit, Wien: Historisch-Kulturwissenschaftliche Fakultät der Universität Wien.
Schreiber, Johann (John)
1904*a*: "Jesuit Astronomy. Part I. The Old Society, 1540-1773", *Popular Astronomy* vol. 12 (1904), pp. 9-19.
1904*b*: "Jesuit Astronomy. II.", *Popular Astronomy* vol. 12 (1904), pp. 94-112.
Schroeder-Gudehus, Brigitte
1990: "Nationalism and Internationalism", in R.C. Olby, G.N. Cantor, J.R.R. Christie & M.J.S. Hodge (eds.), *Companion to the History of Modern Science*, pp. 909-919. London / New York: Routledge.
Schulze, Ludmilla
1985: "The Russification of the St. Petersburg Academy of Sciences and Arts in the eighteenth century", *British Journal for the History of Science* vol. 18, pp. 305-335.
Seidel, Robert (ed.)
2001: *Die "exakten" Wissenschaften zwischen Dilettantismus und Professionalität: Studien zur Herausbildung eines modernen Wissenschaftsbetriebs im Europa des 18. Jahrhunderts*, Cardanus: Jahrbuch für Wissenschaftsgeschichte vol. 2, Heidelberg: Palatina Verlag.
Sellers, David
2001: *The Transit of Venus. The Quest to find the True Distance of the Sun*, Leeds: MegaVelda Press.
Sheehan, William & John Westfall
2004: *The Transits of Venus,* Amherst, New York: Prometheus Books.
Skocpol, Theda & Margaret Somers
1980: "The Uses of Comparative History in Macrosocial Inquiry", *Comparative Studies in Society and History* vol. 22, pp. 174-197.
Shore, Paul
2000: "The Society of Jesus and the culture of the late Baroque in Bohemia 1730-1773", *East European Quarterly* vol. 34, pp. 1-19.
2007: *Jesuits and the Politics of Religious Pluralism in Eighteenth-Century Transylvania. Culture, Politics and Religion, 1693-1773,* Aldershot: Ashgate.
Shore, Paul & Maurice Whitehead
2010: "Crisis and Survival on the Peripheries: Jesuit Culture, Continuity, and Change at Opposite Ends of Continental Europe, 1762-1814", *History of Universities* vol. 24, pp. 173-205.
Sinnerstad, Ulf
1989: "Astronomy and the first observatory", in Frängsmyr (ed.), pp. 45-71.

Smagina, Galina Ivanovna
2007: "Peterburgskaia akademiia nauk i provintsialn'nye liubiteli nauk XVIII v.", *Voprosy Istorii Estestvoznaniia i Tekhniki* (2007), pp. 121-139.
Smolarski, Dennis C.
2002: "The Jesuit *Ratio Studiorum*, Christopher Clavius, and the Study of Mathematical Sciences in Universities", *Science in Context* vol. 15, pp. 447-457.
Smolka, Josef & Šolc, Martin
2008: "Maximilian Hell und Prager Astronomie", in Firneis & Kerschbaum (eds.), pp. 21-30.
Snorrason, Egill
1974: *C. G. Kratzenstein: professor physices experimentalis Petropol. et Havn. and his Studies on Electricity during the Eighteenth Century*, Acta historica scientiarum naturalium et medicinalium edidit bibliotheca universitatis Hauniensis vol. 29, Odense: Odense University Press.
Sogner, Sølvi
2003: "Fromhed styrker rikene", in Knut Kjeldstadli (ed.), *Norsk innvandringshistorie* vol. I, pp. 240-258. Oslo: Pax forlag.
Sommervogel, Carlos
1893: "Hell, Maximilien" in *Bibliothèque de la Compagnie de Jésus […] Bibliographie* Tome IV, Bruxelles: Oscar Schepens / Paris: Alphonse Picard, pp. 238-258.
Sortkær, Allan
2008: "Hvilken fortræffelig gave fra den danske nation til videnskaben! Fremkomsten af internationale videnskabelige ekspeditioner i 1700-tallet", *Den Jyske Historiker* (spesial issue on *Danske Videnskabelige Ekspeditioner*) Nr. 119, pp. 5-25.
Spring, Ulrike
2011: "Dilettanter og vitenskapsmenn: Tromsø Museums første tiår", in Federhofer & Hodacs (eds.), pp. 287-308.
Stadius, Peter
2010: Review of Pihlaja 2009, *Sjuttonhundratal* [vol. 7] 2010, pp. 207-209.
Standish, E. Myles
2005: "The Astronomical Unit now", in Kurtz (ed.), pp. 163-179.
Steinicke, Wolfgang & Wilhelm Brüggenthies
2004: "Maximilian Hell und der Venustransit von 1769 – Eine abenteuerliche Reise nach Vardø", *VdS-Journal* vol. 15, pp. 78-81.
Steinmayr, Johann
2010*a*: "Die Geschichte der Universitätssternwarte Wien", in Hamel *et al*. (eds.), pp. 169-201.
2010*b*: "Geschichte der Wiener Universitätssternwarte im 19. Jahrhundert, 1. Teil", in Hamel *et al.* (eds.), pp. 202-222.
2010*c*: "Geschichte der Wiener Universitätssternwarte im 19. Jahrhundert, 2. Teil", in Hamel *et al.* (eds.), pp. 223-245.
2010*d*: "Anton Pilgram und die meteorologische Forschung gegen Ende des 18. Jahrhunderts", in Hamel *et al.* (eds.), pp. 246-262.
2010*e*: "Ernst-heiteres Quodlibet aus der Geschichte der Wiener Sternwarten", in Hamel *et al.* (eds.), pp. 263-283.
2010*f*: "Von Instrumenten, Messungen und Finanzen der alten Wiener Universitätssternwarte", in Hamel *et al.* (eds.), pp. 284-304.

2011: “Die alte Jesuiten-Sternwarte in Graz”, herausgegeben und kommentiert von Isolde Müller und Thomas Posch, in Wolfgang R. Dick, Hilmar W. Duerbeck & Jürgen Hamel (eds.), *Beiträge zur Astronomiegeschichte* Band 11, Acta Historica Astronomiae vol. 43, Frankfurt am Main: Verlag Harri Deutsch, pp. 232–260.

Stuber, Martin

2005: “Brief und Mobilität bei Albrecht von Haller: Zur Geographie einer europäischen Gelehrtenkorrespondenz”, in Burkhardt & Werkstetter (eds.), pp. 313-334.

Szenkovits, Ferenc

2006: “A Kolozsvári egyetemi csillagda történetéből”, in Petrovay (ed.), pp. 103-128.

Suhling, Lothar

2006: “Von der Alten zur Neuen Welt und zurück. Meilensteine der Vor- und Frühgeschichte der Europäischen Amalgamation nach Ignaz von Born im Überblick”, in Günter Bayerl, Torsten Meyer & Marcus Popplow (eds.), *Technik, Arbeit und Umwelt in der Geschichte. Günter Bayerl zum 60. Geburtstag*, Münster: Waxmann Verlag, pp. 77-94.

Sühring, Hartmut

1979: “Die Entwicklung der niedersächsischen Kalender im 17. Jahrhundert”, *Archiv für die Geschichte des ganzen Buchwesens* vol. XX, pp. 329-794.

Sutton, Dana F.

2007: Review of Schnur et al. 2006, *Bryn Mawr Classical Review* No. 2007.09.16.

Sørensen, Øystein

2007: *Den store sammensvergelsen: Historien om det hemmelige selskapet Illuminatus og dets mange ugjerninger*, Oslo: Aschehoug.

Sörlin, Sverker

1993: “National and International Aspects of Cross-Boundary Science: Scientific Travel in the 18th Century”, in Elisabeth Crawford, Terry Shinn & Sverker Sörlin (eds.), *Denationalizing Science: The Contexts of International Scientific Practice*, Sociology of the Sciences Yearbook XVI (1992), Dordrecht: Kluwer Academic Publishers, pp. 43-72.

Szilas, László

1972: “Quellen der ungarischen Kirchengeschichte aus ehemaligen Jesuitenarchiven”, *Ungarn-Jahrbuch: Zeitschrift für die Kunde Ungarns und verwandte Gebiete* vol. 4, pp. 172-189.

Szíj, Enikö

1994: “A Demonstratio helye a két jezsuita tudós kutatási”, in Sajnovics 1994, pp. 138-147.

Terrall, Mary

1992: “Representing the Earth’s Shape: The Polemics Surrounding Maupertuis’s Expedition to Lapland”, *ISIS* vol. 83, pp. 218-237.

Thesaurus Linguae Latinae

1900-: editus auctoritate et consilio academiarum quinque Germanicarum: Berolinensis, Gottingensis, Lipsiensis, Monacensis, Vindobonensis [...], Lipsiae : Teubner / Beroloni : de Gruyter.

Thorvaldsen, Steinar

2004: “Observasjoner av Venus på solskiva”, *Naturen: Populærvitenskapelig Tidsskrift* (Oslo) vol. 128, nr. 5/2004, pp. 266-275.

Thykier, Claus, Kjeld Gyldenkerne & Per Barner Darnell

1990: *Dansk Astronomi Gennem Firehundrede År*, 3 volumes, Copenhagen: Rhodos.

Tibenský, Ján
1970: “Pokusy o organizovanie vedeckého života v Habsburgskej Riši a na Slovensku v 18. storočí / Versuche zur Organisierung des wissenschaftlichen Lebens im Habsburgerreich und in der Slovakei im 18. Jahrhundert”, in Novák (ed.), pp. 3-25.
1977: “Miesto cisársko-kráľovského astronóma Maximiliána Hella v učenom svete”, in Littrow 1977, pp. 9-29.
Tjelmeland, Hallvard
1995: *Nordnorsk posthistorie 1665-1850: Med posten inn i ei moderne tid*, [Oslo]: Postmuseet.
Tjelmeland, Hallvard, Miriam Tveit & Steinar Aas (eds.)
2009: *Korleis feire ein nasjonalstat i ei globalisert verd?* Rapport frå Norske historie-dagar 2008, Tromsø 19.-22. juni 2008, Speculum Boreale nr. 10, Tromsø: Universitetet i Tromsø.
Tobé, Erik
1991: *Anders Hellant: En krönika om sjuttonhundratalets märkligaste Tornedaling*, Tornedalica no. 49, [Luleå:] Tornedalica.
Tolomeo, Rita (ed.)
1992: *Ruggiero Giuseppe Boscovich: Lettere per una storia della scienza (1763-1786),* Accademia Nazionale delle Scienze detta dei XL: Scritti e documenti IX, Documenti Boscovichiani III. Rome: Accademia Nazionale delle Scienze detta dei XL.
Tóth, István György
2000: *Literacy and Written Culture in Early Modern Central Europe*, Budapest: Central European University Press.
2003: “Les analphabètes et les almanachs en Hongrie au XVIII^e siècle”, in Hans-Jürgen Lüsebrink, York-Gothart Mix, Jean-Yves Mollier et Patricia Sorel (eds.), *Les lectures du peuple en Europe et dans les Amériques du XVIIe au XXe siècle*, pp. 127-133, Bruxelles: Editions Complexe.
Töchterle, Karlheinz
2004: “Probleme neulateinischer Editionstechnik im Spannungsfeld aktueller Anforderungen und traditioneller Textkritik”, *editio: Internationales Jahrbuch für Editionswissenschaft* vol. 18, pp. 28-37.
Tüskés, Gábor
2010: “Deutsch-ungarische Kontakte auf dem Gebiet der Historia litteraria in der ersten Hälfte des 18. Jahrhunderts”, *Das Achtzehnte Jahrhundert: Zeitschrift der Deutschen Gesellschaft für die Erforschung des achtzehnten Jahrhunderts* vol. 34, pp. 65-81.
Udías, Agustín
2003: *Searching the Heavens and the Earth: the History of Jesuit Observatories*, Astrophysics and Space science library vol. 286, Dordrecht: Kluwer Academic.
2005: “Los libros y manuscritos de los profesores de matematicas del Colegio Imperial de Madrid, 1627-1767”, *Archivum Historicum Societatis Iesu* vol. 74, pp. 369-448.
Ullmaier, Hans
2005: *Puncta, particulae et phaenomena: Der dalmatinische Gelehrte Roger Joseph Boscovich und seine Naturphilosophie*, TROLL: Tromsøer Studien zur Kultur-wissenschaft Band 2, edited by Michael Schmidt, Hannover-Laatzen: Wehrhahn Verlag.

Van Gent, Robert H.
2005: "Observations of the 1761 and 1769 transits of Venus from Batavia (Dutch East Indies)", in Kurtz (ed.), pp. 67-73.

Van Helden, Albert
1995: "Measuring Solar Parallax: the Venus transits of 1761 and 1769 and their nineteenth century sequels", in René Taton & Curtis Wilson (eds.), *Planetary Astronomy from the Renaissance to the Rise of Astrophysics*, part B: *The Eighteenth and Nineteenth Centuries*, New York: Cambridge University Press, pp. 153-168.

Van Horn Melton, James
1988: *Absolutism and the Eighteenth-Century Origins of Compulsory Schooling in Prussia and Austria*, Cambridge: Cambridge University Press.

Vargha, Magda (ed.)
1990-1992: *Correspondence de Ferenc Weiss astronome hongrois du XVIII^{e} siècle* vol. I-II, Bibliotheca Universitatis Budapestinensis. Fontes et Studia vol. 6-7, Budapest: Bibliothèque de l'Université.

Varićak, Vladimir
1912: "Drugi ulomak Boškovićeve korespondencije", *Rad Jugoslavenske akademije znanosti i umjetnosti, Matematičko-prirodoslovni razred* vol. 52, pp. 163-383.

Vass, József
1857: "Sajnovics János két ismeretlen levele", *Új Magyar Muzeum* vol. 1, pp. 136-146.

Vedel, Poul
1882*a*: *Den ældre Grev Bernstorffs Ministerium*, Copenhagen: J. Jørgensen & Co.
1882*b*: *Correspondance ministérielle du comte J.H.E. Bernstorff*, 2 vols, Copenhagen.

Verdun, Andreas
2004: "Die Bestimmung der Sonnen-Parallaxe aus den Venus-Transits im 18. Jahrhundert", *Orion* vol. 3/2004, no. 322, pp. 4-20.

Verhas, Pierre
2001: "Histoire de la parallaxe solaire", *Ciel et Terre* vol. 117, pp. 169-183.

Vlachovič, Jozef
1970: "Banská Štiavnica – postredie, v ktorom vyrastal Maximilián Hell (Banská Štiavnica – das Milieu, in dem Maximilian Hell herangewachsen war)", in Novák (ed.), pp. 27-44.

Vladár, Zsuzsa
2008: "Sajnovics's *Demonstratio* and Gyarmathi's *Affinitas*: Terminology and Methodology", *Acta Linguistica Hungarica* vol. 55, pp. 145-181.

Voje Johansen, Nils
2002: "Da avstanden til sola ble bestemt", *Forskningspolitikk* vol. 2/2002, pp. 14-15.
2004: "Vitenskap som springbrett – Jens Finne Borchgrevinck satset og vant", *Fjellfolk: Årbok for Rørosmuseet* vol. 29, pp. 20-29.
2009: "In ultimo fine Europae: Astronomen Maximilian Hell på besøk i Vardø", in Benedicte Gamborg Briså & Bente Lavold (eds.), *Kompassrosen: Orientering mot Nord*, Oslo: Nasjonalbiblioteket, pp. 40-51.
2011*a*: "'Jeg kan aldri faae nok af Sol og Maane' – Gotfred Bohr i spennet mellom musikk og astronomi", in Federhofer & Hodacs (eds.), pp. 129-154.
2011*b*: "Da venuspassasjer endret verden", in *Almanakk for Norge* vol. 199: *For året etter Kristi fødsel 2012*, Oslo: Universitetet i Oslo, pp. 81-85.

Vorontsov-Vel'yaminov, Boris A.
1969: *Astronomical Problems: An Introductory Course in Astronomy*, translated by P. M. Rabbitt, Arthur Beer and John. B. Hutchins (Russian orig. 1957), Oxford: Pergamon Press.
Vucinich, Alexander
1963: *Science in Russian Culture: A History to 1860*, London: Peter Owen.
Wagner, Florian
2004: *Die Entdeckung Lapplands: Die Forschungsreisen Carl von Linnés und Pierre Louis Moreau de Maupertuis' in den 1730er Jahren*, Norderstedt: Books on Demand.
Wallnig, Thomas
2011: "Approaches to the 'Aufklärung' in Austrian Historiography after 1945", in Wallnig et al. (eds.), pp. 33-50.
Wallnig, Thomas, Johannes Frimmel & Werner Telesko (eds.)
2011: *18th Century Studies in Austria, 1945-2010*, The Eighteenth Century and the Habsburg Monarchy International Series vol. 4, Bochum: Dieter Winkler.
Waquet, Françoise
2001: *Latin or the Empire of a Sign*, translated by John Howe (French orig. 1998), London / New York: Verso.
Weidler, Wilhelm
1915: *Leben und Schriften des Astronomen, Phsyikers und Rechtsgelehrten Johann Friedrich Weidler (1691–1755)*, Altona: Selbstverlag des Verfassers.
Weyss, Norbert
1986*a*-1986*b*-1987: "Maximilian Hell und sein Fernsehen vor 200 Jahren" [Part 1-3], *Maria Enzersdorfer Kulturnachrichten*, Nov. 1986, pp. 4-6; Dec. 1986, pp. 3-6; Jan. 1987, pp. 3-6.
Whyte, Lancelot Law (ed.)
1961: *Roger Joseph Boscovich S.J., F.R.S., 1711-1787: Studies of his life and work on the 250th anniversary of his birth*, London: George Allen & Unwin.
Widmalm, Sven
1990*a*: *Mellan kartan och verkligheten: Geodesi och kartläggning, 1695-1860*, Institutionen för idé- och lärdomshistoria, Uppsala universitet, Skrifter vol. 10, Uppsala: Institutionen för idé- och lärdomshistoria, Uppsala universitet.
1990*b*: "Accuracy, Rhetoric, and Technology: The Paris-Greenwich Triangulation, 1784-88", in Frängsmyr *et al.* (eds.), pp. 179-206.
1991: *A Commerce of Letters: Astronomical Communication in the 18th Century*, CERUM Working Paper 1991-13, Uppsala: Office for History of Science, Uppsala University.
1992: "A Commerce of Letters: Astronomical Communication in the 18th Century", *Science Studies* vol. 5, pp. 43-58.
Willoch, G. I. (ed.)
1960: *Vardøhus Festning 650 år. Jubileumsskrift*, Oslo: Generalinspektøren for Kystartilleriet.
Wimmer, Andreas & Nina Glick Schiller
2002: "Methodological nationalism and beyond: nation-state building, migration and the social sciences", *Global Networks* vol. 2, pp. 301-334.
Wittmann, Reinhard
2000: "Frühes Druck- und Verlagswesen der Jesuiten – Ein Desiderat der Forschung", *Mitteilungen der Gesellschaft für Buchforschung in Österreich* 2000/2, pp. 1-11.

Wolf, Rudolf

1877: *Geschichte der Astronomie*, Geschichte der Wissenschaften in Deutschland. Neuer Zeit, Sechszehnter Band, München: R. Oldenbourg.

Wolfschmidt, Gudrun

2008: "Die Entwicklung und Verbreitung der Urania zur Popularisierung der Astronomie", in Firneis & Kerschbaum (eds.), pp. 92-103.

2009: "Cultural Heritage and Architecture of Baroque Observatories", paper delivered at *The European Society for Astronomy in Culture* 17th Annual Meeting, SEAC 2009, internet: http://www.math.uni-hamburg.de/spag/ign/stw/seac09-obs-barock.pdf

Woolf, Harry

1953: "Eighteenth-Century Observations of the Transits of Venus", *Annals of Science* vol. IX, pp. 176-190.

1959: *The Transits of Venus. A Study of Eighteenth-Century Science*, Princeton, New Jersey: Princeton University Press.

1962: *Les astronomes français, le passage de Vénus et la diffusion de la science au XVIIIe siècle*, Paris: Université de Paris.

Wurzbach, Constant von

1856-1891: *Biographisches Lexikon des Kaiserthums Oesterreich, enthaltend die Lebensskizzen der denkwürdigen Personen, welche seit 1750 in den österreich-ischen Kronländern geboren wurden oder darin gelebt und gewirkt haben*, Erster-Sechzigster Theil, Wien: Verlag der Universitäts-Buchdruckerei / k.k. Hof- und Staatsdruckerei.

Zuidervaart, Huib J. & Rob H. Van Gent

2004: "'A Bare Outpost of Learned European Culture on the Edge of the Jungles of Java': Johan Maurits Mohr (1716-1775) and the Emergence of Instrumental and Institutional Science in Dutch Colonial Indonesia", *ISIS* vol. 95, pp. 1-33.

Örneholm, Urban

2003: *Four Eighteenth-century Medical Dissertations under the Presidency of Nils Rosén: edited, with an introduction and commentary*, Acta Universitatis Upsaliensis, Studia Latina Upsaliensia vol. 28, Uppsala: Uppsala Universitet.

Östlund, Krister

2000: *Johan Ihre on the Origins and History of the Runes: Three Latin Dissertations from the mid 18th Century, edited with translation and commentary*, Acta Universitatis Upsaliensis, Studia Latina Upsaliensia vol. 25, Uppsala: Uppsala Universitet.

Aase, Monica & Mikael Hård

1998: "'Det norska Athen': Trondheim som lärdomsstad under 1700-talets andra hälft", *Lychnos* 1998, pp. 37-74.

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