

REASSEMBLING
THE REPUBLIC OF LETTERS
IN THE DIGITAL AGE

Standards, Systems, Scholarship

Edited by Howard Hotson and Thomas Wallnig



Göttingen University Press



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Howard Hotson/Thomas Wallnig (eds.)
Reassembling the Republic of Letters in the Digital Age

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IV.5 Networking the Republic of Letters

Ruth Abnert and Sebastian E. Abnert

*With contributions from Per Pippin Aspaas, Howard Hotson,
Christoph Kudella, Ikaros Mantouvalos, Alexandra Sfoini,
and Anna Skolimowska*

In recent years it has become common to speak about the republic of letters as a network. But this was not always the case. Rather, it is the product of a specific set of conditions: the confluence of readily available digitized documents, computational power to analyse that data, and a ready acceptance of the ‘network perspective’ in the popular consciousness. In our increasingly interconnected world we encounter networks at every turn. The Internet, public transport networks, and power grids make our everyday lives possible; our careers are dependent on networking; and social networking sites provide an online account of our professional and personal capital. Networks have become a metaphor for connectedness, but also a concrete framework for visualizing and measuring complex systems of knowledge in the era of big data.

Although scholars working in the humanities might not realize it, the network turn is due to the emergence of ‘network science’ as a field of interdisciplinary study. In a series of key publications in the late 1990s and early 2000s, scholars such as Albert-László Barabási, Reka Albert, Duncan J. Watts, and Steven Strogatz showed that a huge variety of real-world networks – such as, for example, neural networks, transport networks, biological regulatory networks, and social networks – share an underlying order, follow simple laws, and therefore can be analysed

using the same mathematical tools and models.¹ These publications build on work from various different disciplines, such as sociology, mathematics, and physics, which stretches back some decades; but the emergence of network science as a field in its own right was the product of certain conditions that did not exist before. Barabási and Albert explicitly cite the computerization of data acquisition as essential to their research. In other words, what they needed was numerous examples of big network data, which they could compare, and the computational power to analyse that data. In this field, thousands of publications every year describe the development of new quantitative network analysis methods, and the analysis of new types of network data.

The advent of large-scale digitization efforts in the humanities has given scholars unprecedented access to their research materials. Perhaps more importantly, however, it has also put quantitative analysis methods within the reach of this community. This is particularly true of large collections of metadata, as these represent structured information that is easier to abstract and quantify. Correspondence metadata, such as the data collected by the constituent members of the COST Action *Reassembling the Republic of Letters*, lends itself particularly well to quantitative analysis, as it is exactly the kind of data that network analysis was designed to study – a set of well-defined relationships, namely letters sent and received, between well-defined entities, namely individuals. As discussed in chapter II.4, some work may be necessary to establish the identities of the individuals, but correspondence is a social relationship that is particularly clearly defined, due to its physical manifestation in the form of the manuscript letter.

The value of the COST Action *Reassembling the Republic of Letters* additionally relies on a ‘network effect’ – a term employed in the context of modern technology companies, which means that the value of a software product rises with the number of people using it, as such products typically facilitate interactions between users in some way. By combining the metadata of a wide range of historical correspondence projects, and by making them compatible with each other, their combined value to the scholarly community is greatly increased. Consistent metadata allows for much more wide-ranging searches across correspondence collections, and the power of quantitative network analysis grows rapidly with the size and scope of the network under study.

¹ See Duncan Watts and Steven Strogatz, ‘Collective Dynamics of “Small-world” Networks’, *Nature* 393 (1998): 440–2, see <https://doi.org/10.1038/30918>; Albert-László Barabási and Reka Albert, ‘Emergence of Scaling in Random Networks’, *Science* 286 (1999): 509–12, see <https://doi.org/10.1126/science.286.5439.509>; and Reka Albert and Albert-László Barabási, ‘Statistical Mechanics of Complex Networks’, *Reviews of Modern Physics* 74 (2002): 47–97, see <https://doi.org/10.1103/RevModPhys.74.47>.

1 Letters as Data

While correspondence is an ideal form of data to analyse using network analysis, there are a number of obstacles that we face when applying these methods to the republic of letters. The biggest of these is what we might call ‘data silos’. For hundreds of years vast resources have been invested in collecting, cataloguing, editing, annotating, and translating the letters exchanged between leading political and intellectual figures scattered across and beyond early modern Europe. These collections might be divided into two separate types: the physical archive and the virtual archive. The former, the physical archive, is determined by the actual location of the document, in a particular institutional or national repository. In the case of letters that were actually sent (as opposed to drafts or copies), their final resting place usually correlates with the location to which a missive was sent. Some of these locations would have been institutional, but most would have ended up in the personal records of their recipients, many of which later found their way into local or national libraries. The concept of the personal archive is often the basis too for the ‘virtual archive’. We use this term here to think about the mission behind edited collections of correspondence: these were traditionally published between boards and brought together the unified personal archives of a named individual’s received letters with their sent letters, which were, necessarily, scattered in perhaps as many locations as the number of people to whom the original author wrote. The task of reuniting these scattered letters often became the life’s work of a given scholar, or, in some cases, whole communities of scholars.

While digitization efforts create great promise for the use of computational methods, like network analysis, the digitization of historical documents has for the most part only reinscribed these silos. While large sums of money have been invested to make letters available online, these tend to be available either through online archives that are accessed through institutional websites or virtual online archives focused around a particular identity (such as the *Hartlib Papers*, or *Bess of Hardwick’s Letters*).² Such repositories have transformed the way research is done, and have been used both by traditional scholars and, more recently, by digital humanists. For both groups, however, the reliance on these data silos as sources means that the way we ask research questions is often circumscribed by the contours of those archives. More importantly for this chapter, these silos act as a barrier to network analysis.

Historians and literary scholars easily see the problem when the barrier is introduced by the contours of a physical archive; they already understand that individuals with letters contained therein may have other letters held in numerous other archives. However, this is in fact less of a problem than it initially seems: below we examine a network analysis of the letters held in the Tudor State Papers, and how such work can tell us some powerful things about an archive’s making. By

² See <https://hridigital.shef.ac.uk/hartlib/>, and <https://www.bessofhardwick.org/>, both accessed 20/03/2019.

contrast, scholars feel confident that the collected correspondence of a named individual will be able to yield important insights about his/her network. In fact, this silo is much more difficult to analyse because it constitutes what we might call an ego-network. The standard definition of an ego-network is one that consists of a focal node ('ego') and the nodes to whom the ego is directly connected to (these are called 'alters'), plus the ties or edges among the alters.³ Of course, the networks we have in edited collections of correspondence actually contain even less data than this because we lack those connections or edges between the alters. We can of course visualize that network; but without those edges between alters there are very few quantitative measures that can be derived. All we can count are: the degree of the ego (i.e. how many unique correspondents s/he has), the ego's in- and out-degree (the total number of people s/he writes to, or receives letters from), and the strength or weight of the edges the ego shares with their alters (i.e. how many letters passed along those edges in each direction). To derive these statistics, however, you do not really need network analysis.

The COST Action, however, presents an opportunity both to overcome these silos of knowledge, and to undertake more interesting network analysis of the republic of letters. The solution is the meta-archive (in this instance, hosted by *Early Modern Letters Online*, or EMLO). The concept of the meta-archive is an online resource that collects together metadata⁴ from many different sources, both by creating metadata files for early modern letters that currently only exist in material forms, and by integrating metadata from numerous other digital projects, to create a powerful research hub for early modern researchers. While many of the correspondences that members of the Action are working on might be described as ego-networks, by bringing them together we create overlapping archives that provide those cross-links between the alters within the constituent ego-networks. The main challenge in establishing this meta-archive, as outlined in the foregoing chapters, is reconciling the metadata fields, and in particular of person identities, across different correspondence projects. This is why a substantial proportion of the overall time and energy of this COST Action has been spent on the development of technical resources for metadata disambiguation, de-duplication, and reconciliation (see chapter III.2). However, once this is achieved the composite archive presents exciting opportunities for analysis.

³ Stanley Wasserman and Katherine Faust, *Social Networks Analysis: Methods and Applications* (Cambridge: Cambridge University Press, 1994), 41–3.

⁴ Metadata is a set of data that describes and gives information about other data. For a letter this would be the name of sender, name of recipient, date and place from which it was sent, description of contents, and reference information such as shelf-mark.

2 What Can Networks Offer?

In abstract terms, and in its simplest form, a network is simply information about the presence or absence of connections (often termed ‘edges’ or ‘links’) between entities (often termed ‘nodes’ or ‘vertices’). Wherever we encounter a definable set of entities – such as people, objects, institutions, or devices – and definable relationships – such as letters, phone calls, face-to-face interactions, or affiliations – we can cast a set of relationships in the language of network analysis. A network need not be binary. We can move beyond the presence or absence of connections and include information about the number of interactions, the frequency, the exact timings, or the length of each communication. The higher the resolution of the data in this regard, the more complex and therefore restricted the scope of quantitative analysis becomes. This trade-off between analytical power and resolution is the inevitable consequence of any process of abstraction.⁵

The number of properties that can be measured is vast and ever-expanding. Simple examples include the number of connections of a node: its ‘degree’ (already mentioned above). More complex, and often more interesting, examples include ‘clustering coefficient’, which measures the density of connections among the network neighbours of a node, and ‘betweenness centrality’, which measures the number of shortest paths through the network that pass through a given node. Newer analysis methods can take into account the temporal nature of a network, and can calculate the accessibility of information as a result of the time ordering of connections. Simply put, if B stops talking to C before A starts talking to B, information cannot pass from A to C. More basic analysis can be done using off-the-shelf software tools, such as *Gephi* and *Cytoscape*, whereas quantitative analysis that is tailored to a specific historical research question, or investigates more complex network measures, such as temporal ones, needs to be programmed in languages such as Python or R. More information on the former language can be found in the lesson written for *The Programming Historian* on ‘Exploring and Analyzing Network Data with Python’ written by John Ladd, Jessica Otis, Chris Warren, and Scott Weingart.⁶

There is a growing body of scholarship that demonstrates the power of such methods to uncover new findings in the humanities. The highly cited *Science* article ‘A Network Framework of Cultural History’ reconstructed aggregate intellectual

⁵ There is not space here to outline the subtleties of this huge interdisciplinary field. For a more thorough introduction, there are several options. For an overview designed for a popular readership, see Albert-László Barabási, *Linked: The New Science of Networks* (Cambridge, MA: Perseus, 2002); for the mathematically literate there is Mark E. J. Newman, *Networks: An Introduction* (Oxford: Oxford University Press, 2010); and for humanists, Scott Weingart has produced a number of resources, including a series of blogposts called ‘De-mystifying Networks’, available at <http://www.scottbot.net/>, accessed 20/03/2019, and chapters in the book by Shawn Graham, Ian Milligan, and Scott Weingart, *Exploring Big Historical Data: The Historian’s Macroscope* (London: Imperial University Press, 2015).

⁶ See <https://programminghistorian.org/lessons/exploring-and-analyzing-network-data-with-python>, accessed 20/03/2019.

mobility over two millennia through the birth and death locations of more than 150,000 notable individuals.⁷ The resulting network of locations provides a macroscopic perspective of cultural history, which helped to retrace cultural narratives of Europe and North America using large-scale visualization and quantitative dynamical tools and to derive historical trends beyond the scope of specific events or narrow time intervals. In particular, they used this data to show the changing locations of cultural centres over time. There are several other communities of scholars that are making incremental developments, including: *The Connected Past*, a community that has held regular conferences and published outcomes in articles and books;⁸ the Arts Humanities and Complex Networks Symposia, which have led to a large number of contributions in *Leonardo Journal*;⁹ and the contributors behind the newly launched *Journal of Historical Network Research*,¹⁰ among others. In the latter we see how those working on the republic of letters are already making key contributions: Ingeborg van Vogt's article 'Using Multilayered Networks to Disclose Books in the Republic of Letters', appeared in the inaugural issue.¹¹

A common misconception surrounding the application of network analysis – and more generally, of quantitative methods – to the humanities is the idea that quantitative methods by themselves offer wholly new outcomes and insights. What these new approaches do best however is to *facilitate* new outcomes and insights in the context of traditional scholarship. Much like aerial photography enables archaeologists to gain an unprecedented large-scale overview of structures concealed underground, quantitative approaches such as network analysis can place an individual, group, or institution of historical interest into a much larger context in which their role can be examined from an entirely new perspective. Aerial photography also offers the opportunity to discover entirely unknown structures in overlooked areas of the landscape, just as quantitative analysis can use a variety of measurements to highlight the infrastructural roles of understudied individuals in a network. In both scenarios the quantitative analysis outcomes do not represent an endpoint, not least because the data they rely upon is inevitably an incomplete and biased representation of the social network at the time. Rather, these outcomes should be understood as stepping stones in an iterative process between large-scale analysis and detail-focused scholarship in the traditional vein. Just as the archaeologists must eventually return to the ground to actually dig up the structures they

⁷ Maximilian Schich et al., 'A Network Framework of Cultural History', *Science* 345:6196 (2014): 558–62, see <https://doi.org/10.1126/science.1240064>.

⁸ Anna Collar, Fiona Coward, Tom Brughmans, and Barbara J. Mills, eds., *The Connected Past: Critical and Innovative Approaches to Networks in Archaeology*, a special issue of *Journal of Archaeological Method and Theory* 22:1 (2015); and Tom Brughmans, Anna Collar, and Fiona Coward, eds., *The Connected Past: Challenges to Network Studies in Archaeology and History* (Oxford: Oxford University Press, 2016).

⁹ See, for example, Special Sections in *Leonardo Journal* issues 43:3 (2010), 44:3 (2011), 45:1 (2012), 45:3 (2012), 46:3 (2013), 47:3 (2014).

¹⁰ *Journal of Historical Network Research*, <https://jhn.uni.lu/index.php/jhn>, accessed 20/03/2019.

¹¹ Ingeborg van Vogt, 'Using Multilayered Networks to Disclose Books in the Republic of Letters', *Journal of Historical Network Research* 1:1 (2017): 25–51, see <https://doi.org/10.25517/jhn.v1i1.7>.

have mapped or discovered from above, the humanities scholar has to dig down into the outcomes of the quantitative analysis.

An example of this iterative process can be found in the work of Ruth Ahnert and Sebastian E. Ahnert (the lead authors of this chapter), who studied the underground network of a Protestant community during the reign of Queen Mary I of England.¹² From the metadata and content of almost 300 letters the authors extracted a network of correspondence relationships and other social interactions. The leaders of this community were the well-studied Protestant martyrs documented in contemporary writings such as *Foixe's Book of Martyrs* (1563, and later editions), and they unsurprisingly represent the nodes with the most connections in the network. By using more sophisticated network measurements, however, such as the aforementioned betweenness centrality, other figures came to the fore. These included women who provided important infrastructural support to the network in the form of money and shelter, as well as the letter couriers who formed the postal infrastructure. Both have largely been written out of the histories of this time, often already in the versions of the letters printed by Foixe, where references to women were disguised by reducing their names to initials or, in some cases, even changing their gender. However, these same figures rise again to the surface when their importance is measured using a network approach. Importantly the output of the quantitative analysis here is tied back to the underlying history – the numbers in themselves are not a final outcome.

The term ‘network analysis’ is often understood as ‘network visualization’.¹³ The field of quantitative network analysis as described above, however, does not necessarily overlap with visualization. This is because visualization offers a complementary approach, with its own opportunities and challenges (as described in ch. IV.1). A visual representation of a network can provide an intuitive overview of a network data set. The dominant hubs of the network are likely to stand out immediately, as are largely disconnected sub-communities, and parts of the network with a particularly high density of connections. Moreover, visualization can provide guidance in understanding the structure of sets of data too heterogeneous for formal network analysis, particularly when network visualizations are combined with cartographical and other perspectives on the data. Visualizations can therefore offer a powerful way to gain first intuitive insights into a network data set. It also offers a powerful rhetoric of its own for supporting scholarly arguments with concision and clarity – sometimes a picture really is worth a thousand words. The downside of visualizations is that their legibility for the purposes of interrogation

¹² Ruth Ahnert and Sebastian E. Ahnert, ‘Protestant Letter Networks in the Reign of Mary I: A Quantitative Approach’, *English Literary History* 82:1 (2015): 1–33, see <https://doi.org/10.1353/elh.2015.0000>.

¹³ On the distinctions between network visualization and quantitative network analysis, see Ruth Ahnert, ‘Maps Versus Networks’, in Noah Moxham and Joad Raymond, eds., *News Networks in Early Modern Europe* (Leiden: Brill, 2016), 130–57; Shawn Graham, Ian Milligan, and Scott Weingart, *Exploring Big Historical Data: The Historian's Macroscope* (London: Imperial College Press, 2015), 250.

decreases as the data set grows; whilst very large data sets may produce very beautiful images, it is often difficult for an untrained eye to intuit much more than the sprawling complexity of that data. In addition, many network visualizations are highly arbitrary, as there are multiple ways in which the same network can be displayed. Even the same network layout algorithm may generate very different visualizations from two identical or near-identical networks. In summary, network visualization offers an intuitive means of exploring small and medium-sized data sets, with the drawback of arbitrariness and therefore limited reproducibility. Quantitative network analysis by contrast produces no visual outputs, and few directly interpretable intuitive insights. It does however offer a plethora of well-defined, reproducible network measurements in order to guide scholarly enquiry in new directions.

In the following we will illustrate how a number of research projects in the COST Action can both contribute to and benefit from the large-scale collection and quantitative analysis of historical correspondence metadata from the republic of letters.

3 From Ego-network to Network

An example of an ego-network is that of the Korais's Correspondence Project (1777–1833), overseen by Ikaros Mantouvalos and Alexandra Sfoini.¹⁴ Adamantios Korais (1748–1833), the most prominent scholar of the Modern Greek Enlightenment, was born in Smyrna into a prosperous merchant family of Chiot origin. He worked unsuccessfully as a merchant in Amsterdam (1771–6) and subsequently studied at the Medical School of the University of Montpellier. From 1788 until his death in 1833, Korais lived in Paris, where he was a member of the Société des Observateurs de l'Homme, and where he produced *inter alia* many critical editions of Ancient Greek authors. Korais may be considered to belong to the European republic of letters, with whose members he had developed relations and corresponded on issues of Greek interest. His six-volume correspondence (1777–1833) contains 1,511 letters, 1,286 of which were authored by Korais. These were sent to a total of 149 persons: 100 of them were Greek scholars, merchants, politicians, and military officers; and the other forty-nine were non-Greeks, mainly Hellenists – scholars and editors – such as Chardon de la Rochette, J.-F. Thurot, d'Anse de Villoison, A.-M. Bandini, J.-F. Boissonade, and Fr.-A. Wolf, but also philosophers and politicians such as Jeremy Bentham, Thomas Paine, and Thomas Jefferson. As is shown by a letter of his to Chardon de la Rochette (27 July 1793), he considers

¹⁴ Mantouvalos and Sfoini have contributed the following two paragraphs to this chapter. For some of their research on Korais, see Ikaros Mantouvalos, “‘The Great Korais died on April 6’: An Unpublished Letter from Philip Fournarakis to Thomas Spaniolakis (1833)”, *Eranistis* 27 (2009): 149–63 (in Greek); Alexandra Sfoini, ‘Korais and Michaelis: The Democracy of the Language’, *Eranistis* 29 (2016): 229–55 (in Greek).

no part of Europe as his homeland, but rather feels like a ‘citizen of the world’, his fellow citizens being a very small number of scholars who recognize the role of Ancient Greek texts in disseminating the Lights in Europe and commiserate with the enslavement of the Greeks.

Korais’s communication with classical scholars and Philhellenes shows the long-distance intellectual community of the age of Greek Enlightenment, a world of literary figures that stretched across geographical and social boundaries. If we examine the location of his correspondents on the maps designed by Eleni Gadoulou we can see sent letters to sixty-six cities and towns (forty-one in Europe, three in America and twenty-two in Greece – see fig. 1), and he received letters from eighty-nine letter-writers, fifty of whom were Greek and thirty-nine non-Greek scattered across various cities (fig. 2).

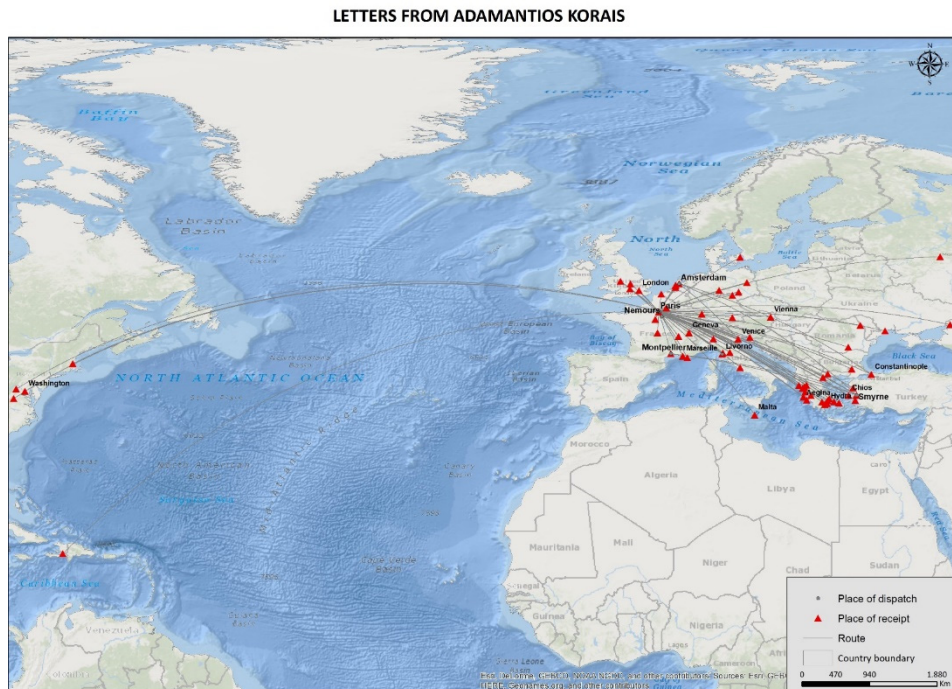


Figure 1

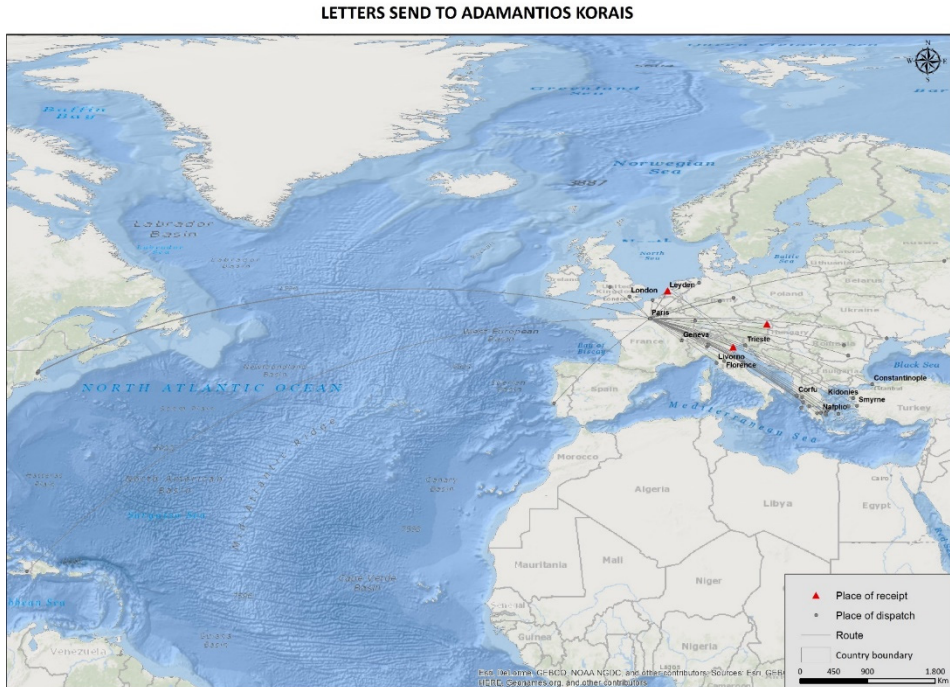


Figure 2

These maps quickly show us the wide geographic dispersal of Korais's epistolary network. The varying intensity of these exchanges helped create centres of intellectual life, mostly in Europe, defining which regions were more involved in cultural exchange and intellectual debate.

Through this example we can begin to see how ego-networks like this form the essential building blocks of the collective effort of the COST Action. At least some of the 149 people Korais sends letters to, and the eighty-nine he receives correspondence from, are likely to appear in other correspondence projects of the period. In the framework of the COST Action, as a result of the reconciliation of person identities, these networks become connected to each other. This enables both a re-examination of individual ego-networks in the light of their correspondents' own correspondences, as well as a larger-scale analysis of their infrastructural roles in a much larger network. The potential of these overlaps to generate important discoveries has been a major point of exploration in various working groups within the COST Action, including the visualization working group who have explored avenues for visualizing large correspondence corpora in their relations to one another, using the metadata of four or five correspondences contained in EMLO, and to do this in a readily comprehensible way. Their aim was to help users navigate intersections of such corpora, especially when seeking to explore new aspects

of the data, such as the role played by sub-networks or gain new insights into knowledge exchanged between third parties (see ch. IV.1).

The power of examining these intersections between ego-networks is demonstrated by the ongoing work of Christoph Kudella and Anna Skolimowska on Erasmus of Rotterdam (1466?–1536).¹⁵ Erasmus's oeuvre is deservedly famous for its size, and its geographical, and social, scope. Of Erasmus's epistolary exchange, 3,098 letters, written exclusively in Latin, are preserved between 1484 and 1536 (of which 37 per cent are letters to him). Erasmus corresponded with almost all the eminent figures of his time, whose respective corpora of correspondence provide researchers with insights into the interlinked nature of the early modern republic of letters. The intersections between individual networks of correspondence in the Erasmian republic of letters can be exemplified by the case of Ioannes Dantiscus (1485–1548), a diplomat in the service of the king and queen of Poland, bishop in Kulm and Ermland, and a patron of scholars and artists. Of his correspondence, 6,120 letters from the years 1500–48 are preserved (of which 72 per cent are letters to him), written predominantly in Latin and German. While a direct epistolary contact between Erasmus and Dantiscus is evidenced solely by a single letter, they had twenty-four correspondents in common. These two dozen individuals constitute only 3–4 per cent of the total correspondents of Erasmus and Dantiscus, but they serve to illustrate how even two geographically disparate correspondents with minimal direct contact can be linked by multiple third parties ('alters') who were in contact with both. Analysing the 'alters' connecting multiple correspondents is one of the obvious opportunities arising from the collection of multiple correspondences in EMLO.

The analysis of multiple intersecting correspondence is also a means of testing hypotheses difficult to assess through traditional means. A promising example is Per Pippin Aspaas's exploration of the correspondence of several eighteenth-century astronomers, funded by an STSM within the COST Action.¹⁶ It is now well established that, by the middle of the eighteenth century, the theories of Kepler and Newton had gained *de facto* acceptance in all quarters. As a result, an increasing number of observatories popped up across Europe and beyond. With these institutions there followed a degree of professionalization that has led to eighteenth-century astronomy being described as a scientific discipline *avant la lettre*.¹⁷ This discipline was driven forward by collaboration: in order to test new

¹⁵ This paragraph has been contributed by Kudella and Skolimowska. Kudella's contribution draws on his unpublished PhD Thesis, 'The Correspondence Network of Erasmus of Rotterdam: A Data-Driven Exploration', University College Cork, 2017. Skolimowska's contribution draws on her work directing Internet publication of the 'Corpus of Ioannes Dantiscus: Texts and Correspondence' at the University of Warsaw, see <http://dantiscus.al.uw.edu.pl/>, accessed 20/03/2019.

¹⁶ Aspaas, 'Astronomia disciplina maxime oecumenica?', an STSM hosted by Fritz Nagel at the Bernoulli-Euler Zentrum, Basle, from 19 February to 2 March 2017. The following two paragraphs derive from this work.

¹⁷ Irène Passeron, René Sigrist, and Siegfried Bodenmann, 'La république des sciences: Réseaux des correspondances, des académies et des livres scientifiques', *Dix-huitième siècle* 40:1 (2008): 5–27 (esp. 20), see <https://doi.org/10.3917/dhs.040.0005>.

instruments and observational procedures, fix the longitude, calculate trajectories of planets and comets, etc., widespread exchange of ‘corresponding observations’ became necessary. A question that has rarely been raised is to what extent individual astronomers crossed linguistic, political, and – above all – denominational borders in their pursuit of corresponding observations. It is widely attested that they did so, but the exact extent and duration of such trans-denominational collaboration, and how it may have fluctuated over time, has not yet been the object of scrutiny. Within the framework of the COST Action, five astronomers from the latter half of the eighteenth century have been singled out for analysis. The primary correspondence collections (where the incoming and/or outgoing correspondence remains largely intact) are those of Placidus Fixmillner OSB, head of the observatory of the Kremsmünster Monastery from 1762 to 1791; the Protestant Pehr Wilhelm Wargentin, secretary of the Royal Swedish Academy of Sciences and head of Stockholm Observatory from 1753 to 1783; and Johann III Bernoulli of Hugenot stock, head of the observatory of the Berlin Academy of Sciences from 1767 to 1787. They are enriched by two correspondences that are more fragmentarily preserved: those of Franciscus Weiss SJ, head of the University Observatories in Tyrnavia (Trnava) and Budapest from 1755 to 1785, and Maximilianus Hell SJ, imperial and royal astronomer of Vienna and head of the University Observatory from 1755 to 1792.

The resulting collection comprises several thousand letters, exchanged between astronomers from all over Europe. Basic metadata on all these letters (date of composition, names, geo-coordinates, and denomination of both sender and recipient) will, in due course, be entered into the EMLO database. By extracting the metadata and using both visual and quantitative network analysis one can study how the various correspondents’ networks developed over time, with the hope that two corollaries may be achieved. First and foremost, one may expect that the analysis will illustrate the implications of pivotal developments, such as the abolition of Jesuits from Portugal, Spain, and France beginning in the late 1750s and culminating with the universal suppression of the Society of Jesus by the pope in 1773. A likely assumption is that (ex-)Jesuit astronomers will either be less visible, or disappear altogether from the map, as these developments unfold. Secondly, more basic questions of historical methodology may be tested, including: to what extent can visual and quantitative network analysis help pinpoint trends and ruptures that cannot be observed through more traditional methods of hermeneutics?¹⁸

Bringing together even larger collections of overlapping correspondences potentially opens up the possibility of understanding the structure and formation of increasingly large portions of the republic of letters more generally. A good example is ongoing work designed to understand the network of the Anglo-German

¹⁸ A preliminary result, based on the study of a subset of this data is currently in press, see Per Pippin Aspaas and Katalin Pataki, ‘Did astronomy constitute a denominationally neutral space within the Republic of Letters? An outline for the use of visualization tools in the study of astronomical correspondence’, *Jahrbuch der Österreichischen Gesellschaft zur Erforschung des 18. Jahrhunderts* 34 (2019).

intelligencer of mid-seventeenth-century London, Samuel Hartlib (c. 1600–1662).¹⁹ For almost half a century, historians have frequently labelled this network as ‘the Hartlib circle’, a designation which seems to imply that Hartlib himself is both the centre of that circle and the agency which brought it into being. The difficulty is that these assumptions are dangerously tautological. Hartlib is naturally the central figure in his own ego-network and the archive of it which he collected, and that archive is the key source of documentation of ‘his circle’. But did that ‘circle’ have a robust reality outside his archive? Was he as central to the intellectual activity of the 1630s, 1640s, and 1650s as naturally appears when we view that period through the lens of his archive?

In order to answer this question, it is necessary to step outside the archive and immerse it within a representative cross-section of data documenting the intellectual commerce of England and neighbouring regions during Hartlib’s active period. With that prospect in mind, EMLO has gradually assembled inventories of the letters’ numerous contemporary intellectuals who corresponded with Hartlib: these currently include Johann Valentin Andreae, Elias Ashmole, John Aubrey, the Dutch Church at Austin Friars, Johann Heinrich Bisterfeld, Antoinette Bourignon, Robert Boyle, Johannes Coccejus, Jan Amos Comenius, Elisabeth Stuart, René Descartes, Abraham von Frankenberg, Hugo Grotius, Athanasius Kircher, Marin Mersenne, Henry Oldenburg, Nicolas-Claude Fabri de Peiresc, Johann Permeier, Henricus Reneri, and John Wallis. With this newly amassed data, we will be able to test that contention for the first time. Network analysis is ideally suited to quantifying the centrality of Hartlib’s correspondence within this much larger body of data, and to determine the degree to which members of ‘his circle’ were independently connected with one another. Moreover, a chronologically organized series of studies may also help to reveal the process in which Hartlib’s network was formed, and his own centrality – or otherwise – to that process.

Broader insights may then be gleaned by immersing this entire composite data set within a still larger catalogue. In existing historical literature, Hartlib is typically listed alongside Mersenne, Peiresc, Kircher, and Oldenburg as one of the key intellectual networkers or ‘intelligencers’ of the seventeenth-century republic of letters. Yet the parliamentary pension he was granted between 1645 and 1660 for his intelligencing activity was not for services to the republic of letters: it was ‘in regard of the intelligence and correspondence maintained by him abroad’ on behalf of the

¹⁹ The following three paragraphs have been contributed by Howard Hotson. Although the idea that Hartlib was an important linking figure, central to several important groups, is much older, the formulation ‘the Hartlib circle’ seems to have been first used by Charles Webster’s pioneering collection of source material, *Samuel Hartlib and the Advancement of Learning* (Cambridge: Cambridge University Press, 1970), vii and *passim*. It was further developed in what remains the central study of the topic: Webster’s *The Great Instauration: Science, Medicine and Reform, 1626–1660* (London: Duckworth, 1975). See also Mark Greengrass, Michael Leslie, and Timothy Raylor, eds., *Samuel Hartlib and Universal Reformation: Studies in Intellectual Communication* (Cambridge: Cambridge University Press, 1994).

Commonwealth and Protectorate.²⁰ More specifically, between 1654 and 1661 Hartlib conducted a news agency, collecting excerpts from letters from the Continent, very often of a military, political, or diplomatic character, for delivery to Cromwell's secretary of state, John Thurloe, many of them from the newsbooks of the day, including *The Moderate Intelligencer* and *The Public Intelligencer*. For that reason Hartlib presents a fascinating site of experiment: he straddles the international, intellectual 'intelligencing' characteristic of the republic of letters, and the more pragmatic intelligence gathering central to the formation of the English state. A large body of correspondence representative of this kind of political intelligencing within the Commonwealth and Protectorate are readily available within the English seventeenth-century State Papers. Analysing the manner in which Hartlib's intelligencing activities cut across these two intersecting data sets might open up fresh perspectives on the manner in which the intellectual intelligencing within the republic of letters both contributed to and was superimposed on the information-gathering of the early modern state.²¹

The above cases outline briefly the potential of bringing together multiple ego-networks with others kinds of archives. However, such a narrative falls into the common pattern of digital humanities scholarship of speaking in the future tense: of what could, or should, or will be possible; of outlining work in progress, or methodologies developed that will be able to solve problems. As Franco Moretti has observed: 'Somehow digital humanities has managed to secure for itself this endless infancy, in which, it is always a future promise'.²² Moretti, with others, has complained of the relative lack of completed research that has demonstrated unequivocally the value of digital methods to uncover new findings or to establish grand theories. There is often a good reason for this: the scale of ambition in projects like the COST Action means that a lot of preparatory work is required. We can either get quick and dirty results, or take the time to clean and prepare data meticulously so that we can have faith in our findings. As the previous chapters have thoroughly documented, the particular problems of historical humanities data clearly shows why there have been few interventions demonstrating the application of quantitative network analysis to early modern letters. Nevertheless, despite the considerable groundwork required, long-standing projects on large-scale early

²⁰ George Henry Turnbull, *Samuel Hartlib: A Sketch of His Life and His Relations to J. A. Comenius* (Oxford: Oxford University Press, 1920), 49.

²¹ In order to pursue this possibility, Hotson and the *Cultures of Knowledge* project have joined forces with the lead authors of this chapter in the pursuit of the funding necessary to amass this body of data on EMLO and subject it to network analysis.

²² Melissa Dinsman, 'The Digital in the Humanities: An Interview with Franco Moretti', *LA Review of Books*, <https://lareviewofbooks.org/article/the-digital-in-the-humanities-an-interview-with-franco-moretti/>, accessed 20/03/2019.

modern letter networks are beginning to yield results. The following is a preview of forthcoming work by the lead authors of this chapter.²³

4 A Test Case: *Tudor Networks of Power*

The benefits offered by the large-scale collection and analysis of historical correspondence data are demonstrated by the AHRC-funded *Tudor Networks of Power* project, which examines the correspondence network formed by 132,747 letters in the Tudor State Papers from the period 1509–1603. The archive comprises the accumulated papers of the secretaries of state relating to home affairs, the papers produced or received by the secretaries as a result of their conduct of British diplomacy abroad, as well as petitions written to the government by ordinary people like farmers and widows, and bodies of letters seized or intercepted for the benefit of government intelligence. The epistolary archive implicates 20,663 unique people, either as senders or recipients. The project underwent an extensive disambiguation and de-duplication effort to map variant spellings, changing titles, name changes, and aliases to the correct individuals, and a similar process to clean the fields of place names and map them to geo-coordinates. It is now employing a range of network analysis measures as well as textual and geographical analysis to study a wide variety of historical research questions, such as: What is the changing role of the early modern ‘intelligencer’ during the Tudor period? What infrastructural roles did women occupy in the Tudor networks of power? Who were the individuals bridging disparate political communities? Can we use networks to make new predictions about the true identities of aliases? Which individuals weathered the mid-sixteenth-century political and religious changes better than others, and why? Which individuals were talked about by others, and how do the networks of those who were talked about relate to the networks of those talking about them?

So what can network measures reveal about this archive? Starting with the most basic observations, the ranking of nodes by their degree (the number of unique people with whom a given node shares edges) is able to show the prominence of certain hubs. Unsurprisingly, the nodes with the very highest degree are the Tudor monarchs, secretaries of state, foreign leaders, and key statesmen. The measure of betweenness centrality (which measures the number of a times a shortest path travels through any given node) is a valuable measure for highlighting figures who act as bridges, crossing ‘structural holes’ in a network and are therefore good at highlighting the Tudor diplomatic corps:²⁴ resident ambassadors, special ambassadors and commissioners, and intelligencers (often soldiers, or merchants,

²³ The monograph *Tudor Networks of Power* is a work in progress; the majority of the findings below draw on material reported in Ruth Ahnert and Sebastian E. Ahnert, ‘Metadata, Surveillance, and the Tudor State’, *History Workshop Journal*, dby033, <https://doi.org/10.1093/hwj/dby033>.

²⁴ On structural holes, see Ronald S. Burt, *Structural Holes: The Social Structure of Competition* (Cambridge, MA: Harvard University Press, 1992).

but sometimes travelling academics) sending weekly news bulletins to the secretaries of state). More interesting, however, are those nodes with the statistical combination of high betweenness centrality and relatively low degree, i.e. those who only have a few connections within the epistolary network, but nevertheless still have a high bridging function. If we look at the 1570s–1590s, a large number of the people who fulfil this condition are recognizable as spies, double agents, and conspirators. The clustering of similar figures is intriguing and implies that there may be a specific network profile for those trading in secrets; it seems unlikely that such a striking trend can be attributed merely to chance.

If there is a network profile for spies and conspirators, then a predictive model can also be developed. The discovery that such figures have this specific combination of statistical features led to an exploration of whether that information could be used to predict other likely spies and conspirators. Such methods could tell us which of the 20,656 people in the archive were most likely to have been involved in, or the focus of, Tudor surveillance, and therefore which of the 132,747 letters were worth reading in closer detail. By bringing in six further measures in addition to degree and betweenness centrality (in-degree, out-degree, strength, in-strength, out-strength, and eigenvector centrality) it is possible to assign each node a network ‘profile’ based on their individual scores and ranking for each of these eight measures: a kind of signature. It is then possible to measure the distance between these signatures (using Euclidean distance on the logarithms of the ranks), and thereby construct a measurement of network similarity between individuals. The result is a ranked list of people most similar to a given individual in terms of their network profile.

The results are striking. If we begin with Cardinal William Allen, who was leader of the English Catholic exiles and implicated in various conspiracies to dethrone Elizabeth I and replace her with a Catholic monarch, the fifteen most ‘similar’ people writing in Elizabeth I’s reign include seven Catholic conspirators from the British Isles, and five continental Catholics, four of which are Spanish men in positions of diplomatic and military leadership.²⁵ What unites them is that all of these were perceived to present foreign threats to England’s security, and the majority of their correspondence entered the archive through interception. These were people who were being carefully watched by the Tudor government, and this kind of surveillance leaves behind a particular kind of network profile in the archive.

This distance measurement not only finds patterns of conspiracy and interception, however. Its use is more general, helping us to understand the commonalities in network properties within and between particular groups of people. In this way we can, for example, find clusters of diplomats sharing network attributes. For example, if we look at Tommaso Spinelli – one of England’s earliest resident am-

²⁵ These are William Douglas, earl of Angus, Robert Persons, Francis Dacre, Anthony Babington, Hugh Owen, Thomas Paget, Gilbert Curl; and Antonio de Guaras, Don Juan d’Idiaquez, Pedro de Zubiaur, and Charles of Lorraine, duke of Mayenne.

bassadors, serving at the court of Margaret of Austria – we find that nineteen of the twenty most similar individuals in the reign of Henry VIII all served on diplomatic missions during this reign.²⁶ Similarly, we can use the method to highlight a category of extra-diplomatic ‘intelligencers’ working in the Elizabethan period. Here our starting point is one Pietro Bizzarri, who offered himself to William Cecil, Lord Burghley (the principal secretary to Elizabeth I) as an intelligence-gatherer in Venice, in return for permission to travel.²⁷ It was an offer Burghley readily accepted, having no diplomatic presence in Venice at that time; and so began Bizzarri’s lifelong career as an intelligencer, passing political and diplomatic information to the Tudor government. We find that the fifteen most similar people to Bizzarri in the Elizabethan period include fourteen who also provided the government with intelligence.

What is perhaps notable about this list of fourteen intelligencers is that only five of them have any kind of biography, either in the *Oxford Dictionary of National Biography*, *Wikipedia*, or *The History of Parliament*. Rather, the majority of these men are the kind of figures who only get a single sentence in reference books, normally saying something along the lines of ‘X sent a letter to Walsingham/Burghley/Cecil with the information that ...’. The focus is on the events reported on by these men, rather than on the men themselves and their intelligence roles. The men individually may not have been deemed worthy of their own histories (although the potted histories above suggest that some are), but one might contend that, considered as a group, they are. By using the similarity score we are encouraged to understand the commonalities between those men, and the way that the government employed them to supplement the information gathered through formal diplomatic arrangements. As a group they greatly influenced the foreign policy of the Elizabethan government, as is evident in their substantial contributions to its collected archives. This predictive approach, then, has the additional benefit of suggesting to us not only individual men and women whose letters may merit closer attention, but also of proposing to us new categories of writers whose significance perhaps only emerges when understood as a group.

5 Conclusion

This brief outline of the application of quantitative network analysis to the republic of letters is a narrative of trade-offs and pay-offs. In the application of quantitative network analysis, one such trade-off is between data complexity and computational power. The kinds of analysis undertaken on the *Tudor Networks of Power* project

²⁶ On Spinelli, see Betty Behrens, ‘The Office of the English Resident Ambassador: Its Evolution as Illustrated by the Career of Sir Thomas Spinelly, 1509–22’, *Transactions of the Royal Historical Society* 16 (1933): 161–95 (esp. 162), see <https://doi.org/10.2307/3678668>.

²⁷ The only book-length study on the intelligencer and historian is Massimo Firpo, *Pietro Bizzarri: esule italiano del Cinquecento* (Torino: Giappichelli, 1971).

takes place often at the most abstract level: namely, when network data is abstracted as a system of nodes and directed edges. The majority of the algorithms used do not take account of the weight of the edges (i.e. number of letters that passed), or any incidental information which enriches our understanding of those nodes or edges (such as roles held by node, or additional information about relationships between nodes, such as kinship). By ignoring that additional information in the first stage of analysis, the project has been able to find overarching patterns and trends, to identify anomalies that require closer analysis and discover people who might have been overlooked, and to develop predictive models and an understanding of commonalities between nodes. But in the humanistic context, network analysis is not necessarily undertaken as an end in itself. Rather, it can serve to open up revealing new perspectives on historical data in all its richness. The abstract, quantitative findings act as prompts to return to the concrete peculiarities of the individual letter, where close reading is needed to explain and illuminate these quantitative results, which in turn can help to form new large-scale questions that can be asked and answered with network analysis.

Further trade-offs will be needed to apply similar methods to analysing data pertaining to the republic of letters. The basic precondition for moving beyond ego-centred archives and the analyses based on them is to create data sets where we can add those all-important edges between alters. Before we can undertake meaningful computational analysis, in other words, a great deal of foundational work is required, of the kind outlined above and in previous chapters. This will require trade-offs in the scholarly environment more broadly, in order to commit to sharing data, collaborating, and undertaking the unglamorous curatorial work of reconciling name and place data across these archive silos. But the pay-offs for such a cultural shift are potentially transformative: if the work is undertaken properly, we will be able to navigate between multiple archives, executing computational measures that leverage all this data to give us an overview of the early modern social, political, and intellectual networks that is greater than the sum of its parts.

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Between 1500 and 1800, the rapid evolution of postal communication allowed ordinary men and women to scatter letters across Europe like never before. This exchange helped knit together what contemporaries called the ‘respublica litteraria’, a knowledge-based civil society, crucial to that era’s intellectual breakthroughs, formative of many modern values and institutions, and a potential cornerstone of a transnational level of European identity.

Ironically, the exchange of letters which created this community also dispersed the documentation required to study it, posing enormous difficulties for historians of the subject ever since. To reassemble that scattered material and chart the history of that imagined community, we need a revolution in digital communications.

Between 2014 and 2018, an EU networking grant assembled an interdisciplinary community of over 200 experts from 33 different countries and many different fields for four years of structured discussion. The aim was to envisage transnational digital infrastructure for facilitating the radically multilateral collaboration needed to reassemble this scattered documentation and to support a new generation of scholarly work and public dissemination. The framework emerging from those discussions – potentially applicable also to other forms of intellectual, cultural and economic exchange in other periods and regions – is documented in this book.

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