



**UiT** The Arctic University of Norway

Faculty of Humanities, Social Sciences and Education

## **Crosslinguistic Influence in Third Language Acquisition**

Acquisition of an artificial language by Persian-English bilinguals

Parisa Nazari

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# Dedication

\* To my adorable partner and my lovely family and friends for their boundless love and support \*

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## Abstract

**Aims and objectives:** This thesis investigates the role of the previously acquired languages, Persian and English, in the acquisition of morphosyntax of an artificial language (AL) at the very early stages of third language acquisition (L3A). The main objective of the study is to ask how lexical and syntactic similarities between the L3 and previously acquired languages affect crosslinguistic influence (CLI) at the very beginning of L3 acquisition.

**Methodology:** The study compared two groups of Persian-English bilingual L3 learners who were exposed to an artificial language with varying degrees of syntactic similarity to their L1 and L2. However, the study kept the participants' pre-existing languages constant. They were tested on V3 (grammatical in both languages) vs. Adjective-Noun (Adj-N)/Noun- Adjective (N-Adj) word order which differs between the two languages.

**Data and analysis:** The forced-choice AJT data was analyzed in RStudio, R version 4.1.2 (R Core Team, 2022). The lme4 R package (Bates et al., 2015) was used to fit a mixed-effects binomial logistic regression model to the data. The response variable was the forced choices (N-Adj or Adj-N) and the predictor variables were Group (A: English-Persian syntax and B: Persian syntax), English Proficiency Test (EPT) Scores and Age of onset in learning English (AoO). Participants' ID and Items were added as the random intercepts.

**Findings and conclusion:** The findings indicate that although there was a discernible pattern in the expected direction (it was anticipated that Group B, who were exposed to the Persian syntax, would choose the N-Adj word order more frequently than Group A.), the impact did not attain statistical significance, possibly due to significant variability of participants. Furthermore, the study revealed a fact about the AoO and critical item scores, in which the later the participants started learning English, the more likely they were to activate their Persian word order and they chose N-Adj (Persian syntax) word order.

**Significance:** This study adds to the existing data on the acquisition of an artificial language and contributes to the ongoing discussions on the role of multilingualism.

**Keywords:** Artificial language learning, Cross-linguistic influence, Third language acquisition, LPM, TPM.

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## List of Abbreviations

2L1 Simultaneously acquired first languages

ACC accusative

AoO Age of onset (in learning English)

Adj-N adjective-noun word order

AJT Acceptability judgment task

AL Artificial language

CEM cumulative enhancement model

CLI cross-linguistic influence

DEF definite

Eng English

EPT English proficiency Test

EZ ezafe

INDF indefinite

L2 second language

L2A second language acquisition

L2SF second language status factor

L3 third language

L3A third language acquisition

LPM linguistic proximity model

N-Adj noun-adjective word order

Per Persian

SG singular

SOV Subject-Object-Verb

SV subject-verb word order

SVO Subject-Verb-Object

TPM typological primacy model

V2 verb second word order

V3 verb third word order

UG universal grammar

# 1 Introduction

As the area of language acquisition progresses, with a particular focus on surpassing the field of bilingualism research, there are still uncertainties regarding the effective acquisition of a third or more languages by individuals. Particularly, the precise impact of Cross-linguistic Influence (CLI) during the initial phases of adult language acquisition remains unclear. It is evident that adults can attain an exceptional level of proficiency in learning an extra language, as evidenced by the vast migrant communities worldwide where individuals achieve fluency even in their later years. Therefore, it is worth questioning how much a person's existing bilingualism can aid or impede their acquisition of a third language. Additionally, how does it influence the initial phases of language learning?

The area dedicated to researching third language acquisition (L3A), especially in the domain of morphosyntax, is still in its early stages and encounters a distinctive challenge obtained from bilingualism research – the possibility of multiple sources of CLI. Rothman et al. (2019) elaborate on how this challenge has been addressed in various previous studies and proposed models, which will be further explored in Chapter 2. In general, these models can be classified into two categories: order of acquisition models, which prioritize the sequence of acquisition in identifying the source of influence, and structural/typological models, which contend that the source of influence is rooted in the structural or typological likeness between the third language and either of the two previously acquired languages.

In second language (L2) acquisition, identifying the source of crosslinguistic influence (CLI) is straightforward as there is only one potential candidate – the individual's first language (L1). Establishing the origin(s) of influence in third language (L3) acquisition is a more intricate undertaking as they could arise from the L1, the L2, or both pre-existing grammars. Currently, there is a lack of agreement among L3 models regarding whether learners opt for a primary or exclusive source of influence, which requires the inhibition of one of the pre-existing grammars for a brief period, or whether they have access to both previously acquired languages as sources of influence throughout the entire acquisition process. Another concern is whether the learners' (unconscious) decisions are influenced by the linguistic resemblance between the L3 and the languages acquired previously. If that is the case, the question arises as to how learners ascertain whether the L1 or the L2 bears greater similarity to the L3.

The goal of this study is to outline an artificial language (AL) learning experiment that offers new perspectives on the comparative impact of lexical and syntactic resemblances between an

artificial L3 and pre-existing grammars. By utilizing an AL, the initial encounter with an L3 and the ability to exercise full control over the stimuli is examined. Moreover, the study will isolate the effects of CLI by assessing the learning of a linguistic representation that the participants have not previously encountered in their L3. Another advantage of employing an artificial or constructed language as the research medium is that it enables a researcher to conduct studies while controlling for prior knowledge and exposure to the target language and provides a unique opportunity to control the variables of the third language being acquired. This level of flexibility permits a precise concentration on aspects of CLI that would otherwise have too many variables to investigate in a concise manner and with reproducible and verifiable outcomes. As language is a human phenomenon and therefore inherently variable, the capacity to control for variables is an invaluable tool accessible to the language research community.

In this study, an AL is used to facilitate research on CLI in the earliest phases of L3A among Persian-English bilinguals, as part of a quantitative study encompassing 80 participants. All participants speak Persian as their L1 and English as their L2, and with the aid of an AL, the current study is equipped to examine the very beginning phase of L3A and the way in which CLI interacts with the process of acquiring morphosyntax.

This thesis is structured as follows: the next chapter (chapter 2) introduces the theoretical background, including the models of L3A and empirical evidence, and discusses cross-linguistic differences in Persian and English. Chapter 3 outlines the study's design, research questions, and corresponding predictions. Moreover, the results of a pilot study that was conducted prior to the main study are presented in detail. Chapter 4 presents the study's results along with the statistical analysis, while chapter 5 discusses the study's findings which are then followed by the limitations and recommendations for future research discussed in Chapter 6. The last chapter (chapter 7) provides a concise summary and conclusion to this thesis. Finally, the appendices section contains pertinent supplementary information about the study's tasks, including a comprehensive list of all items used for data collection.

## 2 Background

In this chapter, I first discuss the concepts of Cross-linguistic Influence (CLI) and transfer. I then provide an overview of the previous literature in this field and the models that have emerged from it. Also, I discuss the two currently dominant models in the field; the Typological Primacy Model (TPM) and the Linguistic Proximity Model (LPM). Afterwards, I describe a study by Jensen & Westergaard (2022) – in a PhD dissertation by Jensen (2022) – in detail, which is an inspiration for this master thesis. Finally, I explain the differences between the languages involved in the present study – Persian and English, respectively – regarding the properties under investigation – Subject-Verb-Object (SVO) vs. Subject-Object-Verb (SOV) word order, and Adjective-Noun (Adj-N) vs. Noun-Adjective (N-Adj) word order.

### 2.1 Cross-linguistic Influence

As a technical term, grammar can be defined as a collection of linguistic representations. Representation is defined by Sharwood Smith (2019, p.10) as “a network of features expressing some basic structural category”; to be more specific, a linguistic representation contains the syntax, morphology, phonology, semantics, and so on of a particular language in the mind of a speaker. The grammar then consists of the language domains, which are used to parse linguistic input in order to comprehend or produce a certain language. Consider a bi- or multilingual mind in which there are two or more linguistic representations. CLI, which may occur at the lexical, structural, and phonological levels and affect the usage and processing of a language, is defined as the impact one language system has on another language system in the mind or brain (Sharwood Smith, 1983, 1989; Kellerman & Sharwood Smith, 1986). CLI seems to be one of the most significant factors affecting the acquisition of a third language. The term refers to the notion that knowledge of one’s previously acquired language(s) affects the process of learning or using another language (Jessner, 2008).

In the L3 literature, the words CLI and *transfer* are sometimes used interchangeably. Transfer is a “handy metaphor”; however according to Sharwood Smith (2021, p.410), it is a misleading term that has limitations in describing this phenomenon. He continues that the term transfer is inaccurate as it implies that grammatical elements are moved from one language to another, and as a result, the host grammar will deteriorate, but this does not actually occur. Therefore, the term CLI will be used throughout this study, since it is a more comprehensive term than *transfer* and encompasses many types of interference or interactions at both the “product and

process” levels (Sharwood Smith & Truscott, 2014, p.194). Only the models and earlier studies that utilize the term *transfer* are described and discussed using this concept in this research.

In the context of L3A, “product” and “process” refer to similar concepts as in second language acquisition (L2A). “Product” refers to the outcome of language learning, including the learner’s ability to use the third language accurately, fluently, and appropriately. It also encompasses aspects such as the L3 learner’s proficiency level, language use, and communication skills. “Process”, on the other hand, refers to the underlying cognitive and social processes involved in L3 learning, including attention, memory, motivation, and the strategies and techniques that the learner employs to acquire and use the third language. It also includes the interactions between the L3 learner and the language environment, as well as the influence of other languages already known by the learner (e.g., L1 and L2).

Therefore, CLI refers to the impact that previously learned languages (e.g., L1 and L2) may have an impact on the acquisition, processing, and use of the third language, affecting both the final product of the L3 learner’s language ability and the underlying processes involved in L3A.

CLI can be either facilitative or non-facilitative. Positive CLI is said to be facilitative when a feature present in one or both of the background languages shares a significant resemblance with the corresponding structure in the target language. As a consequence, the speaker is able to correctly process the input and speak grammatically in the target language. Non-facilitative (negative) CLI, on the other hand, happens when a structure in one or both previously acquired languages differs from the matching structure in the target language. The speaker may then improperly process the input, resulting in issues with comprehension and production. It should be also mentioned that there is often non-facilitative CLI in production as the learner must use (one) of the previously acquired languages (see Westergaard, 2021b for more details).

## **2.2 Third Language Acquisition**

Third language acquisition (L3A) is a relatively new area of research, and thus much of the existing research in this field builds upon prior studies in the realm of second language acquisition (L2A), with a particular emphasis on research related to CLI. While certain studies delineate L3A as the acquisition of any non-native language(s) after the L2, and therefore,  $L3 = L_n$ , other studies, such as the present investigation, regard L3A to be the process by which learners who have already learned two other languages are in the process of acquiring a third (Perić & Novak Miji, 2017), and hence  $L3 \neq L_n$ .



L3A is studied formally from a variety of linguistic perspectives, including sociolinguistics, psycholinguistics, and generative approaches (Rothman & Cabrelli Amaro, 2009). The field is informed by prior research on L2A (Westergaard et al., 2022), and, like the latter, it intensively investigates the issue of CLI (Arıbaş & Cele, 2021). A critical distinction between CLI investigations in both fields of L2A and L3A is reflected in this scenario by the fact that, whereas L1 transfer is a logical need in L2A, it is not always the case in L3A (Westergaard et al., 2022). Additionally, it is claimed that as the learner's previously acquired languages are interrelated and constitute a dynamic system, the CLI patterns in L3A are fundamentally more complicated than those in L2A (Forys-Nogala et al., 2020).

In light of this, researching successive multilingual acquisition can offer insights into whether (a) the L1 is the primary source of transfer for all subsequent languages learned, (b) The most recent language learnt is chosen as the source language for the future language acquisition (in the present context, the L2 and L3, respectively), or (c) if the acquisition of the multilingual L3 occurs while both the L1 and L2 are equally active (Rothman & Cabrelli Amaro, 2009). As previously stated, the L3A area is primarily committed to research on CLI source, i.e., whether all previously acquired languages impact the L3, or whether just one is chosen as the major or single source of influence (Forys-Nogala et al., 2020; Westergaard et al., 2017). According to this, “the necessity to investigate L3 learning in multilingual situations from many viewpoints is dictated by the number of variables involved and their numerous interactions, making L3 acquisition a very complex phenomenon” (Sanz, 2000, p. 37).

### **2.3 L3 Models and Relevant Previous Research**

Several L3A models have been presented in the last two decades (or so). The primary research questions in these models concerned the origin of CLI, i.e., whether the L1 or L2 is the source of influence, whether CLI is wholesale or property by property, as well as the effects of other variables like the importance of the communication language, typological or structural similarity, etc.

There are various theories in the field of L3A and only a few will be highlighted in the sections that follow. However, the Typological Primacy Model and the Linguistic Proximity Model will receive utmost attention as these will be discussed further in light of the current study.

Other external variables, including the dominant language of communication, may impact the choice of source(s) of influence in L3A. The language of communication is defined as the

language that is more frequently spoken by the subjects in various settings (Fallah et al., 2016, p.226). The early stages of L3A of English possessives by Mazandarani-Persian bilinguals were studied by Fallah et al. (2016). The results revealed that the dominant language of communication is a key factor in CLI source(s) selection in the early phases of L3A. However, the influence of communication language will not be addressed in this study since in-depth data on the participants' language usage were not obtained when data about their linguistic background was collected.

### **2.3.1 The Default L1 Effect**

The L1 Factor makes the case that the L1 should be the language that is thoroughly transferred in the L3A (Hermas, 2010, 2014). According to Hermas (2010, 2014), while the L1 is often considered to be the primary source of transfer, surpassing the impacts of linguistic proximity and psychotypology, both facilitative and non-facilitative transfer can occur. Although no model of L1 involvement in L3A has been presented, certain studies have found significant L1 influence (Jin, 2009; Na Ranong & Leung, 2009; Hermas, 2010, 2015), arguing that since the learners may be more proficient in their L1 and then make it more accessible for transfer, the original language may be the main source of impact in L3A.

In a study by Jin (2009), which provided evidence for L1 influence, the aim was to investigate how advanced L2 English learners from China who were studying at the graduate level in Norway were able to acquire Norwegian objects in L3. Chinese is a topic-prominent language, whereas Norwegian and English are both subject-prominent languages. Thus, Chinese allows null objects, whereas Norwegian and English need a referential pronoun or noun phrase. The findings of a grammaticality judgment and a sentence correction task revealed variation in the rejection of null objects in the L2 and L3. Based on the group results, Chinese learners rejected English null objects with high accuracy (70%). It was also demonstrated that more than half of the participants appraised and corrected English null objects at a native-like level. However, Chinese learners found it difficult to reject the null object sentences in Norwegian, which was evidence of non-facilitation from the L1 (Chinese). Consequently, the researchers concluded that L1 Chinese had a considerable negative effect on L3 learning of Norwegian items, but L2 English had no influence.

Hermas (2010) also examined the L3 verb movement acquisition of adult Arabic-French bilinguals who were L3 English starter learners. An acceptability judgment task and a preference test were used to evaluate the participants' competence of this variable. French and

Arabic are similar as they both include verb movement, but English does not. Adverbs only follow verbs in French. Adverbs are inserted preverbally in English, but they can precede or follow the verbs in Arabic. The outcomes of both tests demonstrated that the accuracy of the L3 learners' English was only adversely affected by their L1 Arabic, and the L3 group was considerably different from the French and English natives. The results were interpreted as evidence for the particular status of the L1 as the main source of influence in early L3 English.

### **2.3.2 L2 Status Factor**

The L2 Status Factor (L2SF) theory suggests that, in contrast to the standard L1 setting, the L2 has a predominance as the source of influence in L3 acquisition (Bardel & Falk, 2007, 2012; Falk & Bardel, 2011). The Declarative/Procedural model of Paradis (2009), on which the L2SF hypothesis is founded, contends that native and non-native grammars are stored in distinct locations in the mind/brain, the former in procedural memory and the latter in declarative memory. In light of the fact that an L3 is acquired in the same manner as an L2, both the L2 and L3 are retained in declarative memory, which makes transfer from L2 to L3 easier than L1 to L3.

Bardel and Falk (2007) looked at the V2 phenomenon. Depending on the points they addressed, German, Dutch, and Swedish are V2 languages among the previously taught languages in this research, however English, Italian, and Albanian are not. The researchers ensured that each participant had one V2 language and one non-V2 language as either their L1 or L2 language. Swedish classes were recorded on video and audio for ten sessions. The results of analyzing the oral data revealed that individuals who had a V2 language as their L2 fared much better in learning either Dutch or Swedish than those who had a V2 language as their L1. The study's findings suggest that the L2 functions as a filter to prevent L1 effect on L3 acquisition.

Falk and Bardel (2011) provided more evidence supporting the L2SF model in the investigation of object pronoun placement in L3 German. In the experiment, intermediate-level L3 learners were divided into two groups: one consisted of L1 English – L2 French speakers, and the other group was made up of L1 French – L2 English speakers, with the aim of comparing their performance. English and German share a similar structure in main clauses, where object pronouns are positioned after the verb. On the other hand, German and French have a structural similarity in subordinate clauses, as object pronouns are placed before the verb in both languages. The results of the study indicated that the performance of both groups was influenced by their L2. Specifically, participants with L2 French tended to accept object

pronouns in pre-verbal position in both main and subordinate clauses, while participants with L2 English showed a tendency to accept post-verbal object pronouns.

### **2.3.3 Cumulative Enhancement Model**

A change in perspective regarding the influence of previously acquired languages in L3A is denoted by the Cumulative Enhancement Model (CEM) (Flynn et al., 2004). The CEM contends that influence in L3A is selective and can originate from any source as long as it is facilitative, in contrast to the Default L1 Effect and L2SF. This implies that the source of impact can be L1, L2 or both, and that previously learned languages should affect the L3A either positively or have no effect. Thus, a learner first evaluates a specific property in the background languages; if that trait has an equivalent in one of the languages, it is then chosen to transfer. If no equivalent exists, the property is learnt. The CEM is based on research by Flynn et al. (2004), who used an elicited imitation task to examine the effect of L1 and L2 in the acquisition of English restricted relative clauses in three participant groups: L1 Spanish and L1 Japanese learners of L2 English, as well as L1 Kazakh-L2 Russian learners of L3 English. While Kazakh and Japanese are head-final languages, English, Spanish, and Russian are all head-initial. The outcomes revealed that although the L1 Japanese group responded differently, the bilingual group (L1 Kazakh-L2 Russian) and L1 Spanish performed identically. The scientists deduced from this that the bilingual and L1 Spanish groups performed better than the L1 Japanese group with the head-final parameter because they had already learned a language (L1 or L2) with the head-initial parameter. In general, the data revealed that all previously acquired languages can positively enhance the acquisition of a third language, prompting the authors to propose the CEM.

### **2.3.4 Typological Primacy Model**

The Typological Primacy Model (TPM; Rothman, 2011, 2015; Rothman et al., 2010; Rothman et al., 2019) is the next model in the field of L3A. According to the TPM, the initial grammar of the L3 is constructed by the learner by duplicating the whole linguistic structure of the language that is more similar to the target language typologically<sup>1</sup>. According to the Schwartz and Sprouse (1996, p. 41), the Full Transfer/Full Access (FT/FA) model is related to the TPM

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<sup>1</sup> The Full Transfer/Full Access Model by Schwartz and Sprouse (1996, p. 40) in L2 acquisition is expanded upon by wholesale transfer in the TPM in which they argue “the initial state of L2 acquisition is the final state of L1 acquisition (Full Transfer) and the failure to assign a representation to input data will force subsequent restructurings, drawing from options of UG (Full Access).”

in L3A, as both models attempt to explain the order in which languages are learned and the extent to which prior languages affect the acquisition of subsequent ones. The FT/FA model proposes that learners have access to all the linguistic knowledge acquired from previous languages, while the TPM suggests that language transfer depends on the typological similarities between languages. Both models assume that L1 and L2 can affect the acquisition of L3, but they differ in the degree and manner of this influence. The FT/FA model suggests that L1 and L2 knowledge is fully available and transferable to L3, while the TPM predicts that transferability depends on the typological similarity between L1, L2, and L3.

The TPM contends that the source of the effect is determined by the target language's general typological resemblance to one of the previously acquired languages. Therefore, the TPM is similar to the CEM in that the source of the influence can be either L1 or L2, but crucially not both. In contrast to the default L1 effect and L2SF where the sequence of acquisition is crucial, the TPM considers total typological similarity as the source of influence, regardless of whether the impact is facilitative or not. There is empirical evidence from research where the results were evaluated as transfer from a typologically relevant language (e.g., Hopp, 2019). Hopp's (2019) research focused on the acquisition of English as a third language by children who are Turkish-German heritage speakers, as opposed to German monolingual children learning English. The findings of the phrase repetition and oral sentence generation tasks revealed transfer from German in both groups, which was taken as evidence of transfer from the typologically closer language to the target language (English). However, Hopp (2019) noted that L3 learners were more dominant in German than in Turkish, which may influence transfer patterns. Transferring from German may also be due to the fact that English was taught via the language of the majority, German, and students may progressively see parallels between German and English (Hopp et al., 2019).

In 2010, Rothman and Cabrelli Amaro introduced the TPM, which was based on empirical evidence gathered from four different groups of early L2 or L3 learners who were studying either French or Italian. There were four groups included in the study: L1 English-L2 French, L1 English-L2 Italian, L1 English-L2 Spanish-L3 French, and L1 English-L2 Spanish-L3 Italian. It should be noted that the participants consistently had English as their L1 and Spanish as their L2. The research focused on the syntax of null-subjects, which was explored through the use of an AJT and a context/sentence-matching task. According to the findings, as anticipated, the bilingual groups (L1 English-L2 French and L1 English-L2 Italian) were influenced by their L1, English, which was the sole potential origin of cross-linguistic

influence. On the other hand, the trilingual groups (L1 English-L2 Spanish-L3 French and L1 English-L2 Spanish-L3 Italian) were influenced by their L2, Spanish, as per the results. Although the outcome could be accounted for by either an L2 default effect or typological proximity, it is the foundation of the Typological Primacy Model, which was initially introduced in Rothman's (2010) work, albeit not named as such. In the subsequent publication, Rothman employed a mirror-image experimental design to distinguish between the possible impact of an L2 default effect and the consequences of linguistic similarity. To elaborate, Rothman studied the acceptability ratings of various syntactic structures (such as word order preferences in declarative and interrogative clauses and attachment preferences in relative clauses) among L1 Spanish-L2 English and L1 English-L2 Spanish speakers who were learning L3 Brazilian Portuguese. According to the findings, both sets of learners demonstrated patterns consistent with those of native Spanish speakers, implying that linguistic similarity between the L3 and a previously acquired language had a more pronounced effect on CLI than the L2 status.

According to Rothman (2015, p. 184), wholesale transfer is advantageous from a cognitive economy viewpoint since it eliminates the need to compare each characteristic against two highly active languages when it happens all at once. Additionally, inhibition is required in a bilingual mind, among other executive control systems, to restrict the activation of other languages. Therefore, it would be more effective to transfer grammars entirely based on general typological similarities between the target language and other grammatical systems. However, other TPM studies (such as Rothman, 2015; Rothman et al., 2019) demonstrate that property-by-property transfer is indeed feasible (both prior to and after wholesale transfer), especially in L4 acquisition, since "L3 experiences of non-facilitation might very well mean that full transfer will be disregarded as a viable option when the mind is an experienced multilingual one." (Rothman et al., 2019, p.157). Thus, structural similarity is a deterministic component in evaluating typological similarity.

What factors does the parser consider when determining typological similarity? Rothman (2013, p.238) presented a property hierarchy via which the parser finds typological/structural similarity. The following list of the hierarchy's relative impact/influence is presented in order:

1. Lexicon
2. Phonology/Phonotactics
3. Functional Morphology
4. Syntactic Structure

This property hierarchy allows the parser to determine which attribute is most similar to one of the previously learned languages in order to choose a source of influence. If similarity at one level is insufficient for CLI, the parser will move on to the next level, and so on.

### **2.3.5 Linguistic Proximity Model**

The Linguistic Proximity Model (LPM; Westergaard et al., 2017; Westergaard, 2019) is similar to the TPM but varies in some areas. The LPM views transfer as a phenomenon that occurs property by property and allows for both facilitative and non-facilitative impact, with the source of influence being either one or both of the previously acquired languages. Furthermore, this theory asserts that CLI happens when a linguistic property in the target language and a property in the background languages share an abstract structural resemblance. Based on Slabakova (2017), the LPM can be characterized as a structural model, similar to the TPM. However, it differs from the TPM and other models discussed previously in that it does not support the concept of complete transfer. This view is also shared by the Scalpel Model<sup>2</sup>. Westergaard (2021b) continues by arguing that overall typological/lexical similarity may override structural similarity at early stages. All preceding grammars are active and available to the learner in L3A, as stated by the LPM; nevertheless, “... the typological/lexical similarity between the L3 and one of the previously acquired languages will cause stronger activation of the syntactic structure of this particular language” (Westergaard, 2021b, p.6). Thus, facilitative influence results from structural similarity, while non-facilitation results from misanalysis of L3 input, leading the learner to build structures that are not target-like. Additionally, property-by-property transfer is a more effective cognitive process, according to Westergaard et al. (2017, p.670), since “this would lower the amount of effort necessary to unlearn wrongly transferred properties”. Further elaborating, Westergaard (2019, p. 393) clarifies that it is impossible to determine if transferring a complete grammar only once is cognitively more efficient than transferring little amounts repeatedly.

The LPM was initially introduced in a research study (Mykhaylyk et al., 2015; Westergaard et al., 2017) that compared a group of 2L1 Russian-Norwegian bilingual L3 English learners with two groups of L2 English speakers whose L1s were Norwegian and Russian (aged between 11-14). The bilingual participants were classified as either simultaneous bilinguals or early sequential bilinguals. The research gathered assessments of acceptability regarding two

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<sup>2</sup> Both the LPM and the Scalpel Model, which Slabakova (2017) suggested, assume that L3 acquisition is a cumulative process and that transfer occurs property-by-property. Structure similarity is a driving element for CLI in both models. The Scalpel Model is not discussed in this study because of these similarities.

syntactic structures in English: Adverb-Verb (Adv-V) word order in subject-initial declarative clauses, and Subject-Auxiliary (Aux-S) inversion in interrogative clauses. The former constitutes a correspondence between English and Russian, whereas the latter constitutes a correspondence between English and Norwegian. According to the outcomes, the Russian-Norwegian speakers exhibited notably greater accuracy in the Adv-V word order condition compared to the Norwegian speakers. However, they were also significantly less accurate than the Russian speakers. The authors explained this pattern of behaviour as resulting from the simultaneous presence of facilitative and non-facilitative CLI from both Russian and Norwegian in L3 English, which was activated by structural matches or mismatches between English and the previously learned grammars.

Recent LPM work (Westergaard, 2019; 2021a; 2021b) has defined CLI as the outcome of co-activation of previously acquired grammars (to varying degrees based on structural similarity) in order to parse L3 input. The parser has access to all of the earlier grammars during this procedure. Full Transfer Potential (FTP) then contends that “everything may transfer”, not that “everything does transfer”, by stressing property-by-property transfer (Westergaard, 2019, p.389). As a result, the parser evaluates the L3 input using the features of the previously learned languages, which are engaged concurrently, to produce a representation that is unstable and weak at first, but will strengthen with more input and parsing.

A series of other studies conducted by Stadt et al. (2016, 2018, 2020), Dahl et al. (2021, 2022), as well as Kolb et al. (2022) have provided further evidence for the property-by-property influence in L3A in line with the LPM and the Scalpel model.

Stadt et al. (2020) examined the extent to which language transfer from the L2 into the L3 can be affected by language combinations, considering L3 German and L3 French while maintaining a constant L1 (Dutch) and L2 (English). The property under investigation was verb placement in declarative root clauses, specifically focusing on V-to-T movement, where the finite verb moves to T in French but not in English, and V-to-C movement, which follows the V2-rule in Dutch but not in French. The article compared the previous studies’ results by Stadt et al. (2016, 2018) that indicated a significant supportive effect of L2 English on L3 French, with another L3 language – L3 German. For instance, in Stadt et al. (2018), the results showed that in the first year of learning French, L3 learners transfer a considerable amount from L1 Dutch, which significantly decreases in the subsequent years. Additionally, L2 English is less activated in the early stages of L3 learning, but its impact increases and remains consistent in later years. The research was conducted in a setting among third-year bilingual stream students



in the intermediate stages of L3 learning. Data were collected through the utilization of a gap-filling and a grammaticality judgment task. The impact of L2 through the V-to-T movement construction present in Dutch, French, and German but absent in English was identified. The study aimed to answer the research question of whether the role of L2 English in L3 German is similar to its role in L3 French, and it was discovered that the role of L2 English in intermediate learners of L3 German is significantly less compared to its role in L3 French, which can be attributed to the perceived typological and structural similarity between L1 Dutch and L3 German. They concluded that at the early stages there is a strong influence from Dutch in French, but at somewhat later stages, when their proficiency in English is higher, there is more influence from English.

Dahl et al. (2021, 2022) explored how L1 speakers of Norwegian with English as their L2 acquire verb movement in either L3 French or L3 German. The first study (Dahl et al. 2021) examined a group of high-school students (n=112) aged between 16 and 17 years, as well as a group of university students (n=12) with a mean age of 21 years. The high-school students were at different stages of French studies, ranging from their first to fifth year. The students carried out acceptability judgment tasks in both their L2 and L3. The findings did not suggest that either language had a special status in terms of transfer. Instead, there were indications that both previous languages might have an impact on the learning of French as a third language (L3). According to their argument, the presence of similar surface word order in both the prior languages and French could lead to non-target transfer in the L3. Additionally, they found that better proficiency in the second language (L2) was linked to reduced evidence of L2 transfer in the L3. The second study (Dahl et al. 2022) involved high-school students who were in their first, second, fourth, and fifth year of learning German. The participants carried out tasks to assess acceptability in both their third language (L3) German and their second language (L2) English. The findings indicated that the earliest learners did not exhibit a distinct preference for either V2 or non-V2 in German. However, as their language development progressed, they showed an inclination towards more native-like intuitions. The researchers found no evidence to suggest that achieving native-like judgments in L2 English was linked to an increase in transfer from L2 to L3 for a specific structure. Additionally, they observed that higher proficiency in L2 did not necessarily result in more transfer from L2 to L3.

Kolb et al. (2022) conducted a study where they looked at the English language proficiency in a group of 10-12-year-old children who spoke Russian and German as 2L1 and were learning English as their L3. They compared this group to two other groups of children who spoke

German or Russian as their L1 and were learning English as their L2. The study discovered simultaneous facilitative and non-facilitative crosslinguistic influence in L3 English from both the more lexically comparable language (German) and the more distant language that has a specific feature with the L3 (Russian). Based on these findings, The authors concluded that the influence of fine-grained structural similarities in the L3 input is more significant in CLI than the overall structural similarity between the L3 and pre-existing grammars.

## 2.4 An Overview on the Effect of Linguistic Similarity in L3A

In Jensen (2022), the first article (Jensen & Westergaard, 2022) examined the relative effect of lexical and syntactic similarities between an L3 and pre-existing grammars on very early learners of an artificial L3. In other words, this question was addressed: “How do lexical and syntactic similarities between the L3 and previously acquired languages affect CLI at the very beginning of L3 acquisition?” (Jensen & Westergaard, 2022).

They investigated four groups of L3 learners whose target AL differed in lexical and syntactic similarities to the participants’ L1 and L2, while keeping the individuals’ pre-existing languages unchanged. This modification allowed them to explore the effect of input variation. They used a within-groups experimental design to examine four groups of L1 Norwegian-L2 English sequential bilinguals (N = 120) ranging in age from 16 to 72 (M = 25.73, SD = 13.70). The participants’ knowledge of languages other than Norwegian and English was either non-existent or limited, and their L2 age of onset (AoO) ranged from 5 to 12. The participants were randomly divided into one of four L3 groups, known as Languages A-D. Languages A and B had lexical parallels to Norwegian and English, respectively, but there was no difference in syntactic input since the participants were exposed to Subject-Verb-Object (SVO) word order, which both English and Norwegian possess. Examples 1 and 2 illustrate SVO word order in Norwegian, English, and the artificial L3s.

The lexico-phonotactic input in Language C was based on Norwegian, while the syntax was based on English, and vice versa in Language D, as shown in (2-a) and (2-b). More particularly, the learners were exposed Language C learners to do-support, as demonstrated in (3). As shown in (4), this is available in English but not in Norwegian (5).

(1) *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. (Jensen, 2022)

(2) *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.’ (Jensen, 2022)

(3) *Do-support in Language C*

Ej **do neit beudro** knurk.

I do not like grapes.

‘I do not like grapes.’ (Jensen, 2022)

(4) *Do-support in English*

I **do not** like grapes. (Jensen, 2022)

(5) *Negation in Norwegian*

Jeg **liker ikke** druer.

I like not grapes

‘I do not like grapes.’ (Jensen, 2022)

Jensen and Westergaard (2022) provided post-nominal possessives to Language D learners, as demonstrated in (6). This structure appears in Norwegian, as demonstrated in (7a), but it is incompatible with English pre-nominal possessives, as shown in (7b).

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

**Thamey miz** ef Manene.

Name.DEF my is Manene

‘My name is Manene.’ (Jensen, 2022)

(7) *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.

(Jensen, 2022)

Following the exposure to one of the artificial languages, Jensen & Westergaard (2022) tested the participants’ preferences for word order in the L3 using a forced-choice acceptability judgement task (AJT). The learners had to select between two non-subject-initial declarative clauses that varied between adverbial-verb-subject (referred to as XVS) and adverbial-subject-verb (XSV) word order, as shown in (8). Importantly, before the AJT, the participants had not encountered non-subject-initial declaratives in the L3.

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

On Monday eat I apples

‘On Mondays I eat apples.’

(Jensen, 2022)

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

On Monday I eat apples

‘On Mondays I eat apples.’

(Jensen, 2022)

In non-subject-initial declaratives, English and Norwegian have different word orders, with the verb moving to the second position in Norwegian main declarative clauses (XVS; Vikner, 1995; Westergaard & Vangsnes, 2005). This is exemplified in (9a). In contrast, in English, the verb remains in the verb phrase, resulting in XSV word order. This is exemplified in (9b)<sup>3</sup>. The mismatch allowed the authors to identify the source of the subjects’ crosslinguistic effect.

(9) *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.

(Jensen, 2022)

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<sup>3</sup> Although English is not regarded a V2 language in the same way as Norwegian is, the verb nonetheless appears in the second place in some structures, such as *wh*-questions (Rizzi, 1996) and declaratives with informationally light verbs (Westergaard, 2007).

When the lexical items were based on English instead of Norwegian, Jensen & Westergaard (2022) discovered a statistically significant main effect of Lexicon, which demonstrated that XVS word order selections (i.e., Norwegian-like syntax) occurred less frequently. Additionally, they discovered a significant interaction between the variables Lexicon (*Norwegian-based or English-based*) and Congruency between the lexical and syntactic cues in the L3 input (*incongruent or congruent*), demonstrating that participants chose more V3 (the verb occurs in the third position) when the syntactic input had English-like syntax, in this case *do-support*, as opposed to when the syntactic input was neutral. To put it another way, the participants did not exhibit selective transfer from English, which has greater lexical similarities, as would have been predicted if wholesale transfer had occurred at the time of testing or if the L2 had been chosen as the source of influence by default. This demonstrates that, as suggested by property-by-property models of L3 acquisition, the pattern of the L3 input determines the trajectory of CLI and that lexical and syntactic signals in the input may contribute to this.

Furthermore, when the syntactic input was based on Norwegian (post-nominal possessives), Jensen & Westergaard (2022) did not notice an increase in V2 word order selections to the same degree that they saw when the input had *do-support*. This might reflect that the exposure to Norwegian-like syntax has little to no effect on the influence of other languages. Possible reasons include lexical signals being more significant than syntactic clues, a foreign/L2 status effect, or learners having a general preference for unmarked English word order. However, none of these hypotheses fully account for the participants' behaviour. In other words, if CLI was exclusively determined by lexical cues, the influence of *do-support* would not be observed, resulting in no interaction effect. Also, if the source was determined by a foreign/L2 status effect or a general preference for the unmarked word order, they should not observe the strong impact of exposure to a Norwegian-based lexicon when only the lexicon revealed an L1/L2-L3 match.

## **2.5 Crosslinguistic Differences in Persian and English**

English is classified as a Germanic language, but Persian is considered as an Indo-Iranian language with a completely separate script and writing system. There are structural differences between English and Persian, namely in the Subject-Verb-Object (SVO) vs. Subject-Object-Verb (SOV) word order and adjective placement, which cause these two languages to act

differently in the linguistic properties under investigation, and this is the reason why I have chosen these properties for the investigation. Another reason behind selecting these specific properties is that they are considered to be problematic and may cause challenges for Persian L2 learners of English. There are previous research studies for the properties under investigation, showing that they cause difficulties for Persian L2 learners of English (Abdollahi Dehooei, 2022; Gholami, 2020; Rajabi, 2022).

In the remainder of this section, the grammar of the above language properties in both languages will be described in detail.

### **2.5.1 Subject-Verb-Object (SVO) vs. Subject-Object-Verb (SOV) word order**

Persian and English exhibit mismatching word orders in main declarative clauses with Subject-Verb-Object (SVO) vs. Subject-Object-verb (SOV) word order. In English, the verb precedes the noun, resulting in (SVO) word order, as shown in (10). As for Persian, although the word order in spoken Persian is quite flexible, the written language has a rigid (SOV) word order, in that the finite verb follows the subject, as exemplified in (11).

(10) Emma eats apples.

S    V    O

(11) Emma    sib    mikhoræd.

S            O            V

Emma    apples    eats.3SG

‘Emma eat apples.’

As previously mentioned, Persian is typically categorized as a pro-drop language with SOV (subject-object-verb) word order. The subject of the sentence usually comes at the beginning of a sentence and a direct or indirect object also follows the subject. Furthermore, an adverb expressing time or location follows the indirect object, and lastly, the verb appears at the end of the sentence (Gholami, 2020). According to Ramsay, Ahmed, and Mirzaiean (2005), Persian word order is SOV, but because it is so flexible, it may also be thought of as a free word order. However, despite how flexible the word order appears to be, many forms are not grammatically correct. These structures are often identified as either unacceptable or ungrammatical structures, although they may be intuitively understood by L1 Persian speakers. The Persian language is less ambiguous because of the accusative (ACC) markers. Additionally, affixes can

be used to explain the verb's tense and subject(s). Lexical verbs are usually followed by auxiliary verbs.

Izadi and Rahimi (2015, pp. 38,39) examined the word order of English and Persian according to Dabirmoghaddam (2001) and Dryer (1992). They investigated 26 orders for their study and identified some discrepancies between word order of these two languages including “relative clause, want and verb, content verb, auxiliaries, adverbial subordinator, and declaratives”. Example (14) demonstrates an example of Persian word order that is relevant to this study.

(14) Diruz            Pedær    be    dokhtær-æsh    yek kif    dād.  
 Adv                    S            Prep                    IO                    DI                    V  
 Yesterday    father    to    daughter.her    a bag    gave.3SG  
 ‘Father gave a bag to her daughter yesterday.’

In contrast, English is a subject-verb-object (SVO) language, as discussed before, which means that the verb has a fixed position in the sentence and always comes after the subject. So, the sentences (b) in the example (15) and (16) will be ungrammatical in English.

- (15) a. The father gave a bag to her daughter.  
 b. \*Gave the father a bag to her daughter.

- (16) a. The father gave a bag to her daughter.  
 b. \*The father, a bag to her son, gave.

### 2.5.2 Adjective Placement

In English, adjectives precede the noun, resulting in Adjective-Noun word order, and adjectives have the same form for definite, indefinite, singular and plural nouns, as in example (17a-d).

- (17) a. A green apple  
           Adj    N  
 b. Green apples  
           Adj    N  
 c. The green apple  
           Adj    N  
 d. The green apples  
           Adj    N

Persian, on the other hand, behaves differently from English in that adjectives follow a noun, resulting in Noun-Adjective word order. Adjectives maintain their original form across different types of nouns (singular or plural, definite or indefinite) in Persian, and nouns are linked to adjectives by adding Ezafe (-e) as can be seen in example (18a-c).

(18) a. Yek     sibe     sæbz  
         INDF apple.EZ green  
         ‘a green apple’

b. Sibe            sæbz  
         apple.EZ green  
         ‘the green apple’

c. sibhāye sæbz  
         apple.EZ green  
         ‘the green apples’

In general, the Adj-N word order patterns between these two languages showing the contrast in relation to the placement of adjective, i.e., English has prenominal adjectives and Persian has postnominal adjectives.

## 2.6 Chapter Summary

This chapter first introduced the study’s central notion, cross-linguistic influence, a phenomenon in which the grammar of one language influences the grammar of another, and then detailed the existing models and theories in this topic. These models concentrated on the factors that may be used to identify the source of CLI.

In my opinion, the TPM and LPM are currently the two most promising and dominant models in the field of L3A. Although there are studies that support these ideas, they cannot both be true. The Default L1 Effect and L2SF presume a dominant role for either L1 or L2 to be the exclusive source of CLI.

There are several studies that support non-facilitation, however the CEM does not take this influence into consideration. Puig-Mayenco et al. (2018) discovered in a comprehensive evaluation of 71 L3 investigations that the Default L1 Effect and L2SF account for only 14.1% and 28.2% of the data, respectively. Last but not least, the TPM is a model that is restricted to the early stages and cannot forecast the later phases, but the LPM can predict any stage of L3A.



Thus, the LPM and, to a lesser extent, the TPM will be included in the current study's analysis. On the other words, the L2SF and the Default L1 Effect argue that the sequence of acquisition affects the choice of CLI source. The L2SF asserts that the L2 is a more accessible source for CLI, contrary to the Default L1 Effect, which holds that the first language has a dominant role in influencing the target language. Both ideas are supported by empirical data that suggests that either L1 or L2 might be the origin of CLI. The two major theories, TPM and LPM, however, presuppose that the order of acquisition is not as fundamental as other factors. The parser chooses a language (L1 or L2) that is typologically more similar to the target language to be the only source of CLI based on the TPM's introduction of a hierarchy of features. According to the LPM, CLI arises from the co-activation of prior grammars, and the selection of the source of CLI is determined by how closely a specific language feature in the prior grammars matches a feature in the target language.

The article by Jensen & Westergaard (2022) was then explained in which it studied a within-groups experimental design. Four groups of L1 Norwegian-L2 English sequential bilinguals were used, and the four L3s, referred to as languages A-D, were randomly allocated to the participants. The participants were exposed to the Subject-Verb-Object (SVO) word order, which is shared by both English and Norwegian. Languages A and B had lexical similarities to Norwegian or English, respectively, but the syntactic input did not reveal a similarity to one previously acquired language over the other. Language C had lexico-phonotactic input based on Norwegian and syntax based on English, and vice versa in Language D. They exposed the Language C learners to do-support in more detail and Language D learners were exposed to post-nominal possessives which conflicts with English pre-nominal possessives.

Finally, the syntactic distinctions between Persian and English were explored in detail, in which they differ in the adjective placement and Subject-verb-object word order. Table 1 summarizes the properties under investigation in both languages.

**Table 1.** *Summary of the properties*

Language Properties	English	Persian
SVO word order	VO	OV
Adjective placement	Adj-N	N-Adj

In the following chapter, I present the research questions and hypotheses that are based on the models covered in this chapter. I then go over the research concept, give specifics on the methods, and briefly touch on the pilot study.

### **3 Research Questions and Methodology**

In this chapter, the research questions and predictions for the current study are described and the methods and procedures are presented. In section 3.1, the research questions that the current study is aiming to find answers to as well as the hypothesis and predictions based on previous research are described. Then, in section 3.2, the methodology is presented that is followed by section 3.3 which explains about the paradigm of learning an AL which includes the definition of an AL as well as the answer to this question that whether AL learning reflects the process of natural language acquisition. Afterwards, in section 3.4 the participants of the present study are discussed. Section 3.5 discusses the general proficiency test and a background questionnaire regarding the participants' age and language use. Then, section 3.6 presents the main experiment including the materials, the utilized method which is a forced-choice AJT, and the procedure of the study in detail. Finally, section 3.7 presents the pilot study which was carried out prior to the main test.

#### **3.1 Research Questions and Predictions**

The current study investigates CLI 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 L3A. Persian-English bilinguals are exposed to two types of artificial languages that vary in syntactic crossover, but which are similar to English with respect to phonology and lexicon. I refer to the artificial languages as Languages A and B. Both languages are lexically and phonotactically based on English. The two languages vary in that for language A, the participants are exposed to non-subject initial declaratives, where English and Persian have the same word order (XSV), hence the syntactic input does not demonstrate a resemblance to one previously acquired language over the other. Language B, on the other hand, reveals a syntactic similarity to Persian.

The study addresses the following main research question:

How do lexical and syntactic similarities between the L3 input and previously learned languages influence L3 learners' preferences for word order at the very early stages of L3 learning?

In other words, what factor is the most important one at early stages? Is it just lexical/phonological similarity or does syntactic similarity also play a role at the early stages?

I build the study based the following three hypotheses (Hs) inspired by Jensen & Westergaard (2022, p.105 and 106):

- H<sub>0</sub>: There is no relationship between L3 and L1/L2 similarities and word order preferences.
- H<sub>1</sub>: Word order preferences and **lexical similarity** between the L3 and the L1/L2 are related.
- H<sub>2</sub>: Word order preferences and **syntactic similarity** between the L3 and the L1/L2 are related.

These hypotheses build upon the claim that participants will be tested on the word order that they haven't been taught or been exposed to before. According to the assumptions of the LPM and CEM, the behaviour of participants would vary based on the type of L3 they are exposed to. However, the TPM model diverges from these assumptions and predicts that the source of CLI is dictated by lexical cues. Therefore, all three models would suggest rejecting the H<sub>0</sub>. If wholesale transfer based on lexical input has occurred, then I would expect to see behaviour consistent with H<sub>1</sub>. Conversely, if behaviour aligns with H<sub>2</sub>, this would suggest that wholesale transfer has not taken place. Thus, the LPM and the TPM would diverge on H<sub>2</sub> – the LPM would predict that at very early stages, lexical similarity would play a role – and probably be stronger than syntactic similarity at that stage, and the TPM would reject H<sub>2</sub>. Additionally, behaviour that corresponds to H<sub>2</sub> would also support the notion of a property-by-property account of L3 acquisition.

Based on the LPM theory, it is predicted that lexical and syntactic similarities between the L3 input and previously learned languages will influence L3 learners' preferences for word order at the very early stages of L3 learning. This is because L3 learners will tend to rely on their prior linguistic knowledge and transfer the word order patterns they are familiar with from their L1 and L2 to their L3. This can lead to a preference for word orders that are more similar to their previously acquired languages, and it would be presumably easier to learn something for which the learners have a similar structure in one of their previous languages.

To state it differently, when L3 learners are exposed to new input, they will tend to use their prior linguistic knowledge as a kind of “mental map” to help them make sense of the new input. This can manifest in several ways, one of which is in their word order preferences. Because L3 learners already have experience with word order patterns from their L1 and L2, they may transfer these patterns to their L3. For instance, if a learner's L1 is English and their L2 is French, both of which have subject-verb-object (SVO) word order, they may tend to use SVO word order when learning their L3, even if the L3 has a different word order pattern such as

subject-object-verb (SOV). This may make it more difficult for the learner to fully acquire the word order patterns of their L3 and may lead to errors or inconsistencies in their speech and writing.

## **3.2 Methodology**

The methodology in the current study is inspired by Jensen & Westergaard (2022) and Stevens (2021). These two studies aimed to test the role of previously acquired languages, Norwegian and English, in the acquisition of morphosyntax of an AL at the early stages of L3A. What I have done in this study was to replace Norwegian language, in Jensen & Westergaard (2022), with Persian language as the learners' L1 and English as their L2.

Section 3.3 provides an overview on the paradigm of learning an artificial language.

## **3.3 The Artificial Language (AL) Learning Framework**

The approach to learning artificial languages involves exposing learners to a precisely crafted language that is tailored to examine various aspects of how humans acquire natural languages. According to Ettliger et al. (2016, p. 2), an experimental paradigm for AL learning can be described as follows: "...participants learn a language, or language-like system, in a lab setting and are then tested on what they learned." I utilized this approach to explore inquiries concerning CLI in the acquisition of a third language (L3). In my case, the laboratory setting referred to by Ettliger et al. was substituted with a web-based version of the experiment, as it enabled me to recruit a larger participant pool than would have been feasible in a face-to-face condition (due to the time and distance limitations), resulting in more robust statistical analyses of the data. AL learning experiments have been advocated by multiple researchers to explore inquiries pertaining to language acquisition (e.g., Ettliger et al., 2016; Fedzechkina et al., 2016; Grey, 2020; Morgan-Short et al., 2010). A frequently made point is that this methodology provides researchers with complete control over the stimuli. The primary reason for my choice of an AL learning paradigm was the ability to manipulate the L3 input with precision, which enabled me to test the predictions made by modern models of third language acquisition. Also, using an AL as the L3 offered another significant advantage, as it enabled me to explore the initial encounter with the L3 learning task. This was possible since the participants had not been exposed to the target language before the experiment. The methodology employed also allowed me to gather data from a sizable and relatively homogeneous group of L3 speakers.

This was feasible since many individuals in Iran are sequential bilinguals who speak L1 Persian and L2 English, with minimal exposure to other languages.

### **3.3.1 What Is an Artificial Language?**

The use of AL learning experiments is not a new development in the realm of language acquisition research. Since Esper (1925) introduced this methodology nearly a century ago, there have been numerous examples of such experiments in the field. Nevertheless, as noted by González Alonso et al. (2020, p. 3), the majority of studies employing this methodology have focused on inquiries regarding implicit versus explicit non-native language acquisition. The L2 default effect is explained by the cognitive and situational parallels between explicitly learned non-native languages and implicitly acquired first languages. These similarities can be observed in several factors, such as the age of onset (AoO), learning context, and metalinguistic awareness and knowledge. Specifically, non-native languages are usually learned at a later age than the L1 and in a classroom environment where learners are instructed in the target language, while the L1 is acquired naturally. Additionally, metalinguistic awareness and knowledge tend to be more developed in instructed non-native languages than in the L1, as noted by Falk and Bardel (2011) and Falk et al. (2015). According to Truscott and Sharwood Smith (2019, p. 215), these factors collectively embody an “otherness” that is common among non-native languages but differs from implicitly acquired native languages. Conversely, in the fledgling area of L3 acquisition, there have been limited instances of AL learning experiments investigating crosslinguistic influence. Examples include the works of González Alonso et al. (2020), Mitrofanova & Westergaard (2019), Sanz et al. (2015), and Stevens (2021).

The definition of artificial languages, according to Grey (2020), is as follows:

Artificial languages refer to miniature linguistic systems that consist of a limited number of grammatical structures aligned with natural language structures. These systems incorporate both lexical-semantics and grammar, and they can be fully spoken and comprehended. (Grey, 2020, p. 81)

Moreover, artificial languages are frequently categorized into various types depending on the composition of their lexical inventories. This classification can be observed in studies by Ettliger et al. (2016) and Grey (2020), among others. At the most general level, there are two categories. The initial category encompasses artificial languages that are composed of nonce words. These types are typically identified as *mini-languages*, *miniature (artificial) languages*, or *artificial languages* themselves. Instances of such artificial languages include BROCANTO

(Friederici et al., 2002), BROCANTO2 (Morgan-Short et al., 2010), as well as the language implemented in Culbertson and colleagues' research (e.g., Culbertson et al., 2017; Culbertson et al., 2019; Culbertson & Newport, 2015; Culbertson et al., 2012). The second group is identified as semi-artificial languages. These languages combine elements of one natural language with components of another. Generally, semi-artificial languages combine the lexical items of one language with the morphosyntax of another language, according to Grey (2020). Two recent examples of semi-artificial languages include González Alonso et al. (2020) who developed mini-English and mini-Spanish by combining English or Spanish lexical items with Spanish-based grammatical gender, and Mitrofanova and Westergaard (2019) who added case marking (similar to Russian case endings) to Norwegian lexical items, a language that lacks overt case. Rebuschat and Williams (2012) provide an additional instance, where they merged English lexical items with German syntax. Mini- and semi-artificial languages are distinct from artificial grammars, which generate strings of symbols using rules, usually without a semantic component, as noted by Ettliger et al. (2016, p. 823). Another example of an artificial grammar is Reber's (1967) work. Also, as we saw in section 2.4, Jensen & Westergaard (2022) conducted an experiment on AL learning to explore how the early stages of acquisition are affected by CLI in the presence of lexical and syntactic similarities between an artificial L3 and existing grammars.

In this study, I have chosen to refer to the L3s as artificial languages, as they share some characteristics with semi-artificial languages, incorporating (pseudo-)cognates from natural languages.

### **3.3.2 Does Artificial Language Learning Resemble Natural Language Acquisition?**

There has been significant interest in whether AL learning experiments accurately capture natural language learning, or whether they merely measure general learning abilities and/or intelligence. Friederici et al. (2002) and Morgan-Short et al. (2010) investigated this matter through EEG research on adults who learned either BROCANTO or BROCANTO2, two artificially created Romance-based languages. According to Friederici et al. (2002, p. 530), the ERP data indicated a comparable neural activation pattern in the comprehension of both artificial and natural syntactic systems. Opitz and Friederici (2003) also reported detecting neural activity consistent with natural language processing while studying BROCANTO using functional magnetic resonance imaging (fMRI). In terms of research on behaviour, Ettliger et al. (2016) contrasted learning an American English-based AL with acquiring L2 Spanish in a

university setting. The findings indicated a significant and positive correlation between the participants' performance in learning the AL and their performance in the L2 Spanish course. Crucially, this association remained even after controlling for general intelligence. The authors posit that the outcome suggests that experiments involving AL learning can be dependable means of gaining understanding into the acquisition of non-native natural languages, but only if the AL used contains both complexity and meaning. It could be implied that investigating natural language acquisition related issues may be better suited for mini- and semi-artificial languages, as opposed to artificial grammars. This is because they are more complex and meaningful than artificial grammars. By being more similar to natural languages, they may better reflect the cognitive processes involved in language learning and be more relevant to understanding how people learn and use language in real-life situations.

### 3.4 Participants

A total of 80 participants in two groups took part in this study. They ranged in age from 15 to 58 ( $M = 28.53$ ,  $SD = 7.84$ ). They were bilingual speakers of L1 Persian-L2 English who acquired English at home or school from ages 2-31. The participants were recruited through some language institutes and a group of my friends in Iran, and they had no or little knowledge of other languages than Persian and English. They were randomly assigned to one out of two L3s, referred to as Languages A and B. There were 34 female and 46 male participants. Table 2 shows the participants description in detail.

**Table 2.** *Description of the participants*

Groups	n	Mean Age (years)	Mean AoO <sup>4</sup> in English (years)	LoC <sup>5</sup> with mother/father	LoC with friends	Mean English Proficiency
A	42	28	12.26	Per/Per	Per <sup>6</sup> (n =21) Eng <sup>7</sup> (n =3) Per&Eng (n =18)	0.75
B	38	29	11.32	Per/Per	Per (n =20) Eng (n =3) Per&Eng (n =15)	0.74

<sup>4</sup>AoO = Age of Onset, <sup>5</sup>LoC = Language of Communication, <sup>6</sup>Per = Persian, <sup>7</sup>Eng = English

### 3.5 Proficiency Test and Background Questionnaire

A proficiency test was utilized to determine whether the participants' general competency had any link with the conditions I intended to investigate and whether the participants should be

separated into age groups. In other words, the age of the participants may suggest their general English abilities, but it does not guarantee that each participant's proficiency matches the expected level of proficiency. Therefore, I employed a subset of the standardized Oxford proficiency test which can be seen in Appendix 2. The test in question has a widespread usage (e.g., Jensen, 2016; M. Jensen, 2017; Slabakova & Garcia Mayo, 2015). The standardized Oxford proficiency test involves multiple-choice questions, where a sentence with a blank space is presented along with three options to select from. The participants were required to fill in all the blanks by selecting one of the three options to make the sentence acceptable, and they received one point for each correct answer. As demonstrated in examples 14 and 15, the proficiency test consists of two sections, with the sentences in the second section being taken from a continuous narrative.

(14) Example: Multiple choice with individual sentences

1. Water \_\_\_\_\_ at a temperature of 100° C.

a. is to boil      b. is boiling      c. boils

(15) Example: Multiple choice with a continuous story

11. Mohammed Ali \_\_\_\_\_ his first world title fight in 1960.

a. has won      b. won      c. is winning

12. After he \_\_\_\_\_ an Olympic gold medal, he became a professional boxer.

a. had won      b. have won      c. was winning

Some modifications were made to the proficiency test in comparison to its usage in Jensen et al. (2020) and Jensen (2017). One alteration was related to the test's length. In the study conducted by Jensen et al. (2020), the proficiency test consisted of 40 questions, however, in the current study, the number of questions was reduced to 29. Additionally, the number of questions was consistent with the proficiency test used in Jensen (2017). To prevent any misunderstandings or confusion, supplementary written information was provided in Persian.

The next task was a short background questionnaire in which the participants were requested to respond to several questions regarding their age, gender, and language use with their mother, father, and friends, as outlined in Appendix 3. To prevent any confusion regarding these questions, the questions were prepared in both English and Persian.



## 3.6 Main Experiment

In section 3.6.1, the materials used in this study are discussed in two detailed sub-sections including the “L3 Input” and the “experimental task and critical condition”. Then, in section 3.6.2, the procedure of data collection containing two different phases is explained.

### 3.6.1 Materials

#### *L3 Input*

The lexical items were either made based on (pseudo)cognates (verbs, function words and adverbials) or using the online generator: <https://gibberishfactory.com/>. This way, the words have changed slightly and L3 had a high similarity to English. Therefore, it was much easier for the learners to acquire a new language within a short period. Also, as I was comparing lexical to structural similarity, it was important that the words are lexically like English.

Regarding the syntactic input, half of the participants were exposed to non-subject initial declaratives (XSV) and the other half were exposed to Subject-Object-Verb (SOV) word order in the L3. As described in the Background chapter, Persian and English exhibit matching word orders in non-subject-initial declarative clauses (XSV) – the XSV word order is the same in both languages – but mismatching word orders in the Verb-Object (VO), i.e., V-O in English and O-V in Persian. To put it another way, in language A, the participants were exposed to a word order that is the same in both languages, as exemplified in (6a), whereas in language B, the learners were exposed to a word order that only exists in Persian, as shown in (6b).

(6) a. Ons Daymon Pari eafs.

On Tuesdays Pari eats.

‘On Mondays Pari eats.’

b. Ons Daymon Pari freeto eafs.

On Mondays Pari fruits eats.

‘On Mondays Pari eats fruits.’

Table 3 summarizes how Languages A and B vary in terms of lexical and syntactic matches to Persian and English.

**Table 3.** Summary of linguistic crossover in the language triads

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

### ***The Experimental Task and Critical Condition***

The main task for data collection in this study was a forced-choice acceptability judgement task (AJT), which is a widely used method in linguistics due to its easy administration (Dabrowska, 2010). In these tests, participants are asked to choose one of the sentences in a sentence pair that they think it is correct.

The AJT, also known as the *grammaticality judgement task*, is one of the quantitative research methodologies. “Although certain scholars have argued that acceptability and grammaticality are two separable notions that refer to different concepts, there are contexts in which the two terms are used interchangeably” (Leivada & Westergaard, 2020, p. 1). These two concepts, according to Leivada and Westergaard (2020), are not identical; some sentences are acceptable even if they are not grammatical (ungrammatical), whereas others are unacceptable even though they are grammatical. In terms of grammaticality, a sentence follows the standards of a language’s grammar. With regard to acceptability, “the focus shifts from the stimulus to a speaker’s perception” (ibidem, p. 2). For instance, the sentence in (16) is grammatical but it is unacceptable. And a sentence in (17) is ungrammatical but it is acceptable.

(16) Colorless green ideas sleep furiously. (Chomsky, 1957 as cited in Evelina and Westergaard (2020, p. 4)

(17) Fewer people have been to Tromsø than I have.

Following Leivada and Westergaard (2020), the term acceptability judgement task will be used in this study.

There were 18 pairs in total including 7 fillers and 7 critical items (see all sentences including the test items and fillers in Appendix 4). The critical condition was either Adjective-Noun (Adj-N) word order in which half of the phrases had the structure Adjective-Noun (Adj-N) and the other half had Noun-Adjective (N-Adj) word order. The participants were asked to choose between these two structures.

Examples are shown in (18-a) and (18-b) in which one word order corresponds to English, the other to Persian. Note that the participants had not been exposed to these structures.

- (18) a. Gree affle
- b. Affle gree

The use of a forced-choice AJT provides insight into the preferences of bilinguals regarding word order, as they must choose between options that are either acceptable or unacceptable in their previously acquired languages. Importantly, the participants' behaviour cannot be attributed to their exposure or training in the third language (L3), as they had no prior experience with Adjective-Noun (Adj-N) or Noun-Adjective (N-Adj) word order in L3 before participating in the AJT. A preference for a specific word order is instead understood to be the result of cross-linguistic influence, and that is understood as co-activation of both languages, where the one with the strongest activation wins.

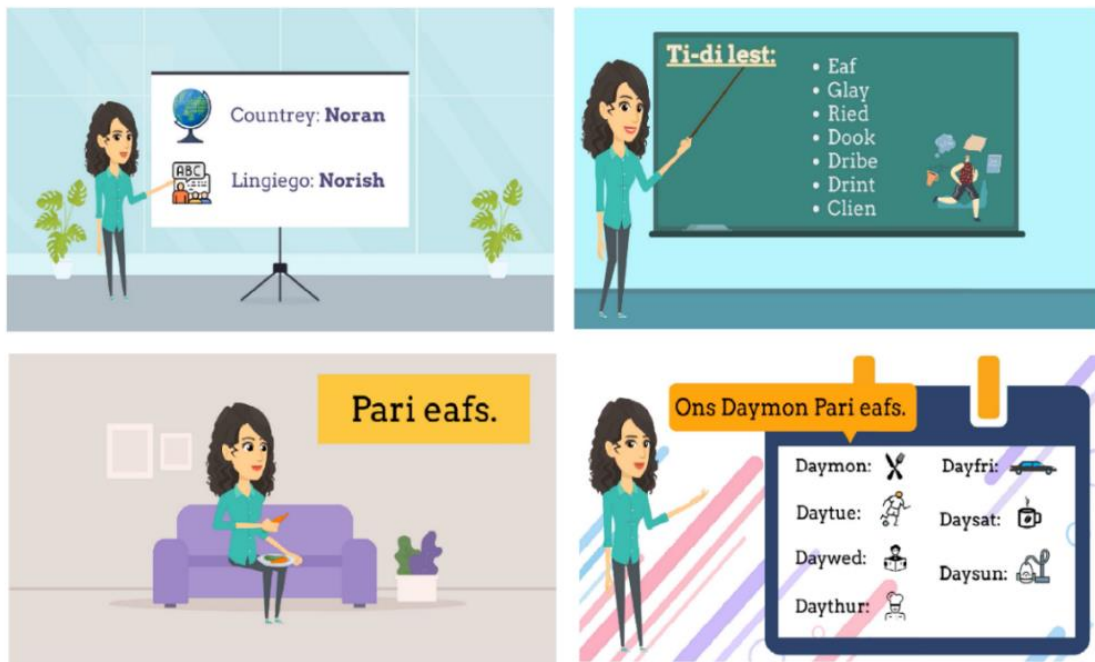
### **3.6.2 Procedure**

The online experiment builder *Gorilla* was utilized to create and conduct the experiment ([www.gorilla.sc](http://www.gorilla.sc)). According to Anwyl-Irvine et al. (2019), this web-based platform simplifies the process of recruiting participants from various parts of the world. Due to the participation of individuals from Norway and Iran, the experiment was conducted entirely online. It took around 25-30 minutes to complete the experiment. The participants were firstly informed that they would be introduced to and taught words from an unfamiliar language, followed by a test to assess their learning. As part of the experiment, a consent form was also incorporated, containing an information section (refer to Appendix 5) that provided essential details about the study. To prevent priming participants with an instruction language, animated videos were used to provide guidance on the tasks. Animaker (2021), an animation software, was employed to create the videos (to be explained in the following section). The experiment consisted of two phases, inspired by the works of Jensen & Westergaard (2022). The data collection was ended when I reached 80 participants for both groups.

#### ***The Exposure Phase***

At the outset of the experiment, participants were allocated randomly to either Language A or B. Initially, participants were presented with an animated video (Animaker, 2021) in which a native speaker of the L3 introduced herself, her country, and the language they speak. Then, she explained her daily routines, including at which weekday she does which activity. There

were 17 sentences in each video including 4 practice sentences at the beginning. Figure 1 shows examples from the video exposure (from Language A), and figure 2 illustrates examples from language B.



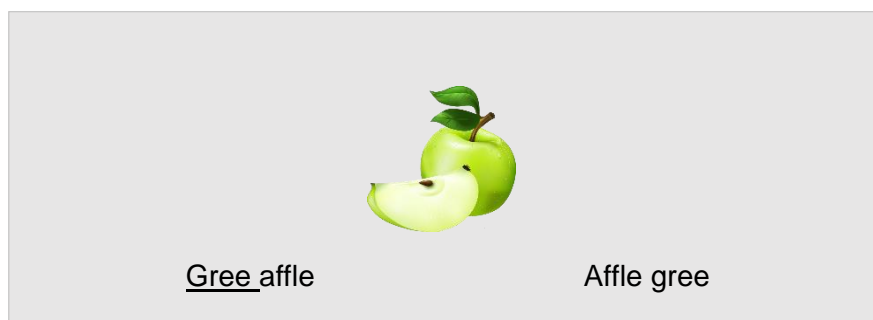
**Figure 1.** Example of video exposure to the artificial L3 (Language A)



**Figure 2.** Example of video exposure to the artificial L3 (Language B)

### *The Testing Phase*

I conducted a forced-choice AJT to assess the participants' preferences for word order. The AJT comprised of 18 trials, consisting of 4 practice sentences, 7 target items and 7 fillers. The phrases in the critical condition differed in word order (Adj-N versus N-Adj word order), as shown in Figure 3. Participants were asked to select the sentence that they perceived as more natural by clicking on it. Upon selecting a sentence, the participants were automatically redirected to the next trial. All trials were randomized.



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

### **3.7 Pilot Study**

Prior to the main experiment, a pilot study was conducted to test the format and content of the forced-choice AJT. A total of 10 participants (6 female, 4 male, mean age  $M = 28.7$ , age range 19-32) took part in the piloting. They were all L1 Persian and L2 English speakers living in Iran. They were randomly distributed across languages A and B, and they were asked to answer three tasks including a forced-choice AJT, a background questionnaire, and a proficiency test (as it was explained in section 3.5). The reason was to confirm their clarity and appropriateness for the participants' English proficiency level. The purpose was also to assess the participants' comprehension of the experimental procedure and to determine the level of difficulty of the task.

The results indicated choosing more of the N-Adj word order structure in Group B (69% in average) than the group A (25% in average), see table 4. This would correspond to the predictions of the LPM, i.e., both lexical and syntactic factors may play a role in L3A. Consequently, it would go against predictions of the TPM, which would predict wholesale transfer from English for both learner groups. The participants' mean score for N-Adj word order responses is presented in Appendix 1.

**Table 4.** Comparison of structure selection during the pilot

Condition		Group A (n = 4)	Group B (n = 6)
1	XSV word order (fillers)	28/28 (100%)	–
2	XSOV word order (fillers)	–	36/42 (85.71%)
3	N-Adj word order (critical items)	7/28 (25%)	29/42 (69.05%)

### 3.8 Chapter Summary

This chapter first presented the primary goal of this thesis which was to explore the cognitive processes associated with language acquisition and examine how individuals utilize their existing linguistic knowledge subconsciously during the acquisition of new knowledge. Based on the two main models in the field of L3A, namely LPM and TPM, predictions were subsequently formulated.

The TPM emphasizes that the origin of CLI in the acquisition of L3 is impacted by the degree of lexical similarity between a previously acquired language and the input of the L3. Therefore, this model posits that the origin of CLI is determined primarily by lexical cues, as they are considered the most important factor based on Rothman's (2013, 2015) four-way hierarchy of lexicon, phonology, morphology, and syntax. Therefore, lexical cues take precedence as the first cues to consider. In other words, if there is lexical similarity between the L3 and one of the previously acquired languages, then wholesale transfer will occur. Therefore, if the H<sub>1</sub> occurs, it is anticipated that all participants in both A and B groups would select the Adj-N structure since these languages share lexical similarities with English. Consequently, if this holds true, it is predicted that there would be no distinction between the groups, and the findings would corroborate the TPM.

The LPM, on the other hand, proposes that participants' behaviour would differ depending on the type of L3 they are exposed to (language A and language B). Thus, unlike the TPM, which emphasizes the significance of lexical cues, the LPM recognizes the potential role of both lexical and syntactic cues. Consequently, in such cases, there could be CLI from both previously acquired languages. In this scenario, the argument put forth by the LPM aligns with H<sub>2</sub>, which posits that apart from lexical similarities, syntactic similarities also have a role. Therefore, according to both models, L3 participants would be influenced by English due to the lexical similarity between English and the artificial language (L3).

The concept of artificial languages was explained in the remainder of this chapter, and the AL utilized by the present study was introduced. Finally, the main procedure of the experiment as well as the pilot study undertaken prior to the present experiment were discussed. Based on the results of the pilot study, no changes were made in the design of the main experiment. In the next chapter, there will be a discussion of the findings of this study, which includes a detailed statistical analysis.

## 4 Results

As previously stated in section 3.7, the pilot results showed that participants in Group B showed a greater tendency to select the N-Adj word order structure than those in Group A. This outcome would align with the LPM's predictions that both lexical and syntactic factors could impact L3A. No changes in the forced-choice AJT were made following participants' score results in the pilot. Therefore, the main experiment results included all of those who joined the pilot study.

It is noteworthy that the findings of the main experiment were nearly identical to those of the pilot study, indicating that participants in Group B continued to exhibit a greater inclination towards the N-Adj word order. Table 5 provides the corresponding statistics.

**Table 5.** Comparison of structure selection during the main test phase

Condition		Group A ( <i>n</i> = 42)	Group B ( <i>n</i> = 38)
1	XSV word order (fillers)	261/294 (88.78%)	–
2	XSOV word order (fillers)	–	224/266 (84.21%)
3	N-Adj word order (critical items)	96/294 (32.65%)	121/266 (45.49%)

The main data were retrieved from Gorilla and then analyzed in RStudio, R version 4.1.2 (R Core Team, 2022). In the next sections, the following will be reported: the visualisation of data including the participants' responses in the forced-choice AJT for both filler and critical items, the association between N-Adj word order and the EPT scores as well as the Age of Onset in English (AoO), and the distribution of critical items. Finally, the statistical analysis will be discussed in detail for a regression model.

### 4.1 Statistical Analysis: Data Visualisation

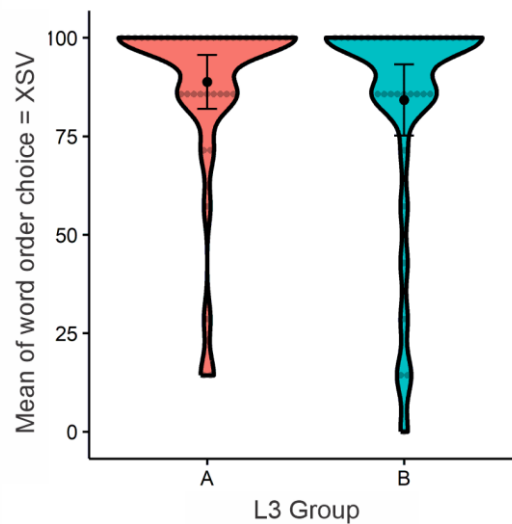
#### 4.1.1 The Acceptability Judgements

This section describes the participants' acceptability judgements in two plots that illustrate the mean proportions of XSV and N-Adj selections in the forced-choice AJT by group (Languages A and B). Figure 4 shows the filler/control condition and Figure 5 shows the critical conditions. I used the ggplot2 and rempsyc R packages to create the graphs (Thériault, 2022; Wickham, 2009).



For the filler/control condition (XSV/XVS), it was expected that the participants would reject verb-second sentences (XVS) because this word order is ungrammatical in both Persian and English and was not present in the AL input. The learners were exposed to (XSV), and they mainly chose this word order. Therefore, this could be the result of learning as well as the CLI, rather than a random preference.

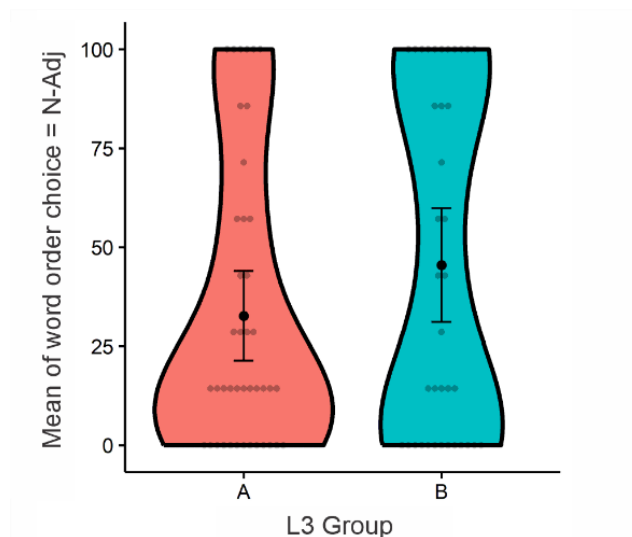
Figure 4 shows that word order preferences are distributed almost evenly across the L3s, ranging from around 88% XSV selections in Language A (English-based lexicon/neutral syntax) to around 84% XSV selections in Language B (English-based lexicon/Persian syntax). These findings confirm that our expectation of the two groups being identical in this regard has been met. It is thus plausible that they have acquired the XSV word order they were exposed to or are transferring knowledge from both languages.



**Figure 4.** *Acceptability judgements of non-subject initial declaratives (XSV)*

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

Figure 5 illustrates the judgements of the critical items (Adj-N and N-Adj) by group. As it can be seen, both speaker groups frequently chose the Adj-N structure. Recall that the participants had not been exposed to this structure in the AL input. We had expected the participants in Group B to produce more of the Persian word order (N-Adj), as their exposure to another property with Persian word order (OV) was hypothesized to activate their Persian grammar somewhat more, than the learners of Language A. On average, the group A scored 32.65% and the group B scored 45.49% on the critical items.



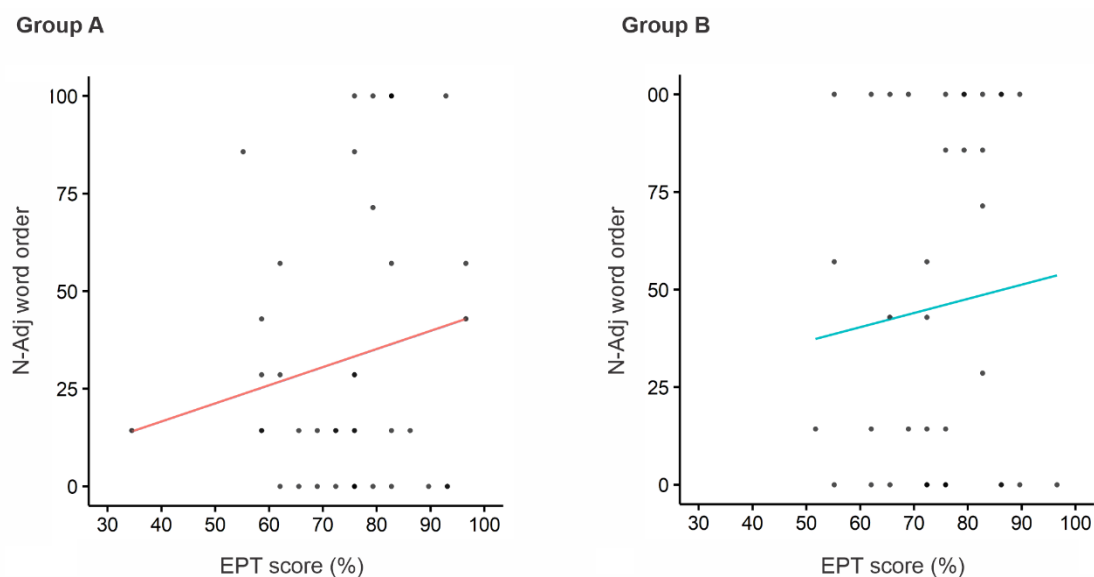
**Figure 5.** *Acceptability judgements of adjective placement*

#### 4.1.2 Analyzing the Impact of EPT Score and AoO on N-Adj Word Order

##### *EPT Score*

As discussed in section 3.5, the students' proficiency was measured with a multiple-choice task. This test is a subset of the Standardized Oxford Proficiency test with 29 items. Each correct answer gives one point, i.e., the highest score is 29. In this study, the assigned proficiency score for all the participants ranged between 10 and 28 points (mean = 21.60).

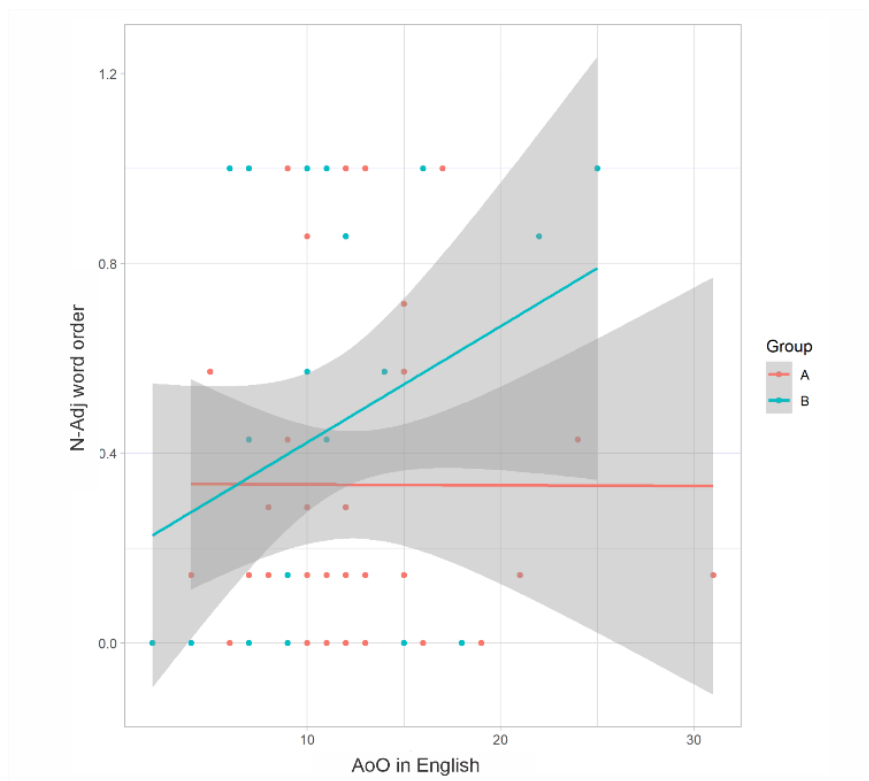
In Figure 6, the distribution of critical item scores based on the N-Adj word order is depicted among the two groups, A and B, which are determined by the EPT scores. The regression lines in the figures suggest that as the participants' English proficiency levels increase, their critical item scores also tend to increase. i.e., their tendency is to opt for the Persian structure.



**Figure 6.** *N-Adj word order by EPT score for the two groups*

### *Age of Onset (AoO)*

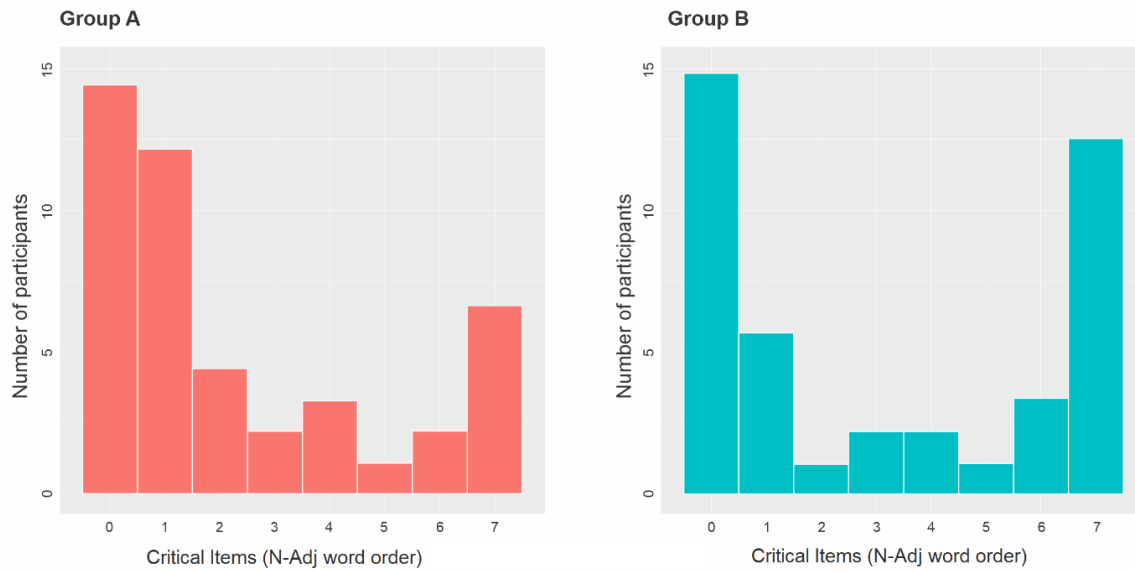
To investigate the correlation between the N-Adj word order and the Age of Onset (AoO) in two groups, A and B, figure 7 was created. As illustrated in the figure, there is a positive relationship between the learners' tendency in Group B to choose the Persian (N-Adj) structure and their AoO in English. In other words, the later the learners started learning English, the more likely they were to activate their Persian word order. This finding suggests that the AoO may have an impact on the learners' use of their native language structures, particularly when dealing with structures that differ from those in English. In contrast, Group A does not exhibit any noticeable impact of AoO, which could be attributed to the insufficient exposure to Persian-related syntax among its members.



**Figure 7.** *N-Adj word order by AoO for the two groups*

#### **4.1.3 Distribution of Critical Items**

Repeating the descriptions of section 3.4, the total number of participants who took part in this study were 80 which were randomly assigned into two groups of language A ( $N = 42$ ) and language B ( $N = 38$ ). The forced-choice AJT which was applied in this experiment consisted of 18 trials, including of 4 practice sentences, 7 target items and 7 fillers (as previously stated in section 3.6.2, the testing phase). The main phrases in the critical condition differed in word order (Adj-N vs. N-Adj word order).



**Figure 8.** *Critical items distribution*

Figure 8 shows the number of participants who selected the Persian structure (N-Adj word order) among the main phrases ranging from 0 to 7. As it is seen, in both A and B groups, 26 people (13 each) scored 0 in choosing this structure, indicating a high rate of answers for the English syntax (Adj-N). This suggests that a significant proportion of participants in both groups did not perform well in selecting the Persian (N-Adj) structure from the main phrases. Moreover, there were 11 individuals in Group A and 5 individuals in Group B who selected only one item among Persian-related syntax, which appeared to be a notable observation.

However, participants in Group B exhibited a higher frequency of selecting the N-Adj structure (in Group A, 6 participants chose all 7 test items that were based on Persian structure, whereas in Group B, the number of participants who did so was 11).

## 4.2 Statistical Analysis: Logistic Regression

A mixed-effects binomial logistic regression model with Participants and Items as random intercepts was fitted to the data (see Appendix 6 for the regression table of the AJT task), using the lme4 R package (Bates et al., 2015). To predict the variance in the response variable, Word order choice (N-Adj = 1 and Adj-N = 0), the variables *Group (Language A and B)*, *AoO* and the *EPT Scores* as potential fixed effects were added. Therefore, the model was fitted with the *N-Adj word order* as the dependent variable, *Group* as the predictor and (*centered*) *AoO* and *EPT Scores* as covariates (see Figure 9).

The results of the regression model showed that while there is a trend in the predicted direction (the mean of critical items (N-Adj word order) in Group B was 45.5%, which is higher than in

Group A - 33%), the effect does not reach statistical significance due to a high degree of variation between participants.

```
summary(m)

## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula:
## NA_Order ~ Group + AoO_EnglishC + EPT_scoreC + (1 | Participants_ID) +
## (1 + Group | Item)
## Data: Pdata2
## Control: glmerControl(optimizer = "bobyqa")
##
##      AIC      BIC  logLik deviance df.resid
##  510.9   545.5  -247.5   494.9     552
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.5678 -0.3957 -0.1802  0.2387  2.5482
##
## Random effects:
##  Groups      Name      Variance Std.Dev. Corr
##  Participants_ID (Intercept) 9.9836  3.1597
##  Item          (Intercept) 0.1479  0.3845
##              GroupB      0.2633  0.5131  -0.72
## Number of obs: 560, groups: Participants_ID, 80; Item, 7
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -1.39616    0.58255  -2.397  0.0165 *
## GroupB      1.03829    0.84823   1.224  0.2209
## AoO_EnglishC 0.12240    0.08738   1.401  0.1613
## EPT_scoreC  0.09877    0.12010   0.822  0.4108
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) GroupB AO_EnC
## GroupB      -0.682
## AoO_EnglishC -0.108  0.111
## EPT_scoreC  0.014  0.021  0.144
```

**Figure 9.** *Summary of the regression model*

As shown in Figure 9, the model reveals that group A (represented by the Intercept) was significantly below chance in choosing the N-Adj word order (for average AoO and EPT score). It also confirms that group B had higher score than Group A (since the Group B estimate is positive = 1.04), but this effect was not statistically significant ( $p = 0.22$ ).

## 5 Discussion

This section focuses on the discussion of the data illustrated in chapter 4. To begin with, I will reiterate the research questions and predictions, and clarify what the results have and have not indicated with respect to the research question and hypotheses. Then, I will examine the findings in the context of the theories discussed in the literature review.

This experiment aimed to investigate the extent to which word order preferences, which may serve as a proxy for crosslinguistic influence, are influenced by lexical and syntactic similarities between the artificial L3 and the L1/L2 during the initial stages of L3 acquisition. As previously discussed in chapter 3, Persian-English sequential bilinguals ( $N = 80$ ) were assigned randomly to one of two potential L3 languages, each differing in syntactic similarity to English and English/Persian. The participants experienced two phases, an exposure and a testing phase. The latter comprised a forced-choice Acceptability Judgment Task (AJT), which involved experimental items that were both familiar (fillers) and unfamiliar (critical items) to the participants. Then, I proposed the following research question and predictions:

**RQ:** How do lexical and syntactic similarities between the newly acquired L3 and the previously learned languages impact CLI at the onset of L3 acquisition?

**Hypotheses:**

H<sub>0</sub>: The similarities between L3 and L1/L2 are not associated with word order preferences.

H<sub>1</sub>: There is a correlation between word order preferences and lexical similarity between L3 and L1/L2.

H<sub>2</sub>: There is a correlation between word order preferences and syntactic similarity between L3 and L1/L2.

As explained in section 3.1, the predictions are based on the main two models of L3A, LPM and TPM, and drawn from the findings of the previous studies in determining the source of syntactic CLI in L3 acquisition.

The study's findings can be linked to the theoretical assumptions of the LPM, CEM, and TPM models. The LPM and CEM models predicted that the participants' behaviour would vary based on the type of L3 they were exposed to, while the TPM model predicted that the source of CLI would be determined by lexical cues only. The experiment results showed that there is a relationship between word order preferences and both lexical and syntactic similarity between

the L3 and previously acquired languages. Specifically, I found that participants chose more of the English word order, which is similar to their L2, than the Persian word order, which is similar to their L1, which suggests rejecting the  $H_0$ . Moreover, the results showed a relationship between word order preferences and lexical similarity, supporting  $H_1$ . However, despite observing a strong trend towards syntactic similarity, as indicated by a positive numerical trend, our statistical analysis did not establish significant evidence to support  $H_2$ . Overall, these findings provide support for a property-by-property account of L3 acquisition.

As previously mentioned in section 4.2, a mixed-effects binomial regression model reported that there is a trend in the predicted direction which shows the probability of selecting Persian-like word order (N-Adj), but the effect is not statistically significant due to a high degree of variation between participants. In the following sections, I discuss the findings of data analysis in turn.

### **5.1 The Forced-choice AJT: An Analysis on Filler and Critical Items**

The graphs in Figures 4 and 5 showed the mean proportions of XSV and N-Adj selections by group (Languages A and B). Regarding the filler/control condition (XSV/XVS), we expected participants to reject verb-second sentences (XVS) since this word order is ungrammatical in both Persian and English and was not present in the AL input. The results in Figure 4 indicated that word order preferences were distributed almost evenly across the L3s, with a preference for XSV sentences ranging from around 84-88%. Based on this result, our expectation of the two groups being identical in this aspect has been met. Therefore, it is possible that they have acquired the word order (XSV) they were exposed to or are transferring knowledge from both languages.

Moving to the critical items (Adj-N and N-Adj), the participants had not been exposed to this structure in the AL input. However, contrary to our expectations, both speaker groups frequently chose the Adj-N structure, as illustrated in Figure 5. The result suggests that participants' behaviour was consistent with the LPM, as both the LPM and TPM hypothesize that lexical similarity would exert a significant influence. However, it should be noted that the predictions were not based solely on the LPM, but rather on the predictions of three different models that were discussed.

Overall, the AJT results revealed that the responses related to the filler items were more in line with the assumptions of the LPM as compared to those related to the critical items in both

groups. This could be attributed to the limited exposure of the participants to the main test items. However, during the main test phase itself, it was observed that group B chose the N-Adj structure more frequently than group A. This difference between the two groups, in the intended direction, lends support to the LPM and suggests an effect of syntactic similarity as well. This means that exposure to the OV structure in one group had an impact on the selection of N-Adj word order in group B.

## **5.2 The Forced-choice AJT: Exploring the Effect of EPT Score and AoO on N-Adj Word Order**

Based on the results presented in section 4.1.2 (figure 6), the study suggests that there is a positive relationship between English proficiency levels and critical item scores (N-Adj), and both groups have learners who are more proficient on these items. The analysis of the EPT score was carried out to ensure that the two groups were comparable, and the figures revealed that this was indeed the case.

This finding extends the results of Dahl et al. (2021, 2022), as discussed in section 2.3.5, who found both L1 and L2 can affect L3 learning, but stronger proficiency in L2 was associated with less evidence of L2 transfer to L3. In other words, Dahl et al. (2022) noted that increased proficiency in L2 did not necessarily lead to greater transfer from L2 to L3. Therefore, their conclusion was that the stronger the English proficiency of learners, the stronger their proficiency in German and French. They attributed this to a general language proficiency or talent, suggesting that individuals who excel in one language tend to excel in others as well. Thus, a high level of English proficiency could be associated with a higher metalinguistic knowledge in the current study, leading the study participants to more likely connect the Persian word order in N-Adj phrases with the word order they have encountered in O-V as opposed to V-O. In contrast, the correlation between selecting the Persian (N-Adj) and achieving high scores on the EPT contradicts the results of Stadt et al. (2020) which indicated that L2 English had a greater influence on L3 French than on L3 German, and this effect increases with English proficiency at the later stage. So, their conclusion indicates that there is a positive correlation between English proficiency and the extent of transfer from English into the learners' L3.

In the same section (4.1.2), figure 7 was created to examine the relationship between the N-Adj word order and the AoO in the two groups. The figure clearly demonstrates that there is a positive correlation between the learners' tendency in Group B to choose the Persian (N-Adj)



structure and their AoO in English. In other words, the later the learners started learning English, the more likely they were to rely on their native language structure. This finding suggests that the AoO may play a role in shaping the learners' use of their first language structures, particularly when dealing with structures that differ from those in English. On the other hand, Group A did not exhibit any noticeable impact of AoO on their choice of word order. This could be due to the insufficient exposure to Persian-related syntax as they have been exposed to the XSV construction which is common in both English and Persian. Therefore, it is possible that the lack of exposure to Persian-related syntax in Group A might have influenced their ability to activate their native language structure.

In addition to the findings discussed previously, figure 8 (section 4.1.3) presented the number of participants who selected the N-Adj word order in the main phrases, ranging from 0 to 7. The results showed that a substantial number of participants in both Groups A and B struggled with selecting the item showing the Persian (N-Adj) structure, with 26 individuals in each group scoring 0. This high rate of selecting the English syntax (Adj-N) indicates that many participants in both groups failed to choose N-Adj word order choices. However, the participants in Group B exhibited a higher frequency of selecting the N-Adj structure. This aligns with the study's hypothesis that exposure to Persian syntax featuring the OV structure would activate learners' Persian grammar to a greater extent, compared to Language A learners. Therefore, the results suggest that exposure to other languages or grammatical structures can impact L3 acquisition and influence the activation of native language structures in L3 processing.

### **5.3 Interpretation of the Findings**

As per the preceding discussion, the results suggest that both groups exhibited an overall preference for English (Adj-N word order) syntax over Persian syntax, which could be attributed to the early acquisition of this word order in English and the relative ease with which learners whose AL is similar to English may have been able to produce it. Therefore, this may have contributed to the learners' tendency to choose the English syntax more often than the Persian syntax, as it was a more familiar and perhaps easier structure for them to produce.

On the other hand, comparing the data from each group, it was found that Group A, in which English and Persian syntax were congruent, had a lower frequency of N-Adj word order selections in comparison to Group B, where the syntax was based on Persian. This supports the LPM theory, which suggests that syntactic similarity also contributes to the phenomenon.

To put it differently, the participants in Group B did not exhibit selective transfer from the more lexically similar language, English, as would have been anticipated if wholesale transfer had occurred during testing or if the L2 had been automatically chosen as the primary source of influence. This indicates that the nature of the L3 input influences the direction of CLI, and that both lexical and syntactic indicators in the input may contribute to this, as posited by property-by-property models of L3 acquisition.

It is important to note that we did not notice a rise in the selection of N-Adj word order where English and Persian shared common syntactic input (language A). This suggests that being exposed to neutral syntax does not significantly affect CLI. However, none of these explanations fully account for the behaviour of the participants. In other words, if CLI was exclusively determined by lexical cues, we would not expect to observe the influence of OV.

In cases where there is a contradiction between linguistic cues, markedness appears to have an impact on CLI, and the rationale behind it is that Adj-N is supposedly less marked than N-Adj. Additionally, there may be an effect of foreign language status, but it is neutralized by similarity, rendering it difficult to examine (due to the absence of a comparison group). This elucidates why we only observe the foreign language effect when the L2 is the least similar language.

## **5.4 Chapter Summary**

The section discussed the findings of a study on the extent to which word order preferences, which serve as a proxy for crosslinguistic influence, get influenced by the lexical and syntactic similarities between the artificial L3 and the L1/L2 at the early stages of acquiring L3.

The study involved Persian-English sequential bilinguals who were randomly assigned to one of two L3 languages, each differing in their syntactic similarity to English and were either paired with English or Persian. The participants experienced two phases, an exposure and a testing phase, which involved a forced-choice Acceptability Judgment Task (AJT).

The study aimed to determine the relationship between CLI and both lexical and syntactic similarity between the L3 and previously acquired languages. The study's findings supported the H<sub>1</sub> showing that the more similar the L3 was to participants' previously acquired languages, in terms of sentence vocabularies, the more likely they were to use word order patterns consistent with those languages. The study's results were discussed in the context of the theoretical assumptions of the LPM, CEM, and TPM models.

The AJT results showed that, in general, both groups showed a preference for English (Adj-N word order) syntax over Persian syntax, potentially due to the early acquisition of this structure in English and the similarity between the learners' L2 and L3. This may have influenced learners to select the English syntax more frequently. However, further analysis of the data revealed that Group A, with congruent English and Persian syntax, had a lower frequency of N-Adj word order selections compared to Group B, where the syntax was based on Persian. This supports the LPM theory, indicating that syntactic similarity also plays a role in L3A.

## 6 Limitations and Future Direction

The present study had several limitations that should be considered. One limitation is that it only focused on the domain of morphosyntax, which may not fully capture the impact of CLI on L3A. Another limitation is that the study only utilized two language properties, namely *SVO* vs. *SOV* word order, and *Adj-N* vs. *N-Adj* word order, to investigate CLI in an AL learning setting, and this may not fully reflect the complexity and variability of real-world L3s. It should be also mentioned that the type of AL that was created in this experiment was very similar to English in terms of lexicon, and this may have affected the results not to be in line with the study's expectations.

Additionally, the study's findings highlighted the importance of considering participants' prior knowledge and exposure to the target language, as well as language-specific factors in shaping their acceptability judgments. Also, based on the results of the regression model, while there was a trend in the predicted direction, the effect did not reach statistical significance due to a high degree of variation between participants. This means that in the future we would need larger samples of participants to establish the effect. Moreover, further analysis is needed to fully understand why participants did not behave as expected for the critical items.

Thus, while the study found that participants' EPT score and AoO were useful predictors of test performance, other factors may also be important. Therefore, further research is needed to fully understand the complex interplay of factors that contribute to success on critical test items. Additionally, future research should consider expanding the scope of the study to investigate the impact of CLI on other aspects of L3A, such as phonetics or pragmatics. Furthermore, the use of a more naturalistic L3 could help address some of the drawbacks of the current study.

## 7 Conclusion

The present study investigated the extent to which word order preferences, as a proxy for crosslinguistic influence, were influenced by lexical and syntactic similarities between an artificial L3 and L1/L2 at the early stages of L3 acquisition. The study used a forced-choice AJT to test the participants' preferences for the word orders (Adj-N and N-Adj) that were unfamiliar in the L1/L2 and the L3.

The study's hypotheses ( $H_0$ ,  $H_1$ , and  $H_2$ ) were based on the assumptions of three different models of L3 acquisition: the LPM, CEM, and TPM models. And the findings provided support for a property-by-property account of L3 acquisition, as they suggested that word order preferences are influenced by both lexical and syntactic similarities between the L3 and previously acquired languages. Participants were more likely to choose word order patterns consistent with the L2 than with the L1. Moreover, the study revealed a relationship between word order preferences and both lexical and syntactic similarity, supporting  $H_1$  and  $H_2$ , respectively.

The results were discussed in two sections. The first section analyzed the responses to the filler and critical items in the AJT, and it showed that participants rejected verb-second sentences (XVS) since this word order is ungrammatical in both Persian and English and was not present in the artificial L3 input. Moreover, the participants frequently chose the Adj-N structure in critical items. However, the difference between the two groups, where one was exposed to OV structure, lends support to the LPM and suggests an effect of syntactic similarity as well.

The second section explored the effect of English proficiency levels and AoO on the participants' preferences for N-Adj word order, in that the findings showed a positive relationship between English proficiency levels and critical item scores (N-Adj), suggesting that English proficiency may have an impact on L3A.

Overall, the study contributes to our understanding of CLI in L3A and the factors that may affect the acquisition process.

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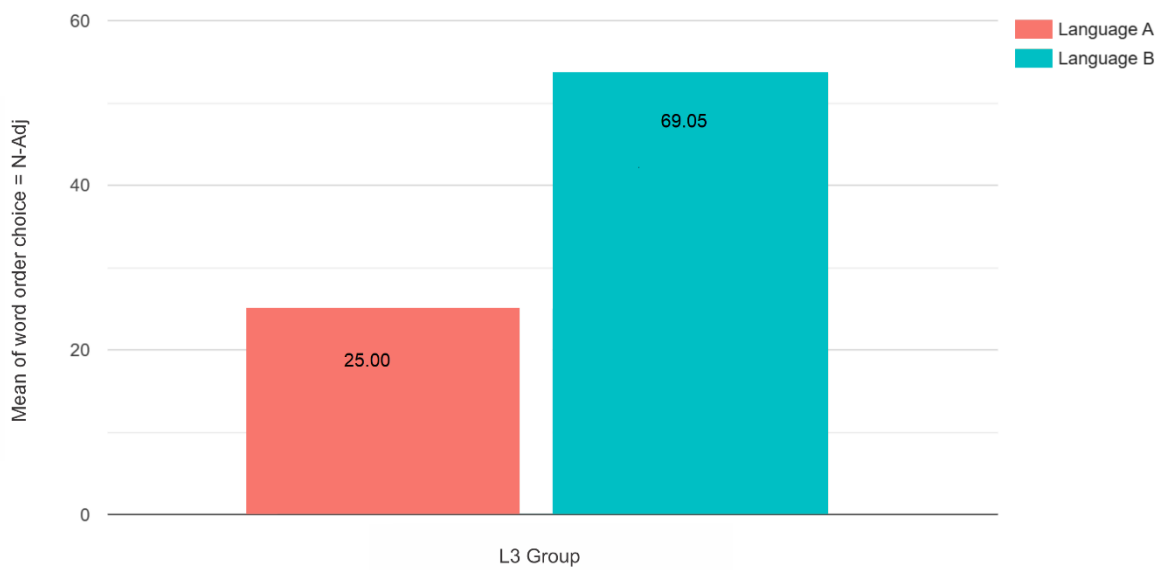
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# Appendices

## Appendix 1 - Pilot Results of the Participants' Mean Score for N-Adj Word Order Responses



## Appendix 2 - English Proficiency Test (EPT)

**Instructions: Please complete the sentences by selecting the best answer from the available answers below.**

**1) Water \_\_\_\_\_ at a temperature of 100° C.**

- a. is to boil    b. is boiling    c. boils

**2) In some countries \_\_\_\_\_ very hot all the time.**

- a. there is    b. is    c. it is

**3) In cold countries people wear thick clothes \_\_\_\_\_ warm.**

- a. for keeping    b. to keep    c. for to keep

**4) In Norway people are always talking about \_\_\_\_\_.**

- a. a weather    b. the weather    c. weather

**5) In Bergen \_\_\_\_\_ almost every day.**

- a. it rains    b. there rains    c. it raining

**6) In the Sahara Desert there isn't \_\_\_\_\_ grass.**

- a. the    b. some    c. any

**7) Some countries in Africa have \_\_\_\_\_ weather even in the cold season.**

- a. a warm    b. the warm    c. warm

**8) In Norway \_\_\_\_\_ time of year is usually from December to February.**

- a. coldest    b. the coldest    c. colder

**9) \_\_\_\_\_ people don't know what it's like in other countries.**

- a. The most    b. Most of    c. Most

**10) Very \_\_\_\_\_ people can visit the King.**

- a. less    b. little    c. few

**11) Mohammed Ali \_\_\_\_\_ his first world title fight in 1960.**

- a. has won    b. won    c. is winning

**12) After \_\_\_\_\_ an Olympic gold medal, he became a professional boxer.**

- a. had won    b. have won    c. was winning

**13) His religious beliefs \_\_\_\_\_ change his name when he became a champion.**

- a. have made him    b. made him to    c. made him

**14) If he \_\_\_\_\_ lost his first fight with Sonny Liston, no one would have been surprised.**

- a. has   b. would have   c. had

**15) He has traveled a lot \_\_\_\_\_ as a boxer and as a world-famous personality.**

- a. both   b. and   c. or

**16) He is very well known \_\_\_\_\_ the world.**

- a. all in   b. all over   c. in all

**17) Many people \_\_\_\_\_ he was the greatest boxer of all time.**

- a. is believing   b. are believing   c. believe

**18) To be the best \_\_\_\_\_ the world is not easy.**

- a. from   b. in   c. of

**19) Like any top sportsman, Ali \_\_\_\_\_ train very hard.**

- a. had to   b. must   c. should

**20) Even though he has now lost his title, people \_\_\_\_\_ always remember him as a champion.**

- a. would   b. will   c. did

**Read the following passage about the history of aviation and choose the best answer for each blank. Note that it is a continuous story.**

**21) The history of \_\_\_\_\_ is**

- a. airplane   b. the airplane   c. an airplane

**22) \_\_\_\_\_ short one.**

- a. quite a   b. a quite   c. quite

**23) For many centuries men \_\_\_\_\_ to fly,**

- a. are trying   b. try   c. had tried

**24) but with \_\_\_\_\_ success.**

- a. little   b. few   c. a little

**25) In the 19th century a few people succeeded \_\_\_\_\_ in balloons.**

- a. to fly in   b. flying into   c. flying

**26) But it wasn't until the beginning of \_\_\_\_\_ century that anybody**

a. last b. next c. that

**27) \_\_\_\_\_ able to fly in a machine**

a. were b. is c. was

**28) \_\_\_\_\_ was heavier than air,**

a. who b. which c. what

**29) in other words, in \_\_\_\_\_ we now call a 'plane'. The first people to achieve**

a. who b. which c. what



## Appendix 3 - Background Questionnaire

The following questionnaire is to collect background data relevant for our study. Our goal is to understand the proportions of exposure/use you have.

پرسشنامه زیر برای جمع آوری داده های زمینه ای مرتبط با این تحقیق است

**Please take your time to respond to each question. Note that all of the data will be collected anonymously.**

لطفاً برای پاسخ دادن به هر سوال وقت بگذارید. توجه داشته باشید که تمامی داده ها به صورت ناشناس جمع آوری خواهد شد

جنسیت Sex

- Female مونث  
 Male مذکر  
 Other غیره

سال تحصیلی جاری Occupation/student status, شغل/وضعیت تحصیلی

چند سال دارید؟ How old are you?

چند ساله بودید که شروع به یادگیری زبان انگلیسی کردید؟ How old were you when you started learning English?

یادگیری زبان انگلیسی را از کجا شروع کردید؟ Where did you start learning English?

- School مدرسه  
 English institute (private teacher) (مدرس خصوصی) موسسه زبان انگلیسی  
 Home (parents) (والدین) خانه

به چه زبانی با مادر خود صحبت میکنید؟ What languages do you use speaking to your mother?

به چه زبانی با پدر خود صحبت میکنید؟ What languages do you use speaking to your father?

به چه زبانی با دوستان خود صحبت میکنید؟ What languages do you use speaking to your friends?

ممنون از مشارکت شما! Thank you for participating!

## Appendix 4 - List of Sentences

### a) Exposure Items:

	Language A	Meaning	Language B	Meaning
1.	Ons Daymon Pari eafs.	On Mondays Pari eats.	Ons Daymon Pari freeto eafs.	On Mondays Pari eats fruits.
2.	Ons Daytue Pari glays.	On Tuesdays Pari plays.	Ons Daytue Pari puitar glays.	On Tuesdays Pari plays guitar.
3.	Ons Daywed Pari rieds.	On Wednesdays Pari reads.	Ons Daywed Pari boog rieds.	On Wednesdays Pari reads book.
4.	Ons Daythur Pari dooks.	On Thursdays Pari cooks.	Ons Daythur Pari pesta dooks.	On Thursdays Pari cooks pasta.
5.	Ons Dayfri Pari dribes.	On Fridays Pari drives.	Ons Dayfri Pari an cer dribes.	On Fridays Pari drives a car.
6.	Ons Daysat Pari drints.	On Saturdays Pari drinks.	Ons Daysat Pari rine drints.	On Saturdays Pari drinks wine.
7.	Ons Daysun Pari cliens.	On Sundays Pari cleans.	Ons Daysun Pari couse cliens.	On Sundays Pari cleans house.

### b) Test Items:

	Language A/B	Language A/B	Meaning
1.	Gree affle	Affle gree	Green apple
2.	Purfle grafes	Grafes purfle	Purple grapes
3.	Yello banala	Banala yello	Yellow bananas
4.	Vite coponut	Coponut vite	White coconut
5.	Redd strawperries	Strawperries redd	Red strawberries
6.	Jrown kibi	Kibi jrown	Brown kiwi
7.	Bink feach	Feach bink	Pink peach

**c) Fillers:**

	<b>Language A</b>		<b>Language B</b>	
1.	Ons Daymon Pari eafs.	Ons Daymon eafs Pari.	Ons Daymon Pari freeto eafs.	Ons Daymon eafs Pari freeto.
2.	Ons Daytue glays Pari.	Ons Daytue Pari glays.	Ons Daytue glays Pari puitar.	Ons Daytue Pari puitar glays
3.	Ons Daywed Pari rieds.	Ons Daywed rieds Pari.	Ons Daywed Pari boog rieds.	Ons Daywed rieds Pari boog.
4.	Ons Daythur dooks Pari.	Ons Daythur Pari dooks.	Ons Daythur dooks Pari pesta.	Ons Daythur Pari pesta dooks.
5.	Ons Dayfri Pari dribes.	Ons Dayfri dribes Pari	Ons Dayfri Pari an cer dribes.	Ons Dayfri dribes Pari an cer.
6.	Ons Daysat drints Pari.	Ons Daysat Pari drints.	Ons Daysat drints Pari rine.	Ons Daysat Pari rine drints.
7.	Ons Daysun Pari cliens.	Ons Daysun cliens Pari.	Ons Daysun Pari couse cliens.	Ons Daysun cliens Pari couse.

## Appendix 5 - Information Letter and Consent Form

با سلام و به این پروژه تحقیقاتی خوش آمدید! Hi and welcome to this research project!

لطفا این فرم را به دقت و تا انتها بخوانید

This is a document ensuring that you as a participant in this research project are fully educated on the nature of the project and are given ample opportunity to ask any questions you need to fill comfortable and informed.

این سندی است که تضمین می کند شما به عنوان یک شرکت کننده در این پروژه تحقیقاتی به طور کامل در مورد ماهیت پروژه آموزش دیده اید و دارای فرصت کافی برای پرسیدن هر سوالی که نیاز دارید راحت و آگاهانه بپرسید، هستید

### About the Study درباره پروژه

My name is Parisa. I am a master's student at [UiT The Arctic University of Norway](#). This experiment is part of my master's thesis in Multilingualism. The experiment has 4 parts and it will take about 20 minutes to complete.

من پریسا دانشجوی کارشناسی ارشد در رشته ی زبانشناسی هستم و این تحقیق بخشی از پایان نامه ی من هست. این تحقیق دارای 4 قسمت میباشد و تکمیل آن حدود 20 دقیقه طول می کشد

In this study you will acquire knowledge of a set of vocabulary from an artificial foreign language. Your task will be to remember the words and phrases as accurately as possible throughout the experiment. We will also ask you a few questions about English and your linguistic background.

در این تحقیق شما مجموعه ای از واژگان را از یک زبان خارجی (مصنوعی) آموزش خواهید دید. وظیفه شما این است که کلمات و عبارات جدید را تا حد امکان به دقت در طول تحقیق به خاطر بسپارید و مراحل تحقیق را تا انتها انجام دهید. همچنین از شما چند سوال در مورد زبان انگلیسی و پیشینه زبانی شما خواهیم پرسید

### Experiment Stages مراحل تحقیق

1. You will be exposed to an animated video in which someone uses another (artificial) language to speak. در ابتدا یک ویدیوی انیمیشن به شما نشان داده میشود که در آن شخصی به یک زبان دیگر (مصنوعی) با شما صحبت میکند
2. You should choose between the two options that will be shown on the screen afterwards (choose the one which you think is the correct one according to what you have seen in the video). سپس شما باید از بین دو گزینه ای که بر روی صفحه نشان داده میشود یک گزینه را انتخاب کنید (گزینه ای را که از نظر شما درست ترمیباشد را انتخاب کنید)
3. You will be then asked to read and complete an "English Proficiency Test". در مرحله ی بعد می بایست یک آزمون مهارت زبان انگلیسی را خوانده و تکمیل کنید
4. You will be asked to read and fill-in a "Background Questionnaire" at the end. در آخر می بایست یک فرم مربوط به پیشینه ی زبانی خود را خوانده و تکمیل کنید

### Research Ethics اخلاقیت پروژه

This project is approved by [Norsk Senter for Forskningsdata](#) (NSD). Participation in the project is voluntary. All answers and data are **anonymous**. If you choose to participate, you

can withdraw your consent at any time without giving a reason. All information about you will be removed.

این پروژه مورد تایید مرکز داده های تحقیقاتی نروژ است. همه پاسخ ها و داده ها ناشناس هستند. در صورت تمایل به شرکت، می توانید در هر زمان رضایت خود را بدون ذکر دلیل پس بگیرید. تمام اطلاعات مربوط به شما حذف خواهد شد

We will only use your personal data for the purpose(s) specified in this information letter. We will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act). We do not collect sensitive or personally identifying information. It will not be possible to directly or indirectly recognize you in the publication.

ما فقط از داده های شخصی شما برای اهداف مشخص شده در این نامه اطلاعاتی استفاده خواهیم کرد. ما داده های شخصی شما را به صورت محرمانه و مطابق با قوانین حفاظت از داده ها (مقررات عمومی حفاظت از داده ها و قانون داده های شخصی) پردازش خواهیم کرد. ما اطلاعات حساس یا شناسایی شخصی را جمع آوری نمی کنیم. شناسایی مستقیم یا غیرمستقیم شما در نشریه امکان پذیر نخواهد بود

## حقوق شرکت کنندگان Participants' rights

So long as you can be identified in the collected data, you have the right to:

- Access the personal data that is being processed about you
- Request that your personal data is deleted
- Request that incorrect personal data about you is corrected/rectified
- Receive a copy of your personal data (data portability), and
- Send a complaint to the Data Protection Officer or The Data Protection Authority.

We will process your personal data based on your consent.

تا زمانی که در داده های جمع آوری شده شناسایی شوید، حق دارید:

- به داده های شخصی که در مورد شما پردازش می شود دسترسی داشته باشید
- درخواست کنید که اطلاعات شخصی شما حذف شود
- درخواست کنید که اطلاعات شخصی نادرست در مورد شما تصحیح شود
- یک کپی از اطلاعات شخصی خود (قابلیت انتقال داده ها) و غیره دریافت کنید
- یک شکایت به افسر حفاظت از داده ها یا سازمان حفاظت از داده ها ارسال کنید

ما اطلاعات شخصی شما را بر اساس رضایت شما پردازش خواهیم کرد

## زمان بندی پروژه Project Timeline

The project is scheduled to end in May 2023. All the personal information will be excluded from the data after the completion of the project.

این پروژه در ماه مه 2023 به پایان میرسد. تمام اطلاعات شخصی پس از تکمیل پروژه از داده ها حذف خواهد شد

## اطلاعات تماس Contact Info

If you have any further questions about the project, contact: Parisa Nazari via email ([pna018@uit.no](mailto:pna018@uit.no)) or The Norwegian Centre for Research Data AS, by email ([personverntjenester@nsd.no](mailto:personverntjenester@nsd.no)).

اگر سوال بیشتری در مورد پروژه دارید، از طریق ایمیل با من در تماس باشید (pna018@uit.no)

**To participate in this study, please agree to all the points outlined below:**

جهت شرکت کردن در این تحقیق لطفا موافقت خود را با علامت زدن جمله های پایین اعلام کنید

I give consent to participate in this study. من برای شرکت در این مطالعه رضایت می دهم.

I give consent for my personal data to be processed until the end date of the project. من رضایت می دهم که اطلاعات شخصی من تا تاریخ پایان پروژه پردازش شود.

I give consent for my anonymised data to be presented/used in research activities (i.e., conferences, journal articles). من برای ارائه/استفاده از داده های ناشناس خود در فعالیت های تحقیقاتی (مانند کنفرانس ها، مقالات مجلات) رضایت می دهم.

## Appendix 6 - Regression Table of the AJT

Formula: (NA\_Order ~ Group + AoO\_EnglishC + EPT\_scoreC + (1|Participants\_ID) + (1 + Group | Item))

<i>Predictors</i>	<b>NA_Order</b>		
	<i>Odds Ratios</i>	<i>CI</i>	<i>p</i>
(Intercept)	0.25	0.08 – 0.78	<b>0.017</b>
Group [B]	2.81	0.53 – 14.82	0.224
AoO EnglishC	1.13	0.95 – 1.34	0.162
EPT scoreC	1.10	0.87 – 1.40	0.409
<b>Random Effects</b>			
$\sigma^2$	3.29		
$\tau_{00}$ Participants_ID	10.01		
$\tau_{00}$ Item	0.15		
$\tau_{11}$ Item.GroupB	0.26		
$\rho_{01}$ Item	-0.72		
ICC	0.76		
$N_{\text{Participants\_ID}}$	80		
$N_{\text{Item}}$	7		
Observations	560		
Marginal $R^2$ / Conditional $R^2$	0.042 / 0.765		

\* NA\_Order: N-Adj word order

