UiT The Arctic University of Norway

Faculty of Humanities, Social Sciences and Education

Crosslinguistic influence in third language acquisition

Isabel Nadine Jensen

A dissertation for the degree of Philosophiae Doctor – April 2022

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Abstract

In this dissertation, crosslinguistic influence in third language (L3) acquisition is investigated in three articles that explore how linguistic variables affect the influence of pre-existing grammars. The goal is to contribute to novel insights about the cognitive process of language acquisition.

We collected data in offline acceptability judgements tasks. In articles 1 and 2, we tested Norwegian–English bilinguals who were exposed to an artificial L3. In article 3, we tested Russian–Norwegian bilinguals who had been instructed in English for five–six years. We analysed the data by means of mixed-effects modelling.

The results show that L3ers are influenced by both pre-existing languages, at early and intermediate stages. At intermediate stages, we documented both facilitative and non-facilitative influence. We clearly see that the source of the influence is affected by similarities between the L3 and pre-existing grammars, but we find no indications of wholesale transfer. We argue that the results reflect a complex learning situation in which candidate structures from both pre-existing languages are co-activated and compete for the overall best fit to the L3 input. The goodness of fit of a given structure determines the level of activation and consequently, the influence on the target interlanguage.

Sammendrag

I denne avhandlingen utforsker vi tverrspråklig innflytelse i tredjespråkstilegnelse gjennom tre artikler som undersøker hvordan ulike lingvistiske variabler påvirker innflytelsen av tidligere tilegnede språksystemer. Målet med avhandlingen er å bidra til ny innsikt i språktilegnelse som kognitiv prosess.

Vi samlet data ved hjelp av offline akseptabilitetstester. I artikkel 1 og 2 testet vi norsk–engelsk tospråklige som ble eksponert for et kunstig tredjespråk. I artikkel 3 testet vi tospråklige talere av russisk og norsk som hadde hatt engelsk på skolen i fem–seks år. Vi brukte regresjonsanalyse (blandet modell) til å utforske dataene.

Resultatene viser at begge tidligere tilegnede språk påvirker tredjespråket, både tidlig i tilegnelsesprosessen og ved senere stadier. Blant mer erfarne tredjespråksinnlærere finner vi både positiv og negativ innflytelse. Vi finner ingen indikasjoner på at et av språkene blir valgt som den eneste kilden til tverrspråklig innflytelse, men derimot at likheter mellom målspråkets grammatikk og tidligere tilegnede grammatiske systemer påvirker hvor innflytelsen kommer fra. Vi argumenterer for at resultatene reflekterer en kompleks læringssituasjon der lingvistiske strukturer fra begge tidligere tilegnede språk er parallelt aktivert og kjemper mot hverandre i en konkurranse der likheter mellom målspråket og de eksisterende språkene i stor grad avgjør innflytelsen på tredjespråket.

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Abbreviations

2L1	Simultaneously acquired first languages
AJT	Acceptability judgement task
AL	Artificial language
CEM	Cumulative-Enhancement Model
DEF	Definite article
EEG	Electroencephalography
ERP	Event-related potentials
L1/L2/L3/L4/L5/L*n*	First/second/third/fourth/fifth/non-specified language
L2SF	Second Language Status Factor
LPM	Linguistic Proximity Model
MCF	Modular Cognition Framework
TPM	Typological Primacy Model
UG	Universal Grammar
V2	The verb occurs in the second position
V3	The verb occurs in the third position

List of Papers

Article 1: Jensen, I. N. and Westergaard, M. (Submitted). Syntax matters: Exploring the effect of linguistic similarity in third language acquisition. Submitted to *Language Learning.*

Article 2: Jensen, I. N. (Submitted). Testing similarity-based models of third language acquisition: Learning versus crosslinguistic influence. Submitted to *Studies in Second Language Acquisition.*

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Cover article

1 Introduction

The majority of the world's population speaks more than one language. In recognition of this multilingual reality, there is need for a sophisticated understanding of how new languages are acquired in bi- and multilingual populations. This topic has been investigated from an array of different perspectives over the last two decades, including the fields of linguistics (formal linguistics, sociolinguistics, neurolinguistics and psycholinguistics), psychology and education (García-Mayo, 2012; Saville-Troike & Barto, 2017, p. 25). The present dissertation represents a linguistic point of view, focusing mainly, but not exclusively, on the way in which syntactic structures in a third language (henceforth referred to as an L3) are influenced by two pre-existing grammars. We refer to this phenomenon as crosslinguistic influence, defined as a subconscious process in which pre-existing linguistic representations are used (activated or copied) to expedite the acquisition process. In line with Kubota et al. (2020), we observe crosslinguistic influence as behaviour in the L3 that can be attributed to one or both of the previously acquired languages and that cannot otherwise be explained by developmental processes.

Over the last two decades, L3 acquisition has been treated separately from second language (L2) acquisition, not because acquiring an L3 is fundamentally different from an L2, but rather because bilinguals have different starting points than monolinguals when they are faced with a language learning task. For example, on a conscious level, sequential bilinguals have already experienced non-native language learning, which allows them to potentially reuse learning strategies or other metacognitive tools (Haukås, 2014). On a subconscious level, bilinguals have access

to two linguistic systems rather than one in their minds that can offer facilitative or non-facilitative crosslinguistic influence. Regarding the latter topic, a strong empirical foundation in the L2 literature has led to a general consensus that the first language (L1) exerts decisive influences on the L2, at least at the beginning of the acquisition process (Green, 2017). Therefore, it is also assumed that pre-existing grammars influence L3 acquisition, but there is currently little consensus about whether the influence comes from both previously acquired languages or primarily from one of them. Over the last two decades, identifying and explaining the source(s) of crosslinguistic influence in L3 acquisition has been a subject of controversy, as empirical studies have shown conflicting results that have led to several different models of L3 acquisition. The main purpose of the present dissertation is to fill some of the gaps in our knowledge about how bilinguals acquire a new language, thereby contributing to insight into the cognitive process involved in language acquisition more generally.

The present dissertation focuses on L3 models of syntax that can be divided into similarity- and default-driven approaches. Similarity-driven models include the Linguistic Proximity Model (Westergaard, 2021a), the Scalpel Model (Slabakova, 2017), the Cumulative-Enhancement Model (Flynn et al., 2004) and the Typological Primacy Model (Rothman, 2011, 2015). The former three models treat crosslinguistic influence as a property-by-property phenomenon. Their empirical support comes from studies that have found crosslinguistic influence from both previously acquired languages (e.g., Bruhn de Garavito & Perpiñán, 2014; Ionin et al., 2015; Jensen et al., 2021; Kolb et al., 2022; Listhaug et al., 2021; Westergaard et al., 2017). The

Typological Primacy Model argues for wholesale transfer, defined as making a copy of one of the pre-existing grammars that then constitutes the initial L3 interlanguage. This model has been supported by studies that find non-facilitative and/or facilitative crosslinguistic influence from the pre-existing grammar that is linguistically more similar to the L3, regardless of whether it is the L1 or the L2 (Cabrelli Amaro et al., 2015; Giancaspro et al., 2015; Montrul et al., 2011; Rothman, 2011; Rothman & Cabrelli Amaro, 2010). Advocates for the default approach argue that crosslinguistic influence primarily comes from the L1 or the L2, regardless of the linguistic nature of the L3 input. A number of studies have reported an L1 default effect, although it has not been formalized in a model of L3 acquisition (Hermas, 2010, 2015; Mollaie et al., 2016; Na Ranong & Leung, 2009; Park, 2016). The L2 Status Factor, on the other hand, argues that the foreign language has a privileged status as the main source of crosslinguistic influence. Support for this claim has been found in studies that report primary influence from the L2, even when the L1 offers facilitation (Bardel & Falk, 2007; Bayona, 2009; Berends et al., 2017; Falk & Bardel, 2011).

In this dissertation, we ask two overarching research questions: First, whether human beings are sensitive to fine-grained linguistic properties in the learning process or if languages are treated as monolithic wholes. And second, whether crosslinguistic influence is a matter of copying or co-activation. We discuss these research questions in light of three articles summarised in Section 5, which each investigate their own separate, but related, research questions about crosslinguistic influence in L3 acquisition. All data discussed in articles 1–3 were collected by means of offline acceptability judgement tasks (henceforth referred to as AJTs). In articles 1 and 2, we

use artificial language learning experiments to investigate the very beginning of L3 acquisition of word order by sequential Norwegian–English bilinguals. In article 1, we explore the relative influence of similarities between the L3 and pre-existing languages by exposing the participants to four types of L3s that each vary in lexical and syntactic similarities to Norwegian and English. To separate crosslinguistic influence from learning, we test the participants in a structure that they have not been exposed to in the L3. In article 2, we compare the bilinguals to a group of native English speakers with no or limited knowledge of other languages. Both speaker groups are exposed to an artificial language that is lexico-phonotactically similar to English, but syntactically similar to Norwegian. The intention is to investigate whether the least lexico-phonotactically similar language, Norwegian, exerts influence on the L3. In this experiment, we also explore the effect of learning versus crosslinguistic influence by comparing structures that the participants have been exposed to with structures that have not been present in the input of the artificial language. In article 3, we investigate Russian–Norwegian simultaneous or very early sequential bilinguals who have been instructed in L3 English for 5–6 years. We compare them to two groups of age- and proficiency-matched L2 English speakers with Russian or Norwegian as their L1s, respectively. In this article, we are interested in whether the L3 learners are influenced by both previously acquired languages, whether crosslinguistic influence could be both facilitative and non-facilitative, and if the amount of crosslinguistic influence is the same across three linguistic domains: syntax, morphology, and the syntax-semantics interface.

Overall, we find that both lexico-phonotactic and syntactic cues in the L3 input affect the trajectory of crosslinguistic influence. We observe simultaneous influence from both previously acquired languages, and at intermediate levels of the acquisition process, we find that the influence can be both facilitative and non-facilitative across three linguistic domains. However, we also find that what is easier or more difficult to acquire in a new language does not only depend on facilitation or non-facilitation from pre-existing grammars, but also on factors such as saliency and complexity of the linguistic properties. Regarding the overarching research questions, we argue in this dissertation that articles 1–3 show that human beings are sensitive to fine-grained linguistic properties in the L3 learning process, both at very early and intermediate stages, and that crosslinguistic influence is a matter of co-activation and competition between candidate structures—a competition that is affected by a number of factors—rather than copying of pre-existing linguistic properties.

2 Background: Theoretical and empirical foundations

2.1 Terminological and conceptual issues

In the relatively nascent field of L3 acquisition, terms and concepts are sometimes imprecise across papers. For example, the term *L3 learners* has been used about sequential bilinguals who acquire a new language (e.g., Cenoz, 2013; González Alonso et al., 2020) and simultaneous bilinguals with two first languages (2L1) who acquire a third one, which would mean that the simultaneous bilinguals do not have an L2 (e.g., Kolb et al., 2022). Other definitions of an L3 has been that it refers to any language acquired beyond the L2 (Truscott & Sharwood Smith, 2019, p. 214) or to any language under investigation in a multilingual study (Falk et al., 2015). By the two

latter definitions, the target language could quantitatively be the learners' L3/L4/L5/L*n.* In the present work, following Foucart and Frenck-Mestre (2013, p. 394; see also Grosjean, 1989), we define a bilingual as a person who must deal with two languages within one mind. We define the L3 in quantitative terms, which means that it refers to the bilinguals' first experience with multilingualism. That is, the L3 of a simultaneous bilingual is their first non-native language, while the L3 of a sequential bilingual is their second non-native language.

Another controversy in the field of L3 acquisition is the use of the two terms *transfer* and *crosslinguistic influence.* Odlin (1989, p. 27) defines transfer as "…the influence resulting from similarities and differences between the target language and any other language that has been previously (and perhaps imperfectly) acquired." The term crosslinguistic influence was introduced in Sharwood Smith and Kellerman (1986) to describe the many ways in which language systems can affect each other in a bi- or multilingual mind, including not only transfer, but also behaviour such as borrowing and avoidance (Sharwood Smith, 1989).

Sharwood Smith (2021; see also Sharwood Smith and Truscott, 2021) argues for a reconceptualization of the term transfer due to its association to Lado's behaviourist view of language acquisition as "acquiring a new set of habits", which builds on so-called Skinnerian behaviourist principles. That is, transfer was a key concept in Lado's view on L2 acquisition, as he predicted errors in the L2 by comparing it to the L1. Similarities would lead to positive transfer (facilitation) and differences to negative transfer (non-facilitation, i.e., errors). This is known as the Contrastive Analysis Hypothesis. However, empirical studies have shown that L2 acquisition is not as

straightforward as predicted by a contrastive analysis. For example, researchers have observed behaviour that resembles what has been found in studies of L1 acquisition, such as over- and undergeneralization, even when there is a similarity between the L1 and the L2 (Sharwood Smith & Truscott, 2021). This led to Selinker's (1972) post-behaviourist *interlanguage* approach, in which language transfer is viewed as merely one of many subconscious strategies that the learner applies during language acquisition. The association of the term transfer to the Contrastive Analysis Hypothesis, and thereby behaviourist ideas, is problematic because it fails to acknowledge the creativity of a learning human mind (Sharwood Smith & Truscott, 2021). Sharwood Smith (2021, p. 411) suggests that crosslinguistic influence "as a matter of alternative connections within a network" is a better way of describing the presence of previously acquired linguistic representations in a bi-/multilingual mind.

In accordance with Sharwood Smith and Kellerman (1986), Rothman et al. (2019, p. 24; see also González Alonso and Rothman, 2017) use crosslinguistic influence as an umbrella term that refers to both transfer and *crosslinguistic effects*.[1] Transfer is defined as reduplication, or copying, of pre-existing linguistic representations, while crosslinguistic effects refer to all other ways in which pre-existing and new languages could interplay. By this definition of transfer, it follows that transferred linguistic representations are fully specified and stable in the interlanguage (Rothman et al., 2019, p. 23). Rothman et al. (2019) and González Alonso and Rothman (2017) argue

[1] The phenomenon referred to as crosslinguistic effects in Rothman et al. (2019) is called crosslinguistic influence in González Alonso and Rothman (2017). We use the former term when we refer to both papers to avoid confusion.

that both transfer and crosslinguistic effects are useful terms, but emphasize that they should not be used interchangeably, as transfer is argued to reflect *competence*, i.e., internalized, underlying linguistic knowledge and crosslinguistic effects are related to processing and/or *performance* effects, defined as surface forms or the use of language. Examples of crosslinguistic effects could be false cognates or variability in the interpretation of certain linguistic structures (Rothman et al., 2019, p. 25; see also González Alonso & Rothman, 2017, p. 686).

Based on the concerns raised by Sharwood Smith (2021) and the emphasis on a conscious use of terminology by Rothman et al. (2019), we generally use the term crosslinguistic influence in the present dissertation, unless we discuss concepts that explicitly argue for or use the term transfer (e.g., the Typological Primacy Model).

2.2 What can be acquired in non-native acquisition?

A prerequisite for crosslinguistic influence of a given linguistic representation is that the representation has been acquired. This idea is based on the logical argument that a learner cannot be influenced by something that they do not know. For that reason, it is necessary to discuss what can be acquired in a non-native language, since the non-native L2 is a potential source of crosslinguistic influence in L3 acquisition.

White (2000, p. 133) summarises the issue addressed in the present section by pointing out that the learning tasks involved in native and non-native language acquisition are similar: "the learner must acquire a mental representation on the basis of deficient input…", but crucially, native and non-native language acquisition typically differ when it comes to the manner in which the languages are acquired and the outcome of

the acquisition process. A characteristic of L1 acquisition is that all L1 learners end up with more or less identical grammars and become native speakers of the target language. Bley-Vroman (2009, p. 175) refers to this as *reliability* and *convergence* in the L1, meaning that native languages are typically acquired uniformly and successfully. In contrast, non-native language acquisition is typically non-uniform, the outcome of the acquisition process varies considerably from learner to learner, and the learners rarely end up with native-like competence (see e.g., White & Genesee, 1996). This raises the question of whether native and non-native language acquisition are fundamentally different processes, and whether there exists a biological critical period after which native-like attainment is no longer possible. If so, it would predict that L1 and L2 acquisition are fundamentally different.

The question of whether there is a critical period for language acquisition presupposes that we view language as an aspect of our biological nature (Lenneberg, 1967). Our experience in the world influences our brain, and consequently, our behaviour. In certain periods of life, usually at an early stage, the effect of the experience is particularly strong. This is referred to as a *sensitive* period (Knudsen, 2004). A *critical* period can be understood as a sensitive period in which the experience is crucial, i.e., there is a cut-off point after which the experience can no longer contribute to normal development. An example of a critical period is exposure to visual stimuli. Vision in human beings is what Herschensohn (2013, p. 318) describes as "…a developing organic system that is genetically scheduled to respond to a maturational event … at the onset of a critical period, and reaches its terminus when the development is complete…". Such a strict definition was applied to first language acquisition by

Penfield and Roberts (1959) and later popularized by Lenneberg (1967). Although there is no consensus about the exact timing for such a 'window of opportunity', studies have shown support for the claim that such a critical period exists for the L1 (Herschensohn, 2013). This has been supported by numerous studies on deaf children and adults with late onsets of exposure to sign language, but also by cases of so-called feral children, who have been deprived of sufficient linguistic input and other elementary needs during early childhood. With respect to second language acquisition, empirical studies have argued both for and against the claim that younger is better (for a discussion, see e.g., Cadierno & Eskildsen, 2018). Nevertheless, this does not necessarily mean that there exists a biological critical period. Support for the claim that there is no critical period is that adult learners can be highly successful in their L2/L*n*, and that results from behavioural and neurolinguistic studies show that there are no qualitative differences between native and non-native speakers (see e.g., Hopp, 2007; Slabakova, 2016). There are, however, several studies that show support for a sensitive period in second language acquisition, at least for some modules of the grammar (see e.g., Slabakova, 2016). Overall, then, one can argue that the human brain is programmed to seek linguistic input during L1 acquisition, i.e., it is experience *expectant*, whereas it is experience *dependent* in L2/L*n* acquisition (Herschensohn, 2013).

In generative L2 acquisition, the term *Universal Grammar* (UG) is used to describe constraints that are shared by all human languages. From a generative perspective, the discussion about whether or not there is a critical period in non-native language acquisition is a discussion about whether, and if so to which extent the L2 learners

have access to UG. There are three possible scenarios: full, partial or no access. Crosslinguistic influence in L3 acquisition can come from the L1 and the L2 only if there is full or partial access to UG in non-native language acquisition. No access would be the case if there is a critical period in non-native language acquisition. If there is no critical period, but perhaps sensitive periods, in non-native language acquisition, the learners may have partial (e.g., Hawkins & Hattori, 2006) or full (e.g., Schwartz, 1998) access to UG. According to Sanz et al. (2015), partial and full access to UG make different predictions about L3 acquisition. If there is partial access, crosslinguistic influence of syntactic features and functional categories cannot come from the L2 (since the learner did not acquire them). If there is full access, L2 learners can acquire linguistic representations that are not available in their L1, and these may influence subsequent language acquisition.

2.3 The role of the native language in L2 acquisition

One of the factors that differentiates native and non-native language acquisition is the fact that non-native language learners already have one or more linguistic systems in their minds when they are exposed to a new language. This has led researchers to ask what non-native language learners bring to the learning task—do they make use of (a) previously acquired language(s), and if so, how do they make use of it/them? In other words, what is the starting point, or *initial state*, of the L2/L*n*? This is an important question, as the nature of the initial state has implications for the rest of the acquisition process.

In Section 2.2, we discussed the ways in which non-native languages may be regulated by UG and listed three possibilities: no, partial or full access to UG. Similarly, there

are three possible ways in which the L1 may influence the L2: no, partial or full influence from the L1. Combining these two factors and their potential nature leaves us with five different perspectives on the initial state of L2 acquisition, as identified by White (2000, p. 133): 1) No Transfer from the L1/Full Access to UG, 2) Partial Transfer/Full Access, 3) Partial Transfer/Partial Access, 4) Full Transfer/Partial Access, 5) Full Transfer/Full Access.

The fifth perspective, full transfer of the L1 and full access to UG, has received considerable support in the field of L2 acquisition research (e.g., Conradie, 2005; Grüter, 2006; Montrul, 2000; White, 1985). This perspective was formalized by Schwartz and Sprouse (1996), who proposed the Full Transfer/Full Access model for L2 acquisition. Full Transfer/Full Access is by many considered the leading hypothesis of the L2 initial state, both because it is a conceptually simple and elegant view of how the L1 influences the L2, thereby operationalizing the principle known as Occam's razor, but also because it has received considerable empirical support in L2 studies (e.g., Epstein et al., 1996; see also Newmeyer, 1996 for a discussion).

From the idea of Full Access, it follows that L1 and L2 acquisition must be similar in terms of the access to constraints regulated by UG. However, Full Transfer reflects that L1 and L2 acquisition have different starting points/initial states. Schwartz and Sprouse (1996) describe the idea of Full Transfer as follow: when monolinguals are exposed to a second language, they copy their entire L1 system (except for the phonetic matrices of lexical and morphological items)—a mechanism that is referred to as *wholesale transfer*. It follows that "…the initial state of L2 acquisition is the final state of L1 acquisition…" (Schwartz & Sprouse, 1996, pp. 40). L1–L2 matches lead to

facilitative transfer, whereas non-facilitative transfer is a result of mismatches between the two languages. Parsing failures of the incoming L2 input lead to restructuring of the L2 interlanguage (the copied L1).

Westergaard (2021b) challenges Schwartz and Sprouse's definition of Full Transfer as wholesale by proposing that the role of the L1 during L2 acquisition is better understood as Full Transfer Potential.[2] Full Transfer Potential predicts that everything in the L1 may, but does not have to, be shared with the L2. This idea is often called *property-by-property* acquisition (also referred to as piecemeal or hybrid transfer/crosslinguistic influence). According to Full Transfer Potential, the L2 is parsed through the L1 system, where the learner subconsciously searches for similarities between the L1 and the L2. Candidate structures are activated in parallel and compete against each other for the overall best fit (cf., the Modular Cognition Framework in e.g., Truscott & Sharwood Smith, 2019; see Section 2.4). The goodness of fit of a given structure determines its level of activation and consequently, its degree of influence on the L2 interlanguage. It follows that the early L2 grammar does not consist of robust L1 representations, as the Full Transfer approach predicts. Instead, the grammar starts small, with vulnerable representations, and grows incrementally. As the acquisition process proceeds, the representations become more robust. Non-facilitative influence is considered a result of misanalysis of the incoming input or insufficient input. The former typically happens when learners process the target

[2] Sharwood Smith (2021) suggests that Westergaard changes the name of the hypothesis from Full Transfer Potential to Full Crosslinguistic Potential—a suggestion that Westergaard (2021a) admits would be worth considering.

language for comprehension and the latter for production (Westergaard, 2021a, p. 506). According to Finkelstein and Haleblian (2002, p. 38), non-facilitation can be described in three steps. First, the learner observes two situations—one in the L1 and one in the L2—that appear to share similarities. What the learner is yet unaware of is that these similarities are superficial, and the two situations are in fact underlyingly different. Secondly, the learner—believing that they have observed an overlap between the two languages—uses inappropriate pre-existing knowledge to parse the L3 input. If parsing failure occurs, the third step takes place, which involves the underlying difference being discovered and restructured.

Importantly, the Full Transfer/Full Access and the Full Transfer Potential hypotheses cannot be distinguished in L2 acquisition but make different predictions about crosslinguistic influence in L3 acquisition, as we show in Section 2.5.

2.4 Language processing and the bilingual mind

The generative framework has an internal focus, which means that it accounts for internalized, underlying knowledge of language (competence) rather than surface linguistic forms (performance). Since the 1950s, generative linguists have argued that human beings are genetically endowed with the ability to acquire human language by means of an innate language faculty. This includes knowledge about what constrains human language, referred to as UG (first mentioned in Section 2.2). Since the 1950s, a recurring topic of discussion and investigation has been exactly what constitutes UG. A contemporary generative approach is the Minimalist Program, first proposed during the 1990s (Chomsky, 1995), and later supplemented by the idea of interfaces during the 2000s, introduced in Jackendoff's (2002) Parallel Architecture of the language

faculty. Saville-Troike and Barto (2017, p. 55) describe the concept of interfaces as "the most important recent development" within generative linguistic theory. This is mainly because the concept of interfaces leads to attention beyond pure syntax (Saville-Troike & Barto, 2017; Sharwood Smith et al., 2013) to different types of meaning, such as lexical, grammatical, semantic, pragmatic/discourse (Slabakova, 2010, 2013), as well as its focus on language processing in addition to representational issues (Sharwood Smith et al., 2013).

Jackendoff's take on the language faculty was adopted by the Modular Cognition Framework, proposed by Sharwood Smith and Truscott (see e.g., Sharwood Smith, 2017; Truscott, 2015; Truscott & Sharwood Smith, 2019). According to the Modular Cognition Framework, the mind can be understood as a network of individual cognitive systems (*modules*) that each performs a specific task. Importantly, this framework holds that there are two fundamental types of language processing: the processing of linguistic structures and the processing of non-linguistic structures. The former involves two cognitive systems that are specialized for grammar: the phonological system and the syntactic system. The non-linguistic structures are processed by the auditory, visual, conceptual, affective, and motor systems. Each module runs according to unique principles that are not shared with other modules, but the modules interact by means of internal and external interfaces. As opposed to the Minimalist Program, which typically also includes lexical and semantic modules in the architecture of language, lexical items should be understood as a processing chain involving the phonological, syntactic and conceptual systems: phonological structures coindex with syntactic structures, which in turn coindex with the conceptual system,

which links syntax and meaning (Sharwood Smith et al., 2013, p. 568; Truscott & Sharwood Smith, 2019, p. 32).

Importantly, bi- and multilinguals are no different from monolinguals because every language that an individual can use is processed with the same set of systems. Consequently, there is no need for, for example, two or more lexicons or syntactic systems in the minds of bi- and multilinguals. This is in line with the general consensus in the psycholinguistic literature, i.e., that in both production and comprehension, bi-/multilinguals process both/all of their languages simultaneously (Declerck et al., 2020; Grainger & Dijkstra, 1992; Thierry & Wu, 2007; Van Heuven et al., 1998). When a bi-/multilingual is exposed to a new language, pre-existing representations compete for the purpose of being activated in the processing task. Importantly, this competition takes place subconsciously.

2.5 The role of pre-existing grammars in L3 acquisition

The previous sections (2.2–2.4) have established three points that are crucial in order to describe crosslinguistic influence in L3 acquisition. First, it is uncontroversial in generative approaches to language acquisition to assume that all linguistic properties can be acquired in L2 acquisition. Secondly, there is consensus in the field of L2 acquisition that the L1 affects the L2, although there is disagreement about whether everything in the L1 must or may influence the L2. Finally, there is consensus in the psycholinguistic literature that bilinguals do not switch off any of their previously acquired languages, but rather keep them activated to different degrees (Green, 1986, 1998; Truscott & Sharwood Smith, 2019).

Treating L2 and L3 acquisition as separate areas of research is relatively new, as L3 acquisition was not investigated autonomously until the 1980s. According to Sanz et al. (2015), the focus on (morpho)syntax in L3 acquisition is even more nascent, as it only started to receive attention over the last two decades, in particular within generative approaches to language acquisition. The main focus thus far has been to identify the source(s) of crosslinguistic influence and the factors that contribute to the source selection process. We assume here that acquiring an L3 is not fundamentally different than acquiring an L2 (De Bot & Jaensch, 2015), which means that influence from pre-existing grammars should be the null hypothesis in L3 acquisition, at least at the very beginning of the acquisition process (García Mayo & Rothman, 2012; Green, 2017).

However, as we show in the present section, there are two main issues that divide current L3 models. The first issue is whether the manner of acquisition (implicit versus explicit) blocks the possibility of crosslinguistic influence from the L1, as argued for by the L2 Status Factor (Bardel & Falk, 2007, 2012; Falk & Bardel, 2010, 2011). Similarity-driven models argue against this, as they hold that crosslinguistic influence can come from both previously acquired languages regardless of the manner of acquisition. However, similarity-driven models disagree about whether the previously acquired languages compete against each other as monolithic wholes (wholesale transfer), or if the competition is between fine-grained linguistic representations across the grammars (property-by-property crosslinguistic influence). The Typological Primacy Model (Rothman, 2011, 2015) argues for the former view, while the Linguistic Proximity Model (Westergaard, 2021b), the Scalpel Model (Slabakova,

2017) and the Cumulative-Enhancement Model (Flynn et al., 2004) argue for the latter.

In this section, we outline the theoretical and empirical foundation of the L3 models mentioned here, focusing on their hypotheses about the source(s) of crosslinguistic influence at the morphosyntactic level and which factors contribute to the source selection process. We divide the models into similarity-driven and default approaches to L3 acquisition. The similarity-driven approach is further divided into models that argue for wholesale transfer or property-by-property crosslinguistic influence.

2.5.1 Similarity-driven wholesale transfer

Although L2 and L3 acquisition are investigated autonomously, hypotheses about L2 acquisition make implications about crosslinguistic influence in L3 acquisition. For example, the idea of wholesale transfer (cf., the Full Transfer/Full Access model of L2 acquisition, Schwartz and Sprouse (1996; see Section 2.3)) was extended to L3 acquisition by the Typological Primacy Model (Rothman, 2010, 2011, 2015). This model argues that L3 learners subconsciously select one of their previously acquired languages as the initial interlanguage of the L3. The decision about which language to copy—referred to as the *Big Decision* by Schwartz and Sprouse (2021, p. 16)—is made early in the acquisition process. In fact, Rothman (2011) proposed the Typological Primacy Model as an account of the L3 initial state, suggesting that wholesale transfer should happen immediately upon exposure to the target language, as the Full Transfer/Full Access hypothesis predicts for L2 acquisition. However, in Rothman (2015), it was argued that wholesale transfer does not take place immediately after exposure to an L3, as the bilinguals need time to decide whether to copy their L1

or their L2 (or one of their L1s if the learners are simultaneous bilinguals). Therefore, Rothman (2015) proposes that the initial state of the L3 includes the L1, the L2 and UG (see also García Mayo & Rothman, 2012), while wholesale transfer takes place at the *initial stages*. Rothman (2015), as well as Cabrelli Amaro, Amaro and Rothman (2015, p. 22), hypothesise that the initial stages take place immediately after the initial state. However, the exact time frame may vary from learner to learner, as the occurrence and length might depend on factors such as the context of acquisition, quality and quantity of the input, the language combination and the type of bilingual (González Alonso & Rothman, 2017, p. 687).

According to the Typological Primacy Model, the pre-existing grammar that is linguistically more similar to the target language is selected for transfer. The similarity is assessed module by module, following the hierarchical order shown in (1), adapted from Rothman (2015, p. 185; see also Rothman, 2013; Rothman et al., 2015), from most to least influential. The order of the hierarchy is based on considerations of saliency and availability of cues in the input, as lexical and structural learning has to be in place in order to make use of morphosyntactic information (González Alonso et al., 2020, p. 5).

(1) The lexicon → Phonology/phonotactics → Morphology → Syntax

It follows that when a bilingual is exposed to a new language, the parser should first assess the lexical information. If there are none or too few similarities for the parser to make the Big Decision, it moves down to the next level of the hierarchy, which is phonology/phonotactics. The process is repeated until the decision about which

language to copy is made. According to Rothman et al. (2019), there is no reason for the parser to consider subordinate levels if there is unambiguous and sufficient information present at a higher level of the hierarchy: knowledge of the target language's phonological and syntactic systems matters only when "…the motivation for selection cannot come from the lexicon" (Rothman et al., 2019, p. 162). When a decision is made, wholesale transfer takes place and the language that is deemed more similar constitutes the L3 interlanguage.

Wholesale transfer has been criticized for suggesting that when L3 learners select a source of transfer, they block the other language off. This is incompatible with recent psycholinguistic literature, which shows that bilinguals do not switch their languages on an off, but rather, change the levels of activation of the two languages (e.g., Green, 1986, 1998). According to Rothman et al. (2019), wholesale transfer does not denote complete inhibition of one of the previously acquired languages, but rather that the activation level of the pre-existing grammar that is less similar to the L3 is decreased to the point where it is not productive as a source of crosslinguistic influence. The highest level of activation is argued to occur when the speaker has chosen a language that controls the output (Rothman et al., 2019). In other words, the two languages are always active in the speaker's mind, but to different degrees, even when the speaker has selected one of them as the L3 interlanguage. Supporters of wholesale transfer argue that it should be more costly for the mind to switch between languages than to copy one of the systems.

The empirical foundation for the Typological Primacy Model was first presented in Rothman and Cabrelli Amaro (2010), where the authors reported data from four

groups of early L2 or L3 learners of either French or Italian. The groups were L1 English–L2 French, L1 English–L2 Italian, L1 English–L2 Spanish–L3 French and L1 English–L2 Spanish–L3 Italian. Note that the L1 was always English and that the L3ers' L2 was Spanish. The linguistic phenomenon under investigation was the syntax of null-subjects, investigated by means of an AJT and a context/sentence-matching task. The results showed that both of the bilingual groups (L1 English–L2 French and L1 English–L2 Italian) were influenced by their L1, English, as expected, since the L1 was the only possible source of crosslinguistic influence. In contrast, both of the trilingual groups (L1 English–L2 Spanish–L3 French and L1 English–L2 Spanish–L3 Italian) were influenced by their L2, Spanish. Although this result could be explained by both an L2 default effect (see Section 2.5.4) and typological proximity, it is considered the seed of the Typological Primacy Model, which was first mentioned by name in Rothman (2010). In the latter paper, Rothman applied a mirror-image experimental design to isolate a potential L2 default effect from effects of linguistic similarity. That is, he investigated acceptability judgements of different syntactic phenomena (word order preferences in declarative clauses and interrogatives and attachment preferences in relative clauses) in L3 Brazilian Portuguese by L1 Spanish–L2 English and L1 English–L2 Spanish speakers. The results showed that both groups of learners behaved in line with native speakers of Spanish, indicating that linguistic similarity between the L3 and a previously acquired language had a stronger impact on crosslinguistic influence than the L2 status.

Furthermore, Rothman (2011) compared data from two groups of L3 learners at the low–intermediate proficiency levels. One group were L1 Italian–L2 English speakers,

while the other group consisted of L1 English–L2 Spanish speakers. Both groups acquired a Romance L3 (Spanish and Brazilian Portuguese, respectively). The results showed that all learners demonstrated knowledge of structures that are present in the Romance languages, i.e., there was influence from the L1 in the L1 Italian group and from the L2 in the L1 English group. More recently, González Alonso et al. (2020), investigated whether wholesale transfer had taken place in an artificial language learning experiment using electroencephalography (EEG). The participants were L1 Spanish–L2 English speakers, exposed to an artificial L3 that was either lexically similar to Spanish (called mini-Spanish) or English (mini-English). Both L3s overtly marked grammatical gender, which is a morphosyntactic match with Spanish and a mismatch with English. The authors predicted to observe a P600 event-related potential (ERP) component in the mini-Spanish group due to wholesale transfer from Spanish, as a P600 is typically related to the processing of syntactic violations. This expectation was not met. However, the authors reported another between-groups difference, as they found a P300 component in the mini-Spanish group—a component that is typically related to the processing of low-probability items. González Alonso et al. (2020) concluded that although their results are not in line with the type of behaviour that is expected if wholesale transfer had taken place, the results could reflect so-called *pre-transfer processing,* defined as the time between the initial state and wholesale transfer.

According to Rothman et al. (2019), the idea of wholesale transfer does not preclude crosslinguistic influence from the language that was not copied at the initial stages later in the acquisition process. This is referred to as *secondary property-by-property*

transfer and means that if a parsing failure occurs as a result of non-facilitation from the copied language, the learner may transfer the facilitative representation (if present) from the language that was originally not selected as the transfer source (Rothman et al., 2019, p. 155). Consequently, the main difference between wholesale transfer and property-by-property accounts is their predictions about the very beginning of the acquisition process.

2.5.2 Similarity-driven property-by-property crosslinguistic influence

Over the last two decades, several property-by-property models of L3 acquisition have been proposed, including the Cumulative-Enhancement Model (Flynn et al., 2004), the Scalpel Model (Slabakova, 2017) and the Linguistic Proximity Model (Westergaard, 2021b). These models reject the idea of wholesale transfer. Instead, they argue that both previously acquired languages are activated in parallel and may be used as sources of crosslinguistic influence.

According to the Linguistic Proximity Model, pre-existing linguistic structures across grammars compete against each other for the strongest activation, determined by the overall fit to the L3 input (cf., Sharwood Smith, 2021; Truscott & Sharwood Smith, 2019). The outcome of the competition determines the degree of influence on the L3 by each candidate structure. Consequently, the L3 interlanguage may be influenced by the L1, the L2 or both previously acquired languages. Several factors determine the strength of activation of a given candidate, but the most influential one should be the degree of shared features with the L3 (Truscott & Sharwood Smith, 2019). Similarly, Westergaard (2021b) argues that the structural cues in the L3 input are particularly important. In cases where there are not enough structural cues in the input, or the

learner is not yet able to parse them (typically at early stages of the acquisition process), the source of influence may be selected on the basis of other factors. For example, it is expected that early learners are more sensitive to lexical and phonotactic cues in the input, since information about (pseudo)cognates and overlapping sounds is immediately available. The access to morphosyntactic information, on the other hand, requires a certain level of lexical and structural knowledge and should become more important later in the acquisition process. Westergaard (2021b) expects syntactic matches to become increasingly important as the acquisition process develops and the learners become more advanced speakers of the target language.

The Linguistic Proximity Model was first described in an empirical study (Mykhaylyk et al., 2015; Westergaard et al., 2017) that compared a group of 2L1 Russian–Norwegian bilingual speakers of L3 English against two groups of L2 English speakers with Norwegian and Russian as their L1s (age range 11–14). The bilinguals were simultaneous or very early sequential bilinguals. The study collected acceptability judgements of two syntactic structures in English: Adverb–Verb (Adv–V) word order in subject-initial declarative clauses and Subject–Auxiliary (Aux–S) inversion in questions. The former represents a match between English and Russian, while the latter represents a match between English and Norwegian. The results showed that the Russian–Norwegian speakers were significantly more accurate in the Adv–V word order condition than the Norwegian speakers, but also significantly less accurate than the Russian speakers. The authors attributed this behaviour to simultaneous facilitative and non-facilitative crosslinguistic influence from Russian

and Norwegian in L3 English, triggered by structural (mis)matches between English and the pre-existing grammars.

The Scalpel Model also argues for crosslinguistic influence as a property-by-property procedure. Slabakova (2017) lists a number of factors that may be influential in L3 acquisition, but the Scalpel Model generally makes the same predictions as the Linguistic Proximity Model. According to the Scalpel Model, the rationale for property-by-property crosslinguistic influence is the following:

> In a nutshell, [a property-by-property based view] of [L3 acquisition] argues that the activated grammatical possibilities of the L1-plus-L2 combined grammar act with a *scalpel-like precision*, rather than as a blunt object, to extract the enhancing, or facilitative, options of L1 or L2 parameter values. There is no need for wholesale initial transfer because the scalpel can successfully single out the uniquely relevant features and properties. However, the scalpel can be blunted or shunted or slanted by additional factors pertaining to the relevant properties, such as processing complexity, misleading input, and construction frequency in the target L3. (Slabakova, 2016, p. 5)

Support for similarity-driven crosslinguistic influence in line with the Linguistic Proximity Model and the Scalpel model has been found in several studies. For example, Kolb et al. (2022) compared 2L1 Russian–German speakers of L3 English (age range 10–12) with two groups of L2 English speakers with German and Russian as their L1s, respectively. The study found simultaneous facilitative and non-facilitative crosslinguistic influence in L3 English, both from the lexically more

similar language (German) and from the more distant language that shares a particular property with the L3 (Russian). Based on these results, the authors argued that fine-grained structural similarities in the L3 input have a bigger impact on crosslinguistic influence than overall structural similarity between the L3 and pre-existing grammars.

Similar conclusions have been drawn in other studies of L3 word order acquisition where Germanic languages are involved. That is, Dahl et al. (In press) reported that L1 Norwegian–L2 English learners of L3 German showed no preferences for a specific word order in the target language, even if Norwegian offers facilitation. The authors argued that this illustrates a competition between the facilitative structure in the L1 and the non-facilitative structure in the L2. Similarly, Conradie (2005) found influence from both the facilitative and the non-facilitative word order in L3 acquisition of Afrikaans by L1 German–L2 English speakers. Simultaneous facilitative and non-facilitative crosslinguistic influence has also been attested in Romance languages, such as in L3 French by L1 Norwegian–L2 English speakers (Listhaug et al., 2021), in L3 Spanish by L1 French–L2 English speakers (Bruhn de Garavito & Perpiñán, 2014) and in L3 Brazilian Portuguese by L1 Spanish–L2 English/L1 English–L2 Spanish speakers (Ionin et al., 2015; Montrul et al., 2011; Santos, 2013).

The Cumulative-Enhancement Model is also a similarity-driven model, but it holds that crosslinguistic influence can only be facilitative or neutral. The model was first proposed in Flynn et al. (2004), who found facilitative crosslinguistic influence from Russian in L3 English by L1 Kazakh–L2 Russian speakers. More specifically, Flynn et al. investigated the production of English relative clauses—a structure where English is similar to Russian, both being head-initial languages, but different from the head-

final Kazakh. The authors compared the L3 learners to two groups of L2 learners of English—one whose L1 was Spanish and one whose L1 was Japanese (Flynn, 1983, 1987). While Spanish is head-initial like English and Russian, Japanese is head-final like Kazakh. It follows that the L3ers should pattern with the Japanese speakers if crosslinguistic influence came from L1 Kazakh, reflected in non-facilitative head-final structures in English. If crosslinguistic influence came from Russian, the L3ers should pattern with the Spanish speakers.

As already mentioned, the results showed facilitative influence from Russian. This result confounds with an L2 status effect, but Flynn et al. (2004, p. 13) hypothesize that structural similarity is a better predictor of the participants' behaviour than the manner of acquisition (see Section 2.5.4). In other words, the Cumulative-Enhancement Model argues that none of the previously acquired languages hold a privileged position in the acquisition of subsequent languages, but rather that the cumulative nature of languages allows for crosslinguistic influence of structures that are facilitative to enhance the L3 acquisition process (for further support for the Cumulative-Enhancement Model, see e.g., Berkes & Flynn, 2012).

2.5.3 Motivations for property-by-property and wholesale models

The previous sections have shown that the main incompatibility between wholesale and property-by-property accounts of L3 acquisition is the hypothesis that a fully specified pre-existing grammar is copied at an unspecified point during early stages of the acquisition process. According to Rothman et al. (2019), the core of the disagreement is conflicting interpretations of psycholinguistic literature on inhibition and activation, since both property-by-property crosslinguistic influence and wholesale

transfer are motivated by experience and cognitive economy. Cognitive economy can be defined as "[t]he tendency for cognitive processes to minimize processing efforts and resources" (OxfordReference, 2022), cf., the principle of least effort, which according to the American Psychological Association's (APA) dictionary of psychology refers to the basic behavioural hypothesis "… that an organism will choose a course of action that appears to require the smallest amount of effort or expenditure of energy" (APA, 2020).

Westergaard (2021b) argues that a mechanism involving copying and reconfiguration of a linguistic system is costly because it requires unlearning. Unlearning requires negative evidence that illustrates the unacceptability of a given linguistic feature (Montrul & Yoon, 2009, p. 308). This should be more challenging than adding new features to the L*n* interlanguage based on positive evidence from the input. Rothman et al. (2019), on the other hand, argue that it is not a goal for L3 learners to avoid wholesale transfer, simply because the learners are not aware of the troublesome unlearning that might follow from copying a complete linguistic system. That is, the experience from acquiring the L2 has shown the L3 learners that it is not necessary to acquire a new language from scratch, but crucially, the bilinguals are yet unfamiliar with the possibility of more than one source of crosslinguistic influence. Therefore, Rothman et al. (2019) suggest that property-by-property acquisition is more likely beyond L3 acquisition, as L4/L5/L*n* learners would have experience in multilingualism.

Green (2017) criticizes both wholesale and the property-by-property approaches,[3] as he argues that there should be no single trajectory of crosslinguistic influence in L3 acquisition. Instead, differences among learners in implementing language control processes should give rise to different trajectories, and consequently, models of L3 acquisition should allow for a more varied syntactic landscape among learners than what both the Typological Primacy Model and the Cumulative-Enhancement Model allow. For instance, Green (2017, p. 722) argues that use of pre-existing knowledge motivated by facilitation suggests that the learners' mental systems have full knowledge of the linguistic structures of the L3, and he questions whether this could be possible. As a criticism of wholesale transfer, Green argues that the Typological Primacy Model puts too little emphasis on language control as a factor when transfer is predicted. As in any type of action, there are cycles of action and perception involved in conversation. These demand multiple levels of control. The top-down and bottom-up processes represent two of these levels, and they work together to coordinate communicative action (Green, 2017, p. 719). The two levels are described as follows:

> Top-down processes "…activate relevant lexical concepts and grammatical forms, and inhibit competing ones. Bottom-up processes of control elicited by utterances of a conversational partner, activate a network of existing lexical

[3] Green's (2017) critique of the property-by-property approach is directed at the Cumulative-Enhancement Model rather than the Linguistic Proximity Model and the Scalpel Model, as the latter models were proposed in the same special issue as Green (2017).

> concepts and grammatical forms or trigger inductive processes to account for their content. (Green, 2017, p. 719)

The different types of input that a learner receives during acquisition of an L3 will trigger different types of levels. An example of a situation in which the top-down level would be triggered is explicit instruction of L3 structures, for instance in a classroom setting, whereas the bottom-up level could be triggered by a situation in which the learner, based on familiar linguistic structures, interprets L3 input. A typical example of the latter is a conversation between a learner and a speaker of the target language (Green, 2017, p. 720). If the learner is unsuccessful in accounting for the input by known structures, new structures are acquired.

2.5.4 Default sources of crosslinguistic influence

Previous studies that have found systematic crosslinguistic influence from the L1 or the L2 argue that the primary source of crosslinguistic influence in L3 acquisition is selected by default, which means that the linguistic nature of the L3 input should be irrelevant for the trajectory of crosslinguistic influence. It follows that bilinguals who speak the same L1 and L2 are expected to behave similarly. In discussing default models of L3 acquisition, the literature often refers to the *order* of acquisition as the main factor affecting crosslinguistic influence. However, as will become clear in the present section, the issue is rather the *manner* of acquisition.

Truscott and Sharwood Smith (2019) hypothesize that high resting activation levels could lead to a stronger influence of the L1 than the L2 (note that Sharwood Smith & Truscott (2019, p. 216) also support the Linguistic Proximity Model). An L1 default effect has been supported empirically by e.g., Hermas (2010); Hermas (2015); Mollaie

et al. (2016); Na Ranong and Leung (2009); Park (2016). However, empirical studies have also found support for an L2, or foreign language, status effect (e.g., Bardel & Falk, 2007; Bayona, 2009; Berends et al., 2017; Falk & Bardel, 2011). An L2 status effect would explain results such as those reported in Bohnacker (2006), who found that sequential bilingual speakers of L1 Swedish–L2 English acquiring German as their L3 used the non-facilitative word order from English, despite having access to the facilitative word order in Swedish. Since German and Swedish are also overall linguistically more similar than German and English, similarity-driven models of L3 acquisition cannot account for such a result.

The hypothesis about an L2 status effect in L3 acquisition of morphosyntax was formalized in the L2 Status Factor model (Bardel & Falk, 2007, 2012; Falk & Bardel, 2011). This model builds on the empirical findings about multilingual lexis in Williams and Hammarberg (1998), who argued that the L2 would be more influential than the L1 on the acquisition of L3 vocabulary (Sanz et al., 2015, p. 237). Extending this to the domain of morphosyntax, the L2 Status Factor argues that the L2 takes on a stronger role as the source of structural crosslinguistic influence than the L1, both at the initial state (Bardel & Falk, 2007) and at intermediate levels of the L3 (Falk & Bardel, 2011), even when the L1 offers facilitation.

The rationale behind the L2 default effect is attributed to cognitive and situational similarities between explicitly learnt non-native languages, as compared to implicitly acquired first languages. Examples of such factors are the age of onset (non-native languages are acquired later than the L1), the learning context (non-native learners are often instructed in the target language in a classroom setting, while the L1 is acquired

naturalistically), and metalinguistic awareness and/or knowledge (typically higher in instructed non-native languages than in the L1) (Falk & Bardel, 2011; Falk et al., 2015). These factors all represent what Truscott and Sharwood Smith (2019, p. 215) refer to as an otherness that is shared between non-native languages, but differs from implicitly acquired native languages.

On a neurolinguistic level, Bardel and Falk (2012) argue that Paradis's (1994, 2004, 2009) distinction between the declarative and procedural memory can account for the L2 status effect. That is, implicitly acquired structures in the native language are argued to be sustained by procedural memory, while declarative memory sustains the explicitly acquired structures in the non-native languages, as well as the lexical items from both languages (native and non-native). It follows that an L2 effect is only expected if the non-native languages are acquired formally and the knowledge of the L1 structure is subconscious, i.e., little metalinguistic awareness/knowledge in the L1. This is argued in Falk et al. (2015), who investigate how metalinguistic awareness in the L1 impacts crosslinguistic influence in L3 acquisition. The results showed a statistically significant positive correlation between the degree of metalinguistic awareness and facilitative influence from the L1. The authors also argued that the L2 can lose its L2 status. This typically happens when L2 speakers are highly proficient in their L2, when the L2 is introduced in early childhood and when the L2 is present in the speakers' everyday life, for example through the media (Falk et al., 2015, pp. 232-234).

The L2 Status Factor was first proposed in Bardel and Falk (2007), who investigated the placement of negation in L3 Dutch and L3 Swedish by speakers of different L1s

and L2s. Dutch and Swedish are both verb second (V2) languages, which means that the finite verb moves to the second position of main declarative clauses. All participants were speakers of at least one pre-existing V2 language and one non-V2 language. The results showed that L2 speakers of a V2 language were more target-like in the L3 than L1 speakers of a V2 language. The authors argued that a likely explanation for this behaviour is a privileged role of the L2 as the source of crosslinguistic influence. The L2 Status Factor has also been tested in comprehension studies, as Falk and Bardel (2011) investigated the acceptability of object pronouns in L3 German by L1 English–L2 French and L1 French–L2 English speakers. English and French mismatch in object pronoun placement, as post-verbal object pronouns are preferred in English and pre-verbal in French. The results showed crosslinguistic influence from the L2 in both speaker groups, as the L2 French speakers preferred pre-verbal object pronouns in German and the L2 English speakers preferred post-verbal object pronouns.

2.6 Interim discussion: the current state of L3 acquisition

As Section 2.5 shows, there are currently several different hypotheses about how, why and when previously acquired grammars are used during L3 acquisition, as empirical studies have shown conflicting results. Puig-Mayenco et al. (2020) conducted a systematic review of 71 studies of crosslinguistic influence at the morphosyntactic level of L3 acquisition, published between 2014 and 2017. The review found that non-facilitative influence was reported in 92.5% of the reviewed studies[4] and similarity-

[4] Puig-Mayenco et al. (2020) excluded four studies in which non-facilitative influence was impossible.

driven crosslinguistic influence in 60.5% of the studies. Based on these findings, Puig-Mayenco et al. argue that linguistic similarity is a strong motivator for crosslinguistic influence and that it can be both facilitative and non-facilitative. Focusing on the Typological Primacy Model, the Cumulative-Enhancement Model and the L2 Status Factor, they argue that none of the L3 models completely capture the nature of crosslinguistic influence in L3 acquisition. The Scalpel Model and the Linguistic Proximity Model were only considered indirectly, as these had been proposed less than a year prior to the publication of the review.

The strong impact of linguistic cues in the L3 input when it comes to crosslinguistic influence is also argued for in Rothman et al. (2019, p. 178), who list a number of studies in favour of the Typological Primacy Model (Borg, 2013; Bruhn de Garavito & Perpiñán, 2014; Cabrelli Amaro et al., 2015; Giancaspro et al., 2015; Ionin et al., 2015; Montrul et al., 2011; Santos, 2013). While many of these studies show that crosslinguistic influence can be non-facilitative and/or come from the L1, which is problematic for the L2 Status Factor and the Cumulative-Enhancement Model, it is less clear how all these studies can support the Typological Primacy Model, as several of the results listed by Rothman et al. are compatible, or even more compatible, with property-by-property crosslinguistic influence. For example, the results reported in Borg (2013) and Bruhn de Garavito and Perpiñán (2014) are clearly not in line with systematic transfer from one pre-existing language, as would have been expected if wholesale transfer had taken place at the point of testing.

For example, Borg (2013) investigated intermediate–advanced learners of L3 Spanish whose previously acquired languages were either L1 English–L2 French or L1

French–L2 English. The authors found facilitative crosslinguistic influence from French in both speaker groups, indicating that the L1 can influence the L3 if there are L1–L2 matches. This result is problematic for the L2 Status Factor, but compatible with the Cumulative-Enhancement Model, the Typological Primacy Model, the Linguistic Proximity Model and the Scalpel Model, i.e., all models that predict similarity-driven crosslinguistic influence.

Similarly, Bruhn de Garavito and Perpiñán (2014) investigated acceptability judgements of subject pronouns in L3 Spanish after three weeks of exposure to the target language by L1 French–L2 English speakers. In relation to subject pronouns, French is non-facilitative, while English offers facilitation. The results showed simultaneous crosslinguistic influence from both previously acquired languages, which the authors interpreted as a reflection of a competition between the two pre-existing grammars (Bruhn de Garavito & Perpiñán, 2014, p. 10). This result is in line with the Linguistic Proximity Model and the Scalpel Model. In contrast to what Rothman et al. (2019) argue, the results are not compatible with the Typological Primacy Model, as wholesale transfer should have led to systematic transfer from French. Simultaneous influence can also not be accounted for by the L2 Status Factor, as English should have been the primary source of influence, nor by the Cumulative-Enhancement Model, which does not allow for non-facilitation.

Furthermore, Ionin et al. (2015) examined L1 Spanish–L2 English and L1 English–L2 Spanish/French/Italian speakers' acceptability judgements of noun phrases in L3 Brazilian Portuguese. Most of the participants had been studying their L3 for less than three years. The study reported crosslinguistic influence from both previously acquired

languages, although the influence was more pronounced from the Romance languages, i.e., those that were linguistically more similar to the L3. Ionin et al. (2015, p. 246) argue that none of the L3 models of morphosyntactic transfer that were proposed at the time (the Typological Primacy Model, the L2 Status Factor and the Cumulative-Enhancement Model) were able to capture their participants' behaviour. Out of the available models at the time, the Typological Primacy Model was deemed more suitable to account for the results because of the predominant influence of Romance languages. However, the results can also be accounted for by the Linguistic Proximity Model and the Scalpel Model. A similar finding is reported in Montrul et al. (2011) and Santos (2013), who tested the same language combination, i.e., L3 Brazilian Portuguese speakers who already knew English and Spanish. In a nutshell, these studies found that, while the linguistically more similar language, Spanish, seems to be more influential than English, the influence from pre-existing grammars does not seem to be selective and can also come from English.

The empirical studies discussed thus far strongly suggest that non-facilitative influence is possible and that there is no default source of crosslinguistic influence. However, similarity-driven models cannot account for results such as those reported in Bohnacker (2006), who found that L1 Swedish–L2 English learners of L3 German used the non-facilitative English word order rather than the facilitative Swedish word order in production of German. Such behaviour could be accounted for by the L2 Status Factor, but not by any of the similarity-driven models, as these would predict crosslinguistic influence from the linguistically more similar language, Swedish. This illustrates the importance of future empirical studies that explore an array of linguistic

and extra-linguistic factors that might affect crosslinguistic influence. The focus of the current thesis is on the linguistic factors, such as the pre-existing grammars and the nature of the L3 input, but in future studies, other factors should be explored, such as for example metalinguistic awareness (Falk et al., 2015), L2 proficiency/dominance and use (Lloyd-Smith et al., 2021), language mode (Grosjean, 2013) and the principal language of communication (Fallah & Jabbari, 2018; Fallah et al., 2016).

3 Overarching research questions and predictions

The overall objective of the present thesis is to contribute to knowledge about the cognitive process involved in language acquisition by investigating how human beings subconsciously use pre-existing linguistic knowledge when acquiring new knowledge. In the present dissertation, we show how articles 1–3 can inform us about the following questions:

1) Are human beings sensitive to fine-grained linguistic properties in the learning process or are languages treated as monolithic wholes?
2) Is crosslinguistic influence a matter of copying or co-activation?

In research question 1, we address one of the main issues that differentiate the default, wholesale and property-by-property based models of L3 acquisition. Property-by-property models argue that human beings are sensitive to fine-grained linguistic properties in the L3 input across the two previously acquired grammars. Therefore, these models predict that learners can be influenced by lexical, phonological/phonotactic and morphosyntactic similarities between the L3 and the previously acquired languages (Slabakova, 2017; Westergaard, 2021b). In contrast, the

wholesale transfer model argues that learners pay attention to linguistic cues in a modular manner, starting with the lexicon (Rothman, 2013, 2015; Rothman et al., 2015). This view predicts that subordinate levels in the hierarchy of linguistic cues, such as syntax, do not affect crosslinguistic influence if the input contains unambiguous and sufficient information at a higher level of the hierarchy. Finally, if the L2 blocks access to the L1 as a source of crosslinguistic influence, as argued by the L2 Status Factor, the L1 should not influence the L3 (Bardel & Falk, 2007, 2012; Falk & Bardel, 2011).

In research question 2, a copying mechanism should result in robust representations in the L3 from the linguistically more similar pre-existing language (Rothman et al., 2019, p. 24). If copying has taken place at the point of testing, we expect to observe consistent behaviour in the L3 in line with lexical L3–L1/L2 overlaps. In contrast, co-activation and competition between candidate linguistic structures should be reflected in more unstable representations, especially early in the acquisition process (Westergaard, 2021b). The latter view predicts more behavioural variation, depending on a given structure's goodness of fit with the L3 system.

4 Method

4.1 Participants

In articles 2 and 3, we apply a modified subtractive language group design in line with Westergaard et al. (Forthcoming) in order to investigate the impact of linguistic similarity between the L3 and previously acquired languages. In a standard subtractive language group design, three groups are tested—one experimental and two control groups. All groups acquire the same target language, but the experimental group

consists of bilinguals who acquire the target language as their L3, and the control groups consist of monolinguals who acquire the target language as their L2. The control groups' L1 should be shared with one of the bilinguals' pre-existing languages. That is, in an experiment where the L3 learners speak L1A–L2B–L3C, the control groups should speak L1A–L2C and L1B–L2C. Substantial differences between the control groups and the experimental group should be interpreted as a rejection of the null hypothesis, i.e., "the subtracted language does not exert influence on the L3" (Westergaard et al., Forthcoming, p. 12).

In contrast to Westergaard et al., Puig-Mayenco et al. (2020) argue that the ideal experimental set-up in L3 studies is the mirror-image group design. Puig-Mayenco et al. (2020) report a positive correlation between such designs and the reporting of influence from the previously acquired language that is structurally closer to the L3. Studies that report effects from only the L1 or the L2, on the other hand, typically do not test mirror-image groups. This illustrates that a mirror-image group design is useful if the goal is to compare default and similarity-based hypotheses of L3 acquisition. It is less suitable if the goal is to test whether crosslinguistic influence comes from one or both of the pre-existing grammars.

In article 1, we do not apply a subtractive language group design, nor a mirror-image group design, as these make between-groups comparisons. Instead, we apply a within-groups design similar to González Alonso et al. (2020), where we compare speakers of the same L1 and L2 who acquire different artificial L3s. The goal is to investigate what happens when we manipulate the input (the L3) rather than the pre-existing knowledge.

4.2 Acceptability judgements

In articles 1–3, we used off-line AJTs with binary response scales to collect information about the participants' subconscious knowledge of grammar. Typically, acceptability judgements are considered a window into speakers' mental linguistic system (Leow, 1996; Sprouse & Almeida, 2011), which has made AJT methodology a widely used quantitative method within linguistics.

Schutze and Sprouse (2014, p. 6) group AJTs into non-numerical (forced-choice tasks and binary response scales like *Yes/No* or *Good*/*Bad*) or numerical (Likert scales, defined here as ranked sets of points, typically ranging between five and seven (Endresen & Janda, 2015, p. 15)). According to Schutze and Sprouse (2014), there are trade-offs with both types of AJTs, as the non-numerical tasks cannot inform us about the size of the difference between two conditions and the numerical tasks typically fail to detect nuanced differences.

In the experiments presented in this dissertation, we used non-numerical AJTs. In article 1, we were interested in the straightforward qualitative question: *Do the bilinguals prefer word order X (from Language A) or word order Y (from Language B) when they are exposed to an unknown Language C?* For this purpose, a forced-choice task was considered the optimal option, since this type of task is explicitly designed to compare two or more conditions (Schutze & Sprouse, 2014, p. 6). Binary and Likert scales, on the other hand, can only compare conditions indirectly. However, we sacrificed nuanced information about the acceptability of word order in using a forced-choice task, such as information about whether the bilinguals in fact liked or disliked both word orders.

In articles 2 and 3 we measured acceptability judgements on a binary response scale with the two values *Good* and *Bad.* AJTs with binary response scales are often referred to as Yes-No tasks (Schutze & Sprouse, 2014). This is also a qualitative measure, but it differs from the forced-choice task in showing how a given sentence (or condition) relates to the two values *Good* and *Bad,* rather than how two sentences (or two conditions) relate to each other, as would be the case in a forced-choice task. In other words, we were not interested in the participants' preference of one condition in relation to another in articles 2 and 3, but rather, whether a given condition belonged to the category *Good* (i.e., accepted) or *Bad* (i.e., rejected).

Yes-No and forced-choice tasks have in common that they are easy to deploy, which was an advantage in all of the experiments, mainly because of the minimal exposure to the target artificial language in articles 1 and 2 and because of the participants' young age in article 3 (11–12-year-olds). This is the main reason why we used a binary scale rather than a Likert scale. According to Dillon and Wagers (2021, p. 63), Likert scales, binary scales and forced-choice methodology (as well as other acceptability measurements) yield similar results and provide reliable and powerful tools if the main goal is to establish that there is a contrast between two conditions, as in our experiments, rather than investigating gradient acceptability.

Nevertheless, a problem that binary scales have in common with Likert scales is that the levels (responses) do not have an inherent meaning, which makes it possible that the participants do not necessarily interpret the levels of the scale in the same way (Dillon & Wagers, 2021; Schutze & Sprouse, 2014). For example, individuals may

have different boundaries between the values *Yes* and *No*, *Good* and *Bad*, or *Completely unacceptable* and *Somewhat unacceptable.*

Another issue that applies to experimental designs more generally is what Juzek (2015, p. 13) refers to as a purpose bias. This refers to a situation in which the participant is aware of the purpose of the study and accommodates the researcher (e.g., Gibson & Fedorenko, 2013). We controlled for this potential bias in articles 1–3 by either including fillers (articles 1 and 2, where 50% of the test items were fillers) or by testing a wide enough range of linguistic properties for each condition to work as fillers for each other (article 3, where we tested seven different properties across three linguistic modules).

4.3 The artificial language learning paradigm

Artificial language learning refers to a methodology in which learners are exposed to a carefully constructed language that is specifically designed to investigate different issues related to natural language acquisition. Ettlinger et al. (2016, p. 2) define an artificial language learning experimental paradigm as follows: "…participants learn a language, or language-like system, in a lab setting and are then tested on what they learned." In articles 1 and 2, we applied this methodology in order to investigate questions related to crosslinguistic influence in L3 acquisition. What Ettlinger et al. refer to as a lab setting was in our case a web-based version of the experiment—a choice that was made mostly due to social distancing rules related to the COVID-19 pandemic—but importantly, it also allowed us to recruit a higher number of participants than what we would have been able to if we had tested people face-to-face

(due to time limitations), which contributed to more robust statistical analyses of the data.

Several researchers have argued for the advantages of using artificial language learning experiments to address questions related to language acquisition (e.g., Ettlinger et al., 2016; Fedzechkina et al., 2016; Grey, 2020; Morgan-Short et al., 2010). A recurring argument is that such methodology gives the researcher full control over the stimuli. This is the main reason why we chose an artificial language learning paradigm in articles 1 and 2, i.e., it made it possible to manipulate the L3 input precisely so that we could test the predictions put forward by contemporary models of third language acquisition. Another crucial reason for using an artificial language as the L3 was that it allowed us to tap into the very first encounter with the L3 learning task, as it is guaranteed that the participants had not been in contact with the target language prior to the experiment. The methodology also made it possible to collect data from a relatively homogenous and large population of L3 speakers, since it is common in Norway to be a sequential bilingual speaker of L1 Norwegian and L2 English with limited knowledge of other languages. Overall, the factors mentioned here contributed to reduced noise in the data.

4.3.1 What is an artificial language?

Artificial language learning experiments are by no means novel in the field of language acquisition research. Since the introduction of this methodology nearly 100 years ago in Esper (1925), there has been numerous examples of such experiments. However, according to González Alonso et al. (2020, p. 3), most of the studies that apply this methodology have been interested in questions related to implicit versus

explicit non-native language acquisition. In the relatively nascent field of L3 acquisition, on the other hand, there have only been a few examples of artificial language learning experiments that explore crosslinguistic influence (e.g., González Alonso et al., 2020; Mitrofanova & Westergaard, 2019; Sanz et al., 2015; Stevens, 2021).

Grey (2020) defines artificial languages as follows:

> …[S]mall-scale linguistic systems that are composed of a few grammar structures which are consistent with natural language structures. Additionally, they integrate lexical-semantics and grammar and can be fully spoken and understood. (Grey, 2020, p. 81)

Furthermore, artificial languages are often divided into different types based on the nature of their lexical inventories (see e.g., Ettlinger et al., 2016; Grey, 2020). In the broadest sense, there are two groups. The first group includes artificial languages that consist of nonce words. These are usually referred to as *mini-languages, miniature (artificial) languages* or simply, *artificial languages*. Examples are BROCANTO (Friederici et al., 2002) and BROCANTO2 (Morgan-Short et al., 2010), but also the language used in the work of Culbertson and colleagues (e.g., Culbertson et al., 2017; Culbertson et al., 2019; Culbertson & Newport, 2015; Culbertson et al., 2012). The second group is called *semi-artificial languages*. These combine parts of one natural language with parts of another. Typically, the lexical items of a given language are combined with the morphosyntax of another language (Grey, 2020). Recent examples are González Alonso et al. (2020), who created mini-English and mini-Spanish— two

languages in which either English or Spanish lexical items were combined with Spanish-based grammatical gender—and Mitrofanova and Westergaard (2019), who added case marking (similar to case endings in Russian) on Norwegian lexical items (a language without overt case). Another example is Rebuschat and Williams (2012), who combined English lexical items with German syntax. Both mini- and semi-artificial languages differ from *artificial grammars*, which refer to strings of symbols (e.g., letters) generated by a set of rules, often in the absence of a semantic component (Ettlinger et al., 2016, p. 823; see e.g., Reber, 1967 for an example).

In articles 1 and 2, we use the term artificial language to describe the L3s. This decision was based on the fact that our languages partly fit with the definitions of both the mini- and the semi-artificial languages, as we include both nonce words and (pseudo-)cognates from natural languages.

4.3.2 Does artificial language learning reflect natural language learning?

A question concerning artificial language learning experiments that has received considerable attention is whether artificial language learning reliably reflects natural language learning, or whether the method merely taps into general learning abilities and/or intelligence. Friederici et al. (2002) and Morgan-Short et al. (2010) addressed this issue in EEG studies of adult learners who acquired one of the Romance-based artificial languages BROCANTO or BROCANTO2. The ERP data showed a similar pattern of brain activation in the processing of artificial and natural syntactic systems (Friederici et al., 2002, p. 530). Similarly, Opitz and Friederici (2003) observed brain activity that is typical for the processing of natural languages during the processing of BROCANTO, using functional magnetic resonance imaging (fMRI).

With respect to behavioural studies, Ettlinger et al. (2016) compared the acquisition of L2 Spanish in a university context with artificial language learning of an American English-based language. The results showed a strong positive correlation between the participants' performance in artificial language learning tasks and their performance in the L2 Spanish class. Importantly, the association held when general intelligence was controlled for. Based on this result, the authors argue that artificial language learning experiments are reliable tools that serve to provide insight into non-native natural language acquisition, but only when the artificial language reflects complexity and meaning. This might suggest that mini- and semi-artificial languages, rather than artificial grammars, are better suited to investigate issues related to natural language acquisition.

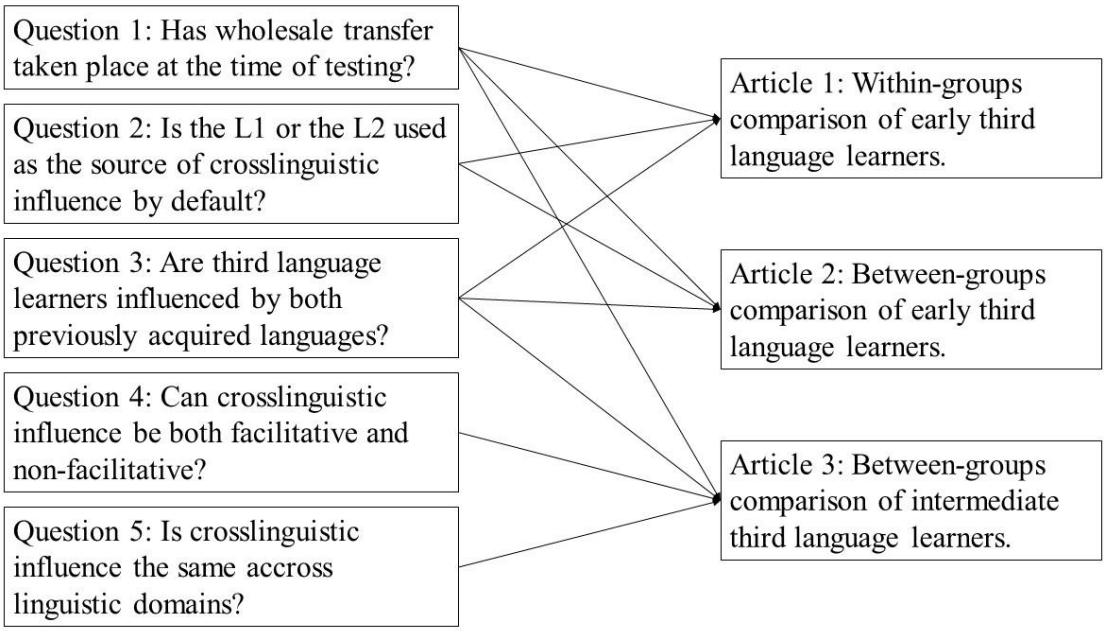
5 Summary of articles

In this section, we present and discuss articles 1–3, in which we investigated a number of research questions based on the theoretical and empirical foundation outlined in Section 2. Across the three articles, we addressed the questions of *when* crosslinguistic influence takes place, *how* previous knowledge is used, *what* exactly is shared between languages and *why* something is shared.

In articles 1 and 2, the participants were early learners of an artificial language and we focused on syntactic crosslinguistic influence. In article 1, we used a within-groups experimental design in which we investigated how similarities between the L3 input and pre-existing grammars affected syntactic preferences in the L3. In article 2, we applied a between-groups design in which we compared L2 and L3 learners of an artificial language. The L2 learners' L1 was the L3 learners' L2. We asked whether

the L3ers' additional language—the L1—would influence the target language, despite being lexico-phonotactically less similar to the L3 than the L2. In article 3, we also asked whether the lexico-phonotactically less similar language could influence the L3, but we tested more advanced L3 learners than in articles 1 and 2, and we extended our focus on syntactic crosslinguistic influence to also include morphological features and properties in the syntax-semantics interface. We also asked whether crosslinguistic influence could be both facilitative and non-facilitative. Figure 1 visualises the research questions asked in articles 1–3.

Figure 1. *Summary of hypotheses investigated in Articles 1–3.*



5.1 Article 1

5.1.1 Aims and objectives

In article 1, we investigated the relative influence of lexical and syntactic similarities between an L3 and pre-existing grammars by very early learners of an artificial L3. We asked the following research question: How do lexical and syntactic similarities

between the L3 and previously acquired languages affect crosslinguistic influence at the very beginning of L3 acquisition?

We compared four groups of L3 learners whose target artificial language varied in lexical and syntactic similarities to the participants' L1 and L2, but kept the pre-existing languages of the participants constant. This manipulation allowed us to investigate the impact of variation in the input. Similarity-driven models would predict changes in the participants' behaviour depending on the nature of the L3, but unlike property-by-property models, wholesale transfer would predict that the source of crosslinguistic influence is determined by the lexical cues. We tested the following three hypotheses: 1) Similarities between a previously acquired language and the L3 **do not** affect the source of crosslinguistic influence in L3 acquisition; 2) **Lexical** similarity between a previously acquired language and the L3 input affects the source of crosslinguistic influence; 3) **Syntactic** similarity between a previously acquired language and the L3 input affects the source of crosslinguistic influence.

5.1.2 Design and methodology

We investigated the research question in a within-groups experimental design where we compared four groups of L1 Norwegian–L2 English sequential bilinguals (N = 120) who ranged in age between 16–72 (M = 25.73, SD = 13.70). The participants had no or little knowledge of other languages than Norwegian and English, and the L2 age of onset ranged between 5–12. The participants were randomly assigned to one out of four L3s, referred to as Languages A–D. Languages A and B displayed lexical similarities to Norwegian or English, respectively, but the syntactic input did not reveal a similarity to one previously acquired language over the other, as the

participants were exposed to Subject-Verb-Object (SVO) word order, which both English and Norwegian exhibit. SVO word order in Norwegian, English and the artificial L3s are shown in examples 2 and 3.

(2) *Subject-Verb-Object word order in Norwegian (a) and English (b)*

a. Emma **elsker** kirsebær.

Emma loves cherries

'Emma loves cherries.'

b. Emma **loves** cherries.

(3) *Subject-Verb-Object word order in Languages A/C (a) and B/D (b)*

a. Emma **beudro** gau.

Emma loves cherries

'Emma loves cherries.'

b. Emma **cher** pronlim.

Emma loves cherries

'Emma loves cherries.'

In Language C, the lexico-phonotactic input was based on Norwegian and the syntax on English, and vice versa in Language D. More specifically, we exposed the learners of Language C to *do*-support, as exemplified in (4). This is found in English, as shown in (5), but not in Norwegian, as shown in (6).

(4) *Do-support in Language C*

Ej **do** **neit** **beudro** knurk.

I do not like grapes.

'I do not like grapes.'

(5) *Do-support in English*

I **do not** like grapes.

(6) *Negation in Norwegian*

Jeg **liker** **ikke** druer.

I like not grapes

'I do not like grapes.'

We exposed the learners of Language D to post-nominal possessives, as shown in (7). This structure exists in Norwegian, as illustrated in (8a), but constitutes a mismatch with the pre-nominal possessives in English, as shown in (8b).

(7) *Post-nominal possessives in Language D*

Thamey **miz** ef Manene.

Name.DEF my is Manene

'My name is Manene.'

(8) *Post-nominal possessives in Norwegian (a) and English (b)*

a. **Navnet** **mitt** er Emma.

Name.DEF my is Emma

'My name is Emma.'

b. **My name** is Emma.

After having exposed the participants to one of the artificial languages, we tested their word order preferences in the L3 in a forced-choice AJT in which the learners had to choose between two non-subject-initial declarative clauses that varied between Adverbial-Verb-Subject (henceforth referred to as XVS) and Adverbial-Subject-Verb (XSV) word order, as exemplified in (9). Crucially, the participants had not been exposed to non-subject-initial declaratives in the L3 prior to the AJT, to ensure that we tapped into crosslinguistic influence rather than learning.

(9) a. Pån dagman **knetter** **ej** aporo. [XVS]

On Monday eat I apples

'On Mondays I eat apples.'

b. Pån dagman **ej** **knetter** aporo. [XSV]

On Monday I eat apples

'On Mondays I eat apples.'

English and Norwegian exhibit different word orders in non-subject-initial declaratives, as the verb moves to the second position in Norwegian main declarative clauses (XVS; Vikner, 1995; Westergaard & Vangsnes, 2005). This is exemplified in (10a). In contrast, the verb stays in the verb phrase in English, resulting in XSV word

order (Lehmann, 1978). This is exemplified in (10b). [5] The mismatch allowed us to trace the participants' source of crosslinguistic influence.

(10) *Word order in Norwegian (a) and English (b) non-subject-initial declaratives*

a. Hver morgen **drikker** **Emma** kaffe.
Every morning drinks Emma coffee.
'Every morning Emma drinks coffee.'

b. Every morning **Emma drinks** coffee.

5.1.3 Data and analysis

We analysed the forced-choice AJT data in RStudio (Team, 2021), version 1.2.5033 (2019-12-04). We used the lme4 R package (Bates et al., 2015) to fit a mixed-effects binomial logistic regression model to the data in a manual step-wise step-up forward elimination procedure that led to a minimally adequate model. The response variable was the forced choices (*XVS* or *XSV*) and the predictor variables were Lexicon (*Norwegian-based* or *English-based*) and Congruency between the lexical and syntactic cues in the L3 input (*incongruent* or *congruent*). We added Participants and Items as random intercepts.

5.1.4 Findings and conclusion

We found a statistically significant main effect of Lexicon, which showed that XVS word order selections (i.e., Norwegian-like syntax) occurred less frequently when the lexical items were based on English, as opposed to when they were Norwegian-based.

[5] English is not considered a V2 language like Norwegian, but the verb still occurs in the second position in some constructions, such as *wh*-questions (Rizzi, 1996) and declaratives with informationally light verbs (Westergaard, 2007).

We also found a significant interaction between the variables Lexicon and Congruency, which showed that when the syntactic input included English-like syntax—in this case *do*-support—the participants selected more V3 than in cases where the syntactic input was neutral. In other words, the participants did not show selective transfer from the lexically more similar language, English, as would have been expected if wholesale transfer had taken place at the time of testing or if the L2 had been selected as the source of influence by default. This reflects the main argument in article 1, i.e., that the nature of the L3 input shapes the trajectory of crosslinguistic influence and that both lexical and syntactic cues in the input might contribute to this, as argued for by property-by-property models of L3 acquisition.

Crucially, we did not observe an increase of V2 word order selections when the syntactic input was based on Norwegian (post-nominal possessives) to the same extent as we observed an increase of V3 with inputs containing *do*-support. This might indicate that the exposure to Norwegian-like syntax has no substantial impact on crosslinguistic influence. Possible explanations could be that lexical cues are more influential than syntactic cues, that there is a foreign/L2 status effect or that the learners have a general preference for the unmarked English word order. However, none of these explanations completely captures the participants' behaviour. That is, if the source of crosslinguistic influence was solely determined by the lexical cues, we should not observe the impact of *do*-support (i.e., there would be no interaction effect). Also, if the source was determined by a foreign/L2 status effect or a general preference for the unmarked word order, we should not observe the strong impact of exposure to a Norwegian-based lexicon when only the lexicon revealed an L1/L2–L3 match.

Instead, the observed behaviour might indicate that when there is clear evidence for one pre-existing language as more similar to the L3 than the other pre-existing language—in this case illustrated by lexical similarities—factors such as markedness and a foreign language effect matters little. However, when there is a conflict between the linguistic cues, foreign language status and/or markedness seem to influence crosslinguistic influence. This would explain why we only see the foreign language effect when the input is incongruent.

5.2 Article 2

5.2.1 Aims and objectives

In this paper, we investigated crosslinguistic influence at the very beginning of artificial L3 acquisition by comparing an experimental group of sequential bilinguals to monolinguals whose L1 was the L2 of the bilinguals. All participants were exposed to the same L3. The artificial language was lexico-phonotactically similar to the shared language, but syntactically similar to the bilinguals' L1. We asked two research questions:

1) Can learning effects be observed after minimal exposure to a new language?

If structural learning takes place, we expect that exposure to a given sentence structure in the L3 input will lead to an increased preference for this given structure. This is best seen when the learners' previously acquired language(s) do not offer facilitation, in order to avoid confounds of crosslinguistic influence.

2) Do the bilinguals show influence of both previously acquired languages, or is the L3 only affected by the lexico-phonotactically more similar pre-existing language?

If the bilinguals are only affected by the lexico-phonotactically more similar language, we should see no difference between the bilingual and monolingual groups. Such behaviour is expected if wholesale transfer based on lexical input has occurred at the time of testing. Differences between the groups would indicate that the bilinguals are influenced by both lexico-phonotactic and syntactic cues in the input, as argued for by property-by-property models of L3 acquisition.

5.2.2 Design and methodology

We compared L1 Norwegian–L2 English bilinguals to L1 English monolinguals. Both groups were exposed to, trained on and tested in an artificial language that was lexico-phonotactically similar to English, but syntactically similar to Norwegian in terms of being a V2 language. To demonstrate the V2 rule in the artificial language, we exposed the participants to SVO sentences and, crucially, non-subject-initial declarative clauses with XVS word order. The XVS word order (V2) is grammatical in Norwegian, but not in English, as explained in Section 5.1.

We collected acceptability judgements (two levels: *Good* or *Bad*) of sentence pairs that differed in word order: subject-initial declarative clauses (SOV/SVO; fillers), non-subject-initial declaratives (XSV/XVS) and subject-initial declarative clauses with sentence adverbials (SXV/SVX). The participants had not been exposed to the latter sentence type before the acceptability judgement task. This was done in order to

compare effects of learning to crosslinguistic influence. As in non-subject-initial declarative clauses, there is a word order mismatch between Norwegian and English when an adverbial is added to a subject-initial declarative clause, as Norwegian moves the verb to the second position. The three different sentence types are exemplified in English and Norwegian in (11)–(13).

(11) *Subject-initial declarative clauses in Norwegian (a) and English (b)*

a. Emma **elsker** kaffe

Emma loves coffee.

'Emma loves coffee.'

b. Emma **loves** coffee.

(12) *Non-subject-initial declarative clauses in Norwegian (a) and English (b)*

a. Hver morgen **drikker** **Emma** kaffe.

Every morning drinks Emma coffee.

'Every morning Emma drinks coffee.'

b. Every morning **Emma drinks** coffee.

(13) *Declarative clauses with adverbials in Norwegian (a) and English (b)*

a. Emma **drikker** **ofte** kaffe.

Emma drinks often coffee

'Emma often drinks coffee.'

b. Emma **often drinks** coffee.

5.2.3 Data and analysis

We fitted a mixed-effects binomial logistic regression model to the acceptability judgement data in a manual step-wise step-up forward elimination model to determine the final minimal adequate model. We used the lme4 R package (Bates et al., 2015) in R version 4.1.2 (2021-11-01, Team, 2021). The response variable was the acceptability judgements (*Good* or *Bad*) and the predictor variables were Group (*English* and *Norwegian–English*), Sentence type (*XSV/XVS* and *SXV/SVX*) and Word order (*V2* and *V3*). We included Participants as the random intercept.

5.2.4 Findings and conclusions

The participants did not judge the sentence type to which they had been exposed (SVX/SXV) differently than the novel type (XSV/XVS), as would be expected if learning had taken place. This may indicate that the time between exposure, training and testing was too short for structural learning to take place. However, we found that the linguistic background of the speakers affected the acceptability judgements, as the Norwegian–English speakers accepted significantly more V2 word order than the English group. This suggests that crosslinguistic influence did not only come from the lexico-phonotactically more similar language, English. Such findings are in line with the predictions put forward by property-by-property models of L3 acquisition, and also show that, if there is wholesale transfer, it had not taken place at the time of testing.

Examining the acceptability judgements in more detail, we observed that the L1 English speakers accepted as much as 35–37% V2 word order, even if these sentences would be ungrammatical in English. We attributed this behaviour to the fact that

English is considered a residual V2 language that allows for the verb to occur in the second position in certain cases (Rizzi, 1996; Westergaard, 2007).

Furthermore, although the bilinguals behaved significantly different from the monolinguals, we also observed that the bilinguals categorically accepted V3 word order, while judging V2 word order close to chance. This is similar to what we observed in the incongruent inputs in article 1 and to Dahl et al. (In press; cf. Section 2.5.2), who found no clear word order preferences in L3 German—a V2 language—by Norwegian–English bilinguals. We interpreted this behaviour as a reflection of parallel activation and competition between candidate structures, rather than fully specified pre-existing representations from the L1 or the L2. That is, when the lexical and syntactic cues in the input are incongruent, factors such as early availability of lexical cues (in this case English) and the foreign language status and/or markedness might tip the scale in favour of English, which would explain why the bilinguals typically accept V3 while at the same time remain indecisive about V2.

5.3 Article 3

5.3.1 Aims and objectives

In the final paper, we investigated crosslinguistic influence at intermediate levels of the acquisition process by comparing L2 and L3 learners of English who had been instructed in the target language for 5–6 years. We asked three research questions:

1) Do both previously acquired languages contribute to crosslinguistic influence at developmental stages of L3 acquisition, or is one language chosen as the sole/primary source of influence?

2) Is crosslinguistic influence always facilitative?
3) Is the amount of crosslinguistic influence the same across grammar domains: morphology, syntax and syntax–semantics?

As described in the next section, we tested several linguistic properties. We predicted that the L2 learners would perform better at the linguistic properties in which their native language offered facilitation, as compared to the properties in which their L1 was non-facilitative. We also predicted that the L3 learners would behave differently from the L2 learners due to simultaneous facilitative and non-facilitative influence from both pre-existing grammars. It is important to note that timing is an important factor in the present experiment, as linguistic properties might have individual developmental trajectories depending on factors such as saliency in the input and complexity (Westergaard et al., Forthcoming)

5.3.2 Design and methodology

Our experimental group was Russian–Norwegian simultaneous or very early sequential bilinguals (N = 31; mean age = 11.5) who had English as their L3. We compared the experimental group with two age- and proficiency-matched control groups: Sequential bilingual speakers of L1 Russian–L2 English (N = 74; mean age = 12.4) and L1 Norwegian–L2 English (N = 90; mean age = 12.1). All participants had been instructed in English for 5–6 years in a classroom setting. This experimental set-up allowed us to assess whether crosslinguistic influence in the L3 group came from Russian, Norwegian or from both languages.

Using an offline AJT (two levels: *Good* and Bad), we tested the participants' accuracy in an array of linguistic properties across three linguistic domains—syntax, morphology and the syntax–semantics interface. Within each domain, one experimental condition represented a similarity between English and Russian (English = Russian ≠ Norwegian) and another between English and Norwegian (English = Norwegian ≠ Russian). The conditions in which Russian offered facilitation were *abstract genericity, subject–verb agreement, subject–verb word order* and *adverb–verb word order.* The conditions in which Norwegian offered facilitation were *definiteness, obligatory copula* and *object-verb word order.* There were six sentence pairs per condition (42 sentence pairs in total), and each pair consisted of one grammatical and one ungrammatical version of the same sentence. Examples 14–20 illustrate some of the items used in the AJT (elements used for context in brackets).

(14) *Definiteness*

a. [Susan thought that her dog was lazy]. **The** dog slept a lot.

b. [Susan thought that her dog was lazy]. *Dog slept a lot.

(15) *Obligatory copula*

a. **Lisa is** a nice person.

b. ***Lisa** a nice person.

(16) *Verb placement in relation to an object pronoun*

a. [Nina was Robert's girlfriend]. Robert **met her** at work.

b. [Nina was Robert's girlfriend]. *Robert **her met** at work.

(17) *Abstract genericity*

a. Life can be difficult.

b. ***The** life can be difficult.

(18) *Subject–Verb agreement*

a. **Ruth walks** to church every Sunday.

b. ***Ruth and John walks** to church every Sunday.

c. **Ruth and John walk** to church every Sunday.

d. ***Ruth walk** to church every Sunday.

(19) *Verb placement in non-subject-initial declarative clauses*

a. Last Monday **the teachers walked** to school.

b. *Last Monday **walked the teachers** to school.

(20) *Verb placement in subject-initial declarative clauses with sentence adverbials*

a. We **usually eat** eggs for breakfast.

b. *We **eat usually** eggs for breakfast.

5.3.3 Data and analysis

We analysed the data in R, version 4.0.3 (2020-10-10). We fitted a mixed-effects logistic regression model to the data using the R package lme4 (Bates et al., 2015) and performed post-hoc pairwise comparisons using emmeans (Lenth et al., 2019). The response variable was the participants' accuracy scores calculated from the AJT. The predictor variables were Group (*Russian–Norwegian*, *Russian* and *Norwegian* speakers) and Condition (*abstract genericity*, *subject–verb agreement*, *subject–verb word order*, *adverb–verb word order*, *definiteness*, *obligatory copula* and *object-verb*

word order) and the random effects were by-item random intercepts and by-participant random slopes.

5.3.4 Findings and conclusions

The results showed that the L3 learners usually patterned with the more accurate L2 group, indicating facilitative influence from both Russian and Norwegian. On one condition, *subject–verb agreement,* the L3 group's accuracy score was in the middle of the L2 groups' scores. That is, the L3 group significantly outperformed the Norwegian group, but performed significantly worse than the Russian group. We argued that this behaviour reflects simultaneous facilitative and non-facilitative influence from the previously acquired languages, Russian and Norwegian, in the L3 group. We concluded that both Russian and Norwegian were active and contributed to grammar building in the L3, and that crosslinguistic influence can be both facilitative and non-facilitative, as predicted by the Linguistic Proximity Model and the Scalpel Model. Some conditions turned out to be more difficult than others, in particular abstract genericity, despite the possibility for facilitative influence from Russian. This illustrates that crosslinguistic influence is not the only factor determining what is easy or difficult to acquire in a new language, as the saliency and complexity of the linguistic properties affected the acquisition process too.

6 Discussion

In this section, we discuss the overarching research questions put forward in Section 3. We asked how articles 1–3 can inform us about 1) whether human beings are sensitive to fine-grained linguistic properties in the learning process and 2) if crosslinguistic

influence is a matter of copying or co-activation. We discuss the research questions in turn.

6.1 Are human beings sensitive to fine-grained linguistic properties in the learning process?

Current models of L3 acquisition all agree that in order to operationalize the principle of least effort (cf. Section 2.5.3), the mind optimizes the learning task by reusing pre-existing linguistic knowledge. However, the models disagree when it comes to what constitutes the path of least resistance. If human beings are sensitive to fine-grained linguistic properties in the input across the two previously acquired grammars, we expect that L3 learners will be influenced by both lexico-phonological/phonotactic and morphosyntactic cues in the input. If, on the other hand, learners pay attention to linguistic cues in a modular manner, starting with the lexicon, we do not expect cues on a lower level, such as syntax, to affect crosslinguistic influence, unless there is no conclusive evidence at the lexical level.

We argue here that the results discussed in articles 1–3 reflect a learning process in which the bilingual L3 learners subconsciously search for similarities between the L3 and pre-existing linguistic properties across languages (L1/L2) and linguistic domains (lexico-phonotactics and morphosyntax). The candidate structures compete against each other for the overall best fit to the L3 system and the best candidate is activated in the target language. The competition is not a matter of comparing languages as monolithic wholes, but rather, comparing fine-grained linguistic properties than can be activated in the L3. The rationale for this is that wholesale transfer leads to a more costly acquisition process because it requires restructuring, i.e., unlearning, in all cases

where the copied language does not match the target language. Overall, our results align with previous research which has found crosslinguistic influence from both pre-existing grammars (Bruhn de Garavito & Perpiñán, 2014; Ionin et al., 2015; Kolb et al., 2022; Listhaug et al., 2021). We now turn to show how articles 1–3 argue for the claim presented here.

In article 1, we found a strong influence of lexical similarity between the L3 and a previously acquired language, Norwegian or English, in early artificial L3 learning by Norwegian–English bilinguals. Crucially, we also found that learners who were exposed to incongruent cues (syntax = Norwegian and lexicon = English or vice versa) behaved differently than those only exposed to lexical cues (syntax = neutral and lexicon = English or vice versa). More specifically, we observed that the exposure to the English-based *do*-support increased the preference for English- over Norwegian-like syntax in a the forced-choice acceptability judgement task, showing that bilinguals are sensitive to both lexical and syntactic cues. As we discuss in the article, we do not observe the same effect of exposure to Norwegian-based syntax, which we argue could be the result of a preference for the unmarked word order in combination with an L2/foreign language effect. Article 2 supports the findings in article 1, as we showed that knowledge of Norwegian had a significant impact on the acceptability judgements of word order in an artificial language when we compared Norwegian–English L3 learners to English L2 learners, even though the target language was both lexically and phonologically similar to English. This suggests that lexical cues are strong, especially at the beginning of the acquisition process, arguably due to early availability, but the

lexical overlap between the L3 and previously acquired languages cannot explain everything.

In article 3, where we investigated Russian–Norwegian intermediate L3 learners of English, the bilinguals sometimes patterned with the L1 Russian control group and other times with the L1 Norwegian control group, indicating facilitative influence from both languages. This mix-and-match behaviour could reflect what we have already suggested in articles 1 and 2, i.e., that learners are sensitive to fine-grained structural cues in the input, even from the language that, on the surface, is very different from the target language—in this case Russian. This result is very similar to what Kolb et al. (2022) found in their investigation of L3 Russian by L1 German–L2 English speakers.

However, it must be noted that the participants in article 3 had been exposed to English for 5–6 years. The idea of treating pre-existing grammars as consistent wholes is typically proposed for the earlier stages of the acquisition process, as Rothman et al. (2019) allows for so-called secondary property-by-property crosslinguistic influence after wholesale transfer. According to the results of the experiments presented in the current thesis, wholesale transfer does not take place after minimal exposure to the target language (articles 1 and 2), nor at intermediate stages (article 3). Although we cannot exclude the possibility that wholesale transfer takes place somewhere in-between these two points in time, we argue that a more elegant hypothesis of the L3 acquisition process is that multilingual acquisition is a matter of parallel activation and competition between pre-existing and new representations, rather than a competition between languages as monolithic wholes.

6.2 Is crosslinguistic influence a matter of copying or co-activation?

The Typological Primacy Model argues that crosslinguistic influence, or transfer, is a matter of copying linguistic representations from one language to another. This should lead to stable and fully specified L3 representations that are identical to the system from which it is copied. In contrast, co-activation of candidate structures that compete against each other to determine the overall best fit should be reflected in less stable representations and more or less variation in the participants' behaviour depending on the nature of the L3 input.

We argue that the L3 behaviour observed in articles 1–3 is not compatible with the idea of crosslinguistic influence, or transfer, as a copying mechanism. Overall, articles 1–3 show that crosslinguistic influence in L3 acquisition is non-selective and, to different degrees, unsystematic depending on the nature of the L3 input. These findings extend the results reported in e.g., Dahl et al. (In press) and Ionin et al. (2015) who also report crosslinguistic influence from both previously acquired languages, rather than stable representations from one of the pre-existing grammars.

For example, the Norwegian–English participants in article 1, who were exposed to incongruent cues (syntax = English and lexicon = Norwegian or vice versa) showed greater variability in their acceptability judgements of word order than the learners who had been exposed to congruent cues (syntax = neutral and lexicon = Norwegian or English). This reflects a learning situation in which the candidate structures in the bilingual mind compete against each other in order to be activated in the processing task (cf., Truscott & Sharwood Smith, 2019). When the cues are congruent, the overall

best fit is easier to determine than when the lexical and syntactic cues disagree. The differences in variation between learners exposed to incongruent and congruent cues show that the former group has a more challenging job determining which candidate has the overall best fit, resulting in more variation in their judgements of word order. This result is similar to Dahl et al. (In press) who found that learners of German show no word order preferences when their L1 offers facilitation and their L2 offers non-facilitation—again this result can be explained by an ongoing competition in the bilinguals' mind. Crucially, such competition should not be necessary if a candidate structure has been copied to the L3.

A similar variability in word order judgements was found in article 2, where Norwegian–English bilinguals who acquired an artificial L3 behaved close to chance when they judged V2 word order. Surprisingly, the L1 English control group also accepted V2 word order relatively frequently (around 35–40%), even if this is not the preferred word order in their L1, nor was it present in the L2 input. This could be a result of an agreement tendency (a task effect), or it could reflect the fact that English is a residual V2 language that allows the verb to occur in the second position of main declarative clauses in certain linguistic contexts (Rizzi, 1996; Westergaard, 2007). If so, the variation could reflect competition between candidate structures also in the L1 English group, which would be problematic for the Full Transfer/Full Access hypothesis of L2 acquisition, which argues that wholesale transfer takes place immediately after exposure to the L2 (Schwartz & Sprouse, 1996).

Finally, when we compared Russian–Norwegian bilinguals with L1 Russian and L1 Norwegian control groups in article 3, we observed that the bilinguals typically

patterned with the L1 group whose language offered facilitation, which would be compatible with the predictions of the Cumulative-Enhancement Model. However, in one condition (subject–verb agreement), the bilinguals outperformed the Norwegian speakers but were outperformed by the Russian speakers. This in-between behaviour suggests that crosslinguistic influence is not selective, i.e., it cannot be a result of a copying mechanism. We also found that the participants' accuracy did not only depend on their pre-existing linguistic knowledge, but also on other factors such as frequency of the evidence, saliency, and complexity of the linguistic properties that we tested, which would not be expected under copying. Instead, the behaviour is compatible with influence from Russian and Norwegian simultaneously, as predicted by the Linguistic Proximity Model and the Scalpel Model.

7 Conclusion and future directions

To summarise, this dissertation presents three articles that investigate crosslinguistic influence in L3 acquisition, focusing on the way in which acceptability judgements in the L3 are affected by the nature of the L3 and the previously acquired languages. Articles 1 and 2 investigated crosslinguistic influence at the very beginning of the acquisition process of an L3 artificial language by Norwegian–English sequential bilinguals. Article 1 compared different types of L3s that varied in lexical and syntactic overlap with English and Norwegian, while article 2 compared Norwegian–English bilinguals to English monolinguals who acquired the artificial language as their L3 and L2, respectively. In article 3, we investigated Norwegian–Russian simultaneous or very early sequential bilinguals who had been instructed in English for 5–6 years. We compared them to age- and proficiency-matched L2 speakers of

English with Russian and Norwegian as their L1s, respectively. Our main conclusions can be summarised as follows:

- There is no default source of crosslinguistic influence at early, nor intermediate, stages of L3 acquisition.
- Crosslinguistic influence does not come exclusively from one previously acquired language, indicating that wholesale transfer has not taken place at the time of testing, i.e., at the very beginning of the acquisition process and at intermediate proficiency levels in the L3.
- Simultaneous crosslinguistic influence comes from both previously acquired languages at early and intermediate stages, even when one of the languages is lexico-phonotactically more similar to the L3, supporting property-by-property L3 models. At intermediate stages, the crosslinguistic influence was found to be facilitative and non-facilitative, supporting the Linguistic Proximity Model and the Scalpel Model rather than the Cumulative-Enhancement Model.
- At early stages of the acquisition process, several factors appear to affect the outcome of the competition between candidate structures. We have seen that both lexical similarity, syntactic similarity and foreign language status/markedness affect the outcome, but to different degrees.

In answering the two overarching research questions (Section 3), we concluded that learners are sensitive to fine-grained linguistic representations during the decoding of a new language. To expedite the acquisition process, the bilinguals activate candidate structures from their pre-existing languages in the L3 interlanguage. The strength of the activation of a given structure is determined by its overall fit to the incoming L3

system. This means that crosslinguistic influence can come from both previously acquired languages and that there are several goodness-of-fit parameters, such as linguistic similarity, foreign language status and markedness, etc. We do not find any indications of wholesale transfer, but we cannot exclude the possibility that copying takes place before or after the time of testing. Longitudinal designs would be advisable to investigate this in future studies. In the future, we must also explore the relative influence of different factors further. For example, we could investigate a situation in which the syntax, rather than the lexicon, is the only cue that reveals a similarity to one of the pre-existing grammars. We could also explore a situation in which there are no linguistic similarities in the input, in order to explore both similarity-driven and default L3 models further.

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Paper 1 (manuscript)

Syntax matters: Exploring the effect of linguistic similarity in third language acquisition

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Abstract

Over the last two decades, the question of which linguistic cues learners pay attention to when they decode a new language has been subject to controversy in the field of third language (L3) acquisition. In this paper, we present an artificial language learning experiment that investigates how lexical and syntactic similarities between an artificial L3 and pre-existing grammars impact crosslinguistic influence at the very beginning of the acquisition process. We exposed and trained 120 Norwegian–English bilinguals on four different L3s. The participants gave forced-choice acceptability judgements on pairs of non-subject-initial declarative clauses that differed in word order, one grammatical in English, the other grammatical in Norwegian. Crucially, the participants had not been exposed to non-subject-initial declaratives during the exposure and training phases, to avoid confounds with learning. The results show that both lexical and syntactic similarities affect crosslinguistic influence. We discuss this result considering contemporary accounts of L3 acquisition.

Keywords: Crosslinguistic influence, wholesale transfer, property by property, artificial language learning, third language acquisition

Introduction

In second language (L2) acquisition, it is easy to identify the source of crosslinguistic influence, as there is only one candidate—the first language (L1). Determining the source(s) of influence in third language (L3) acquisition is a more complicated task, as it might come from the L1, the L2 or from both pre-existing grammars. Currently, there is little consensus among L3 models about whether the learners select a primary,

or even sole, source of influence, which would involve inhibiting (at least for a short period of time) one of the pre-existing grammars, or if they have access to both previously acquired languages as sources of influence throughout the acquisition process. Another issue is whether the learners' (subconscious) choices are determined by the linguistic similarity between the L3 and previously acquired languages. And if so, how the learners determine whether the L1 or the L2 is more similar to the L3. In this paper, we present an artificial language learning experiment that contributes to novel insight about the relative influence of lexical and syntactic similarities between an artificial L3 and pre-existing grammars. Using an artificial language allows us to explore the very first meeting with an L3 and to have full control over the stimuli. We also isolate effects of crosslinguistic influence from learning by testing a linguistic representation that the participants have not been exposed to in the L3.

Our results suggest that adult sequential bilinguals are influenced by both lexical and syntactic similarities between the L3 and previously acquired languages after minimal exposure to the target language, and that lexical cues are particularly influential. This may be attributed to the immediate access to information about lexical crossover, while information about overlaps in syntactic structure requires a deeper knowledge of the L3 (Rothman, 2013; Westergaard, 2021c). This finding is compatible with similarity-driven models of L3 acquisition (Flynn et al., 2004; Rothman, 2011, 2015; Slabakova, 2017; Westergaard, 2021b), as opposed to accounts that argue for a default L1 or L2 effect (e.g., Bardel & Falk, 2007; Bayona, 2009; Berends et al., 2017; Falk & Bardel, 2011; Hermas, 2010, 2015; Mollaie et al., 2016; Na Ranong & Leung, 2009; Park, 2016). Our results do not support the idea of wholesale transfer at the initial

state, as proposed in Rothman (2011), nor do the findings support the idea of wholesale transfer taking place as soon as the parser detects similarity between the L3 and one of the previously acquired languages (at the *initial stages*) based on the four-way hierarchy of Rothman (2013, 2015)—lexicon, phonology, morphology, syntax. However, our findings cannot preclude the possibility that wholesale transfer takes place later in the acquisition process, as discussed in González Alonso et al. (2020). In our view, a more plausible explanation for our results is that learners have access to both previously acquired languages throughout the acquisition process, as proposed by property-by-property accounts of L3 acquisition (Flynn et al., 2004; Slabakova, 2017; Westergaard, 2021b). Finally, we observe that the presence of syntactic cues from the L2 in the L3 input affects crosslinguistic influence more strongly than the presence of syntactic cues from the L1—a finding that could indicate a foreign language/L2 effect.

Background literature

Crosslinguistic influence in L2 acquisition

The Full Transfer/Full Access hypothesis (FT/FA; Schwartz & Sprouse, 1996) has received considerable empirical support in the L2 literature (e.g., Grüter, 2006). In short, the FT/FA argues that a copy of the L1 final state constitutes the L2 initial state. That is, all linguistic representations acquired in the L1 should "…immediately carry over as the initial state of a new grammatical system on first exposure to input from the target language… (Schwartz & Sprouse, 1996, p. 41). This copying mechanism is referred to as wholesale transfer. Consequently, the FT/FA would predict that the L2 is systematically treated as the L1 at the beginning of the acquisition process, as the L2

interlanguage should consist of stable, fully specified L1 representations. Facilitative influence is explained by L1–L2 matches and non-facilitation by mismatches. The representations are restructured when/if parsing failures occur. It follows that crosslinguistic influence is best seen early in the acquisition process, but the timing for restructuring is individual, depending on factors such as the L1–L2 overlap, input quantity and quality, etc.

The idea of Full Transfer has been challenged by Westergaard's (2021b) Full Transfer Potential (FTP), which addresses the question of what *full* transfer really entails. FTP proposes that learners have access to everything in the L1, but crosslinguistic influence (facilitative or non-facilitative) will only take place at the moment when a particular property is needed (in production or comprehension). Consequently, crosslinguistic influence takes place property by property. This means that, in contrast to what wholesale transfer predicts, the L2 grammar starts small, with unstable linguistic representations, and grows incrementally (Westergaard, 2021b). Facilitative influence is a result of L1–L2 matches, while non-facilitative influence could be a consequence of misanalysis (typical in comprehension) or insufficient input (typical in production).

Note that FT/FA and FTP cannot be distinguished in L2 acquisition, but they make different predictions about crosslinguistic influence in L3 acquisition. As we discuss in the next sections, both accounts are similarity-driven and can be contrasted to default accounts.

Similarity-based accounts of L3 acquisition

Wholesale transfer

The Typological Primacy Model (TPM; Rothman, 2011, 2015; Rothman et al., 2019) extends FT/FA to L3 acquisition by arguing that bilinguals subconsciously copy one of their previously acquired languages as the baseline L3 system. It follows that this should be a fully specified grammar with robust L1 or L2 representations (or one of the L1s if the learners are simultaneous bilinguals). The parser should select the pre-existing grammar that is linguistically more similar to the L3—a decision that is made by means of a subconscious modular assessment of how the L3 input overlaps with the L1 and L2. Rothman (e.g., 2013, 2015; see also Rothman et al., 2019) proposes that the linguistic modules are assessed in the order shown in (1), from least to most influential, adapted from Rothman (2015, p. 185). The order of the cues is based on considerations of saliency and availability in the input, as knowledge of words is a prerequisite for parsing syntax (González Alonso et al., 2020, p. 5).

(1) The lexicon → Phonology/phonotactics → Morphology → Syntax

According to Rothman et al. (2019), if the top cue in the hierarchy, the lexicon, reveals unambiguous and sufficient similarities to a previously acquired language, this language should be selected as the source of influence. There is then no reason for the learners to consider subordinate levels. Only when "…the motivation for selection cannot come from the lexicon, knowledge of the particular languages' phonological, morphological and syntactic systems will become paramount" (Rothman et al., 2019, p. 162).

In one of the earliest descriptions of the TPM (Rothman, 2011), wholesale transfer is proposed for the initial state of L3 acquisition. As empirical support, Rothman compares two groups of bilinguals, L1 Italian–L2 English and L1 English–L2 Spanish speakers, acquiring a Romance L3 (Spanish and Brazilian Portuguese, respectively) at beginner–intermediate levels. The results showed that both groups demonstrated knowledge of structures that are present in Romance, i.e., the first group were influenced by their L1 and the second group by their L2. In Rothman (2015), it was argued that wholesale transfer in the L3, unlike the L2, does not take place at the initial state, but rather, at the initial stages. There is no fixed time frame for initial stages, but they are expected to occur very early in the acquisition process (e.g., Cabrelli Amaro et al., 2015, p. 22; González Alonso & Rothman, 2017; Rothman, 2015).

As a result of the unspecified timing, proponents of wholesale transfer argue that the absence of stable representations from the linguistically more similar language in a cross-sectional experimental design does not necessarily mean that wholesale transfer does not occur. Rather, it might simply mean that the process takes place earlier or later. In short, this is what González Alonso et al. (2020) argued for in an artificial language learning experiment that tested the impact of lexical similarity between artificial L3s and the learners' pre-existing grammars, Spanish (L1) and English (L2). The L3s were either lexically like English (mini-English) or Spanish (mini–Spanish). The learners were exposed to and trained on gender agreement—a morphological similarity to Spanish, suggesting that there were incongruent cues in mini-English. The behavioural data (response time and grammaticality judgements) showed no between-

groups differences, as both were relatively accurate in detecting gender violations in the L3 (68–69%; González Alonso et al. (2020, p. 9)). The authors also collected event-related potentials, expecting that wholesale transfer of the lexically more similar language would be reflected in sensitivity to gender violations (a P600 component) by learners of mini-Spanish. The results showed no such component. However, the study found a between-groups difference in brainwave patterns by means of a P300 component in the mini-Spanish group, which is typically observed for low-probability items. The authors argue that this finding indicates attention to the relevant properties of gender violations. They conclude that, while the absence of a component related to processing of syntactic violations suggests that wholesale transfer had not occurred at the time of testing, the P300 could reflect *pre-transfer stages*, defined as the time between the first exposure to the L3 and the moment in which wholesale transfer occurs.

Property by property

L3 models that argue for crosslinguistic influence as a property-by-property process include the Cumulative Enhancement Model (Flynn et al., 2004), the Scalpel Model (Slabakova, 2017) and the Linguistic Proximity Model (Westergaard, 2021b). In line with FTP, these models reject the idea of wholesale transfer, as they argue that bilinguals have access to and may use both previously acquired languages as sources of influence throughout the acquisition process. According to Westergaard (2021b), this means that both pre-existing grammars are activated in parallel, nominating all linguistic representations as candidates for L3 influence (cf., Sharwood Smith, 2021; Truscott & Sharwood Smith, 2019). The candidates compete against each other for the

overall best fit to the L3 input. The outcome of the competition determines the candidates' degree of influence on the L3. This means that crosslinguistic influence can come from the L1, the L2 or from both previously acquired languages. This has been argued for in e.g., Listhaug et al. (2021), who found influence from both L1 Norwegian and L2 English in L3 French, as well as Westergaard et al. (2017), Jensen et al. (2021) and Kolb et al. (2022), who found empirical evidence for simultaneous facilitative and non-facilitative crosslinguistic influence in L3 English, both from a lexically similar language (Norwegian or German) and a more distant language that shares a particular property with the L3 (Russian).

A given candidate's strength of activation is determined by several factors, but the most influential one should be the degree of shared features with the L3 (Truscott & Sharwood Smith, 2019; Westergaard, 2021b). However, the relative impact of shared features differs across linguistic modules and time because of factors such as early availability and saliency of cues in the L3 input (Slabakova, 2017; Westergaard, 2021b). For example, L3 learners have immediate access to information about overlapping lexical items and phonology/phonotactics, as this requires no lexical learning. In contrast, it is typical that no syntactic structures are involved at the very beginning of the decoding process of an unfamiliar language, as this does require that lexical and structural learning has taken place. Consequently, lexico-phonological/phonotactic L3–L1/L2 crossover should be particularly influential at the very beginning of the L3 acquisition process. Westergaard (2021b) expects syntactic matches to become increasingly influential as learners become more advanced in the target language.

The impact of early availability of linguistic cues has been investigated by e.g., Culbertson et al. (2017), who compared the effect of saliency and early availability of phonological and semantic gender cues in adult (N = 192) artificial language learning (see Culbertson et al., 2019 for a discussion of child artificial language learning). The results indicate that when adults learn a noun classification system such as grammatical gender, they tend to select the more salient cue regardless of whether it is phonology or semantics. Crucially, when the participants were exposed to one cue type before the other (e.g., semantics before phonology or vice versa), they were more likely to use the earlier available cue type when the saliency was equal (Culbertson et al., 2017, p. 354). In other words, a cue that is available earlier is more likely to be used, unless there are substantial differences in the saliency of the cues.

Default-based accounts of L3 acquisition

Other accounts of crosslinguistic influence in L3 acquisition by sequential bilinguals argue that the nature of the target language has no impact. Instead, the L1 or L2 is selected as the primary source of influence by default, suggesting that bilingual speakers of the same language combination should behave similarly, regardless of how the L3 overlaps with the L1 or the L2. A default L2 effect would explain the results in Bohnacker (2006), who found that L1 Swedish–L2 English learners of L3 German used the non-facilitative English word order when producing German instead of the facilitative word order that was available from Swedish. Since German is lexically more similar to Swedish than English, similarity-driven models would not expect such behaviour.

Previous studies have argued for both an L1 (e.g., Hermas, 2010, 2015; Mollaie et al., 2016; Na Ranong & Leung, 2009; Park, 2016) and an L2 default effect (e.g., Bardel & Falk, 2007; Bayona, 2009; Berends et al., 2017; Falk & Bardel, 2011; Williams & Hammarberg, 1998). However, only the latter position has been formalized as an L3 model, the L2 Status Factor (L2SF; Bardel & Falk, 2007; Falk & Bardel, 2011; Falk et al., 2015). The rationale for an L2 effect is that explicitly learnt non-native languages (as opposed to implicitly acquired L1s) are typically more similar in terms of factors such as the age of onset (later than the L1), the learning context (classrooms versus naturalistic settings), and metalinguistic awareness/knowledge (typically higher in explicitly acquired languages). Importantly, it is not clear whether the L2SF can make predictions about the present study, as e.g., Falk et al. (2015) argue that an L2 can become so similar to an L1 that the L2 effect disappears. A typical example of such a case is an L2 that is introduced at an early age and is present in the everyday life of a speaker, for example through the media. According to Falk et al. (2015, pp. 232–234), this is typical for English in Sweden, and it is also true for English in Norway. As English is the L2 of the learners in the present experiment, we cannot directly test the claims of the L2SF, but rather investigate the possibility for an L1/L2 default effect more generally.

The current study

Research questions and predictions

The current study investigates crosslinguistic influence at the very beginning of L3 acquisition by asking how lexical and syntactic similarities between the L3 input and

previously acquired languages affect word order preferences in the L3. We exposed Norwegian–English sequential bilinguals to different types of artificial languages that varied in lexical and syntactic crossover with the participants' L1 (Norwegian) and L2 (English). We refer to the artificial languages as Languages A–D. Languages A/C were lexically and phonotactically based on Norwegian and Languages B/D on English. Syntactically, Languages A and B overlapped with both English and Norwegian, while Languages C and D revealed a syntactic similarity to English or Norwegian, respectively.

The participants completed a one-session procedure in which they were exposed to and trained on six nonce words and sentences in the L3, before they were given a forced-choice acceptability judgement task (AJT) in which they had to choose between sentence pairs that only differed in word order. Crucially, the participants had not been exposed to the experimental items prior to the AJT to avoid confounds with learning. The study asks the following research question:

- How do lexical and syntactic similarities between the L3 and previously acquired languages affect crosslinguistic influence at the very beginning of L3 acquisition?

To answer this question, we investigated the dependency relationship between word order preferences, as a proxy for crosslinguistic influence, and Languages A–D, by fitting a mixed-effects binomial regression model to the forced-choice AJT data. We tested the following three hypotheses (Hs):

- H_0: there is no relationship between word order preferences and similarities between the L3 and the L1/L2.

- H_1: there is a relationship between word order preferences and **lexical** similarity between the L3 and the L1/L2.

- H_2: there is a relationship between word order preferences and **syntactic** similarity between the L3 and the L1/L2.

A similarity-driven account would predict a rejection of H_0. If wholesale transfer based on the lexical input has taken place, we should observe behaviour in line with H_1. Behaviour in line with H_2 would indicate that wholesale transfer has not taken place. Behaviour in line with H_2 would also be compatible with a property-by-property explanation of L3 acquisition.

Method

Participants

We tested sequential bilingual speakers of L1 Norwegian–L2 English (N = 120). The participants had acquired English in school from ages 5–12. They were recruited through schools and the online recruitment service Prolific (2021). The participants ranged in age from 16–72 (M = 25.73, SD = 13.70). There were 69 female and 51 male participants.

At the end of the experiment, we gave the participants two mini-AJTs—one in Norwegian and one English—in which they had to accept or reject non-subject-initial declaratives that differed in word order (N = 2 per language). This was to ensure that the participants judged English and Norwegian as expected. Importantly, these AJTs were given after the artificial language learning experiment to avoid priming. The

participants also filled out a modified version of the Language and Social Background Questionnaire (LSBQ, Anderson et al., 2018). The LSBQ reflects three factors: L2 proficiency and home use, how the L2 is used in societal and community contexts and L1 proficiency. We calculated individual bilingualism scores by combining these factors, following the method described in Anderson et al. (2018). The scores were used to group the participants as *monolinguals*, *bilinguals* or *speakers with ambiguous language backgrounds*. None of the participants fell into the monolingual group. There were 24 participants with ambiguous language backgrounds and 96 bilinguals (see details in Table A1, Appendix A).[1]

We excluded participants who failed to meet at least one of the following criteria:

- Correct acceptance/rejection of the relevant properties in Norwegian and English.
- No higher education and/or teaching experience in languages/linguistics to avoid substantial differences in metalinguistic awareness, since this factor has been argued to affect crosslinguistic influence (Falk et al., 2015).
- No higher proficiency levels than beginner in other languages than Norwegian and English. We could limit, but not completely avoid, knowledge of other languages since an additional foreign language to English is offered in Norwegian schools.

  We excluded 23 participants (16.1%). These were replaced to get to a final sample of $N = 30$ in each group.

Materials

L3 input

The lexical items were either (pseudo)cognates (verbs, function words and adverbials) or nonce nouns. The nonce nouns (N = 6) were created in a series of three steps. First, we determined which sounds to include. We selected unique sounds, i.e., those that exist in English, but not in Norwegian, and vice versa. The purpose was to avoid ambiguous cues in the input. Since the input was written, we also took advantage of orthographic differences between Norwegian[2] and English.[3] We used *z* and *w*, which are typically only found in loan words in Norwegian, and *ø* and *å*, which are not used in English. We also included the consonant clusters *fn* and *kj*, which are common in Norwegian, but not in English.

Secondly, we took into consideration the frequency and distribution of sounds and syllable structure in Norwegian and English by analysing the 30 most frequent nouns in each language (Kilgarriff et al., 2014; see Appendices S1 and S2 in the Supporting Information online). The nouns were either mono- (around 60%) or bisyllabic in both English and Norwegian. For that reason, most of the artificial nouns were monosyllabic, but we included one trisyllabic noun in each input (*aporo,* 'apple') to strengthen the illusion of the L3 as foreign, despite clear similarities to a pre-existing grammar.

Finally, we made sure that the nonce nouns did not violate universal principles of natural languages (cf. Hyman, 2008; Lindblom, 1986; Schwartz et al., 1997). Tables 1 and 2 show the spelling, meaning and neighbourhood densities (NDs) of the nonce

nouns used in the Norwegian- and English-based lexicons, respectively. Lexical neighbours refer to the words that can be created in Norwegian (Table 1) and English (Table 2) by adding, removing or changing one sound of a word. A *t*-test showed that the mean neighbourhood densities in the Norwegian- and English-based nouns were not significantly different. We also conducted a norming task in which we asked ten native Norwegian speakers with high self-rated proficiency in English to rank the words on a scale from 0–10 based on how Norwegian or English they sounded. We did not find a significant difference when we compared the Norwegian score for the Norwegian-based nouns with the English score for English-based nouns. This suggests that the six nonce nouns in Languages A–D were comparable and likely to trigger the intended associations.

Table 1. *Norwegian-Based Nonce Nouns Used in Languages A and C*

Noun	Syll. str.	ND	Neighbours	Norwegian equivalent
Aporo	VC.V.CV		-	Eple (‘Apple’)
Føm	CVC	10	føl, føn, fø, øm, tøm, røm, søm, før, fød, føk	Vannmelon (‘Watermelon’)
Åkra	VC.CV	1	okra	Appelsin (‘Orange’)
Fnipp	CCVC	2	flipp, snipp,	Jordbær (‘Strawberry’)
Kjobe	CV.CV	0	-	Banan (‘Banana’)
Gau	CV	7	sau, dau, tau, au, aur, ga, gaur	Kirsebær (‘Cherry’)

Note. Syll. str. = Syllable structure; ND = Neighbourhood density.

Table 2. *English-Based Nonce Nouns Used in Languages B and D*

Noun	Syll. str.	ND	Neighbours	English equivalent
Aporo	VC.V.CV	0	-	Apple.
Neeb	CVC	3	need, neb, nee	Watermelon.
Wesh	CVC	5	wash, mesh, wish, west, welsh	Orange.
Wez	CVC	8	fez, wiz, wet, web, wee, wed, we, wen	Strawberry.
Poty	CV.CV	7	pity, pony, poly, pots, pot, pouty, potty	Banana.
Pronlim	CCVC.CVC	0	-	Cherry.

Note. Syll. str. = Syllable structure; ND = Neighbourhood density.

Regarding the syntactic input, all participants were exposed to main declarative clauses with Subject-Verb-Object (SVO) word order in the L3. Importantly, this was the only syntactic cue in Languages A/B. Both Norwegian and English are considered SVO languages, as exemplified in (2), and for that reason, we refer to SVO as a neutral cue, as it does not contribute to the establishment of either Norwegian or English as syntactically more similar to the L3. Examples (3) and (4) show SVO sentences in the inputs where the lexical items are either Norwegian- or English-based, respectively. We kept the number of the subjects constant to avoid confounds with agreement.

(2) Emma **elsker** lingvistikk.

Emma loves linguistics

‘Emma loves linguistics.’

(3) Ej **hettir** Manene.

I called Manene

‘My name is Manene.’

(4) I **eaf** wesh ons Daytue.

I eat orange on Tuesday

‘I eat oranges on Tuesdays.’

Language C did not only include SVO sentences, but also *do*-support—a syntactic feature that exists in English, but not in Norwegian, as illustrated in (5). An example of *do*-support in the artificial language is shown in (6). This means that the learners of Language C were exposed to incongruent cues, with the syntax being similar to English and the lexicon to Norwegian.

(5) Jeg **liker ikke** druer.

I like not grapes

‘I do not like grapes.’

(6) Ej **do neit beudro** knurk.

I do not like grapes.

‘I do not like grapes.’

In Language D, the additional syntactic cue to SVO word order was post-nominal possessives, which represents a similarity to Norwegian, as shown in (7a). Note that Norwegian also accepts pre-nominal possessives, as exemplified in (7b), but English only accepts the latter, which means that there is a mismatch between the L3 and English. Hence, there is incongruence between the cues, as the syntax is English-based and the lexicon is Norwegian-based. An example of a sentence with a post-nominal possessive in the artificial language is shown in (8).

(7) a. **Navnet** **mitt** er Kari.
Name.DEF my is Kari
'My name is Kari.'

b. **Mitt** **navn** er Kari
My name is Kari
'My name is Kari.'

(8) **Thamey** **miz** ef Manene.
Name.DEF my is Manene
'My name is Manene.'

Table 3 summarises how Languages A–D vary in terms of lexical and syntactic matches to Norwegian and English.

Table 3. *Summary of Linguistic Crossover in the Language Triads*

L3	Similarity		Congruency
	Lexicon	Syntax	
A	Norwegian-based	Both (neutral)	Congruent
B	English-based	Both (neutral)	Congruent
C	Norwegian-based	English-based	Incongruent
D	English-based	Norwegian-based	Incongruent

The experimental task and critical condition

The main task was a forced-choice AJT in which the participants were asked to choose between sentence pairs. There were 18 pairs in total: 12 fillers (see all filler items in Appendix S5 in the Supporting Information, available online) and six critical items (see Table A2 in the Appendix). The critical condition was non-subject-initial declarative clauses that only differed in word order. Half of the sentences had the structure Adverbial-Verb-Subject (henceforth referred to as XVS) and the other half had Adverbial-Subject-Verb (XSV). Examples are shown in (9; Languages A/C) and (10; Languages B/D). Note that the participants had been exposed to and trained on all sentence constituents, but not to fronted sentences during the exposure and training phases.

(9) a. **Pån** **dagman** **knetter** **ej** aporo. [XVS]

On Monday eat I apples

'On Mondays I eat apples.'

b. **Pån** **dagman** **ej** **knetter** aporo. [XSV]

On Monday I eat apples

'On Mondays I eat apples.'

(10) a. **Ons** **Daymon** **eaf** **I** aporo. [XVS]

On Monday eat I apples

'On Mondays I eat apples.'

b. **Ons** **Daymon** **I** **eaf** aporo. [XSV]

On Monday I eat apples

'On Mondays I eat apples.'

Norwegian and English exhibit mismatching word orders in non-subject-initial declarative clauses. In Norwegian, the finite verb moves to the second position, resulting in XVS word order (Vikner, 1995; Westergaard & Vangsnes, 2005), as exemplified in (11a). In English, the verb stays in the verb phrase, resulting in the word order XSV, as shown in (11b).[4] This means that Norwegian–English bilinguals have two candidate structures for word order in their mind when they parse non-subject-initial declarative clauses in a new language: the English XSV and the Norwegian XVS.

(11) a. **På** **mandager** **spiser** **jeg** appelsiner.

On Mondays eat I oranges

'On Mondays I eat oranges.'

b. **On Mondays I eat** oranges.

Using a forced-choice AJT gives us information about the bilinguals' preferences for one word order over another when each are acceptable/unacceptable in a previously acquired language. Crucially, the participants' behaviour cannot be a result of L3 exposure and/or training, as they had never been exposed to non-subject-initial declaratives in the L3 prior to the AJT. Instead, a preference for a given word order is interpreted as a function of crosslinguistic influence.

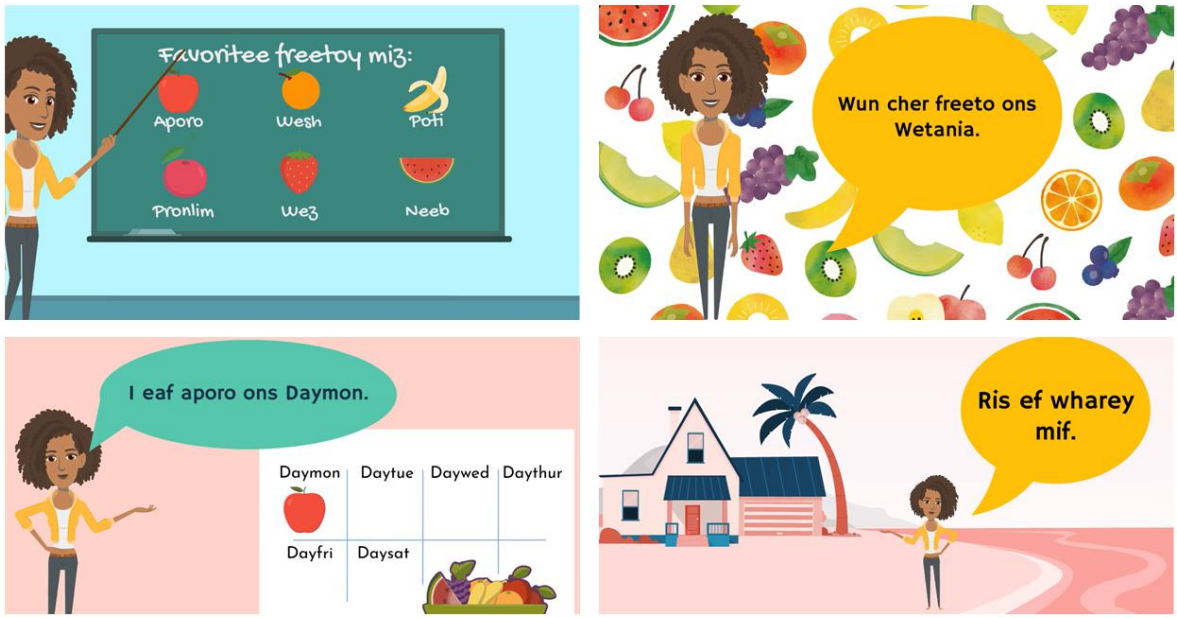
Procedure

The experiment was created and carried out on the online experiment builder Gorilla (Anwyl-Irvine, 2019; Gorilla, 2021). The participants were told that they would be exposed to and learn words from a new language and tested on what they had learnt. All instructions were given in animated videos that demonstrated the tasks to avoid priming the participants with an instruction language. All videos were made using the animation software Animaker (2021). The experiment consisted of three phases, inspired by the works of for example Culbertson et al. (2012). On average, the experiment took around 60 minutes to complete. We ended the data collection when we reached 30 participants per group.

The exposure phase

Upon entering the experiment, the participants were randomly assigned to Languages A, B, C or D (cf., the Materials section). The participants were first introduced to the L3 in an animated video (Animaker, 2021), where a native speaker of the L3 introduced herself and her family. The speaker explained that she eats fruit every day and specified on which weekday she eats which fruit. Importantly, the fruit schedule was presented in SVO sentences. There were 20 sentences in each video. After the video, the nonce nouns were repeated twice, each displayed for 3000 milliseconds. After each display, the noun was used in a sentence displayed for 4000 milliseconds. Figure 1 shows examples from the video exposure (in this case from Language D).

Figure 1. *Example of video exposure to the artificial L3.*



The training phase

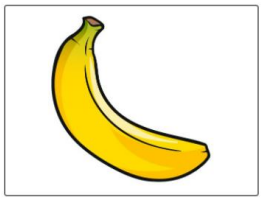
After the exposure phase, the learners practiced remembering the nonce nouns and weekday labels in two matching tasks (images taken from Freepik (2021)). The first task included picture-label matching, as exemplified in Figure 2, and the second task involved assigning the fruit labels to the correct weekday according to the fruit schedule introduced in the video.

Figure 2. *Example of the picture-label matching task.*

The testing phase

We tested the participants' word order preferences in a forced-choice AJT that consisted of 18 trials (six target items and 12 fillers). In each trial, the participants saw two sentences that only differed syntactically. The sentences in the critical condition differed in word order (XSV versus XVS), as shown in Figure 3. We asked the participants to click on the sentence that felt more natural to them. When the participants had selected a sentence, they were automatically directed to the next trial. All trials were randomized.

Figure 3. *Example of the forced-choice acceptability judgement task.*

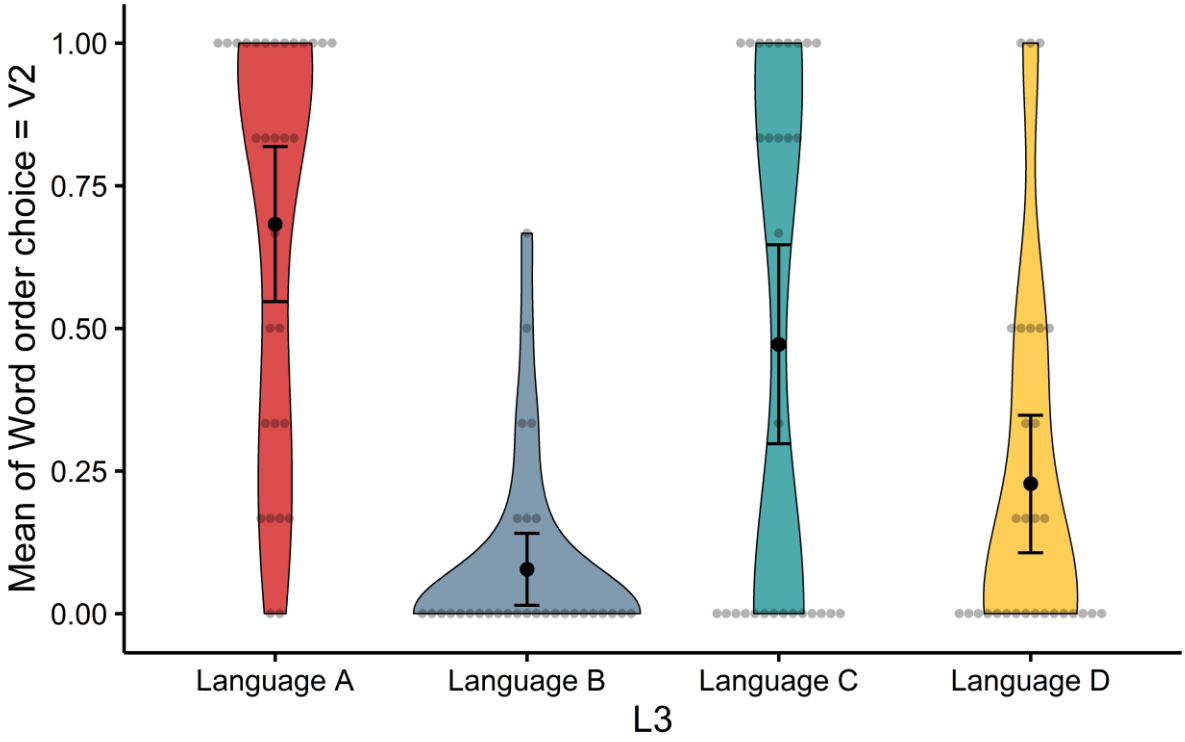


Pån dagons ej knetter kjobe. Pån dagons knetter ej kjobe.

Results

We analysed the data in RStudio (Team, 2021), version 1.2.5033 (2019-12-04). We first report on the participants' responses in the forced-choice AJT, before we present the statistical analysis. Out of the 720 observations, V3 word order was selected 457 times (around 63%; see the raw scores in Table A3 in the Appendix). We used the rempsyc R package (Thériault, 2022) to create Figure 4, which illustrates the mean proportions of V2 selections (V2 = 1 and V3 = 0) in the forced-choice AJT by group (Languages A–D). The figure shows that word order preferences are distributed unevenly across the L3s, ranging from around 68% V2 selections in Language A (Norwegian-based lexicon/neutral syntax) to around 8% V2 selections in Language B (English-based lexicon/neutral syntax). When the lexical cues are Norwegian-based and the syntax English-based (Language C), the participants select the two word orders equally often (a near fifty–fifty split). When it is the other way around, i.e., English-based lexicon and Norwegian-based syntax (Language D), the participants prefer V3 (around 23% V2 selections).

Figure 4. *Mean Proportions of V2 Responses by Group*



Note. The error bars = 95% confidence intervals; the middle dot = the mean; the width = distribution density (frequency); the scattered dots = individual observations. Language A = Norwegian-based lexicon/neutral syntax; Language B = English-based lexicon/neutral syntax; Language C = Norwegian-based lexicon/English-based syntax; Language D = English based lexicon/Norwegian-based syntax.

Statistical analysis

A mixed-effects binomial regression model with Participants and Items as random intercepts was fitted to the data (estimated using ML and BOBYQA optimizer) in a manual step-wise step-up forward elimination procedure (see e.g., Gries, 2013; see Appendices S3 and S4 in the Supporting Information online for the full R script and dataset)[5], using the lme4 R package (Bates et al., 2015). To predict the variance in the

response variable Word order choice (*V2* = 1 and *V3* = 0), we added the variables Lexicon (*English-based* and *Norwegian-based*), Congruency between the lexical and syntactic cues (*congruent* versus *incongruent*) and their interactions as potential fixed effects. Since none of the levels in the variables are obvious baselines, we used *sum* contrasts for the categorical variables. By default, the reference level in Lexicon is *English-based* and the reference level in Congruency is *Congruent*.

We added the potential fixed effects and their interactions successively. For each addition, we checked if the inclusion led to problems regarding multicollinearity, assessed by extracting variance inflation factors (VIFs). If there were no substantial problems with multicollinearity (VIFs < 3), we examined the model's Akaike information criterion (AIC), Bayesian information criterion (BIC) and probability value (*p*). We only accepted a model if the added predictor improved the model's goodness-of-fit (defined by decreased AIC and BIC values) and significantly correlated with the response variable. To evaluate statistical significance, the alpha level was set to .05. The Wald approximation was used to compute 95% confidence intervals (*CI*s) and *p* values.

Table 4 summarises the model-fitting procedure. We found that including the predictor Lexicon (χ^2 (1) = 38.30, $p < .001$) and the interaction between Lexicon and Congruency (χ^2 (2) = 10.08, $p = .006$) improved the model and correlated significantly with the response variable.

Table 4. *Summary of the Model-Fitting Procedure: Mixed-Effects Binomial Logistic Regression*

Model	Term added	Compared to...	AIC (BIC)	χ^2	*p*
Baseline	1 (Intercept)	-	572.76 (586.50)	-	-
Model 1	1 + Lexicon	Model 0	536.46 (554.78)	38.30	**< .001**
Model 2	Congruency	Model 1	538.44 (561.34)	0.02	.88
Model 3	Bilingualism group	Model 1	538.45 (561.35)	0.01	.92
Model 4	Proficiency group	Model 1	537.02 (559.92)	1.44	.23
Final	Congruency + Lexicon : Congruency	Model 1	530.38 (557.86)	10.08	**.006**

The final minimal adequate model performed significantly better than an intercept-only baseline model (χ^2 (3) = 48.38, $p < .001$; see Table A4 in the Appendix) and had a near optimal fit (C = .98, Somers' D_{xy} = .96). The model's total explanatory power is substantial, as the random and fixed effects explain 89% of the variance in the response variable ($R^2_{conditional}$ = .89). A summary of the model is shown in Table 5, where the intercept represents the overall mean across all levels.

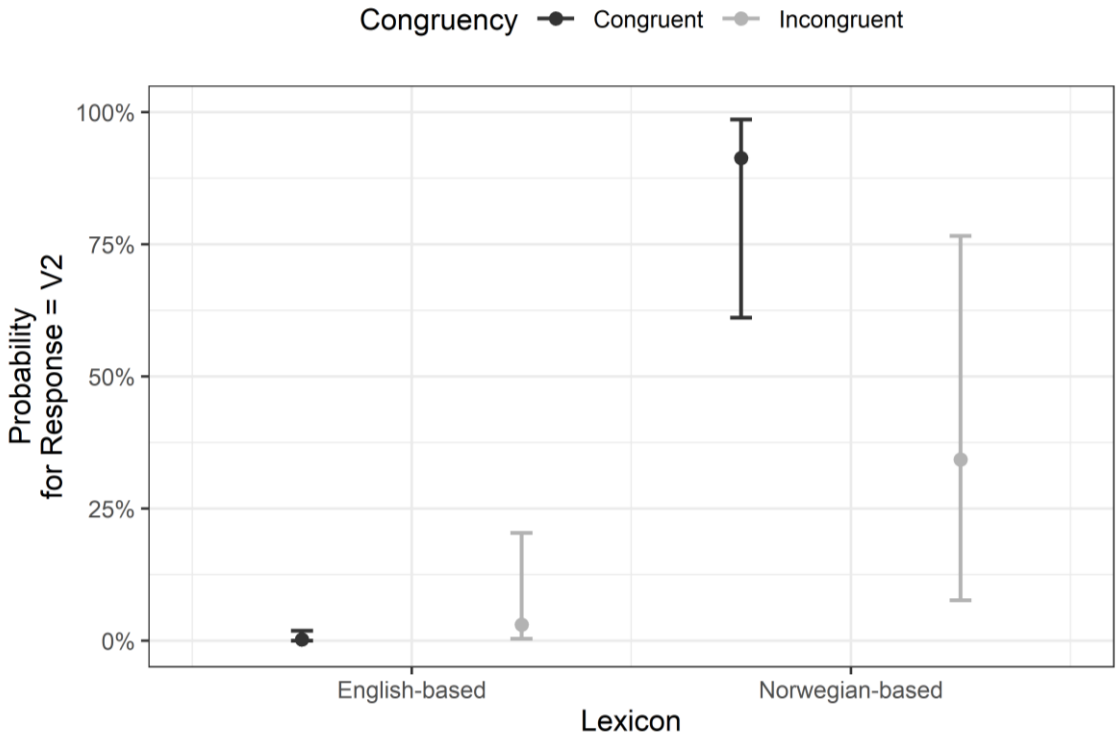
Table 5. *Model Summary Predicting Word Order Choices (V2 = 1; V3 = 0)*

Fixed effects	b	*SE*	*CI* (95%)		*z*	*p*
			Lower	Upper		
Intercept	–1.94	0.52	–2.95	–0.91	–3.73	< .001
Lexicon1	–2.79	0.57	–3.90	–1.67	–4.90	**< .001**
Congruency1	0.12	0.45	–0.77	1.01	0.27	.079
Lexicon1 : Congruency1	–1.38	0.46	–2.28	–0.47	–2.98	**.003**
Random effects	Variance		*SD*			
Participants (intercept)	15.96		4			
Items (intercept)	0.25		0.50			
Residual						
$R^2_{Marginal}$ = .33; $R^2_{Conditional}$ = .89						

Note. Generalized linear mixed model fit by maximum likelihood (Laplace Approximation); family: binomial (logit); response variable: Word order choices (*V2* or *V3*); fixed effects: Lexicon and Congruency; random effects: Participants (*N* = 120) and Items (*N* = 11); control: optimizer = Bobyqa (Powell, 2009); total *N* of observations = 720.

The model reports a main effect of Lexicon, which shows that, overall, V2 word order is selected less frequently when the lexical items are based on English (β = –2.79, *SE* = 0.57, *Z* = –4.90, $p < .001$). The model also reports an interaction between Lexicon and Congruency (β = –1.38, *SE* = 0.46, *Z* = –2.98, $p = .003$), visualized by means of the sjPlot R package (Lüdecke, 2021) in Figure 5.

Figure 5. *Probability of Selecting V2 Word Order by Lexicon*



Note. Probability of selecting V2 over V3 word order in a forced-choice task by the lexical similarity to Norwegian or English as predicted by the final minimal adequate model. The error bars represent a 95% confidence interval on the effect.

The interaction shows that when the lexicon is Norwegian-based, there is a higher probability for V2 to surface when the syntax is neutral (congruent cues) than when the syntax is English-based (incongruent cues). Importantly, this difference is not

present when the lexical input is based on English, as the probability for V2 is close to zero, regardless of whether Norwegian-based syntax is present in the input.

Discussion

In this experiment, we asked how lexical and syntactic similarities between an artificial L3 and the L1/L2 affected word order preferences as a proxy for crosslinguistic influence at the very beginning of L3 acquisition. Norwegian–English sequential bilinguals (N = 120) were randomly assigned to one out of four possible L3s that varied between being lexically similar to Norwegian or English and syntactically similar to Norwegian, English or both languages. The participants underwent an exposure phase, a training phase, and a testing phase. The latter included a forced-choice AJT with experimental items that the participants had not been exposed to. We put forward the following research question and hypotheses:

- How do lexical and syntactic similarities between the L3 and previously acquired languages affect crosslinguistic influence at the very beginning of L3 acquisition?
    - H_0: there is no relationship between word order preferences and similarities between the L3 and the L1/L2.
    - H_1: there is a relationship between word order preferences and **lexical** similarity between the L3 and the L1/L2.
    - H_2: there is a relationship between word order preferences and **syntactic** similarity between the L3 and the L1/L2.

A mixed-effects binomial regression model reported a positive correlation between the probability of selecting Norwegian-like word order (V2) and the exposure to a Norwegian-based lexicon. An interaction effect showed that V2 selections are substantially less likely to appear in an input with English-based syntax (and Norwegian-based lexicon), as compared to an input with Norwegian-based lexical items and neutral syntax. In the following sections, we discuss these two findings in turn.

The effect of Lexicon

The statistically significant effect of Lexicon indicates that H_0 (there is no relationship between word order preferences and any of the predictor variables) should be rejected. This finding extends the results of for example González Alonso et al. (2020), who found that overall linguistic similarity, as opposed to the manner of acquisition, determines the source of syntactic crosslinguistic influence in L3 acquisition. Such results support similarity-driven accounts of L3 acquisition—both property-by-property and wholesale transfer—as they predict a strong impact of lexical cues at the beginning of the acquisition process due to early availability and saliency, as compared to syntactic information, which can only be accessed after a certain level of lexical learning.

The rejection of H_0 is incompatible with a default explanation of crosslinguistic influence in L3 acquisition, as has been suggested in previous studies (e.g., Bardel & Falk, 2007; Bayona, 2009; Berends et al., 2017; Falk & Bardel, 2011; Hermas, 2010, 2015; Mollaie et al., 2016; Na Ranong & Leung, 2009; Park, 2016). An L1 or L2

default would predict that bilingual speakers of the same language combination should behave similarly regardless of the nature of the L3, which is not compatible with the results of the current experiment.

The interaction effect of Lexicon and Congruency

The statistically significant interaction between Lexicon and Congruency shows that not only lexical cues determine word order preferences at an early stage, but also syntactic similarity between the L3 and a previously acquired language—a result that is compatible with H_2 (there is a relationship between word order preferences and syntactic similarity between the L3 and the L1/L2.). This is an important finding, as it shows that wholesale transfer based on the lexical input cannot have taken place at the initial state, as hypothesized in Rothman (2011). That is, if wholesale transfer had taken place, we would not observe an effect of incongruent syntactic cues, as the learners would have decided which language to transfer based on the lexical cues alone, as proposed by the linguistic hierarchy (e.g., Rothman, 2013, 2015; Rothman et al., 2019). In other words, we should not have seen the observed drop in V2 selections in Group C, i.e., the participants that were exposed to Norwegian-based lexical items and English-based syntax. The behaviour of Group C is incompatible with the idea of wholesale copying of the grammar that is lexically more similar to the L3 input at the initial stages. Thus, our results corroborate findings in González Alonso et al. (2020), who also reported results that were inconsistent with the occurrence of wholesale transfer very early on. The authors argued that their findings reflected so-called pre-transfer stages, indicating that wholesale transfer could take place later in the acquisition process (cf., the section on Background literature). In principle, the same

could be argued for the findings in the current study: That is, although we clearly show that there has been no wholesale transfer at the time of testing, we cannot rule out the possibility that wholesale transfer might take place at a later stage. However, while Gonzalez Alonso et al. (2020) argue for the existence of a pre-transfer stage based on the lack of a P600 effect early on, our results show that learners are sensitive to linguistic properties at the bottom of Rothman's (2013, 2015) hierarchy at this very early stage.

Thus, if the participants' behaviour in the current experiment reflects pre-transfer stages of the L3 acquisition process, this raises the question of how the linguistic hierarchy actually works. As mentioned in the section on Background literature, the hierarchical system predicts that, as soon as the parser discovers lexical similarity between the L3 and one of the previously acquired languages, the lexical level will be chosen as the sole determiner of the source of influence. This means that L3 learners should only assess modules at subordinate levels if a higher level cannot motivate a selection (Rothman et al., 2019, p. 162). This idea is problematic considering our results, as we show that even when lexical cues are extremely clear in favour of only one of the previously acquired languages and also highly influential for the preferences of the learners, the syntactic input also affects the participants' word order choices (as seen in the interaction effect). It is unclear how the hierarchy could account for such behaviour.

In our view, a more plausible explanation for the impact of syntactic cues is that crosslinguistic influence is available from both previously acquired languages throughout the acquisition process, as argued for by property-by-property accounts of

L3 acquisition (Flynn et al., 2004; Slabakova, 2017; Westergaard, 2021b). Such an explanation attributes the effect of both lexical and syntactic similarities between the L3 and pre-existing grammars to parallel activation of associated structures during the acquisition process, i.e., that learners pay attention to and actively assess incoming input across modules. Candidate structures, in this case V2 word order, were activated in parallel and competed against each other for the overall best fit. The outcome of the competition determined the candidates' degree of influence on the L3 (cf., Truscott & Sharwood Smith, 2019, p. 53). This can explain why we saw a strong effect of lexical crossover in the congruent inputs, as the lexicon was the only cue that contributed to the outcome of the competition. It also explains why there was more variation in the preferences across the incongruent inputs, as the parser then had to take into consideration conflicting lexical and syntactic cues. As mentioned in the previous section, such variation cannot be explained by sole attention to lexical cues.

Furthermore, the interaction effect (Figure 6) shows that V2 word order is clearly preferred in the absence of English-like syntax, while the learners who are exposed to English-based syntax select less V2—i.e., exactly what is predicted if syntactic overlap influences crosslinguistic influence. Crucially, this contrast is not present between the two inputs with English-based lexicons, as V3 word order is consistently preferred over V2 (close to zero probability of a V2 selection), even when the syntax is Norwegian-like. In other words, Norwegian-based syntax does not seem to affect the preference for word order. While this could be due to the increased impact of cues that are available early, as argued by Westergaard (2021b) and empirically shown in Culbertson et al. (2017), this does not account for why we do not see the same

behaviour when the syntax is English. Thus, a possible explanation is that V3 (XSV) represents an unmarked word order, in the sense that it involves no syntactic movement. Several other studies (e.g., Listhaug et al., 2021; Stadt et al., 2020) have found a general preference for non-movement over movement in different L3 populations. Another, and possibly related, explanation is that this asymmetry reflects a foreign language/L2 effect, but only but only when cues are incongruent, as we do not observe the same in congruent inputs where the lexicon alone indicates a similarity to a pre-existing grammar (Figure 5). A similar result was found in Bohnacker (2006), where Swedish–English learners of German used the non-target-like word order XSV in German non-subject-initial declaratives (interpreted as non-facilitative influence from their L2, English), rather than the facilitative XVS word order from Swedish—another V2 language that closely resembles Norwegian. However, we have already shown that a default L2 analysis cannot account for our results. Thus, our findings seem to best be accounted for by a property-by-property similarity-driven model of L3 acquisition, with an additional effect of a preference for the unmarked (to explain the general preference of V3 over V2), possibly in combination with a foreign language effect.

Limitations and future direction

The present experiment was designed to investigate how differences in lexical and syntactic cues in the input may affect the acquisition of an L3 by bilingual speakers of the same language combination. A limitation of the study is that it tests the participants after very brief exposure to the L3, and we therefore cannot distinguish between two possible explanations of the participants' behaviour. That is, the results could in

principle reflect pre-transfer stages in line with the idea of wholesale transfer, or simultaneous crosslinguistic influence due to co-activation of both previously acquired languages in line with property-by-property accounts of L3 acquisition. To investigate these two positions further, it would be advisable to apply a longitudinal design, as the timing for wholesale transfer is unspecified. We argued that our results support the Linguistic Proximity Model and the Scalpel Model, but additional factors that may affect crosslinguistic influence in L3 acquisition, such as frequency and recency of use, should be explored in further research.

Conclusion

The current study investigated how lexical and syntactic similarities between the L3 input and previously acquired languages affected crosslinguistic influence of syntax by exposing Norwegian–English sequential bilinguals to four different artificial L3s that varied in lexical and syntactic overlap with the L1 and L2. We found that both lexical and syntactic cues in the input affect crosslinguistic influence, and the presence of English-based syntax in the L3 appears to be particularly influential. We argued that the results indicated 1) that there is a non-default source of crosslinguistic influence, but possibly a foreign language effect reflected in the strong impact of English-based syntax; 2) that wholesale transfer does not take place as an immediate result of exposure to lexical cues that are similar to only one of the previously acquired languages; and 3) that there is co-activation of both previously acquired languages in L3 acquisition from early on and thus that property-by-property L3 models are on the right track.

Notes

1 We added bilingualism and proficiency groups as potential fixed effects in the regression analysis, but we did not find a significant correlation to the response variable, nor did the inclusion of these variables contribute to the improvement of the model's fit.

2 The spelling of the Norwegian-based inventory followed the most widely used written variety of Norwegian, *Bokmål*.

3 The spelling of the English-based inventory followed subsets of Standard British English and Standard American English, i.e., we avoided elements that are found in only one of these varieties.

4 Although English is not considered a V2 language, the verb occurs in the second position in some constructions, such as *wh*-questions (Rizzi, 1996) and declaratives with informationally light verbs (Westergaard, 2007).

5 The statistical analysis in this paper was based on Schweinberger (2021a, 2021b).

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's webside:

Appendix S1. Frequency List in Norwegian.

Appendix S2. Frequency List in English.

Appendix S3. R Script.

Appendix S4. Dataset.

Appendix S5. Filler items.

Appendix

Table A1. *Participant Information*

	L3	Min	1st qu.	Median	Mean	3rd qu.	Max	SD
Age	A	16	17	18.5	24.2	25	68	12.1
	B	16	16	18	22.1	24	51	8.9
	C	16	17.3	20.5	27.6	31.8	72	15.8
	D	16	16	20.5	29	37.5	72	16.4
English proficiency scores	A	9	16	17	16.3	19	19	3.3
	B	6	13	16	15.3	18	20	3.4
	C	8	12.5	16	15.1	17	20	3.3
	D	5	15	16	16.1	18.8	20	3.1
LSBQ scores	A	–0.4	2.4	6	6.3	8.6	19.2	4.6
	B	–2.8	2.8	4.2	4.9	7	13.4	3.9
	C	–2.3	2.2	3.3	5.2	7.6	21.1	5.7
	D	–3.8	1.2	6	5.9	8.2	19.2	5.6

Note. LSBQ groups: Monolinguals: < –3.13; ambiguous language backgrounds: –3.12, –1.22; bilinguals: > 1.23.

Table A2. *Experimental Items*

Languages A and C	Languages B and D	WO	Meaning
Pån dagman knetter ej aporo.	Ons Daymon eaf I aporo.	V2	On Mondays I eat apples.
Pån dagtirs knetter ej åkra.	Ons Daytue eaf I wesh.		On Tuesdays I eat oranges.
Pån dagons knetter ej kjobe.	Ons Daywed eaf I poti.		On Wednesdays I eat bananas.
Pån dagtors knetter ej gau.	Ons Daythur eaf I pronlim.		On Thursdays I eat cherries.
Pån dagfre knetter ej fnipp.	Ons Dayfri eaf I wez.		On Fridays I eat strawberries.
Pån daglør knetter ej føm.	Ons Daysat eaf I neeb.		On Saturdays I eat watermelon.
Pån dagman ej knetter aporo.	Ons Daymon I eaf aporo.	V3	On Mondays I eat apples.
Pån dagtirs ej knetter åkra.	Ons Daytue I eaf wesh.		On Tuesdays I eat oranges.
Pån dagons ej knetter kjobe.	Ons Daywed I eaf poti.		On Wednesdays I eat bananas.
Pån dagtors ej knetter gau.	Ons Daythur I eaf pronlim.		On Thursdays I eat cherries.

Pån dagfre ej knetter fnipp.	Ons Dayfri I eaf wez.	On Fridays I eat strawberries.
Pån daglør ej knetter føm.	Ons Daysat I eaf neeb.	On Saturdays I eat watermelon.

Note. WO = Word order

Table A3. *Raw Scores in the Forced-choice Acceptability Judgement Task*

L3	Lexical match	Syntactic match	Congruency	Observations		
				V2	V3	Total
A	Norwegian	Both (neutral)	Congruent	123	57	180
B	English	Both (neutral)	Congruent	14	166	180
C	Norwegian	English	Incongruent	85	95	180
D	English	Norwegian	Incongruent	41	139	180
Total observations				263	457	720

Table A4. *Comparison of the Baseline and Final Models*

	npar	AIC	BIC	logLik	deviance	Chisq	Df	Pr (>Chisq)
Baseline	3	572.76	586.50	–283.38	566.76			
Final	6	530.38	557.86	–259.19	518.38	48.38	3	< .001

Note. The baseline model: Response ~ 1 + (1|Participants) + (1|Items); the Final model = Response ~ (1 | Participants) + (1 | Items) + Lexicon + Congruency + Lexicon:Congruency

Paper 2 (manuscript)

Testing Similarity-based Models of Third Language Acquisition:

Learning versus Crosslinguistic Influence

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Author Note

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Abstract

To investigate how bilinguals use previously acquired syntactic representations in the acquisition of a new language, this study compared very early English and Norwegian–English learners of an artificial language. The artificial language was lexico-phonotactically similar to English, but syntactically similar to Norwegian, to investigate the claim that the primary source of influence is the pre-existing grammar that is lexico-phonotactically closer to the target language. Crucially, we tested the acceptability of one structure to which the participants had been exposed, and one that they had never seen, to compare effects of learning and crosslinguistic influence. Our results showed that structural learning does not, or to a very limited degree, take place after minimal exposure to the target language. We also found that Norwegian–English bilinguals were influenced by both previously acquired languages, indicating that they had access to both pre-existing grammars as sources of influence at the point of testing.

Keywords: third language acquisition, artificial language learning, crosslinguistic influence, property-by-property crosslinguistic influence, wholesale transfer

Introduction

While it is uncontroversial to argue that the first language (L1) affects the acquisition of a second language (L2), there is currently little consensus about how two previously acquired languages interplay during third language (L3) acquisition. For the last two decades, several studies have explored questions related to crosslinguistic influence of (morpho)syntax by asking where the influence comes from (the L1, the L2 or both)

and which factors contribute to the source selection process. However, the findings have led to conflicting conclusions, as some studies report primary crosslinguistic influence from the L1 (Hermas, 2010, 2015; Mollaie et al., 2016; Na Ranong & Leung, 2009; Park, 2016) and others from the L2 (Bardel & Falk, 2007; Bayona, 2009; Berends et al., 2017; Falk & Bardel, 2011). Other studies report simultaneous influence motivated by structural similarities between the L3 and previously acquired languages (Jensen et al., 2021; Kolb et al., 2022), and some report that the influence comes exclusively from the previously acquired language that is more similar to the L3 (González Alonso et al., 2021; Rothman, 2011).

In this paper, we present a study that investigates crosslinguistic influence in L3 acquisition by means of an artificial language (AL) learning experiment. We use an AL to ensure that the participants have no prior knowledge of the target language, to get insight into the very beginning of the acquisition process, and to have precise control over the stimuli (cf., Ettlinger et al., 2016; Grey, 2020).

We test sequential bilingual speakers of L1 Norwegian and L2 English who acquire the AL as their L3 and English monolinguals who acquire the AL as their L2. Our goal is twofold. First, we investigate whether learning effects could be observed already after minimal exposure to the target language. Typically, effects from learning and crosslinguistic influence have been conflated in previous studies of non-native language acquisition. That is, when studies of natural language acquisition report facilitative influence in L3 acquisition, one cannot be certain that the accuracy is a product of the participants' pre-existing grammar(s) or if they have merely acquired it from the input. In the present study, we try to separate effects of learning and

crosslinguistic influence by comparing acceptability judgements (*Good* or *Bad*) of two types of sentences—one that the participants have been exposed to in the AL input and one they have never seen prior to the acceptability judgement task.

Secondly, we want to test current predictions about how pre-existing grammars affect the very beginning of the L3 acquisition process when one language is lexico-phonotactically more similar to the L3 than the other. For this purpose, we compare English monolinguals to Norwegian–English bilinguals to investigate if the lexico-phonotactically less similar language, Norwegian, may also exert influence on the acquisition of the AL. Our goal is to contribute to the ongoing discussion about the role of pre-existing linguistic knowledge in the acquisition of new knowledge, as this may shed light on the cognitive process involved in language acquisition.

We analysed the acceptability judgements in a mixed-effects binomial logistic regression model. Our results do not reveal a learning effect, which suggests that the time between exposure and testing in the present experiment was too short for structural learning to take place. However, the statistical model shows that the behaviour of the Norwegian–English bilinguals is substantially different from that of the English monolinguals, indicating that the previously acquired language that is lexico-phonotactically less similar to the L3 also affects the acquisition process. These results are compatible with property-by-property models of L3 acquisition (Flynn et al., 2004; Slabakova, 2017; Westergaard, 2021b) and suggest that wholesale transfer does not take place at very early stages of the acquisition process, as proposed in Rothman (2011). However, in line with González Alonso et al. (2020), as well as

Rothman (2015), the present study does not rule out the possibility that wholesale transfer takes place at later stages of the acquisition process.

Background

Crosslinguistic Influence in L2 Acquisition

The Full Transfer/Full Access Hypothesis of L2 acquisition (FT/FA; Schwartz & Sprouse, 1996) argues that the final state of the L1 constitutes the initial state of the L2, indicating that when monolinguals are exposed to a new language, they immediately make a copy of their entire L1 system, which becomes the L2 interlanguage. We refer to this copying mechanism as *wholesale transfer*. It follows that L1–L2 matches lead to facilitative influence, while mismatches lead to non-facilitation. If parsing failures occur, the L2 interlanguage is restructured.

An opposing view is Full Transfer Potential (FTP; Westergaard, 2021b), which rejects the idea of the L1 system being copied in its entirety. Instead, all previously acquired linguistic representations are active in parallel and available as sources of crosslinguistic influence, suggesting that all pre-existing grammars may or may not influence the acquisition of new representations. This means that the L2 system starts small and grows incrementally, rather than starting out as a grammar that consists of robust L1 representations, as suggested by wholesale transfer. Crosslinguistic influence happens *property by property*, rather than in one fell swoop. Non-facilitative influence may occur due to misanalysis of the input, which is typical for comprehension, or because of insufficient input, which usually happens during

production (Westergaard, 2021). In the next section, we describe how FT/FA and FTP make different predictions about crosslinguistic influence in L3 acquisition.

Similarity-driven models of L3 acquisition

Two models of L3 acquisition build on FT/FA and FTP. The Typological Primacy Model (TPM; Rothman, 2011; Rothman, 2015) builds on the former and the Linguistic Proximity Model (LPM; Westergaard, 2021) on the latter. Both are considered similarity-driven models because they argue that the way in which the linguistic representations in the L3 overlap with the previously acquired languages determines how pre-existing linguistic knowledge is used. In addition to the TPM and the LPM, the Cumulative Enhancement Model (CEM; Flynn et al., 2004) and the Scalpel Model (Slabakova, 2017) fall into the category of similarity-driven L3 models. The Scalpel Model lists a number of factors that may be influential in L3 acquisition but generally makes the same predictions as the LPM, while the CEM argues that crosslinguistic influence is always facilitative or neutral, i.e., never non-facilitative. In the present experiment, we cannot separate non-facilitative and facilitative influence since we test a linguistic structure that the participants have never seen before. For that reason, we do not address the CEM further.

The main difference between the TPM and the LPM/Scalpel Model is that the former model argues for wholesale transfer (cf., FT/FA) and the latter models argue that crosslinguistic influence takes place property by property (cf., FTP). The consequence of wholesale transfer in L3 acquisition is that the learners copy one of their previously acquired languages, which then becomes the L3 interlanguage and is restructured

based on parsing failures of the incoming L3 input. In Rothman (2011, p. 112), the TPM is presented as a model of transfer at the *initial state* of L3 acquisition i.e., accounting for what the learners bring to the learning task. This is modified in Rothman (2015), where the initial state of the L3 is described as including the L1, the L2 and Universal Grammar (see also García Mayo & Rothman, 2012), while wholesale transfer takes place at *the initial stages*. Cabrelli Amaro et al. (2015, p. 22) describe the initial stages as those "…just beyond what the L3 learner brings to the table at the onset of acquisition…" and similarly, Rothman (2015) argues that wholesale transfer in L3 acquisition should take place after "minimally sufficient exposure" to the target language. This suggests that wholesale transfer should occur very early in the acquisition process. However, it is impossible to make an exact estimation of when the initial stages occur. In fact, González Alonso and Rothman (2017) merely defines the initial stages as the time in which wholesale transfer takes place and argues that the timing varies from speaker to speaker, depending on factors such as the language combination, the acquisition context, input quantity and quality.

When wholesale transfer occurs, the copy should be made of the previously acquired language that is more similar to the L3. In determining which language is more similar, the TPM argues that learners assess the incoming L3 input module-by-module in the following hierarchical order: lexicon, phonology/phonotactics, morphology and syntax. According to Rothman et al. (2015), the hierarchy of cues will determine the parser's selection of a transfer source. However, the TPM acknowledges that there are dependencies between the modules and therefore argues that ultimately, what is transferred is the linguistic system that exhibits "… the most detectable/usable

structural crossover, at the highest levels of the cue hierarchy, at the earliest of timing at the very initial stages…" (Rothman et al., 2015, p. 87).

González Alonso et al. (2020) investigated the predictions put forward by the TPM in an AL learning experiment using electroencephalography. The participants were L1 Spanish–L2 English speakers, exposed to either mini-Spanish or mini-English as the L3. Like Spanish, both L3s overtly marked grammatical gender. The authors predicted that wholesale transfer of the lexically more similar language would lead to sensitivity to gender violations in the mini-Spanish group, but not in the mini-English group, reflected in a P600 event-related potential component in the former group. The predicted P600 component was not observed, but the authors reported another between-groups difference, namely that gender violations in mini-Spanish, unlike mini-English, elicited positivity between 300–600 millisecond (P300). A P300 component is typically related to the processing of novelty. González Alonso et al. (2020, p. 1) argue that this result relates to the lexical similarity between the ALs and English/Spanish, reflecting so-called *pre-transfer processing* rather than outcomes of wholesale transfer. Pre-transfer processing refers to the time in-between the initial state and the moment in which wholesale transfer takes place, assuming that the lack of a P600 does not rule out that wholesale transfer can occur at a later stage of the acquisition process. In other words, González Alonso et al. (2020) demonstrates the importance of timing in investigating the occurrence of wholesale transfer in L3 acquisition.

In agreement with the claims of FTP, the LPM and the Scalpel Model argue that crosslinguistic influence in L3 acquisition happens on a property-by-property basis. In

L3 acquisition, this means that learners have access to and may be influenced by properties from both previously acquired languages throughout the acquisition process. According to the LPM, crosslinguistic influence is a matter of co-activation and competition between pre-existing linguistic representations. This position is in agreement with the Modular Cognition Framework (MCF; Truscott & Sharwood Smith, 2019), which in its turn adopts the Parallel Architecture of language (PA, Jackendoff, 2002). In the MCF and the Parallel Architecture frameworks, there are only two linguistic modules: phonology and (morpho)syntax. Linguistic processing happens as the linguistic modules interact with each other by means of an internal interface and with non-linguistic modules such as for example the conceptual system (meaning) by means of external interfaces.

According to the LPM, when a new language is acquired by a bilingual mind, all previously acquired grammars and their linguistic representations are activated in parallel and compete for the strongest activation. The winner is used in the L3 interlanguage, resulting in crosslinguistic influence. Different factors contribute to the strength of the activation. The main factor for crosslinguistic influence is the linguistic similarities between a given candidate and the incoming input. However, the strength of the activation may be dependent on factors such as frequency, age, recency of use, etc. Importantly, this means that learners are sensitive to fine-grained linguistic cues in the L3 input, but the contributing factors may be more or less influential at different times of the acquisition process. For example, Westergaard (2021) argues that early learners may be more sensitive to lexical and phonotactic cues in the input, since information about (pseudo)cognates and similar sounds is immediately available to the

learners. Information about morphosyntax, on the other hand, requires a certain level of lexical and structural knowledge and should become more important at later stages of the acquisition process.

The present study

We investigate the source(s) of crosslinguistic influence in the very beginning of L2 and L3 acquisition of an AL by English monolinguals and Norwegian–English sequential bilinguals. We compare how the presence of Norwegian—being lexico-phonotactically more distinct from the target language than English, but syntactically more similar—influences the acceptability of word order in the L3.

Word Order in Norwegian, English and the AL

The experimental condition in the current study is word order. Norwegian and English are both considered Subject-Verb-Object (henceforth referred to as SVO) languages (see example (1)), but Norwegian is also a verb second (V2) language, which means that the finite verb moves to the second position of main declarative clauses (Vikner, 1995; Westergaard & Vangsnes, 2005). This leads to the word order Adverbial-Verb-Subject (XVS) in non-subject-initial declaratives (example (2a)) and Subject-Verb-Adverbial (SVX) in subject-initial declaratives with sentence adverbials (example (3a))[6]. The word orders XSV and SXV are ungrammatical (see examples (2b) and (3b)).

[6] In line with Westergaard et al. (2019), we consider non-subject-initial (XVS) and subject-initial (SVX) main declarative clauses different constructions, i.e., not part of a V2 parameter, because the

(1) **Jeg** **leste** en artikkel i går.
I read an article yesterday
'I read an article yesterday.'

(2) a. I går **leste** **jeg** en artikkel.
Yesterday read I an article
'Yesterday I read an article.'

b. *I går **jeg** **leste** en artikkel.
Yesterday I read an article
Intended: 'Yesterday I read an article.'

(3) a. Jeg **leser** **ofte** artikler
I read often articles
'I often read articles.'

b. *Jeg **ofte** **leser** artikler.
I often read articles
Intended: 'I often read articles.'

In contrast, the word orders XVS and SVX are ungrammatical in the equivalent English sentences (see examples (4b) and (5b)) because the verb stays in the verb phrase (Lehmann, 1978), resulting in the word orders XSV and SXV, or V3 (see examples (4a) and (5a)). Hence, the Norwegian–English bilingual learners have two

verb moves to different positions in the clause structure. In XVS, the verb moves to the C position, while in SVX, it moves to the I position of the clause structure.

word order candidates in their mind—XVS from their L1 and XSV from their L2. The English monolinguals only have XSV.

(4) a. Yesterday **I read** an article.

b. *Yesterday **read I** an article.

(5) a. I **often read** articles.

b. *I **read often** articles.

Research Questions and Predictions

In order to test property-by-property vs. wholesale accounts of crosslinguistic influence, we investigated very early L2 and L3 learners. As mentioned above, we tested the participants' acceptability judgements of word order (V2 versus V3) in two sentence types—one to which they had been exposed and one that they had never seen in the AL input.

Our first research question was whether a learning effect could be observed after minimal exposure to the target language. The null hypothesis (H_0) was that the exposure to a given sentence type in the AL input would not affect the participants' judgements significantly. A non-rejection of the H_0 would indicate that no learning had taken place during the exposure and training phases of the AL experiment. The alternative hypothesis (H_1) was that the sentence type to which the participants had been exposed in the AL was judged differently than the sentence type that they had never seen. A learning effect should be best reflected in the English participants'

judgements, as the acceptance of V2 word order cannot be a result of crosslinguistic influence.

The second research question was whether the L3 showed influence of both previously acquired languages, or whether it was only affected by the lexico-phonotactically more similar pre-existing language, English. The H_0 was that the speaker groups should not differ, as both groups would be influenced by English. A non-rejection of H_0 would be compatible with the idea of wholesale transfer from English, since it would indicate that Norwegian does not exert influence on the L3. The H_1 was that the English and Norwegian–English groups would behave differently, driven by more acceptance of V2 word order in the latter group because of influence from Norwegian. A rejection of H_0 would be compatible with property-by-property approaches that expect simultaneous influence from both previously acquired languages and incompatible with Rothman's (2011) version of wholesale transfer at the initial state of L3 acquisition. However, it could also be explained by the idea of pre-transfer stages, as proposed by González Alonso et al. (2020). Table 1 summarises the predictions for the second research question.

Table 1. *Summary of Predictions for Research Question 2*

Type of crosslinguistic influence	Source of crosslinguistic influence	
	Monolinguals	Bilinguals
Property by property	English	Norwegian and English
Wholesale	English	English

Method

Participants

All participants (N = 64) were recruited and compensated through the online recruitment service Prolific (2021). We selected the participants in line with a modified subtractive language group design (Westergaard et al., Forthcoming), which included an experimental group of L3 learners and a control group of L2 learners whose L1 was the experimental groups' L2. Both groups were exposed to the same artificial language.

The experimental group consisted of L1 Norwegian–L2 English sequential bilinguals (n = 31) who ranged in age between 18–45 years (M = 29.8, SD = 7.72). We only included bilinguals who met the following screening criteria: 1) Norwegian-speaking parents and residency in Norway their entire life; 2) English as their chronological L2, introduced in school; 3) no higher education and/or teaching experience in languages and/or linguistics, as some accounts of L3 acquisition argue that metalinguistic knowledge/awareness alters the trajectory of crosslinguistic influence (Falk et al., 2015); 4) no knowledge of other languages than Norwegian and English past beginner stages; 5) acceptance/rejection of the relevant properties in Norwegian and English (V2 and V3 word order) and the control/filler sentences (SVO and SOV word order); 6) Over 60% accuracy in an English 21-item Cloze task and 7) do not fall into the category monolingual according to the Language and Social Background Questionnaire (LSBQ; Anderson et al., 2018). The LSBQ collects information about the participants' L1 and L2 proficiency and use in the context of their home and in societal and community contexts. Following Anderson et al. (2018), we used this

information to calculate an overall bilingualism score per participant, which in turn was used to categorize the participants into monolinguals, *speakers with ambiguous language backgrounds* and *bilinguals.*

We reached the final sample size of 31 after having excluded two participants who reported native and/or advanced proficiency in languages other than Norwegian and English, one participant who accepted V2 word order in English, one who did not finish the experiment and five who rejected SVO and/or accepted SOV in more than 90% (11 out 12) of the filler/control sentences.

The control group consisted of L1 English speakers (N = 33) between the ages of 21–72 (M = 38.13, SD = 13.47). The participants had to meet the following screening criteria: 1) English-speaking parents and residency in an English-speaking country their entire life; 2) no knowledge of other languages than English past beginner stages; 3) no higher education and/or teaching experience in languages and/or linguistics; 4) acceptance/rejection of the relevant properties in English (V2 and V3) and the control/filler sentences (SVO versus SOV word order) and 5) fall into the monolingual group, according to the LSBQ.

We excluded one participant who did not finish the experiment, three participants who reported other L1s than English and/or residency in a non-English speaking country, and 15 participants who accepted SOV and/or rejected SVO in more than 90% of the filler/control sentences (the majority of these 15 participants rejected all sentences). After the exclusion, the sample size was 33. The L1 English speaking participants

reported the following nationalities: the United Kingdom, the United States, Australia and Canada.

Materials

The Lexico-phonotactic Input

The AL input consisted of visual and auditory stimuli designed to trigger a lexico-phonotactic association to English. The aural stimuli were created by means of an open access text-to-speech generator (Voicemaker, 2021). We established the lexical and phonotactic similarities to English by means of (pseudo)cognates (verbs, adverbs and function words) and nonce nouns ($N = 6$) that were created from a subset of the Standard British English sound inventory.

Three factors were considered when we created the nonce nouns: First, we took into consideration universal principles of natural languages (following e.g., Hyman, 2008; Lindblom, 1986; Schwartz et al., 1997). Secondly, we included sounds and symbols (letters *z* and *w*) that exist in English, but only appear in loan words in Norwegian. Furthermore, we selected the sounds based on the descriptions of Standard British English and Norwegian[7] phonotactics in Carr (2012) and Kristoffersen (2000), respectively. The vowel phonemes are listed in (6a) and the consonants in (6b). The

[7] Although Norwegian does not have an official spoken standard, the variety spoken in and around the Oslo area is often referred to as the unofficial standard. We based our analysis on this variety, often referred to as Standard East Norwegian (Strand, 2020). This variety is relatively close to the most dominant written standard, *Bokmål*, and is frequently used in the media and in popular culture. Most Norwegian speakers have been exposed to this variety from an early age.

tense vowels [iː, ɜː] and the consonants [w, ɹ, z] are part of the English, but not the Norwegian, phonotactic inventory.

(6) a. [iː, ɑː, ɜː, ɪ, ɛ, ɒ, ə]

b. [n, t, d, z, ɹ, l, w, k]

Thirdly, we considered the structure and distribution of syllables by analysing the 30 most frequent nouns in English (Kilgarriff et al., 2014), again to ensure that the AL was phonotactically similar to English. Monosyllabic nouns made up around 60% of the nouns in the frequency list, while the remaining 40% were bisyllabic. Inspired by these numbers, 50% (n = 3) of the artificial nonce nouns were monosyllabic, while 33% (n = 2) were bisyllabic. One nonce noun was trisyllabic—a choice that we made in order to strengthen the illusion that the artificial language was foreign, despite clear similarities to a previously acquired language.

Table 2 shows the spelling and pronunciation of the six nonce nouns (*coffee*, *dog*, *physician*, *steak*, *football* and *book*) and their translations into English and Norwegian. We also found the nouns' neighbours and neighbourhood densities in English by means of the Clearpond Database (Marian et al., 2019). A word's neighbours refer to words that can be made by removing, substituting or adding a sound.

Table 2. *Noun Inventory*

Artificial language		Translation		Neighbourhood	
Spelling	IPA	English	Norwegian	ND (count)	Neighbours
Wez	wɛz	Coffee	Kaffe	8	Fez, wiz, wet, web, wee, Wen, wed, we
Neeb	ni:b	Dog	Hund	4	Need, Ned, Neb, nee
Whispurn	wɪspɜ:n	Physician	Lege	0	-
Crez	kɹɛz	Steak	Biff	2	Chez, crew
Caliand	kɑ:lɪənd	Football	Fotball	0	-
Tozzins	tɒzəns	Book	Bok	0	-

Note. ND = Neighbourhood density

The Morphosyntactic Input

The AL was an SVO language with V2, like Norwegian. Thus, there is a conflict between the source languages of the lexico-phonotactic and syntactic cues in the AL input, as the former cue is based on English and the latter on Norwegian. To illustrate that the AL is an SVO language with V2, we showed the participants six sentences with an SVO structure and another six with XVS, as exemplified in (7) and (8), respectively (see all test sentences Table S1 in the On-line Supplementary Materials).

(7) **I** **drenk** wez.

I drink coffee

'I drink coffee.'

(8) At 07:00 **drenk I** wez.

At 07:00 drink I coffee

'At 07:00 I drink coffee'.

The Main Task and Test Items

We tested the participants in an acceptability judgement task (AJT) that had two response levels: Good or Bad. We collected acceptability judgements of sentence pairs that only differed in word order across three different sentence types: subject-initial declarative clauses with the object either preceding or following the verb (SVO/SOV), non-subject-initial declarative clauses in which the verb had either moved to the C position of the clause structure (XVS, i.e., V2) or stayed in the verb phrase (XSV, i.e., V3) and subject-initial declarative clauses with sentence adverbials in which the verb had either moved past the adverb to the I position of the clause structure (SVX, i.e., V2, see Westergaard et al. (2019)) or stayed in the verb phrase (SXV, i.e., V3). As mentioned, the participants had been exposed to SVO and XVS in the input of the AL, but the participants had not been exposed to subject-initial declaratives with sentence adverbials. There were 12 sentences (six sentence pairs) per sentence type, i.e., 36 sentences (18 sentence pairs) in total in the AJT. The SVO/SOV sentences were used as fillers and are exemplified in (9). The experimental conditions were XSV/XVS, as exemplified in (10), and SXV/SVX, as shown in example (11).

(9) a. I **reash** tozzins.

I read books

'I read books'

b. I tozzins **reash**.

I book read

'I read books.'

(10) a. At 20:00 **I** **reash** tozzins.

At 20:00 I read books

'At 20:00 I read books.'

b. At 20:00 **reash** **I** tozzins.

At 20:00 read I books

'At 20:00 I read books.'

(11) a. I **reash** **often** tozzins.

I read often books

'I often read books.'

b. I **often** **reash** tozzins.

I often read books

'I often read books.'

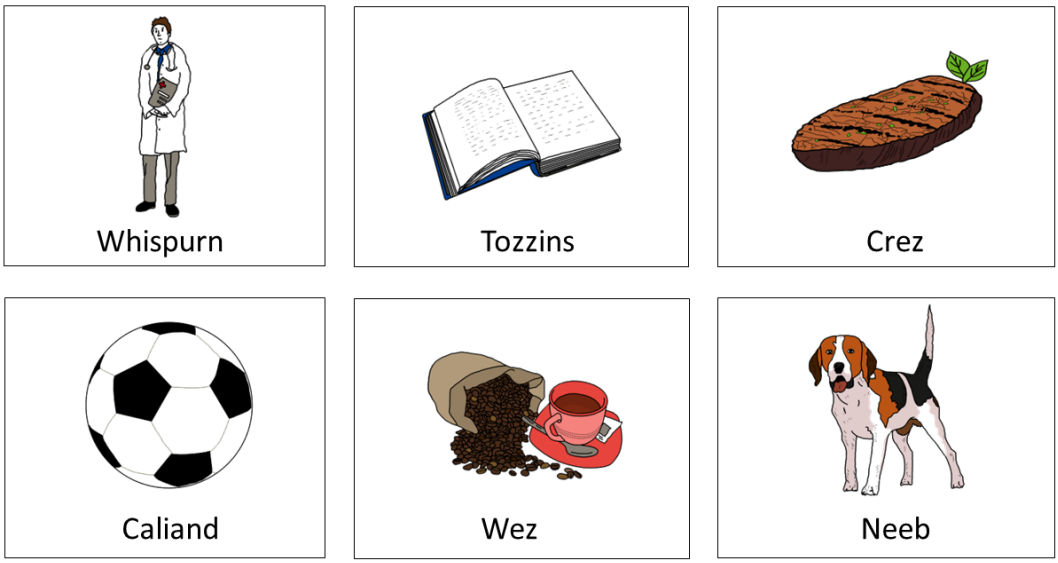
Design and Procedure

We created and deployed the study online on the experiment builder Gorilla (Anwyl-Irvine, 2019; Gorilla, 2021). On average, the participants spent around 60 minutes on the experiment. There were three main components: the exposure, training, and testing phases. In this section, we describe each phase in turn.

The Exposure Phase

In the first step of the exposure phase, the participants were shown the six nonce nouns listed in Table 2 aurally and visually. Each word was displayed twice. As visual stimuli, the participants saw the spelling of the noun and a matching picture that illustrated the meaning, as shown in Figure 1. All pictures were taken from MultiPic, which is a standardized set of drawings with multilingual norms (Duñabeitia et al., 2018).

Figure 1. *Lexical Exposure*



Typically, participants in AL learning experiments are trained on 4–15 nonce words (Ettlinger et al., 2016). In a pilot experiment (N = 60), we only used nonce words, but this turned out to be very hard for the participants. For that reason, we included (pseudo-)cognates for all other items than the nouns, since the goal was not to test the participants' memory, but rather to trigger an association to a previously acquired language.

In the second step of the exposure phase, the participants saw a one-minute animated video in which a (fictitious) native speaker of the AL explained her daily routines, including at which time of the day she did different activities (see examples in Figure S1 in the On-line Supplementary Materials). During the video, the participants were exposed to sentences that included the nonce nouns (one sentence per noun, i.e., N = 6) in addition to SVO sentences (N = 6).

To make sure that the participants remembered the meaning of the nonce nouns, we added a final step of the exposure phase that was identical to the first step, i.e., exposure to the six nouns, each displayed twice together with aural and visual stimuli.

The Training Phase

In the training phase, the participants practiced remembering the meaning of the nonce nouns (displayed in Table 2) by means of a picture–label matching task (18 trials). An example of the picture-label matching task can be found in Figure S2 of the On-line Supplementary Materials. The phase ended with a lexicon test in which the participants had to get all of the trials correct.

The Testing Phase

The third and final part of the experiment was the testing phase. In the AJT, the participants saw sentences from the miniature AL successively and were asked to judge each of them as Good or Bad. Each trial consisted of a nonce noun (Table 2), a sentence in which the noun was used, and a picture that matched the noun. The participants were instructed to judge the sentences based on how natural they sounded. Examples are shown in Figure 2, where the left row displays examples of SXV and SVX sentences; the middle row shows examples of XSV and XVS and the right row illustrates examples of SOV and SVO sentences (fillers/controls).

Figure 2. *Examples of the Acceptability Judgement Task*

Results

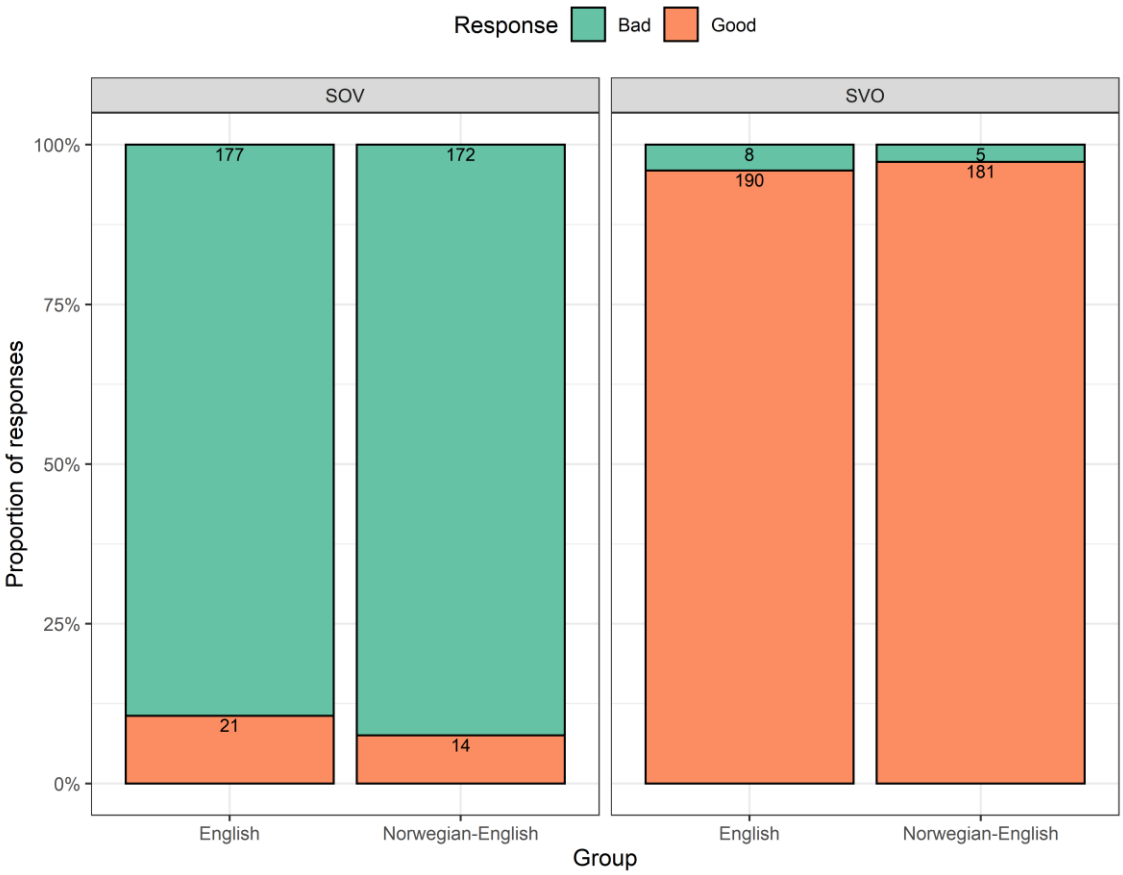
We visualized and analysed the data in RStudio, R version 4.1.2 (2021-11-01; Team, 2021). The dataset can be found in Appendix S1 and the R script in Appendix S2 in the On-line Supplementary Materials.

Acceptability judgements

We first report on the participants' acceptability judgements (Good and Bad) in two plots that demonstrate the proportions of the responses by speaker group and word order. Figure 3 shows the filler/control condition and Figure 4 shows the critical conditions. We used the ggplot2 R package to create the graphs (Wickham, 2009).

For the filler/control condition (SOV/SVO), we expected that the participants would reject verb-final sentences (SOV) because this word order is ungrammatical in both Norwegian and English and was not present in the AL input. Figure 3 shows that the participants clearly behaved in line with our expectations, as both speaker groups accepted over 95% of the SVO sentences and rejected around 90% of the SOV sentences. The numbers within the figure show how many times Bad and Good were selected. This demonstrates that when there is a clear preference for a given word order, the participants do not accept sentences at chance, even after minimal exposure to the target language. Recall that some participants were excluded because frequent (over 90%) acceptance of SOV and/or rejection of SVO sentences.

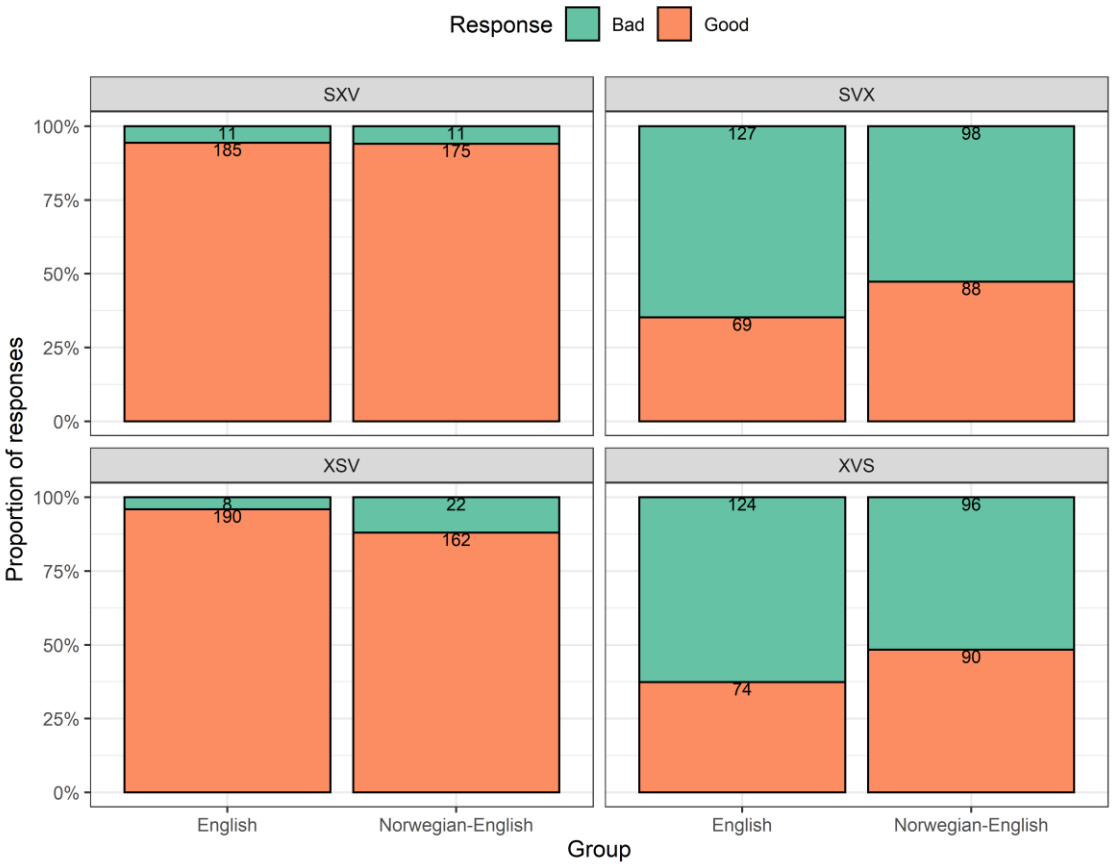
Figure 3. *Acceptability Judgements of Subject-initial Declaratives*



Note. Proportions of *Good* and *Bad* Assigned to the filler items *Subject-Verb-Object* (left-hand panel) and *Subject-Verb-Object* (right-hand panel) word order by group (X-axis). Total $N = 64$.

Figure 4 illustrates the judgements of the critical items (XSV/XVS and SXV/SVX) by group. Recall that the participants had only been exposed to XVS in the AL input (lower right-hand panel). Overall, both speaker groups frequently accepted the V3 word orders SXV and XSV (left-hand panels), while the V2 word orders SVX and XVS were accepted below or at chance (right-hand panels).

Figure 4. *Acceptability Judgements of Verb Placement*



Note. Proportions of *Good* and *Bad* assigned to the V3 (left-hand panels) and V2 (right-hand panels) word orders by speaker group (X-axis). Total $N = 64$.

Statistical Analysis

To answer the research questions, we looked for linear dependencies between the response variable Acceptability judgement (*Good* and *Bad*) and the predictor variables Group (*English* and *Norwegian–English*), Sentence type (*XSV/XVS* and *SXV/SVX*) and Word order (*V2* and *V3*) by fitting a mixed-effects binomial logistic regression model to the data in a manual step-wise step-up forward elimination procedure, using the lme4 R package (Bates, Mächler, Bolker & Walker, 2015). Sentence type and Word order can be classified as within-subjects variables since all participants judged the

same sentences, while Group is a between-subjects variable. The model included Participants as a random effect. We did not include Items in the random effect structure because its inclusion led to an unstable model. Instead, we included Items as a potential fixed effect. We set *sum* contrasts using the rms R package (Harrell, 2021) for the categorical predictor variables. By default, the reference level for the variables Word order and Group were *V2* and *English,* respectively.

We added predictors successively to the model. For each added predictor, we checked whether the inclusion led to problems with multicollinearity. If there were no substantial problems, we examined the Akaike (AIC) and Bayesian (BIC) information criteria and whether the added predictor correlated significantly with the response variable ($p < .05$). A summary of the model comparisons (Table A1) can be found in the Appendix. We refer to the output of the model fitting procedure as the final minimal adequate model.

The final minimal adequate model performed significantly better than an intercept-only baseline model (χ^2 (3) = 565.56, p < .001) and had substantial explanatory and predictive power, as reflected in the goodness-of-fit parameters C (.89) and Somers' D_{xy} (.78; Baayen, 2008), as well as the conditional R^2 value (Vonesh et al., 1996), which indicates that 53% of the variance in the response variable is explained by the random and fixed effects. This is a good fit, especially since predicting human behaviour is notoriously difficult. According to Ballard (2019), R^2 values lower than .5 are common in fields that investigate human behaviour. Table 3 summarises the final minimal adequate model.

Table 3. *Summary of the Final Minimal Adequate Model*

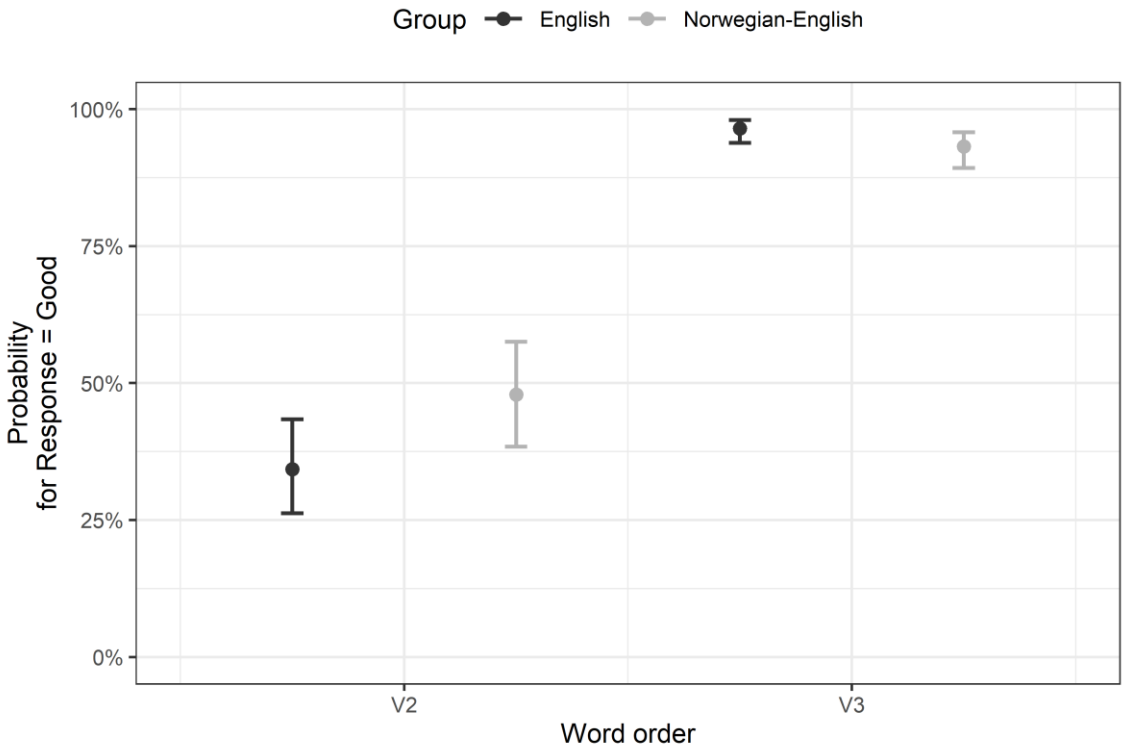
Predictors	Acceptability judgements (Good = 1; Bad = 0)					
	b	*SE*	*CI* (95%)		*z*	*p*
			Lower	Upper		
Intercept	1.30	0.14	1.02	1.58	8.99	.001
Word order1	–1.67	0.09	–1.85	–1.49	–18.12	< .001
Group1	0.03	0.14	–0.25	0.31	0.22	.82
Word order1 × Group1	–0.32	0.09	–0.49	–0.14	–3.53	< .001
Residual						
$R_{Marginal}$ = .42 / $R_{Conditional}$ = .53						

Note. Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) ['glmerMod']; Family: binomial (logit); Formula: Response ~ (1 | Participants) + Word_order + Group + Word_order:Group; Data: See Appendix S1 in the On-line Supplementary Materials; Nor–Eng = Norwegian–English speakers; Total *N* of observations = 1530; Total *N* of participants = 64.

The final minimal adequate model reported a statistically significant main effect of Word order (β = – 1.67, *SE* = 0.09, *Z* = –18.12, $p < .001$) and an interaction between Group and Word order (β = – 1.32, *SE* = 0.09, *Z* = –3.53, $p < .001$). This interaction indicates that an acceptability judgement of a given Word order (V2 or V3) depended

on which speaker group the participant belonged to (English or Norwegian–English). We visualize the interaction effect in Figure 5, using the R package sjPlot (Lüdecke, 2021). The Y-axis shows the predicted probability for the response Good to surface in the AJT (in percentages). The X-axis and the colours indicate the change in predicted probability across the predictor variables and their levels. The error bars represent a 95% confidence interval on the effect.

Figure 5. *Probability of V2 and V3 Word Order Acceptance*



Note. Probability of the value *Good* by Word order (*V2* and *V3*) and Group (*English* and *Norwegian–English*) as predicted by the final minimal adequate model.

Figure 5 shows that English monolinguals are less likely to accept V2 word order, but more likely to accept V3 word order, than the Norwegian–English bilinguals. Chi squared tests showed that both of these group differences were statistically significant,

i.e., Norwegian–English participants were more likely to accept V2 than the English monolinguals ($\chi^2 = 10.03$, $p = .002$, $\varphi = .11$), while the English monolinguals were more likely to accept V3 than the Norwegian–English participants ($\chi^2 = 4.42$, $p = .04$, $\varphi = .08$). Although these group differences were statistically significant, the effect was small, as reflected in Phi (φ) values close to .1.

Discussion

In this section, we discuss the research questions in light of the results presented in the previous section. The first research question was whether a learning effect could be observed after minimal exposure to the target language. If so, we should find that the English participants accepted more XVS than SVX word order, as they were only exposed to the former in the AL input. However, we did not find an effect of sentence type in the statistical analysis. This suggests that we tested the participants at a point in time where very little structural learning had taken place, which is not unlikely given the relatively short experiment (around 60 minutes). This also suggests that the observed differences between groups could be a result of crosslinguistic influence even when the learners have been exposed to the structure in the input.

However, it is surprising that the English monolinguals accept as much as 35–37% of the SVX and XVS sentences, even when that structure had not been present in the AL input. This is not in line with what the FT/FA would expect (Schwartz & Sprouse, 1996; cf., the Backgrounf Literature), as the English monolinguals should transfer their L1 to the L2 interlanguage immediately upon exposure to the AL. This should be reflected in robust L1 representations—in this case V3 word order, which is not what

we see. There are several possible explanations for this behaviour. First, the high acceptance rate could be a result of the response bias known as agreement tendency (also known as acquiescence and yea-saying), which refers to the general tendency for more acceptance than rejection in AJTs (Schütze, 2016). Alternatively, the high acceptance rate of V2 word order could be result of the residual V2 in English (Rizzi, 1996; Westergaard, 2007), making the English speakers more prone to accepting V2 word order because they know that it is possible in certain cases. This would explain why we do not observe the same agreement tendency in the filler/control condition, and why we do not observe a robust V3 representation.

In the second research question, we asked whether both previously acquired languages contributed to crosslinguistic influence in L3 acquisition, or if the lexico-phonotactically more similar language, English, was the sole source of influence. If the latter is true, we should not be able to reject H_0 (Eng = Nor–Eng) since both speaker groups would accept V3 and reject V2 word order. A rejection of H_0 (Eng ≠ Nor–Eng) would indicate that Norwegian exerts influence on the AL, despite being lexico-phonotactically less similar to the AL than English.

Our results showed that H_0 can be rejected, as we found a statistically significant interaction between Group and Word order, indicating that whether a given sentence is accepted or rejected depends on the participants' pre-existing grammar(s) (i.e., Eng ≠ Nor–Eng). In fact, the between-group differences for both V2 and V3 word order were significant (as shown in the Chi squared tests), suggesting that the English monolinguals were more likely to accept V3 than the Norwegian–English bilinguals, and the Norwegian–English bilinguals were more likely to accept V2 than the English

monolinguals. This is in line with the predictions put forward by property-by-property models of L3 acquisition, as it shows that both pre-existing grammars influence the new language simultaneously, reflecting an acquisition process in which associated structures across different modules of the mind are activated in parallel and compete against each other in order to be shared with the L3 interlanguage. The winner of the competition is the representation that, overall, fits the input better (Truscott & Sharwood Smith, 2019). Consequently, whether a Norwegian–English bilingual used V2 or V3 word order in the L3 depended on a general evaluation of structures activated in the different modules of the mind, since these always interact. For example, the English (pseudo-)cognates in the miniature artificial language were associated with language identity tags in the conceptual (meaning) system associated with English, while at the same time, the V2 word order in the input was associated with Norwegian (see e.g., Sharwood Smith & Truscott, 2021). Since information about (pseudo-)cognates and similar sounds, unlike morphosyntactic information, is immediately accessible to the learners, lexico-phonotactic cues are more influential early in the acquisition process.

We saw that the lexico-phonotactic influence was high in the present experiment by means of an overall tendency to accept V3 word order, reflected by for example small effect sizes in the (although significant) between-group comparisons in the Chi squared tests. Overall, the small effect was driven by high acceptance rates for V3 and relatively or at-chance acceptance rates for V2, even for the structure to which the participants had been exposed (XVS). A general preference for V3 over V2 word order has been found in other studies (Bohnacker, 2006; Dentler, 2000; Vogel, 1992).

Previous literature has attributed such results to a preference for the unmarked SV word order (Clahsen & Muysken, 1986), while others argue that it can also be a result of crosslinguistic influence (Bohnacker, 2006). Both property-by-property and wholesale models of L3 acquisition expected an overall preference for V3 word order, due to the lexico-phonotactic similarity between the AL and English, as opposed to Norwegian (see e.g., González Alonso et al., 2020; Westergaard, 2021). That is, lexical and phonotactic cues are expected to be more influential than syntactic cues at early stages of the acquisition process because of the immediate access to information about overlapping words and sounds. Crucially, what we find in the present experiment is that lexico-phonotactics are not the only cues affecting crosslinguistic influence. Syntactic cues in the input also appear to matter at an early stage. A similar result has been found in (Jensen & Westergaard, In progress).

These results could be problematic for the hierarchy of linguistic cues, first proposed in Rothman (2011; 2015), which argues that if there are detectable/usable overlaps between the L3 and a previously acquired language at the lexical level, this should lead to complete transfer as early as possible during the acquisition process (Rothman et al., 2015). As mentioned above, we cannot rule out that wholesale transfer could take place at a later stage, our results thereby reflecting 'pre-transfer stages' as suggested by González Alonso et al. (2020). However, the results presented here show that wholesale transfer in L3 acquisition does not take place as soon as the parser detects lexical and/or phonological similarity with one of the previously acquired languages, as proposed by Rothman (2011, 2015).

Conclusion and Future Directions

In this study, we investigated how bilinguals use their pre-existing grammars when they acquire a new language by comparing very early L3 and L2 acquisition of an artificial language by Norwegian–English bilinguals and English monolinguals. The AL was lexico-phonotactically similar to English, but syntactically similar to Norwegian. After some exposure to and training in the AL, we asked the participants to judge three types of main declarative clauses as either Good or Bad: subject-initial declaratives (fillers/control sentences), non-subject-initial declaratives and subject-initial declaratives with sentence adverbials. English and Norwegian exhibit different word orders in the two latter constructions, as the former language prefers V3 word order and the latter V2. Therefore, the test items were sentence pairs that only varied between V3 and V2 word order: XSV/XVS and SXV/SVX, respectively. Crucially, the participants had only been exposed to XVS in the AL input. We investigated whether we could observe learning effects at this early stage of the acquisition process, and whether the presence of crosslinguistic influence in the L3 primarily reflected the pre-existing grammar that was lexico-phonotactically more similar to the AL (English), or if both previously acquired languages contributed to crosslinguistic influence. The former would be compatible with wholesale transfer and the latter with property-by-property accounts of crosslinguistic influence in L3 acquisition.

A mixed-effects binomial regression model showed that exposure to a given linguistic structure does not have a significant effect on the participants' acceptability judgements after minimal exposure to the AL. This suggests that structural learning does not, or to a very limited degree, take place this early in the acquisition process.

Instead, it is likely that the participants mainly rely on their previously acquired language(s) when they make their acceptability judgements. The model reported an interaction effect of Word order and Group, suggesting that the relationship between acceptance/rejection and Word order depends on the participants' linguistic backgrounds. We argued that this supports property-by-property accounts that predict simultaneous influence from both previously acquired languages based on structural cues in the input. Moreover, the results show that wholesale transfer driven by lexico-phonotactic crossover between the AL and a previously acquired language cannot have taken place at the point of testing, since the Norwegian–English participants do not behave like the English participants. In future studies, longitudinal designs are necessary to investigate whether wholesale transfer takes place later in the acquisition process.

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Appendix

Statistical Analysis

Table A1. *Summary of the Model Comparisons*

Models	Term added	AIC (BIC)	X^2	*p*
m1 vs. m0	1 + Word order	1353.88 (1369.88)	551.43	< .001
m2 vs. m1	Sentence type	1355.86 (1377.19)	0.02	.89
m3 vs. m1	Group	1354.73 (1376.06)	1.15	.28
m4 vs. m1	Group + Word order × Group	1343.75 (1370.42)	14.13	< .001
m5 vs. m4	Group × Sentence type + Sentence type	1346.38 (1383.72)	1.37	.50
m6 vs. m4	Sentence type + Word order × Sentence type	1346.05 (1383.38)	1.7	.43
m7 vs. m4	Group × Sentence type + Sentence type + Word order × Group × Sentence type + Word order × Sentence type	1346.43 (1394.42)	5.33	.26

Online Supplementary Materials

Appendix S1

Appendix S2

Table S1

Figure S1

Figure S2

Paper 3

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Crosslinguistic influence in L3 acquisition across linguistic modules

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Crosslinguistic influence in L3 acquisition across linguistic modules

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ABSTRACT

In this study, we investigated crosslinguistic influence (CLI) at developmental stages of third language (L3) acquisition of English by Russian–Norwegian children ($N = 31$). We tested seven linguistic properties within three linguistic modules (morphology, syntax and syntax-semantics). We compared the L3 learners to Norwegian ($N = 90$) and Russian ($N = 74$) second language (L2) learners of English. We predicted simultaneous facilitative and non-facilitative CLI in the L3 group within all modules, as the previously acquired languages offered conflicting options. Our predictions were partly supported. On one property, the L3 learners were different from both L2 groups, which is in line with cumulative CLI from both previously acquired languages. On four conditions, the L3 learners performed like the more accurate L2 group, indicating facilitative influence. On two conditions, all groups performed alike, showing high rates of accuracy. Taken together, the results indicate that CLI obtains on a property-by-property basis, with none of the L1s being the sole or primary source of CLI. Finally, we found CLI in all linguistic domains, but the developmental slopes for the properties were not equal, which suggests that factors such as complexity and saliency needs to be taken into account when we compare CLI.

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Introduction

This paper presents a study that investigated crosslinguistic influence (CLI) at selected developmental stages of third language (L3) acquisition of English by Russian–Norwegian bilinguals. We examined how the previously acquired languages, Russian and Norwegian, affected the acquisition of the L3 across three linguistic modules: syntax, morphology and the syntax–semantics interface. At the syntax–semantics interface, we tested genericity and definiteness; in the morphological domain, we tested

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subject-verb agreement and the use of the copula in the present tense, and in the syntactic domain, we tested word order. In each domain, at least one condition targeted a property that was similar between Norwegian and English (while Russian was different) and one represented a similarity between Russian and English (while Norwegian was different). Our goal was to investigate whether both previously acquired languages contributed to CLI and whether CLI was always facilitative. Finally, and importantly, studies of CLI, in general, tend to only consider one language domain, and this is true of studies of L3 acquisition as well (for a discussion, see Lago et al., 2021). In the current study, we fill this gap by considering CLI across different linguistic domains.

Following the framework of the Linguistic Proximity Model (LPM; Mykhaylyk et al., 2015; Westergaard et al., 2017) and the Scalpel Model (Slabakova, 2017), we assume that both previously acquired languages would be active during the process of L3 acquisition and will contribute to the building of increasingly more stable L3 representations. This leads to three different scenarios in the case of L3 English acquisition by 2L1 Russian–Norwegian learners.

1. The L3 group could be similar to the low-accuracy group, but this should only happen before they discover the structural similarities between the properties (earliest stages);
2. L3 learners would be in-between the L2 groups due to co-activation of competing related structures in both previously-acquired languages;
3. L3 learners would be similar to the higher-accuracy group, when they learn to inhibit the non-facilitative language.

Outcome 1 is compatible with the LPM and Scalpel Model, but also the Typological Primacy Model (TPM; Rothman, 2011, 2015; if the L3 group patterns with the linguistically more similar L2 group). Outcome 3 is compatible with both the LPM, the Scalpel Model and the Cumulative Enhancement Model (CEM; Flynn et al., 2004), while outcome 2 is only predicted by the LPM and the Scalpel Model, and would go against both the CEM and the TPM. If the L3 speakers' accuracy lies in between the two L2 groups, the LPM's interpretation of this result is that this is due to simultaneous facilitative and non-facilitative influence from the previously acquired languages (see Westergaard, 2021 for more details on this methodology and general predictions). We tested our predictions by comparing Russian–Norwegian learners of L3 English to age- and proficiency-matched groups of L2 learners with Norwegian and Russian as their L1s in an offline acceptability judgment task (AJT).

Background

In the field of L2 acquisition research, there is a strong consensus that the native language exerts a decisive influence, especially early in the acquisition process. This view has been advocated by the Full Transfer/Full Access Hypothesis (FT/FA, Schwartz & Sprouse, 1996) and before that by White (1985). The FT/FA argues for wholesale transfer: L2 learners copy their entire L1 system in one fell swoop, except for phonological features and lexical items, upon first exposure to a new language (Schwartz & Sprouse, 1996, 2020). This copy of the L1 system constitutes the initial state of L2 acquisition. If the learners receive input from the target language that cannot be parsed through their current L2

system, they restructure their L2 grammar (Schwartz & Sprouse, 1996, pp. 40–41). An opposing view to Full Transfer is the Full Transfer Potential approach (FTP, Westergaard, 2019). According to this view, any property from the L1 *may,* but does not have to, influence the L2. FTP argues that all language acquisition happens through parsing, meaning that in L2 acquisition, the new language is parsed through the L1 system. If the learner discovers a structure in the L2 input that matches a structure in the L1, the L1 representation of this property will be activated, resulting in CLI (the structures are referred to as micro-cues; see Westergaard, 2009, 2019 for a discussion of the Micro-cue Model). The learners' L2 system is not a complete copy of the L1 grammar. Instead, the grammar starts small and grows incrementally, i.e. CLI happens property by property. This also means that instead of being robust copies of L1 properties, the L2 structures may be vulnerable at the initial stages of the acquisition process and grow into more robust representations as more input is received from the target language. Misanalysis of the input may lead to non-facilitative influence (see Westergaard, 2021, for some examples).

The LPM aims to model CLI at all stages of the acquisition process and does not distinguish categorically between earlier and more advanced stages of the process. The model is non-default, meaning that it does not assume an L1 or L2 primacy effect. Instead, what drives CLI is structural proximity between the L3 and previously acquired languages. Learning happens in the same way as in L1 and L2 acquisition – by parsing. This suggests that learners use the L1 *and* the L2 systems to parse the L3 input. More specifically, the parser searchers for (micro-)cues that match with the L1 or the L2 representations. If a cue is found, it is used as a facilitative parse and is stored as a cue in the developing L3 system. As the experience in the L3 grows, the learners become more proficient in inhibiting the influence from the previously acquired languages. In practice, this means that we will see co-activation and influence from both the L1 and the L2 at the developmental stages of L3 acquisition.

The LPM argues that influence can be facilitative and non-facilitative. This distinguishes the LPM from the CEM (Flynn et al., 2004). According to the CEM, CLI can come from both previously acquired languages, but it is either facilitative or neutral. The LPM, on the other hand, argues that non-facilitative influence may be a result of a misanalysis of the input (or in some cases, lack of relevant input). This is based on the microvariation approach to language acquisition, cf. the Micro-cue model (Westergaard, 2009, 2019), i.e. that there are fine-grained linguistic distinctions between languages, and even when there are structural similarities between two languages, the properties are rarely identical. According to Westergaard (2019, p. 19), this may account for non-facilitative influence (see also Westergaard, 2021). This is a feature that this model shares with the Scalpel Model (Slabakova, 2017).

Previous studies in L3 acquisition have mainly examined one or two constructions within the same linguistic domain. For example, Flynn et al. (2004) looked at the production of restrictive relative clauses in L3 English by L1 Kazakh/L2 Russian speakers; Falk et al. (2015) examined the production of adjective placement in L3 Dutch by L1 Swedish speakers with previous knowledge of English and a Romance language; Rothman and Cabrelli Amaro (2010) examined null subjects in speakers of English and Spanish who acquired another Romance language; Westergaard et al. (2017) tested knowledge of subject–auxiliary inversion and adverb–verb word order in L3 English by

2L1 Russian–Norwegian speakers. Whether CLI works similarly within different parts of the grammar has not been investigated widely and within the same population. In our study, we address this question by testing an array of linguistic properties across three linguistic modules: morphology, syntax and the syntax–semantics interface.

Research questions and predictions

We investigated CLI in seven properties across three linguistic modules. For the L2 learners, at least one property was similar to their L1 and one was different within each module. For the L3 learners, there was always a conflict between their L1s. We focused on acquisition past the beginner stages, as the participants had been learning English in school for 5–6 years (cf. Participants). It should be noted that some L3 models, such as the L2 Status Factor (e.g. Falk & Bardel, 2010), argue that order of acquisition and proficiency are important factors to understand CLI in L3 acquisition. In the current study, we cannot investigate the effect of these factors since the L3 learners acquired both Norwegian and Russian from birth and were proficient in both languages (cf. Participants). We asked the following research questions:

1. Do both previously acquired languages contribute to CLI at developmental stages of L3 acquisition, or is one language chosen as the sole/primary source of influence?
2. Is CLI always facilitative?
3. Is the pattern of CLI the same across grammar domains: morphology, syntax and syntax–semantics?

We predicted that the L3 group's scores, measured by accuracy in an AJT – at least on some of the conditions – may be in the middle of the two L2 groups' scores due to facilitative and non-facilitative influence from Russian and Norwegian. Alternatively, they would score the same as the L2 group with which it shared the relevant property (a ceiling effect), but they would not be expected to score better than this group (see Westergaard, 2021). We also expected that the L2 groups would outperform each other on the conditions in which the L1 offered facilitation. The predictions are summarised in Table 1 (see details about the conditions in the Methods section).

It should be noted that the predictions for the L3 learners are dependent on these properties being problematic for the L2 learners where the property is missing in the L1; if they are not, then all groups may have already acquired the property, and no differences will be seen. Thus, timing is crucial, and it may not be the case that all properties

Table 1. Predictions

Similarity	Condition	Module	Prediction
ENG = RUS ≠ NOR	Gen	Syntax–semantics	Rus > Rus–Nor > Nor
	Agree	Morphology	
	Topic	Syntax	
	Adv		
ENG = NOR ≠ RUS	Def	Syntax–semantics	Nor > Rus–Nor > Rus
	Cop	Morphology	
	DO-pro	Syntax	

Note: Gen = Abstract genericity; Agree = Subject–verb agreement; Topic = Subject–verb word order; Adv = Adverb–verb word order; Def = Definiteness; Co*p* = obligatory copula; DO-pro = verb–pronoun word order.

tested are problematic at the same stage of acquisition. For some of the properties we have selected, there is previous research showing that they cause problems for L2 learners; e.g. adverb–verb word order in declaratives is difficult for Norwegian learners of English at a certain stage (e.g. Westergaard, 2003), while definiteness has been found to be notoriously hard for learners with an article-less L1 such as Russian (e.g. Agebjörn., 2020; Ionin et al., 2004). For other properties, we may or may not see effects of CLI at the stage that we are testing these learners. Nevertheless, even in cases where a property of the target language is already acquired by the L2 learners, we expect the L3 learners to also have acquired it.

Method

Participants

We tested 31 Russian–Norwegian bilinguals (mean age: 11.5), 90 L1 Norwegian speakers (mean age: 12.1) and 74 L1 Russian speakers (mean age: 12.4). All participants started learning English in school around age six. The Russian–Norwegian bilinguals attended a Russian-speaking evening/Sunday school in Norway. They reported having at least one Russian-speaking parent and they had acquired both languages from birth or from early childhood (age of onset in Norwegian for children with two Russian-speaking parents was typically between 1 and 2 years). The L1 Norwegian and L1 Russian speakers were recruited in Norway and Russia, respectively. They reported no knowledge past beginner levels in other languages than their L1 and English and no other countries of residence than Russia or Norway. The participants were matched for English lexical proficiency by means of a modified British Picture Vocabulary Scale (BPVS 3; Dunn & Dunn, 2009) with 20 items. Only participants with an accuracy score of 60% or above were included in the analysis. We excluded one L1 Russian speaker based on this criterion.

Experimental conditions and test items

In the AJT, the participants assigned the values *good* or *bad* to ungrammatical and grammatical English sentences. For each grammatical sentence, there was an ungrammatical counterpart. We divided the sentences into two lists so the participants never saw both members of a sentence pair. Each list contained six sentences per condition. Because of the large number of different properties tested in this study, the conditions served as fillers for each other. All items were checked for naturalness and grammaticality by native speakers of English ($N = 6$). Examples (1–7) show some of the sentences used in the AJT (sentences used for a context in brackets). English is similar to Norwegian in (1–3) and to Russian in (4–7).

1. Definiteness
   (a) [Susan thought that her dog was lazy]. **The** dog slept a lot.
   (b) [Susan thought that her dog was lazy]. *Dog slept a lot.
2. Obligatory copula
   (a) Lisa **is** a nice person.
   (b) *Lisa a nice person.

3. V-DOpro word order
   (a) [Nina was Robert's girlfriend]. Robert ***met*** **her** at work.
   (b) [Nina was Robert's girlfriend]. *Robert **her** ***met*** at work.
4. Abstract genericity
   (a) Life can be difficult.
   (b) ***The** life can be difficult.
5. Subject-verb agreement
   (a) ***Ruth*** **walks** to church every Sunday.
   (b) ****Ruth and John*** **walks** to church every Sunday.
   (c) ***Ruth and John*** **walk** to church every Sunday.
   (d) ****Ruth*** **walk** to church every Sunday.
6. Topic (XSVO word order)
   (a) *Last Monday* ***the teachers*** **walked** to school.
   (b) **Last Monday* **walked** ***the teachers*** to school.
7. Adv-V word order
   (a) We ***usually*** **eat** eggs for breakfast.
   (b) *We **eat** ***usually*** eggs for breakfast.

Syntactic conditions

While there were two syntax–semantic and morphological conditions, there were in practice three syntactic conditions. Two of these were sub-conditions of the lack of verb movement in English, referred to as subject–verb word order (topic) and adverb–verb word order (Adv) in previous sections. In these cases, Norwegian is different from English, as the former is an SVO language with verb-second (V2) word order (see (8) and (9)).

8. *V2 word order in Norwegian non-subject-initial declarative clauses*
   (a) Forrige mandag **gikk** ***lærerne*** til skolen.
   Last Monday walked teachers.DEF to school.DEF
   'Last Monday the teachers walked to school.'
   (b) *Forrige mandag ***lærerne*** **gikk** til skolen
   Last Monday teachers.DEF walked to school.DEF
   Intended: 'Last Monday the teachers walked to school.'
9. *V2 word order in Norwegian declarative clauses with adverbs*
   (a) Vi **spiser** ***vanligvis*** egg til frokost.
   We eat usually eggs for breakfast
   'We usually eat eggs for breakfast.'
   (b) *Vi ***vanligvis*** **spiser** egg til frokost.
   We usually eat eggs for breakfast
   Intended: 'We usually eat eggs for breakfast.'

We originally used the past tense in sentences with adverbials (example (9)) to test for knowledge of verb position without the confound of knowledge of agreement, which is tested as a morphological condition. However, past tense declaratives were problematic

for the learners, as both grammatical and ungrammatical sentences were rejected. This could be an effect of the test items, as we presented the habitual adverbs *often, always* and *sometimes* in past tense sentences without any context (e.g. *Emma always ate cake)*. We therefore suggest that the present tense sentences are a better reflection of the learners' knowledge of verb position, and we exclude the past tense sentences in further analyses.

Russian is similar to English with regard to verb placement; while verbs are unacceptable in the second position in these structures in English, they are strongly dispreferred in Russian (see (10) and (11)).

10. *Word order in Russian non-subject-initial declarative clauses*
    (a) V proshlyj ponedeljnik ***uchitelj*** **byl** v shkole
        Last Monday teacher was at school.LOC
        'Last Monday the teacher was at school.'
    (b) ?? V proshlyj ponedeljnik **byl** ***uchitelj*** v shkole
        Last Monday was teacher at school.LOC
        Intended: 'Last Monday the teacher was at school.'
11. *Word order in Russian present tense declarative clauses with adverbs*
    (a) My ***vsegda*** **jedim** na zavtrak jaichnicu.
        We always eat.1PL for breakfast scrambled eggs
        'We always eat scrambled eggs for breakfast.'
    (b) ?? My **jedim** ***vsegda*** na zavtrak jaichnicu
        We eat always for breakfast scrambled eggs
        Intended: 'We always eat scrambled eggs for breakfast.'

We also tested a property that is similar in Norwegian and English, but different from Russian: The position of the pronominal object. In Russian, pronominal objects can precede or follow the verb (example (12)), while Norwegian follows the same word order as English (example (13)).

12. *SOproV word order in Russian*
    (a) Mary zabolela. Jonny ***jejo*** **otvjoz** v boljnicu.
        Mary fell ill. Jonny her drove to hospital.DEF
        'Mary fell ill. Jonny drove her to the hospital.'
    (b) Mary zabolela. Jonny **otvjoz** ***jejo*** v boljnicu.
        Mary fell ill. Jonny drove her to hospital.DEF
        'Mary fell ill. Jonny drove her to the hospital.'
13. *SVOpro word order in Norwegian*
    (a) Mari ble syk. Jonny **kjørte** ***henne*** til sykehuset.
        Mari fell ill. Jonny drove her to hospital.DEF
        'Mari fell ill. Jonny drove her to the hospital.'
    (b) Mari ble syk. *Jonny ***henne*** **kjørte** til sykehuset.
        Mari fell ill. Jonny her drove to hospital.DEF
        Intended: 'Mari fell ill. Jonny drove her to the hospital.'

Syntax–semantics conditions

In the syntax–semantics domain, we tested the expression of definiteness in English. Since Russian does not have articles, this is an area of grammar that has often been found to be problematic for Russian learners, who typically produce and accept bare nouns in English (example (14)). Norwegian is similar to English but expresses definiteness by adding a suffix to the noun (example (15)).

14. *Definiteness in Russian*
    Sobaka spala.Dog.BARE slept
    'A dog/the dog slept.'
15. *Definiteness in Norwegian*
    (a) Hund**en** sov.Dog.DEF slept
    'The dog slept.'
    (b) *Hund sov.Dog.BARE slept
    'The dog slept.'

While nouns in English typically require an article, mass and abstract nouns can appear without the definite article. Some examples include nouns such as *life, death, love,* etc. Norwegian uses the definite suffix also in these cases, which means that with this subgroup of abstract nouns, Norwegian in fact differs from English, while Russian is similar.

16. *Genericity in Norwegian*
    (a) Liv**et** kan være vanskelig Life.DEF can be difficult
    'Life can be difficult.'
    (b) *Liv kan være vanskelig Life.BARE can be difficult
    Intended: 'Life can be difficult.'
17. Genericity in Russian
    Zhiznj mozhet bytj tjazholoj. Life.BARE can be difficult
    'Life can be difficult.'

Morphological conditions

In the morphological domain, the conditions were *subject–verb agreement* and *obligatory copula*. Overt subject–verb agreement is obligatory in English and Russian, but not in Norwegian; see (18) and (19). That is, Norwegian does not overtly express the feature [agree] on the verb, resulting in the same present tense morphology on the verb with third person plural and singular subjects; see (19 a, b).

18. *Subject-verb agreement in Russian*
    (a) Ole i Lisa **izuchajut** lingvistiku Ole and Lisa study.3PL linguistics
    'Ole and Lisa study linguistics.'
    (b) Ole **izuchajet** lingvistiku Ole study.3SG linguistics
    'Ole studies linguistics.'
19. Subject-verb agreement in Norwegian
    (a) Ole og Lisa **studerer** lingvistikk Ole and Lisa study.PRES linguistics
    'Ole and Lisa study linguistics.'

(b) Ole **studerer** lingvistikk.Ole study.PRES linguistics
'Ole studies linguistics.'

The copula is obligatory in English and Norwegian present tense sentences, but not in Russian; see (20) and (21).

20. *Copula in Norwegian*
(a) Lisa **er** en flink student.Lisa is.COP a good student
'Lisa is a good student.'
(b) *Lisa en flink student.Lisa a good student
Intended: 'Lisa is a good student.'
21. No copula in Russian
Lisa horoshij uchitelj.Lisa good teacher
'Lisa is a good teacher.'

Research design and procedure

The testing took place during school hours for the L2 groups and during evening/Sunday school for the Russian–Norwegian participants. The study employed three tasks for all participants: an AJT, a lexical proficiency task (BPVS 3; Dunn & Dunn, 2009) and a background questionnaire. In addition, the Russian–Norwegian participants did a Russian AJT in order to establish Russian proficiency (24 sentence pairs in two lists). The study was approved by the Norwegian Centre for Research Data. Multiple participants were tested at the same time in a classroom with the tasks presented on a big screen. All sentences in the AJTs and words in the BPVS were presented written and aurally, recorded by native speakers. Each sentence/word was kept on the screen for approximately 4 s, controlled by the experimenter. The participants marked their answers on a sheet of paper. The sentences were pseudorandomised and the participants were asked to only judge the critical sentences rather than the contextual sentences (see (1–7)). The critical and contextual sentences were marked in different colours. The questionnaire included questions about linguistic background and language habits at home.

Results

To analyse the results statistically,[1] we fit a generalised linear mixed effects logistic regression model where Accuracy was predicted by an interaction of Group (Russian–Norwegian vs Norwegian vs Russian) and Condition (the seven properties, see more in the Methods section). Proficiency in English was added as a separate fixed effect. Random effects included by-item random intercepts and by-participant random slopes. The model revealed a significant effect of group_Norwegian ($ß = -0.44$, $p = .015$), condition_adverb ($ß = 0.70$, $p = .03$), condition_topic ($ß = 1.03$, $p = .003$), condition_definite ($ß = 1.04$, $p = .002$), condition_DOpro ($ß = 2.39$, $p < 0.001$), condition_copula ($ß = 2.01$, $p < .001$), and proficiency ($ß = 0.11$, $p < .001$). Furthermore, four interactions were significant: group_Russian and condition_agreement ($ß = 1.19$, $p < .001$), group_Norwegian

and condition_definite (ß = 0.62, $p = .045$), group_Russian and condition_definiteness (ß = –1.49, $p < .001$), group_Russian and condition_DOpro (ß = –0.93, $p = .03$). No other effects were significant. The syntax and the output of the model is presented in the Appendix and an overview of the participants' demographics is shown in Table 2.

Post-hoc pairwise comparisons of groups within conditions revealed the following significant differences: On adverb placement, the Norwegians were significantly less accurate than the Russians ($p < .0001$) and the Russian–Norwegians ($p = .01$). With respect to agreement, all groups were significantly different from each other: the Russian speakers significantly outperformed the Norwegians ($p < .0001$); the Russian–Norwegian bilinguals also significantly outperformed the Norwegians ($p = .007$), but they were significantly less accurate than the Russians ($p < .0001$). On definiteness, Norwegian and Russian–Norwegian speakers performed significantly more accurately than their Russian peers ($p < .0001$ for both contrasts). The Russian–Norwegian bilinguals and the Norwegian participants performed significantly more accurately with respect to the position of direct object pronouns than the Russians ($p = .03$ and $p = .003$, respectively). The Russian–Norwegian bilinguals and the Russian speakers were significantly more accurate in their use of bare nouns in generic contexts than the Norwegian speakers ($p = .04$ and $p = .008$, respectively). Finally, no differences between the groups were found in the remaining two conditions that tested the use of overt copula and word order in non-subject-initial declaratives (topicalization). Figure 1 illustrates the participants' accuracy scores. The output of the post-hoc pairwise comparisons is presented in the Appendix.

To sum up, on two conditions (Pronoun placement and Definiteness) the Russian–Norwegians patterned with the Norwegians and performed significantly better than the Russians. On two conditions (Adverb placement and Genericity) the Russian–Norwegians and the Russians performed similarly and significantly better than the Norwegians. On subject–verb agreement, the Russian–Norwegians performed significantly better than the Norwegians, but also significantly worse than the Russians. The condition that targeted the use of overt copula in the present tense was unproblematic for all participants (above 85% accuracy). Finally, on Topicalization, we observed a numeric trend in the predicted direction (Norwegians performed slightly worse than Russians and Russian–Norwegians), but this difference did not reach significance (Figure 2).

Discussion

In this section, we discuss the research questions (see Research questions and predictions) in light of the results. To answer research questions 1 and 2, we compared the groups' accuracy scores per condition. Based on the LPM and the Scalpel Model, we expected cumulative facilitative and non-facilitative influence from both of the L3 learners' L1s. As explained in the Introduction, we considered three potential outcomes for the L3

Table 2. Participants' demographics

Group (L1s)	N	Mean age	Proficiency in English (SD)
Norwegian	90	12.1	17.4 (2.1)
Russian-Norwegian	31	11.5	16.9 (1.5)
Russian	74	12.4	16.8 (1.88)

Note: Maximum proficiency in English is 20.

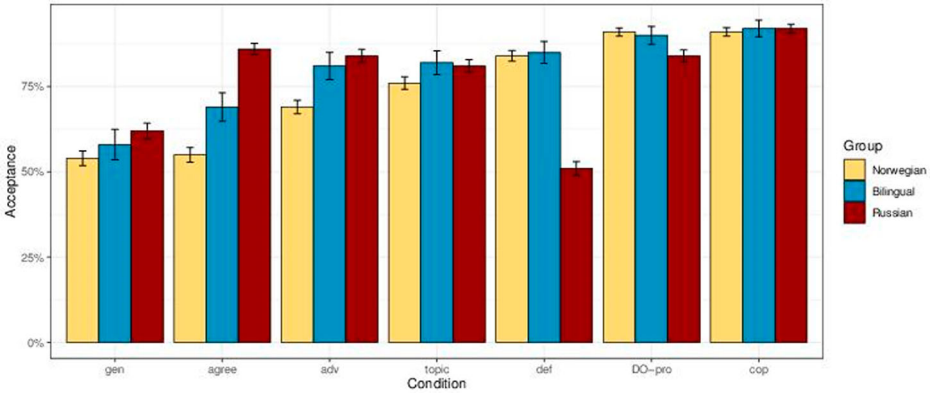

Figure 1. Accuracy by condition and group.

learners. Outcome 1 would be compatible with the LPM, the Scalpel Model and the TPM (if the L3 group patterned with the linguistically more similar L2 group). Outcome 3 would be compatible with the LPM, the Scalpel Model and the CEM and outcome 2 would only be expected under the LPM and the Scalpel Model, but not under the CEM and the TPM. We should *not* observe that the L3 learners patterned categorically with one of the L2 groups on *all* conditions, which would indicate influence from one language only. Table 3 summarises how our predictions matched the results.

As evident from Table 3, we did not observe any differences between the groups on two out of seven conditions (Copula use and Topicalization). All groups performed accurately on these conditions. We can conclude that all groups have already acquired these properties. Furthermore, we did not observe results compatible with scenario 1 (L3 groups patterning with the lower-accuracy L2 group). Recall that according to the LPM, this outcome is only possible for stages when the L3 learners have not yet established structural correspondence between the properties in the new language and the facilitative language. Our learners are already past the beginner stages, and we can conclude

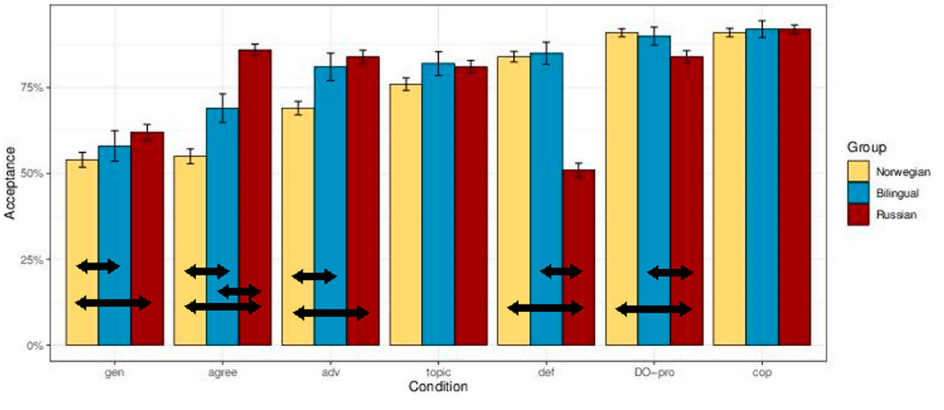

Figure 2. Accuracy by condition and group (significant differences between the groups are marked with arrows).

Table 3. Overview of predictions and results

Similarity	Condition	Module	Prediction	Result
Eng = Rus	Gen	Syntax–semantics	Rus > Rus–Nor > Nor	*Rus = Rus–Nor > Nor*
	Agree	Morphology		**Rus > Rus–Nor > Nor**
	Topic	Syntax		Rus = Rus–Nor = Nor
	Adv			*Rus = Rus–Nor > Nor*
Eng = Nor	Def	Syntax–semantics	Nor > Rus–Nor > Rus	*Nor = Rus–Nor > Rus*
	Cop	Morphology		Rus = Rus–Nor = Nor
	DO-pro	Syntax		*Nor = Rus–Nor > Rus*

Note: Italics indicates results in which the L3 group patterned with one of the L2 groups; bold font indicates results where all groups differed; the underlined text indicates no differences.

that the correspondence between similar structures has already been established. On one property (Agreement), we observed a pattern compatible with scenario 2 (L3 learners being truly in the middle and significantly different from both L2 groups). The 'in-between' behaviour is interesting and could be a result of two scenarios: (a) the L3ers were influenced by both of their previously acquired languages, which was reflected in them scoring in-between the two L2 groups; or (b) *some* of the L3ers patterned with one of the L2 control groups, while *some* patterned together with the other L2 group. Under the first scenario, we would expect the *individual* scores of the L3 learners to come from one distribution, while under the second scenario we expect that individual scores would come from a bimodal distribution, with one sub-group of the participants performing more like the L1 Russians and the other subgroup performing more like the L1 Norwegians. The distribution of individual scores in the Agreement condition is illustrated in Figure 3. As evident from the Figure, the distribution of individual L3 learner scores does not have two distinct modes (peaks), as would be predicted under the second scenario. This suggests that scenario (a), simultaneous non-facilitative and facilitative influence from Russian and Norwegian, is a more likely explanation for the L3 learners' behaviour. This scenario is only compatible with the LPM and the Scalpel Model, indicating cumulative CLI from both previously acquired languages.

Finally, on four conditions we observed a pattern compatible with scenario 3 (L3 learners patterning with the higher-accuracy group). We interpret this result as indicative of a developmental stage when the L3 learners have already learned to inhibit the non-facilitative language with respect to the property in question. The L3ers patterned with the Russian group on two properties where Russian was facilitative (Genericity and Adverb placement), and with the Norwegian group on two properties where Norwegian gave them a boost (Definiteness and the position of the pronominal object). In other words, CLI from one of the previously acquired languages was powerful enough to be decisive in L3 acquisition. Note that this interlanguage state is not at all counter to our predictions: any one of the native languages suffices for a beneficial effect.

Even though we encountered this type of behaviour in most conditions, the relative acceptance of these conditions was not the same. In the Genericity condition, all groups had quite a low accuracy rate, at 54% and 62%. Importantly, however, Norwegian bilinguals were at a disadvantage. Conversely, on the DO-pro condition, all groups were highly accurate (91–92% vs. 84%), but the Russian L2 learners were at a disadvantage this time. We conclude that the predicted pattern of behaviour was visible when bilingual and trilingual speakers were confident in their evaluations, and even when they were not.

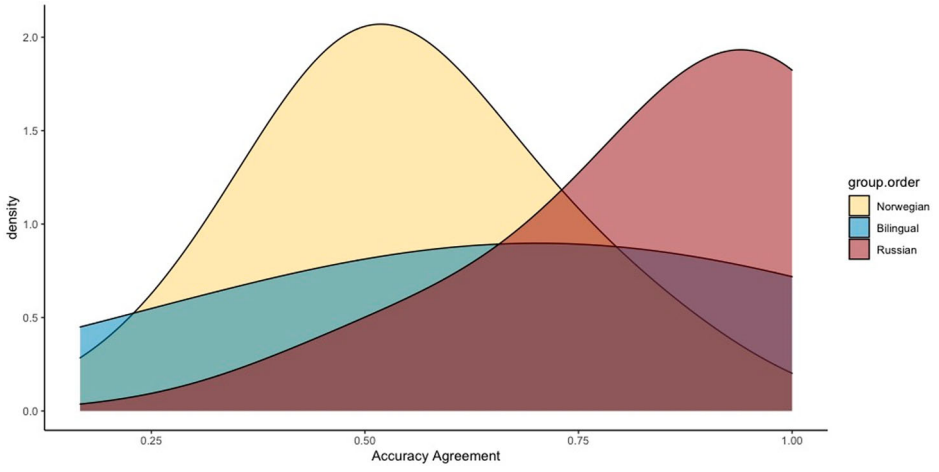

Figure 3. Distribution of individual accuracy scores in the Agreement condition by group.

Overall, the results seem to be best captured by the LPM/Scalpel Model, which both predict cumulative influence from both previously acquired languages. We argue that the results support our prediction for research question 1 and partly support our prediction for research question 2. Regarding research question 1, we observed influence from both L1s, Russian and Norwegian, for different properties. This suggests that influence, at least at developmental stages, was not limited to a single linguistic system, nor was the source of influence determined by overall linguistic similarity between the input and previously acquired languages (as suggested for the early stages of L3 acquisition by Rothman's (2011, 2015) TPM; see more in the Background section). Instead, the results suggest that the learners use both of their L1s as sources of influence. With respect to research question 2, the influence was typically facilitative, as the L3 learners patterned with the more accurate L2 group in four out of seven properties. However, we did observe the predicted 'in-between' accuracy scores by the L3 learners in one condition, *agreement,* suggesting that influence may also be non-facilitating for some properties.

In order to answer research question 3, we tested seven different linguistic properties across three linguistic domains – syntax, morphology and the syntax–semantics interface – in order to explore CLI in different parts of the grammar within the same population. The Scalpel Model (Slabakova, 2017) emphasises the need for such research designs at the developmental stages of L3 acquisition due to additional factors, beyond linguistic similarity, that can contribute to the L3 interlanguage. As mentioned in the Background section, previous studies of CLI in L3 acquisition have typically tested one or two constructions within in the same linguistic domain. As Table 3 illustrates, we found crosslinguistic influence within all linguistic domains, but the developmental slopes were not the same across all properties. We found that the saliency and complexity of the properties played an important role. For example, while the L2 groups outperformed each other on most conditions where the L1 offered facilitation, there were two properties in which there were no differences between the groups: the morphological condition Copula, where all groups were highly accurate (>85%) and Topicalization, a syntactic condition, in which also all participants performed well. In general, word order configurations are considered to be more

salient in language acquisition, and therefore they are frequently acquired very early and with less difficulty (McDonald, 2000, 2006). The copula is also relatively salient in the input and explicitly instructed in school for the Russian speakers. The high accuracy and lack of significant differences between groups suggest that these properties were already acquired by all participants at the point in which the participants were tested.

Abstract genericity, on the other hand, turned out to be relatively difficult for all groups (although significantly more difficult for L1 Norwegian speakers, as we discussed above). A possible reason for this high level of difficulty could be the somewhat exceptional status of this subgroup of nouns in English, which learners in our participants' age group had limited exposure to. Put together, the accuracy on copulas/topicalization and on genericity demonstrates that although CLI is selective and, in the Scalpel Model's terms, 'acts with a scalpel-like precision' from both the L1 and the L2, additional factors can 'blunt the scalpel' (Slabakova, 2017, p. 655). In the most recent version of the LPM (Westergaard, 2021), where CLI is seen as co-activation of structures from the previously acquired languages, other factors are considered to affect the strength of the activation.

Conclusion

In this paper, we posed three questions about the role of previously acquired linguistic knowledge at developmental stages of L3 acquisition. We based our predictions on the LPM and the Scalpel Model and predicted non-facilitative and facilitative CLI from both previously acquired languages across morphological, syntactic and syntax–semantic properties. Our predictions, and by extension the LPM and the Scalpel Model's predictions, were partly supported. First, we showed that the L3ers were influenced by both previously acquired languages, Russian and Norwegian. Importantly, we did not observe that the L3ers selected one primary source of influence, as has been suggested for earlier stages of the acquisition process by the TPM (Rothman, 2011, 2015). Furthermore, the L3 learners patterned with the more accurate L2 group on four out of seven conditions. We interpret this as facilitative influence triggered by a structural similarity between the L3 and a previously acquired language. These results support models that argue for similarity-driven property-by-property CLI and access to both previously acquired languages throughout the acquisition process. Such models are the LPM, the Scalpel Model and the CEM. The latter model argues that CLI cannot be non-facilitative (see the Background section). However, we observed simultaneous facilitative and non-facilitative influence in the Agreement condition. Finally, we found CLI across linguistic domains, but also observed that complexity and saliency affected the participants' accuracy scores, as the properties had different developmental slopes. This suggests, as both the LPM and the Scalpel Model allow for, that linguistic similarity is not the only factor that affects CLI. Factors such as saliency in the input and linguistic complexity of properties are also important and need to be taken into account in future experimental designs that aim to investigate CLI.

Note

1. All generalized linear mixed effects models in this paper were fit using the lme4 package (Bates et al., 2015) of the software R version 4.0.3 (10 October 2020). Post-hoc pairwise comparisons were run using the R package emmeans (Lenth et al., 2019).

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Appendix

Statistical analysis
Model 1: Accuracy predicted by Group and Condition.
Generalised linear mixed model fit by maximum likelihood (Laplace Approximation) ['glmerMod']
Family: binomial (logit)

Formula: acc ~ group*cond1 + prof + (1 + cond1|ID) + (1|item1)

		acc	
Predictors	Odds Ratios	CI	*p*
(Intercept)	0.28	0.14–0.57	**<0.001**
group[Norwegian]	0.64	0.45–0.92	**0.015**
group[Russian]	0.97	0.67–1.40	0.850
cond.order[agree]	1.18	0.66–2.12	0.581
cond.order[adv]	2.02	1.05–3.87	**0.035**
cond.order[topic]	2.81	1.42–5.56	**0.003**
cond.order[def]	2.83	1.47–5.44	**0.002**
cond.order[DO-pro]	10.97	4.66–25.86	**<0.001**
cond.order[cop]	7.46	3.25–17.17	**<0.001**
Prof	1.11	1.08–1.15	**<0.001**
group[Norwegian]*cond.order[agree]	0.88	0.53–1.45	0.611
group[Russian]*cond.order[agree]	3.31	1.90–5.76	**<0.001**
group[Norwegian]*cond.order[adv]	0.80	0.44–1.44	0.453
group[Russian]*cond.order[adv]	1.69	0.90–3.19	0.105
group[Norwegian]*cond.order[topic]	1.10	0.58–2.08	0.776
group[Russian]*cond.order[topic]	0.99	0.51–1.92	0.976
group[Norwegian]*cond.order[def]	1.86	1.01–3.43	**0.045**
group[Russian]*cond.order[def]	0.22	0.12–0.41	**<0.001**

(*Continued*)

Continued.

Predictors	Odds Ratios	acc CI	*p*
group[Norwegian]*cond.order[DO-pro]	1.44	0.61–3.38	0.404
group[Russian]*cond.order[DO-pro]	0.39	0.17–0.92	**0.031**
group[Norwegian]*cond.order[cop]	2.12	0.92–4.90	0.078
group[Russian]*cond.order[cop]	1.41	0.59–3.33	0.439

Post-hoc pairwise comparisons of groups within conditions (with adjusted alpha levels).

$emmeans Group	emmean	SE	df	asymp.LCL	asymp.UCL
cond.order = gen:					
Bilingual	0.5713	0.212	Inf	0.157	0.986
Norwegian	0.1279	0.166	Inf	−0.197	0.453
Russian	0.5357	0.173	Inf	0.197	0.874
cond.order = agree					
Bilingual	0.7367	0.217	Inf	0.310	1.163
Norwegian	0.1625	0.167	Inf	−0.165	0.490
Russian	1.8976	0.201	Inf	1.504	2.291
cond.order = adv					
Bilingual	1.2734	0.253	Inf	0.777	1.769
Norwegian	0. 6048	0.174	Inf	0.264	0.946
Russian	1.7631	0.210	Inf	1.352	2.174
cond.order = topic					
Bilingual	1.6053	0.269	Inf	1.079	2.132
Norwegian	1.2546	0.192	Inf	0.878	1.631
Russian	1.5595	0.202	Inf	1.164	1.955
cond.order = def					
Bilingual	1.6120	0.254	Inf	1.115	2.109
Norwegian	1.7915	0.194	Inf	1.411	2.172
Russian	0.0784	0.169	Inf	−0.252	0.409
cond.order = DO-pro					
Bilingual	2.9667	0.380	Inf	2.223	3.711
Norwegian	2.8869	0.269	Inf	2.360	3.414
Russian	9.9991	0.233	Inf	1.543	2.455
cond.order = cop					
Bilingual	2.5814	0.365	Inf	1.867	3.296
Norwegian	2.8907	0.276	Inf	2.350	3.431
Russian	2.8860	0.282	Inf	2.333	3.439

Results are given on the logit (not the response) scale.
Confidence level used: 0.95.

$Contrasts Contrasts	estimate	SE	df	z_ratio	*p*.value
cond.order = gen:					
Bilingual − Norwegian	0.44334	0.183	Inf	2.424	0.0407
Bilingual − Russian	0.03554	0.188	Inf	0.189	0.9805
Norwegian − Russian	−0.40779	0.136	Inf	−3.003	0.0075
cond.order = agree					
Bilingual − Norwegian	0.57416	0.191	Inf	3.011	0.0073
Bilingual − Russian	−1.16090	0.218	Inf	−5.333	<.0001
Norwegian − Russian	−1.73506	0.171	Inf	−10.155	<.0001
cond.order = adv					
Bilingual − Norwegian	0.66854	0.233	Inf	2.864	0.0117
Bilingual − Russian	−0.48975	0.258	Inf	−2.896	0.1399
Norwegian − Russian	−1.15829	0.185	Inf	−6.250	<.0001
cond.order = topic					
Bilingual − Norwegian	0.35074	0.259	Inf	1.352	0.3663
Bilingual − Russian	0.04580	0.268	Inf	0.171	0.9840

(*Continued*)

Continued.

$Contrasts Contrasts	estimate	SE	df	z_ratio	*p*.value
Norwegian − Russian	−0.30493	0.192	Inf	−1.589	0.2504
cond.order = def					
Bilingual − Norwegian	−0.17954	0.247	Inf	−0.728	0.7469
Bilingual − Russian	1.53359	0.232	Inf	6.622	<.0001
Norwegian − Russian	1.71313	0.165	Inf	10.373	<.0001
cond.order = DO-pro					
Bilingual − Norwegian	0.07984	0.392	Inf	0.204	0.9774
Bilingual − Russian	0.96762	0.385	Inf	2.514	0.0320
Norwegian − Russian	0.88778	0.272	Inf	3.262	0.0032
cond.order = cop					
Bilingual − Norwegian	−0.30931	0.381	Inf	−0.812	0.6956
Bilingual − Russian	−0.30457	0.392	Inf	−0.777	0.7173
Norwegian − Russian	0.00474	0.304	Inf	0.016	0.9999

Results are given on the log odds ratio (not the response) scale.
P value adjustment: tukey method for comparing a family of 3 estimates.