

THE PRODUCTION OF INFLECTIONAL /S/ BY ARABIC LEARNERS OF ENGLISH

A Thesis submitted by

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ABSTRACT

The present study investigated the production of two functional morphemes in the oral modalilty by Arabic learners of English (ALEs): the subject-verb agreement morpheme and the regular plural morpheme. These morphemes both have the phonological shape /s/. Four reasons for morpheme omission were investigated: prosodic transfer from the first language (L1); the distance between the controller and the target in an agreement relation; the animacy of the matrix subject in sentences containing relative clauses (RCs); and, in the same type of sentence, the semantic plausibility of the relationship between the matrix subject and the RC verb. The study consisted of four experiments, one per feature of interest, conducted with 41 ALEs using a self-paced sentence-completion task. Experiment One tested the predictions of the Prosodic Transfer Hypothesis (PTH). The ALEs' production of contrasting target types was elicited and analysed. The results confirmed the predictions of the PTH: the ALEs omitted morphemes due to differences between the prosodic representations found in the L1 and the L2. Experiment Two tested the effect of the distance between agreeing elements in quantifier phrases. The results confirmed that plural inflection was omitted more frequently in longdistance than in adjacent contexts, and in very-long distance than in long-distance contexts. Experiment Three was designed to test the effect of animacy on the production of subject-verb agreement on the matrix verb in sentences containing RCs. The results showed that the ALEs produced morphemes less frequently in inanimate- than animate-subject sentences, confirming an animacy effect. The last experiment tested the effect of plausibility on the production of subject-verb agreement on the matrix verb in sentences containing RCs. It was predicted that inflection would be supplied less accurately when there was an implausible semantic relationship between the matrix subject and the RC verb, than when this relationship was plausible. However, the results did not provide convincing evidence for an effect along these lines.

CERTIFICATION OF THESIS

I, Sumaya Al Zoubi, declare that the PhD thesis entitled *The production of inflectional /s/ by Arabic learners of English* is not more than 100,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references, and footnotes. The thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Date: October 27th 2023

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Student and supervisors' signatures of endorsement are held at the University.

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CHAPTER 1: INTRODUCTION

1.1 Focus of the thesis

Different types of inaccuracy in oral production are observed in the interlanguage of second language (L2) learners regardless of their proficiency level (e.g., Austin et al., 2022; Hawkins & Casillas, 2008; Jin et al., 2009; White, 2008). Among a wide range of non-native-like utterances produced by learners, the omission of inflectional morphemes has been the focus of extensive research, resulting in theories and hypotheses that are aimed at accounting for this deviant performance (e.g., Goad et al., 2003; Hawkins & Liszka, 2003; Prévost & White, 2000; Tsimpli, 2003; Tsimpli & Dimitrakopoulou, 2007). This thesis investigates the omission of the inflectional morpheme /s/ in the oral production of Arabic learners of English (ALEs).¹ It focuses on the production of the subject-verb agreement morpheme in verbs, and the regular plural morpheme in nouns. The rationale behind choosing these two morphemes is the persistent inconsistency with which these morphemes are produced by ALEs (e.g., Al-Afaleg, 1992; Mohammed & Abdalhussein, 2015, among others).

Four reasons for morpheme omission are investigated: prosodic transfer from the first language (L1); the distance between controller and target in an agreement relation; the semantic properties of the matrix subject in sentences containing relative clauses; and, in the same type of sentence, the semantic relationship between the matrix subject and the relative-clause verb.

In the following sections, I give the theoretical framework for this thesis (Section 1.2); then a basic description of the L1, and a brief comparison of the L1 and the L2 (Section 1.3); and finally an overview of the remaining chapters of the thesis (Section 1.4).

¹ I will use /s/ to indicate both the agreement and plural morphemes, keeping in mind that each of these morphemes has three allomorphs depending on the final sound of the stem: [s], [z] and [iz].

1.2 Theoretical framework

Reasons for morphological variability in the interlanguage of L2 learners have generated a lot of debate and yielded many theories. These theories are dichotomized into two groups based on whether they assume that the learner (i) is able to acquire target-like syntactic knowledge in the L2 but omits inflection for other reasons (e.g., Goad et al., 2003; Lardiere, 2003; Prévost & White, 2000), or (ii) is unable to acquire target-like syntactic knowledge (e.g., Hawkins & Liszka, 2003; Tsimpli, 2003; Tsimpli & Dimitrakopoulou, 2007).

In group (i), some studies argue that L1 characteristics, such as phonological transfer, play a role in these errors. For example, consonant clusters that are found in inflected forms in English (e.g., [pt] in 'jumped') are not allowed in some L1 phonological contexts, which may partly hinder the realization of inflection in the L2 (Lardiere, 2003). Another transfer-based approach is concerned with differences between the prosodic structures in the L1 and the L2. This approach is formalised in the Prosodic Transfer Hypothesis (Goad et al., 2003).

In group (ii), variation in morphological production is not due to syntactic incompetence but rather to a computational issue: L2 learners fail to map between the knowledge of syntactic features they have and the inflectional reflexes of these features. In keeping with this assumption, the Missing Surface Inflection Hypothesis (Prévost & White, 2000) proposes that learners struggle to recall morphological inflection under the pressure of language production, and resort to uninflected forms as a result.

Other approaches to unearthing the reasons for morphological variability focus on the processor-working memory interface in language production. This is basically accounted for in Processability Theory (Pienemann, 1998), which assumes that language learners acquire the properties of a new language in a particular order. This order starts from easy structures and moves on to more difficult structures. One example is that language learners can process

agreement easier between elements within the same phrase than elements across two different phrases. A well-established body of research has tried to explore this dimension. This includes the effect of distance between linguistic items within and across different phrases and clauses (Clahsen & Fesler, 2006; Gibson, 2000; Keating, 2010; O'Grady et. al., 2003).

Semantic interference is also believed to play a role in morphological accuracy. Successful language comprehension and production comes from the ability to form correct dependencies between constituents. For example, forming a dependency in a sentence like 'John saw the book_i that the boy very happily read e_i while on holiday' involves accessing the filler 'the book' from memory once the gap *e* is reached. According to cue-based parsing, this process is guided by a set of cues. In the example sentence above, the verb 'read' needs a direct object, and this object needs to be a 'readable' item. This interference between the semantic properties of nouns and verbs helps (and sometimes hinders) the formation of dependencies between linguistic items.

1.3 Brief comparison of Arabic and English

The L1 in the present research is the Arabic language. 'Arabic' is a wide-ranging label used to refer to the varieties of Arabic dialects spoken in different regions of the Arab world, as well as to modern standard Arabic (MSA). MSA is the formal Pan-Arabic version of Arabic, which is used for all forms of official communication, like broadcasting, mass media, legal settings, and university lectures (Kaye, 1975). In the present study, the participants speak the Jordanian dialect of Arabic (JA), a dialect used by the inhabitants of Jordan, an Arab country in the Middle East area. Although JA emerged to fulfill certain sociolinguistic needs in Jordan (Ferguson, 1959; Versteegh, 2014), this dialect and MSA have very similar phonological, syntactic, and lexical systems.

Like English, Arabic instantiates subject-verb agreement and plurality in nouns, and it has an array of suffixes and prefixes to represent these two morphosyntactic features (explained later in Chapter Two). This similarity between the L1 and the L2 rules out any possibility of negative L1 syntactic transfer in the production of subject-verb agreement or plural /s/ in L2 English. If the L1 did not have inflection for subject-verb agreement or plurality, the learners' inability to supply inflection in the L2 might not be solely the result of prosodic transfer, distance or semantics, but could also be due to a lack of inflection in the L1.

A piece of evidence for the validity of this point comes from Dowens et al. (2010), among other studies (e.g., Sabourin & Stowe, 2008; Tokowicz & MacWhinney, 2005). Dowens et al. (2010) addressed the processing of article-noun number agreement and adjective-noun gender agreement by English learners of Spanish. English marks number in article-noun structures (e.g., 'a boy' and 'an elephant') but it does not mark gender in adjective-noun structures (e.g., 'the boy/the girl is tall'). In Dowens et al.'s study, a significant difference between number and gender disagreement sensitivity was reported for the number feature, which is available in English, but not for the gender feature, which is absent in English. The results are shown in Table 1.

Table 1

Correct Responses for Number and Gender Agreement in Dowens et al. (2010)

	Availability in the L1	Correct responses
Number	Yes	92.32%
Gender	No	75.62%

Further support for this contrast can be found in Alemán-Bañón et al. (2014), where English learners of Spanish showed sensitivity to number agreement but not to gender agreement.

1.4 Overview of the remaining chapters

The remaining chapters of this thesis cover the experiments in the study such that each chapter is dedicated to one experiment. In each chapter, an overview of the experiment is given at the beginning, followed by some theoretical background to the experiment. I then give a review of previous studies that identifies the limitations and/or gaps that motivated the experiment. The predictions, method, results, and discussion for each experiment are then presented.

In Chapter Two, the predictions of the Prosodic Transfer Hypothesis (Goad & White, 2004; Goad et al., 2003) are tested to investigate the effect of differences between the L1 and the L2 in terms of how functional morphemes are prosodified. In Chapter Three, the effect of the distance between the quantifier and the noun in quantifier phrases is investigated. In Chapters Four and Five respectively, the effect of animacy and the effect of plausibility on the production of the agreement morpheme are scrutinized. I wrap up the results of the whole study in Chapter Six.

CHAPTER 2: EXPERIMENT ONE: PROSODIC TRANSFER WITHIN THE SAME CONSTRUCTION

2.1 Introduction

The Prosodic Transfer Hypothesis (PTH) assumes that the production of a given second language (L2) morpheme is hindered by differences between the prosodic representations in the first language (L1) and the L2. Specifically, this hypothesis assumes that a prosodic structure from the L1 is transferred to represent a given morpheme in the L2; difficulties in the production of the target morpheme will then arise if the required L2 prosodic representation is lacking in the L1. The present experiment will test the predictions of the PTH regarding the suppliance of the subject-verb agreement and regular plural morphemes by Arabic learners of English (ALEs). In the current cross-linguistic scenario, we have prosodic transfer within the same construction, since, like English, Arabic has inflection for agreement and plurals.

This chapter is organized as follows. In Section 2.2, the theoretical background of the present experiment is provided. This includes some key concepts related to prosodic analysis (Sections 2.2.1 and 2.2.2), a closer look at the PTH (Section 2.2.3), and a basic description of the morphosyntax of the relevant morphemes in the L1 (Section 2.2.4). The prosodic structures of the agreement and plural morphemes in the L1 are described in Section 2.3. In Section 2.4, I review relevant previous studies. The predictions and method of this experiment are provided in Sections 2.5 and 2.6, and the results and discussion follow in Sections 2.7 and 2.8, respectively.

2.2 Theoretical background

2.2.1 The prosodic hierarchy

According to prosodic phonology, prosodic constituents are organized according to the hierarchy shown in (1).

(1) Phonological Phrase (PPh)
|
Prosodic Word (PWd)
|
Foot (Ft)
|
Syllable (
$$\sigma$$
)
|
Mora (μ)

Within the frame of the Strict Layer Hypothesis (Nespor & Vogel, 1986; Selkirk, 1986), the hierarchy of prosodic structure in (1) is strictly layered; that is, a constituent at a higher level (Ci; C = constituent, i = level) must directly dominate a constituent at the next (lower) level (Ci-1). Selkirk (1995) proposed four constraints of prosodic domination, two of which are of relevance to the PTH:

- Nonrecursivity (NONREC): No C_i dominates another C_j, for i = j. For example, a PWd must not dominate a PWd.
- Exhaustivity (EXHAUST): No C_i immediately dominates a C_k , k < i-1, which means that skipping levels of domination is not allowed. For example, a PWd must not immediately dominate a syllable.

Within the framework of Optimality Theory (Prince & Smolensky, 1993), these constraints are violable. This allows a prosodic account of the structure of inflectional morphemes, as we shall see in Section 2.2.2.

A key issue in the current experiment is the definition of a PWd. A PWd is a tightlybound unit whose syllables are phonologically linked to each other (Grosjean & Gee, 1987). Crucially for our purposes, the PWd is also considered the domain of stress assignment (Peperkamp, 1997; Vigário, 2011). As shown in (1), the PWd consists of one or more feet, which in turn consist minimally of a stressed syllable, and optionally also contain one or more unstressed syllables. Each syllable also has one or more moras (McCarthy & Prince, 1990a; Selkirk, 1980; Watson, 2002).

2.2.2 Prosodification of functional morphemes

Morphemes are attached to their host words in ways that may differ from one language to another. According to Selkirk (1996, p. 189), functional morphemes (func.) are represented using three prosodic structures: internal clitic (e.g., the irregular past tense [t] in 'slept' [slept]), affixal clitic (e.g., [s] in 'caps' [kæps]; [t] in 'worked' [w3:kt]), and free clitic (e.g., 'a/an', 'the'). These structures are represented in (2).



As shown in (2), clitics are classified based on the level at which the morpheme is attached to the PWd:

• internal clitic (2a): This structure respects the strict hierarchy of prosodic constituents in (1). It organizes the functional morpheme internally to the PWd. The morpheme is dominated by the same PWd that dominates its sister word stem.

• affixal clitic (2b): The functional morpheme in this case is outwardly adjoined to the PWd. This type of structure allows skipping of levels in the hierarchy of prosodic units. It also allows for recursion, thus violating both EXHAUST and NONREC.

• free clitic (2c): In this structure, the functional morpheme attaches to its host at a higher level in the prosodic hierarchy, namely at the PPh level. This loose attachment to the stem explains the separable nature of the free clitic from its host, which is unique to this type of clitic. For example, in 'the smart boy', the free clitic 'the' is separated from its host 'boy' by the adjective 'smart'.

Goad et al. (2003) argued that regular suffixes in English are affixally cliticized to the PWd, as shown in (3).



The evidence is as follows. English syllabification allows for a maximum of three segments in the rhyme position, as in 'tank' [tænk] (rhyme underlined), 'crown' [kraon] or 'arrive' [əraɪv]. For this reason, an additional segment (e.g., the morpheme for past tense, agreement or plural) can only be adjoined to the stem outwardly. That is, this segment is not dominated by the same PWd as the stem; rather, both the stem and the suffix are dominated by a higher PWd in the hierarchy. Thus, these morphemes violate both the EXHAUST and NONREC constraints, and are therefore hosted as affixal clitics .

2.2.3 Prosodic Transfer Hypothesis

2.2.3.1 Statement of the hypothesis

The initial version of the PTH was proposed in the work of Goad et al. (2003) to account for the omission of the agreement and past-tense morphemes by Mandarin speakers of English. Mandarin (i.e., the L1) lacks the affixal clitic required for hosting these morphemes in English. In Mandarin, verbs are only inflected for aspect, and this inflection is hosted by the internal-clitic structure. The prosodic structures in the L1 and the L2 are represented in (4) (adapted from Goad et al., 2003, p. 248; PERF = perfect [aspect]).



According to the initial version of the PTH, Mandarin speakers of English will not be able to produce the target morpheme in a target-like pattern because the affixal-clitic structure is not permitted in the L1. Also, the influence of the L1 prosodic structure is assumed to be permanent: for L2 functional morphemes whose prosodic structures are not permitted in the L1, variability in the oral production of these morphemes cannot be overcome.

A relaxed version of the PTH was proposed in Goad and White (2004). In this version, Goad and White continued to assume that if the L1 does not permit certain prosodic structures that are required in the L2, then L2 learners will have difficulty in representing functional material in their oral production. However, Goad and White introduced the notion of 'minimal adaptation', a technique of cobbling together missing L2 prosodic structures from prosodic structures available in the L1. Minimal adaptation was outlined as follows (Goad & White, 2004, p. 124):

- a) L2 structures are possible in the interlanguage grammar when they can be built through a combination of pre-existing licensing relations; or
- b) L2 structures are possible in the interlanguage grammar when they involve L1 structures being licensed in new positions.

Examples of (a) and (b) will be provided in the following subsections.

2.2.3.2 Selected key studies

In this section, I demonstrate the scope of research on the PTH to date by summarizing a selection of key studies which have tested this hypothesis. These studies were concerned with the oral production of various functional morphemes, and also feature diverse L1s and L2s. Among these, Goad et al. (2003) is especially important as it introduces the notion of asymmetries in stem length: as we shall see, these asymmetries play a crucial role in determining which prosodic representation is being used to host inflection. Goad et al. (2011) is significant as well, because it illustrates the role played by stress assignment in making the same type of determination.

Goad et al. (2003) studied the production of the English agreement and past-tense morphemes by Mandarin speakers. High-intermediate/low-advanced learners did an oral picture-description task. The agreement and past-tense morphemes in English are hosted by the affixal clitic. However, this prosodic representation does not exist in Mandarin: this language only has the internal-clitic structure, which is used to host aspectual inflection on verbs. Thus, the Mandarin speakers of English in Goad et al.'s study were not expected to produce the agreement or past-tense morphemes in a target-like pattern in the L2. Before we continue, it is necessary to explain the crucial notion of stem length. A short stem is one in which the rhyme contains two segments (e.g., 'cap' $[k\underline{x}p]$; rhyme underlined). By contrast, in a long stem, the rhyme contains three segments: a vowel followed by a two-place final consonant cluster (e.g., 'tank' $[t\underline{x}n\underline{k}]$), or a diphthong followed by a consonant e.g., 'crown' $[kr\underline{a}on]$). Based on this distinction, one more consonant (e.g., the agreement or plural morpheme) can be incorporated within the PWd for a short stem but not a long stem. Adding one more consonant to the long stem will violate the rhyme-binarity constraint in English (Goad et al., 2003); thus, the consonant can only be adjoined to the word as an affixal clitic.

Stem length can be used as a diagnostic in the following way. When the affixal clitic is used to host regular inflection in L2 English in target-like fashion, the inflection attaches using this prosodic structure regardless of the length of the stem; however, when regular inflection is incorporated into the PWd in non-target-like fashion, incorporation is possible only for short stems. Hence, if the affixal clitic is used to host the inflection, suppliance of regular inflection should be high regardless of stem length, but if the internal clitic is used, suppliance should be high for short stems but low for long stems. It follows that, by comparing the suppliance of regular inflection on short and long stems, it is possible to deduce whether learners are using the internal clitic or the affixal clitic to host the inflection.

At the syllable level, four possible phonological contexts for verb inflection are identified in Goad et al. (2003); these are listed below. Of these, three (i.e., [i] - [iii]) allow for internal cliticizing of the morpheme.

(i) Stem verbs that have only two segments in their rhymes (i.e., short stems), as in 'fill' [fil]. Inflection can be incorporated into the PWd in non-target-like fashion in this case because the rhyme capacity allows for a morpheme to be added internally to the stem, as in [fil-z]_{PWd} (rather than [[fil]_{PWd} z]_{PWd}).

- (ii) Stem verbs which are sibilant-final, where schwa epenthesis allows for the morpheme to be internally attached to the coda of the stem, as in 'races' [reI.səz]PWd (rather than [[reIs]PWd [əz]PWd).
- (iii) Verbs followed by a vowel-initial word, so that the morpheme can be resyllabified as an onset, as in 'builds on' [b1ld]PWd [zan]PWd (rather than [[b1ld]PWd z]PWd [an]PWd).²
- (iv) The stem has three segments in its rhyme (i.e., it is a long stem), as in 'build' [b<u>ild</u>], plus the inflection does not occur in a phonotactic environment which permits resyllabification as an onset (like in [iii]). In this situation, the morpheme can only attach as an affixal clitic (cf. [i]), as in 'builds' [[bild]_{PWd} z]_{PWd}.

Goad et al. (2003) predicted two patterns of morpheme production relevant to the four contexts mentioned above: one group of learners will delete the morpheme in all phonological contexts (i.e., deletion across the board [ATB]); by contrast, another group, which I will call the 'variable-suppliance' group, will produce the morpheme in contexts where internal cliticization is allowed (i.e., contexts [i] through [iii] above), but will fail to do so in a context where the morpheme can only attach affixally to the stem (i.e., context [iv]).³

The reasons for this divergence in inflectional production are as follows. According to Goad et al. (2003), the ATB group will realize that the L2 represents inflection using the affixal-clitic structure; however, their L1 does not allow affixal cliticization of inflection. Thus, these learners will opt for deleting the morpheme in all phonological contexts. The variable-suppliance group, by contrast, will transfer the representation used in their L1, and use it with

² In this example, the verb 'build' happens to be long-stemmed. Resyllabification of inflection as on onset is also possible for short stems, as in 'fills on' $[fil]_{PWd} [zan]_{PWd}$ (rather than $[[fil]_{PWd} z]_{PWd} [an]_{PWd}$).

³ To rule out the possibility that the difference between the two groups was due to a difficulty with producing final-consonant clusters that hinders only the ATB group, both groups were tested on the production of clusters in uninflected words, and their production rates in this regard were similar.

stems which end in rhymes that allow the attachment of the morpheme internally in non-targetlike fashion. However, for stems which do not end in rhymes that allow the attachment of the morpheme internally, the morpheme will be deleted.

The results of the study were in accordance with the predictions, as half the participants deleted the morpheme across the board, and half provided the morphemes in contexts in which the morpheme could be attached internally. Goad et al. (2003) paid special attention to the variable-suppliance group. A comparison among the four phonological contexts mentioned earlier revealed a higher suppliance rate for the morpheme when it could be internally cliticized (i.e., contexts [i] through [iii]), than when no option was available except for affixal attachment (i.e., context [iv]). The suppliance rates were 68%, 27% and 75% for contexts (i) to (iii), respectively, compared to only 9% for the affixal-clitic context (iv). This result confirmed that the L2 learners in this study were using the internal-clitic structure from the L1 to represent the target structure in the L2.

In Goad and White (2004), the relaxed version of the PTH was introduced and tested. This investigation was a case study of an end-state Turkish speaker of English called SD. In this study, the subject was at an advanced-proficiency level; hence, it was expected that she would be able to use minimal adaptation of target prosodic structures from existing ones in the L1 to build the necessary representations in the L2. The target morphemes were past tense, agreement and plural (TAP) inflection at the right edge, and articles at the left edge. For regular past tense and plurals, TAP morphemes are represented by the affixal clitic in English, while articles are represented as free clitics. Turkish has the affixal clitic, but at the left edge. It also has the internal clitic, but it does not have the free clitic.

Goad and White (2004) predicted that SD would be able to produce TAP morphemes through minimal adaptation by relicensing the affixal clitic at the left edge in the L1 in a new position in the L2 at the right edge, as shown in (5). (5) Licensing of a left-edge affixal clitic at the right edge of the word



On the other hand, Goad and White (2004) also predicted difficulty in the production of English articles, because the prosodic structure used for hosting articles in English (i.e., the free clitic) is absent from Turkish.

Goad and White (2004) collected data by conducting five interviews over two time periods. SD's spontaneous production was analyzed for the morphemes under investigation. The results confirmed the predictions; the suppliance rates are shown in Table 2.

Table 2

Rates of Morpheme Suppliance by SD

Time period	TAP morphemes	Articles
1	83%	66%
2	84%	68%

As we can see, SD showed high accuracy in the production of TAP morphemes but low accuracy in the production of articles in each period.

Goad et al. (2011) investigated the production of the plural by French learners of Spanish (FLSs). They argued, using syllable stress, that Spanish uses the affixal clitic to host plurality in nouns. In Spanish, stress falls on the penult syllable in verb-final nouns, and on the

ultimate syllable in consonant-final nouns.⁴ Attaching the plural morpheme does not cause the stress to shift to the inflected syllable, which indicates that the morpheme is outwardly attached to the stem as an affixal clitic. Examples are given in (6) (adapted from Goad et al., 2011, p. 2; stressed syllable in bold.

- (6) a. verb-final noun: [**me**sa] 'table', [**me**sas] 'tables'
 - b. consonant-final noun: [balon] 'ball', [balones] 'balls'

The usual way to make a noun plural in French is to add -*s* to the ending, but this morpheme is not pronounced because most final consonants (like -*s*, -*d* or -*t*) in French are not pronounced. So, Goad et al. (2011) turned to verbal inflection, which is the only inflection that is realized on its host in French, to investigate how inflection is organized in this language. In French, words are stressed on the ultimate syllable, regardless of the shape of the ultimate and penult. Goad et al. (2011) showed that stress still falls on the ultimate, even if this syllable is an inflectional morpheme. This implies that the inflection is internal to the PWd. Examples are shown in (7) (adapted from Goad et al., 2011, p. 3; stressed syllable in bold; INF = infinitive, 2PL = second-person plural; IMP = imperative).

(7)	a.	[vi zit] 'visit'	Verb stem
	b.	[vizite] 'visit-INF' or 'visit-2PL'	Verb with inflection
	c.	[vizi t ɛ] 'visit-IMP'	Verb with inflection

Based on this prosodic difference between Spanish and French, Goad et al. (2011) examined how FLSs would produce plural inflection in obligatory contexts. A total of 40 participants in year one (Y1) and year two (Y2) Spanish classes did a picture-description task.

⁴ Ultimate', 'penult' and 'antepenult' are the technical terms used to refer to the last syllable, the second to last, and the third to last, respectively.

The task consisted of a set of pictures, each representing a scene that showed everyday nouns in singular and plural forms. Table 3 shows the rates of plural suppliance in both groups. Using a Chi-square test, at p < .0001, the results showed that the Y2 students supplied the plural morpheme significantly more accurately than the Y1 students did for both consonant-final and vowel-final nouns.

Table 3

Plural Suppliance on Nouns in Goad et al. (2011)

Group	Consonant-final	Vowel-final
Y1	50%	76%
Y2	85%	95%

Goad et al. (2011) also noticed that each group had its own way of prosodifying the plural. For the Y1 group, who were assumed to have lower language proficiency than the Y2 group, the learners realized that the plural is not prosodified in the same manner as verbal inflection is prosodified in their L1, but they could not produce the correct prosodic structure (i.e., the affixal clitic). So, they either omitted the morpheme, or resorted to using the internal clitic from verbal inflection in French to host the morpheme. This was evidenced by stress-shifting (i.e., the pattern in French inflection) when the participants supplied the morpheme. On the other hand, the Y2 group had a higher rate of morpheme production, and fewer cases of stress-shifting when the morpheme was supplied. Based on this, we can infer that the Y2 group were using the affixal clitic. Even so, Goad et al. (2011) took the position that, despite the relatively good performance of the Y2 group, this group were not yet native-like, as they were fluctuating between stressing the ultimate (i.e., the pattern in French inflection).

Jin et al. (2009) studied the production of determiner phrases (DPs) by English and Chinese learners of Norwegian. Norwegian is a language which marks agreement for number, gender and definiteness on nouns and adjectives. In adjectives, the inflection can be hosted by an internal or affixal clitic, depending on the definiteness of the noun head. English and Chinese, on the other hand, do not mark adjectives for number, gender, or agreement. The participants were asked to listen to recordings of short sentences, and then produce a sentence with a prenominal adjective that modified the head noun. The results, summarized in Table 4, showed that, in both L2 groups, the suppliance of internally-hosted inflection was higher than that of affixally-hosted inflection.

Table 4

Rates of Morpheme Suppliance by Type of Prosodic Structure for the English and Chinese L1 Groups

Prosodic structure	English	Chinese
Internal clitic	74.7%	67.5%
Affixal clitic	55.9%	47.1%

This result suggested that the participants in both groups were using the internal-clitic structure from the verbal domain (i.e., irregular past-tense in English, and aspect in Chinese) to represent the inflection in the L2 adjectival domain.

2.2.4 Relevant morphosyntactic characteristics of Arabic

As necessary background to a prosodic analysis of Arabic in subsequent sections, I will describe the relevant morphosyntactic characteristics of this language in this section. First, we will consider the present tense in Section 2.2.4.1. Then, subject-verb agreement in the present

tense will be examined in Section 2.2.4.2. I conclude by explaining number marking on nouns in Section 2.2.4.3.

2.2.4.1 Present tense

Verbs in the present tense, like all words in Arabic, are based on three discontinuous consonants called a 'root' (McCarthy & Prince, 1990b). This tri-consonantal root is inserted into a template to construct the verb. The templates that allow the derivation of verbs are called the *binyanims* of Arabic verbs (Danks, 2011).⁵ For example, the root *d-r-s* 'study' is inserted into the template *ya*-CCVC (C = consonant, V = vowel) to form the present-tense verb *yadrus* 'he studies' (where *ya*- is the subject-verb agreement prefix for a third-person masculine singular subject).⁶ According to McCarthy (1979, 1981), the underlined vowel 'u' in *yadr<u>us</u>* carries the present-tense information.⁷ The stem of the verb is the unit to which the inflectional elements are attached; for example, the stem of *yadrus* 'he studies' is *-drus*.

Within the frame of the Morpheme Tier Hypothesis (McCarthy, 1981), the consonantal root *d*-*r*-*s* occupies a morphological tier different from the present morpheme '*u*' tier, as shown in (8) (representation adapted from Danks, 2011, p. 86). To arrive at the oral output of the structure in (8), the tiers are flattened through Tier Conflation (McCarthy, 1981), yielding the present verb *yadrus* 'he studies' in (9).

⁵ *Binyanim* means 'building' in Arabic.

⁶ Arabic words and examples in this thesis are transliterated using romanization, not the International Phonetic Alphabet.

⁷ This vowel indicates the voice too, which is 'active' in this template.

(8) Tier representation for *yadrus* 'he studies'



(9) Tier conflation for *yadrus* 'he studies'

C V C C V C | | | | | | | y a d r u s

2.2.4.2 Subject-verb agreement in the present tense

In Arabic, the subject-verb agreement morpheme in the present tense is circumfixal, which means that inflection is placed before and after the stem verb. This is why, in the present tense, the verb is sometimes referred to as a prefixed-stem verb, compared to the verb stem in the past, which is exclusively suffixal (Holes, 2004; Ryding, 2005). Note also that, in the present tense, one morpheme can carry information about more than one functional category at the same time. For example, the suffix *-i* (as in *taktub-i* 'you.write-FEM.SING'; FEM = feminine, SING = singular) indicates gender and number as well as present tense.

There are four prefixes that can attach to a present verb stem: ?a-, na-, ya-, and ta-. There are also three suffixes: -u, -in and -i (Benmamoun, 2000). The prefixes are mainly used to mark person, but in the case of first person, they are markers of number too, as shown in Table 5. The suffixes are used to mark gender as well as number, as shown in Table 6.

Table 5

Present-Tense Prefixes: Markers of Person and Number

Prefix	Example	Person	Number
?a-	?a-ktub	First	Singular
na-	na-ktub	First	Plural
ta-	ta-ktub	Second	-
ya-	ya-ktub	Third	-

Table 6

Present-Tense Suffixes: Markers of Gender and Number

Suffix	Example	Gender	Number
- <i>i</i>	ta-ktub-i	Feminine	Singular
-и	ta-ktub-u	Masculine	Plural
-in	ya-ktub-in	Feminine	Plural

2.2.4.3 Number marking on nouns

In Arabic, three number categories are recognized for nouns: singular, dual, and plural. The singular noun is the stem to which the dual or plural suffix is added. Dual nouns have one marker for both masculine and feminine nouns (-e:n); this marker is suffixed to the stem noun, as in (10) (MASC = masculine).

(10) a. *ta:lb-e:n* student(MASC)-DUAL

b. *ta:libt-e:n* student(FEM)-DUAL

The plural has two patterns: sound and broken. Any given noun in this language takes either the sound plural or the broken plural. The sound plural has a marker for masculine nouns (-*i*:*n*) and a marker for feminine nouns (-*a*:*t*). This marker is suffixed to the singular noun (i.e., the noun stem) to form the plural, without applying any changes to the noun stem, which is why this type of plural is called 'sound'. For example, the plurals of the singular noun *muhandis/muhandiseh* 'engineer(MASC/FEM)' are formed by attaching the respective plural suffixes to the stem *muhandis*, as in (11) (PL = plural).

- (11) a. *muhandis-i:n* engineer-MASC.PL
 - b. *muhandis-a:t* engineer-FEM.PL

This type of plural, albeit regular, is the exception rather than the norm. Its use is confined to participles (as in *da:risi:n* 'scholar-MASC.PL'), and to nouns indicating professions (as in *mu?almi:n* 'teacher-MASC.PL') or habits (as in *qawwami:n* 'worshipper-MASC.PL'; Wright, 1995).

The other type of plural in Arabic, and the more common type, is the broken plural. This type of plural is formed, as the name suggests, by breaking up the singular stem and changing the vocalic melody inside this stem; in other words, no affixation is involved. A non-concatenative process is applied whereby vowels are inserted into the trilateral consonant root $(C_1C_2C_3)$ of the singular stem according to a set of broken-plural templates (Al-Suhaibani, 2005; Al-Timimi, 2018; McCarthy & Prince, 1990a; Zabbal, 2002). Arabic has thirty-one templates for the broken plural, all of which are listed by Wright (1995, pp. 199-231). Examples of broken plurals are given in Table 7.

Table 7

Examples of Broken Plurals Based on Three Templates

Singular stem	Plural form	Template	Meaning
sahm	siha:m	CVCVVC	arrows
sult ^ç a:n	sala:t ^c e:n	CVCVVCVVC	Sultans
kita:b	Kutub	CVCVC	Books

To derive a broken plural from the singular stem, we start with the trilateral consonantal root of the singular stem. For example, the root of the singular stem *sahm* 'arrow' is $C_1 = s$, $C_2 = h$, $C_3 = m$. These three sounds are then inserted into the corresponding broken template (i.e., 'CiCaaC') to obtain the plural form *siha:m* 'arrows'. Within the Morphology Tier framework, this process can be represented by the three morphological tiers in (12).

(12) Tier representation for the broken plural *siha:m* 'arrows'

Vowel melody		i	a		
			\square		
CV skeleton	С	V C	V	V	С
Root	S	h			m

2.3 Prosodification of functional morphemes in Arabic

Before discussing the prosodification of the morphemes under scrutiny, I will provide a brief description of suprasegmental elements relevant to the current prosodic analysis, namely, syllable structure and stress assignment in Arabic. Syllable structure is important because stress is assigned based on the structure and location of the syllables, as we will see shortly. Stress assignment helps define the boundary of a PWd, thus enabling us to determine how functional morphemes are attached to their stems at the prosodic level.

2.3.1 Syllable structure and stress assignment

Syllables in Arabic are classified based on the weight of the syllable. In Arabic, weight is measured by the number of moras (μ) in the syllable: each segment in the rhyme is a mora (Al-Jarrah, 2002). There are three main syllable types in Arabic: light syllable, $\sigma\mu$ (CV); heavy syllable, $\sigma\mu\mu$ (CVC, CVV); and superheavy syllable, $\sigma\mu\mu\mu$ or $\sigma\mu\mu\mu\mu$ (CVVC, CVCC, CVVGG; G = geminate). Stress in Arabic follows the 'three syllable window' pattern of stress assignment, according to which stress falls on one of the final three syllables (Cowell, 1964; Mitchell, 1960; Watson, 2011). The pattern of stress assignment in Arabic is given in (13) (following Al-Jarrah, 2002).

- (13) Stress assignment in Arabic (stressed syllable in bold):⁸
 - a. Stress a superheavy ultimate (CVVC, CVCC, CVVGG), as in *za.ma:n* 'time', or *ash.sha:bb* 'young man'.
 - b. If the ultimate is not superheavy, stress a heavy penult (CVV or CVC), as in *mu.ba:*.*rak* 'blessed', or *kom.mith.ra* 'pears'.
 - c. If the penult is not heavy, stress is assigned to either the penult or the antepenult, whichever is separated from a preceding heavy syllable by an even number of light syllables, as in *mad.ra.sih* 'school', or *mak.ta.bih* 'library'.⁹

I will use stress assignment to determine the prosodic structures of the agreement and plural morphemes; particularly, stress assignment can be used to determine whether or not a morpheme is internally cliticized to the stem. If the inflection receives stress, or causes a change in the stress assignment of the word, then it must be located within the PWd, which means that the inflection is hosted by the internal clitic (Anderson, 2005).

An example from Arabic is the use of the prefix *ka* 'as/like' in a simile, as in the phrase *kun ka-Nada* 'be like Nada' (proper name). The prefix *ka-* is concatenated to the left edge of the proper name *Nada*, forming one word, *kaNada*. To be able to tell whether this prefix is internally attached to the PWd, we can study the stress assignment in the stem before and after the attachment of the prefix, as in (14) (stressed syllable in bold).

⁸ Classical Arabic and all modern Arabic dialects follow the rules of stress assignment in (13a) and (13b); however, not all of them follow (13c). The patterns in (13a) through (13c) are applicable to the Jordanian dialect (Al-Jarrah, 2002; see also Jaradat, 2018).

⁹ In each of these two examples, there is no preceding heavy syllable, so the antepenult is stressed.

- (14) Stress assignment with the simile prefix ka
 - a. Stress before prefix attachment: *Na.da* 'Nada'
 - b. Stress after prefix attachment: *ka.Na.da* 'like Nada'

According to the stress-assignment rule in (13), *ka*- should have received the stress in (14b), but this is not the case: the stress in *kaNada* is assigned without considering *ka*. Specifically, the stress falls on the penult syllable *na* rather than the antepenult *ka*. This means that *ka* is not internal to the PWd.

Let us also compare the stress pattern in ka.Na.da 'like Nada' with the stress pattern in the country name Canada *Ka.na.da* in Arabic. Note that *ka.Na.da* and *Ka.na.da* are phonetically identical. In the case of the country name, the first syllable *Ka.na.da* receives the stress based on the rule in (13). This asymmetry in the stress assignment for two phoneticallyidentical words supports my conclusion that the prefix *ka*- in Arabic is not internal to the PWd.¹⁰

In the following subsections, I will discuss the prosodic structures used in Arabic to host the present tense, agreement, and plural (TAP) morphemes. I will limit my discussion of the prosodification of morphemes to suffixes (i.e., right-edge morphology). For ALEs, L1 prosodic structures that host prefixes can only be transferred to the L2 by means of minimal adaptation (Goad & White, 2004); however, this is not assumed to be possible for the participants in my study due to their proficiency level. I will argue that, in Arabic, the TAP morphemes are hosted by the internal clitic structure.

¹⁰ For similar discussion of the use of stress patterns to determine the type of clitic used to prosodify a morpheme in Arabic, refer to Al-Sadhan (2015), Jaradat (2018), and Hellmuth (2006).
2.3.2 Prosodification of tense and agreement suffixes

In Section 2.2.4.1, I discussed the morphosyntax of the present tense in Arabic and demonstrated that this tense is indicated by the vocalic melody of the template used to derive the verb. The vocalic melody in verb *binyanims* (e.g., the underlined vowel u in *yadr<u>us</u>* 'he studies') carries the tense information in a non-concatenative pattern; in other words, functional material is not isolatable into a distinct unit, but rather integrated into the PWd structure, as shown in (15) (1PL = first person). Thus, the present tense morpheme is hosted as an internal clitic.





We now move on to agreement suffixes. Suffixes in the present-tense verb, as indicated in Section 2.2.4.2, are gender and number markers. There is one suffix for singularity for feminine second person (-i), and two suffixes for plurality: -u for masculine plural, and -in for feminine plural. Suffixes in the present verb are hosted by the internal-clitic structure, as I will demonstrate below.

Present-tense verbal suffixes have the syllable structures -V and -VC. Neither of these structures can stand on its own and must be anchored to a consonant onset, because vowel-initial syllables are not permitted in Arabic (Abu-Salim, 1982; Broselow, 2017; Guba, 2018; McCarthy, 1981). The resulting ultimate syllable in the inflected verb does not receive stress,

because it is not a superheavy syllable. Even so, the attachment of these suffixes affects the stress assignment in inflected verbs, as seen in the pattern of stressed syllables in verbs in Table 8 (stressed syllable in bold). This pattern indicates that these suffixes are internally cliticized to the base form.

Table 8

Suffixes in Present Verbs

Base singular	FEM.SING	MASC.PL	FEM.PL	Meaning
yij .ta.hid	tij. tah .di	yij. tah .du	yij. tah .din	Endeavor
yih .ta.rim	tih. tar .mi	yih. tar .mu	yih. tar .min	Respect
yin .ka.sir	tin. kas .ri	tin. kas .ru	yin. kas .rin	Break
yif .ta.tih	tif. tat .hi	yif. tat .hu	tif. tat .hin	launch

Example (16) shows the prosodification of two example verbs. Note that the suffix is internal to the PWd.

(16) Prosodification of *yijtahd-u* 'endeavor-3.MASC.PL' and *yihtarm-in* 'respect-3.FEM.PL'



I summarize the prosodic representation of tense and agreement inflection in presenttense verbs in Arabic in Table 9.

Table 9

Summary of Morpheme Types and Prosodifications for Present-Tense Verbs in Arabic

	Morpheme	Type of morpheme	Prosodification
Tense	Vocalic template	Vocalic melody	Internal clitic
Agreement	-i, -u, -in	Suffix	Internal clitic

2.3.3 Number marking on nouns

As mentioned in Section 2.2.4.3, dual or sound-plural inflection in Arabic nouns is formed by concatenating a long vowel followed by a consonant (VVC) to the right edge of the stem word. As also stated in Section 2.3.2, the syllable structure VVC cannot stand on its own, and must be anchored to a consonant onset because vowel-initial syllables are not permitted in Arabic (Abu-Salim, 1982; Broselow, 2017; Guba, 2018; McCarthy, 1981). The consonant coda of the noun stem is resyllabified with the inflectional suffix VVC to form the ultimate syllable CVVC in the inflected form.¹¹ The number suffix is *-e:n* for duals, and *-i:n* and *-a:t* for plurals; examples are shown in (17).¹²

(17)	a.	mu.han.dis → mu.han.di.se:n	engineer-MASC.DUAL
	b.	tay.ya:r → tay.ya:.ri:n	pilot-MASC.PL
	c.	fa.ra:.shih → fa.ra:.sha:t	butterfly-FEM.PL

¹¹ In a case in which the coda of the noun stem is a vowel too, the morpheme (VVC) is anchored to the consonant that precedes the vowel coda, as in *mu.ha:.mi:* \rightarrow *mu.ha:.mi:n* 'lawyer-MASC.PL'.

¹² In the case of the feminine sound plural, the gender marker in the stem noun (*-ih/-ah*) must be dropped before concatenating the plural suffix *-a:t*, as in (17c).

Based on this, dual and sound-plural nouns in Arabic have CVVC as the ultimate syllable. If the morpheme is internally cliticized, it will receive stress, according to the stress assignment rule in (13), since it is a super-heavy syllable.

In Table 10, I exemplify stress assignment in three nouns before and after the attachment of the number marker (stressed syllable in bold). Compare the stress assignment in the singular stem and the corresponding inflected forms. As the syllable which includes the dual and sound-plural morphemes is the syllable which receives the stress, it is treated as part of the word stem. This indicates that this morpheme is attached internally to the PWd.¹³

Table 10

Examples of Duals and Sound Plurals in Arabic

Singular	Dual	Sound plural (MASC)	Sound plural (FEM)	Meaning
m?al.lim	m?al. me:n	m?al. mi:n	m?al. ma:t	teacher
mu.ta. sa: .biq	mu.ta.sa:.bi. qe:n	mu.ta.sa:.bi. qi:n	mu.ta.sa:.bi. qa:t	competitor
mu. han .dis	mu.han.di. se:n	mu.han.di. si:n	mu.han.di. sa:t	engineer

An example of the prosodification of an inflected noun is given in (18).

¹³ Al-Jarrah (2002) has shown, within the framework of Optimality Theory, that Arabic words which end in superheavy syllables, regardless of whether they are uninflected or inflected words, must receive stress on an ultimate superheavy syllable.



Phonologically, the dual and sound-plural morphemes act like any superheavy ultimate syllable found in a monomorphemic parallel noun, as Table 11 shows (ultimate syllable in bold).¹⁴ This means that these two number morphemes are both internal to the PWd.

Table 11

Inflected sound	Meaning	Monomorphemic	Meaning
plural		parallel	
sa:m. ^se:n	listeners	ти. ^се:п	Mu'en (proper name)
mux.li.s e:n	honest people	ya. se:n	Yasin (proper name)
fa:.?i. ze:n	Winners	ha. ze:n	Sad
shu.ru. fa:t	Balconies	^s a.ra. fa:t	Arafat (proper name)
sha:b. ba:t	young ladies	na. ba:t	Plant

Inflected Sound Plurals and Monomorphemic Parallels

We will now consider broken plurals, in which the functional material indicating number is intermingled with the noun stem. This stem undergoes several internal changes in forming the plural noun. These changes are effected according to a particular template for the

¹⁴ A parallel monomorphemic noun is an uninflected noun that has the same superheavy ultimate syllable as an inflected noun.

broken plural. For example, vowel lengthening is applied in the template CVCVVC, as in *nafs* \rightarrow *nufu:s* 'souls'; gemination in the template CVGGVVC, as in *?a:mil* \rightarrow *?umma:l* 'workers'; and a change in the vocalic melody in the template CVCVC, as in *asfar* \rightarrow *sufur* 'yellow things'.

The majority of broken plurals differ from their corresponding singular forms in having a long vowel (Benmamoun, 2003). The syllable which has this long vowel is the syllable to receive the stress, and it is typically the rightmost syllable in the broken plural. Prosodically, McCarthy and Prince (1990a) suggested shape-defined categories for the patterns of broken plurals in Arabic, as given in Table 12 (stressed syllable in bold). This classification shows that broken-plural nouns behave like uninflected words with respect to stress assignment (classification adapted from McCarthy & Prince, 1990a, p. 213).

Table 12

Inflected	Plural template	Singular	Example	Meaning
form				
Iambic	Cu.CuuC	Ca.CiC	s ha. hir → shu. hu:r	Months
	?aC.CaaC	Ci.CiC	ji.sim → aj.sa:m	Bodies
	Ca.waa.CiC	Ca:.Ci.Ca	da:.?ira→	Circles
			da. wa: .?ir	
Trochaic	Cu.CaC	CuC.Ca	huf.ra → hu.far	Holes
	Ci.CaC	Ci:.Ca	qi:.ma →qi.yam	Values
	Cu.CuC	Ci.Ca:C	ki. ta:b → ku .tub	Books
Monosyllabic	CiCC+aan	CuCa:C	γu. la:m → γil. ma:n	Youngsters
	CuCC+aan	CaCi:C	qa. ti: ^ç → qut. ^ça:n	Cattle

Some Patterns of Broken Plurals

Note. An iamb is an unstressed syllable followed by a stressed one, and a trochee is a stressed syllable followed by an unstressed one.

I summarize the prosodification of number in Arabic nouns in Table 13.

Table 13

Summary of Morpheme Types and Prosodifications for Number Morphemes in Arabic Nouns

	Morpheme	Type of morpheme	Prosodic structure
Dual	-e:n	Suffix	Internal clitic
Sound plural	-i:n / -a:t	Suffix	Internal clitic
Broken plural	Vocalic template	Vocalic melody	Internal clitic

2.3.4 Summary of prosodic structures in Arabic

In Table 14 below, I recap the prosodic structures used for hosting TAP inflection in Arabic.

Table 14

Prosodifications of Present Tense, Agreement, and Number Morphemes in Nouns in Arabic

	Type of morpheme	Prosodic structure
Tense	Vocalic melody	Internal clitic
Agreement	Suffix	Internal clitic
Dual	Suffix	Internal clitic
Sound plural	Suffix	Internal clitic
Broken plural	Vocalic melody	Internal clitic

Note that the internal clitic is used to host all of these types of morpheme.

2.4 Review of relevant previous studies

In this section, I review studies which address the specific phenomenon of interest in the current experiment: prosodic transfer within the same construction. I summarize these studies in Section 2.4.1, before identifying limitations and gaps in Section 2.4.2.

2.4.1 Prosodic transfer in L2 oral production: The role of the domain

Austin et al.'s (2022) study examined the transferability of prosodic structures not only across constructions but also across domains (e.g., past tense [in the verbal domain] in L1 verbs \rightarrow plurals [in the nominal domain] in L2 nouns). They studied the production of the English subject-verb agreement and regular-plural morphemes by intermediate Korean learners (KLEs). Like English, Korean marks tense on the verb, but, in most circumstances, it does not mark nouns for number. Austin et al. (2022) showed that functional morphology is organized internally to the PWd in the Korean verbal domain, and more loosely as a free clitic in the nominal domain; see Table 15 (adapted from Austin et al., 2022, p. 11).

Table 15

Prosodic Structures of Verbal and Nominal Morphemes in Korean and English

	Prosodic representation		
Type of morpheme	Korean (L1)	English (L2)	
Verbal			
Various morphemes	PWd-internal incorporation	-	
Agreement inflection	-	Affixal clitic	
Nominal			
Plural inflection	-	Affixal clitic (regulars)	
Particles	Free clitic	-	

Given this incongruent distribution of prosodic structures in the L1 and the L2, Austin et al. (2022) made predictions that covered all possibilities for prosodic-structure transferability. The goal was to determine if the L2 learners in the study were transferring prosodic structures across constructions and domains, and if they did so, what L1 and L2 morphemes might this involve. The pool of KLEs in the study was predicted to exhibit one or more of the following patterns:

- a) deletion of functional morphology (cf. the ATB group in Goad et al., 2003),
 because the L1 lacks the target prosodic structure;
- b) internal-clitic incorporation, such that participants were predicted to transfer the internal clitic within and across domains to represent both agreement and plurals, respectively; and/or
- c) free-clitic use, such that participants were predicted to transfer the free clitic within the nominal domain (from L1 particles to L2 plurals) and across domains (from L1 particles to L2 agreement).

Spoken production was elicited using a sentence-completion task. To determine which prosodic structures were being transferred from the L1 to the L2, a contrast between short stems vs. long stems was used. The assumption underlying this contrast was that a higher rate of production of the morpheme /s/ on short stems was an indicator that the internal-clitic structure was being transferred from the L1 to the L2 (see pattern [b] above), because incorporation of inflection into the PWd is possible on short stems but not long stems (Goad et al., 2003). The rates of morpheme suppliance in Austin et al. (2022) are shown in Table 16.

Table 16

Type of	Rate of
morpheme	suppliance
Agreement	
Short stem	57%
Long stem	35%
Plural	
Short stem	76%
Long stem	61%

Rates of Verbal and Nominal Morpheme Suppliance by Inflection Type and Stem Length

Austin et al. proposed three possible models of L2 prosodic transfer as a best fit for the data:

- A naïve model, which implied no expectation about morpheme suppliance. This model was used as a baseline to which the models in (b) and (c) could be compared.
- b) An internal-incorporators model, which corresponds to higher suppliance on short stems than on long stems for either agreement or plurals.
- c) A free-clitic users model, which corresponds to transferring the free clitic; in this case, inflection is supplied at a high rate on both short and long stems.

The three models were compared using two measures of the predictive accuracy of the model (i.e., the ELPD and the WAIC).¹⁵ The comparisons showed that the participants were using the incorporation structure not just to represent the agreement morpheme but also to

¹⁵ ELPD stands for 'expected log-point-wise predictive density' (Vehtari et al., 2017), and WAIC for 'Watanabe-Akaike information criterion' (Watanabe, 2010).

represent the plural morpheme in the L2. The former result confirmed the transferability of prosodic structures across constructions within the same domain (i.e., L1 various verbal morphemes \rightarrow L2 agreement), while the latter constituted evidence for transfer across domains (and therefore also across constructions; i.e., L1 various verbal morphemes \rightarrow L2 plurals). In addition, the results showed that a prosodic structure in the L1 could be transferred to another domain even if a prosodic structure was already available in the same domain in L1; specifically, even though Korean has the free clitic in the nominal domain, PWd-internal incorporation (from the verbal domain) was used to host L2 plural inflection. This suggests that it is possible for a representation within the same domain to be 'trumped' by one from another domain as the representation selected for transfer from the L1.

In contrast to Austin et al. (2022), some studies focus specifically on the transfer of prosodic structure within the same construction. These studies are directly relevant to my own experiment. Moreover, the last two studies are of special importance because they target ALEs.

I will start with Goad and White (2006), who investigated the production of the regular present perfect by Mandarin learners of English (MLEs).¹⁶ Note that the present perfect involves inflection for aspect in English, and that this inflection is hosted by the affixal clitic for regular verbs, and by the internal clitic for irregular verbs. Mandarin is inflected for aspect, and it uses the internal-clitic structure to host this inflection. As both the L1 and the L2 are inflected for aspect, this study is a case of transferring prosodic structures within the same construction.

Goad and White (2006) predicted that the MLEs in their experiment would produce inflection in irregular verbs more accurately than in regular verbs, because the internal clitic is

¹⁶ Goad and White also investigated the production of past-tense inflection; however, this does not involve prosodic transfer within the same construction (since Mandarin lacks inflection for tense), and so is not relevant to the present experiment.

available in Mandarin whereas the affixal clitic is not available. Also, in the case of regular verbs, Goad and White expected that, as a result of incorporation of inflection within the PWd, the morpheme would be produced on short stems more consistently than on long stems. The participants in the study, who were at intermediate-proficiency level, did an oral sentence-completion task. They were shown a sentence fragment (e.g., 'My parents can visit me today because'); then they were asked to choose the correct completion (as in 'I clean/have cleaned my apartment'). After choosing the answer, they were given time to memorise the sentence before producing it.

Significant modifications to the method and the types of stimulus verbs were made in Goad and White (2006), compared to those used in Goad et al. (2003) and Goad and White (2004). First, the phonological context of the stems under study was controlled to prevent the resyllabification of the inflection as the onset of the following syllable (context [iii] in Goad et al., 2003). Resyllabification was prevented by choosing a non-vowel onset for the word immediately following the inflection, as in 'Last night after dinner, you **showed me** photos of your daughter' (Goad & White, 2006, p. 253), where the word 'me' does not begin with a vowel. By preventing resyllabification, Goad and White (2006) were able to exclude a context in which the speaker could evade having to use an affixal clitic to host the inflection. In so doing, these researchers were able to make an accurate assessment of the L2ers' ability to produce morphemes in target-like fashion.

Also, monomorphemic parallels were added to the task to ensure that the deletion of inflection was due to prosodic rather than articulatory factors.¹⁷ If the speakers were able to produce /s/ in the rhyme of the monomorphemic parallels, then the omission of the morpheme in inflected words could not be due to a general ban on final-consonant clusters in the L1, but

¹⁷ In Goad and White (2006), and also in the present experiment later on, monomorphemic parallels are uninflected words that have two-position rhymes (like 'ox' $[p\underline{ks}]$ and 'lapse' $[l\underline{\alpha}\underline{ps}]$, rhyme underlined) which parallel the rhyme of an inflected form in phonotactic terms.

must reflect a prosodic (rather than purely articulatory) problem with the suppliance of inflection per se.

The results of the study showed that the participants were able to produce inflection at a high rate in both regular and irregular verbs. By implication. for regular verbs, stem length had no effect on accuracy, as shown in Table 17.

Table 17

Rate of Morpheme Suppliance of English Aspectual Inflection (Present Perfect)

	Type of stem	Rate of suppliance
Regular	Short	91%
	Long	97%
Irregular	-	94%

Goad and White (2006) explained this unexpected result as follows: at a certain stage in interlanguage development, minimal adaptation becomes possible for the learner (Goad & White, 2004).¹⁸ Hence, the participants were able to build the affixal clitic from relations available in Mandarin (i.e., PWd-PWd and PWd- σ).

Cabrelli Amaro et al. (2017) provide further evidence which is relevant to the present experiment. They investigated variability in the suppliance of the English regular past-tense morpheme in Japanese and Spanish. The choice of these two L2 language groups was based on phonotactic and prosodic grounds. Phonotactically, both L2 languages have constraints on CC-final words; this is pertinent because, when regular English past-tense inflection is produced on stems with certain phonotactic shapes, CC codas are created (e.g., 'canned'

¹⁸ More specifically, Goad and White (2009) suggest that, for prosodic structures absent from the L1, beginners will delete functional morphology, less proficient speakers will produce it variably by adapting existing representations from the L1, and more proficient speakers will reach an eventual target-like pattern.

[kænd], 'missed' [mɪst]; coda underlined). Prosodically, Japanese uses the affixal-clitic structure to represent past-tense inflection, while Spanish uses the internal-clitic structure to host this inflection. As the past tense is overtly marked in both L1s and also in the L2, Cabrelli Amaro et al.'s study is a case of transferring structures within the same construction for each L1. The researchers argued that if variability in morpheme suppliance was due to a CC-final ban, then both groups of learners would be expected to have the same difficulty in producing the morpheme; however, if it was a prosodic problem, then the Japanese group should outperform the Spanish group.

Groups of Japanese and Spanish learners of English at advanced-proficiency level did a sentence-completion task. They were given short context sentences with the stimulus words blanked out. They were asked to complete the sentence and produce it orally. The task consisted of 82 sentences; these included inflected verbs, as in 'filled' in (19a), and monomorphemic parallels, as in 'pond' in (19b). Monomorphemic-parallel stimuli were included to investigate the ability of the participants to produce CC-final words. Consider (19) (adapted from Cabrelli Amaro et al., 2017, p. 516).

- (19) a. Johnny had a terrible headache, so he _____ a glass with water and took two aspirins. [fill, write, type]
 - My dad and I were driving, and suddenly he stopped the car and pointed at a nice frozen _____. [pond, sky, truck].

The results for the suppliance rates of the CC-final targets in both inflected and monomorphemic parallels in both groups are shown in Table 18. These findings indicate that the rates of suppliance in both groups did not vary significantly in terms of the type of word (i.e., monomorphemic or inflected), which ruled out the possibility that, for both groups, any omission of the past-tense morpheme was due to a CC-final ban.

Table 18

Suppliance Rates for CC-Final Words in Cabrelli Amaro et al. (2017)

L1 group	Monomorphemic	Inflected
Japanese	98%	88%
Spanish	81%	87%

The morpheme suppliance rates are given in Table 19. These rates show that the Japanese group supplied the morpheme at a higher rate than the Spanish group.

Table 19

Suppliance Rates for the Past-Tense Morpheme By Group in Cabrelli Amaro et al. (2017)

L1 group	Suppliance
Japanese	83%
Spanish	77%

As mentioned earlier, the Japanese learners were expected to outperform the Spanish learners because Spanish does not have the affixal structure. However, the results (at p < .05) did not reveal a significant difference between the performance of the two groups. To account for this, Cabrelli Amaro et al. suggested that the Spanish group had successfully built the affixal structure through minimal adaptation.

White (2008) studied the production of the past tense (both regular and irregular), agreement, and the (in)definite article by French learners of English (FLEs). Past tense, agreement and definiteness are instantiated and marked in French, which means that prosodic

transfer is predicted to occur within the same construction for each morpheme. The prosodic structures in both languages are shown in Table 20.

Table 20

Prosodic Structures of Functional Morphemes in English and French

L1	Tense and agreement	Articles
English	Affixal clitic	Free clitic
	Internal clitic (irregular past-tense	
	only)	
French	Internal clitic	Free clitic

Based on the structures available in the L1, White predicted a high production rate for the irregular past-tense morpheme and the article in the L2; specifically, the FLEs could produce both types of inflection in target fashion by using the internal clitic to host the former morpheme and the free clitic to host the latter. However, for the regular past-tense and agreement morphemes, variability was predicted on the basis that the FLEs would use the internal clitic to host past-tense and agreement inflection in their L1¹⁹. An elicited-production task was implemented, and the results confirmed the predictions of the PTH. As shown in Table 21, the FLEs successfully produced the irregular past-tense and articles, compared to their variable production of the regular past-tense and agreement morphemes.

¹⁹ White did not control for stem length. Thus, her reason for expecting variable suppliance of the regular pasttense and agreement morphemes was presumably that, among the inflected forms produced by the learners, there would be some long-stemmed forms (and therefore some omission of inflection).

Table 21

Morpheme	Rate
Regular past	50%
Irregular past	83.5%
Agreement	60%
Articles	97.3%

Rates of Morpheme Suppliance by FLEs

The final two studies in this section were concerned with ALEs. Kahoul's (2014) study addresses the production of the regular past-tense and agreement morphemes by ALEs at three levels of proficiency (low: N = 11; mid: N = 14; high: N = 9).²⁰ This enabled a comparison among these levels, as we shall see shortly. The goal of the study was to identify what prosodic structures are transferred from the L1 to the L2 to host the past-tense and agreement morphemes. Kahoul used an elicited-imitation task which comprised 50 sentences containing stimulus verbs for the past tense and agreement (20 inflected verbs for tense, 24 inflected verbs for agreement, and 14 uninflected verbs as distractors). Participants were asked to repeat the sentences one by one, and their responses were audio-recorded.

Kahoul took the position that Arabic lacks the affixal-clitic structure: he argued that there is no structure in which both EXHAUST and NONREC constraints are both violated in this language. Instead, he proposed that the past tense and agreement morphemes are both hosted by the internal-clitic structure in Arabic.²¹ As for English, he referred to Goad et al.'s (2003, p. 248) argument that English uses the affixal clitic to host the past-tense and agreement

 ²⁰ The Arabic dialects in Kahoul's (2014) study were Syrian, Jordanian, Iraqi, Saudi, Egyptian and Libyan Arabic.
 ²¹ This is the same as my analysis concerning the prosodification of the right-edge inflection for plurals and agreement in Arabic; see Section 2.3.2.

morphemes. In (20), I provide examples of sentences containing past-tense and agreement inflection (adapted from Kahoul, 2014, pp. 266, 267; items of interest in bold).

- (20) (a) Last year, John **travelled** around several countries.
 - (b) Every year, Bob **buys** a new car and **sells** the old one.
 - (c) Tom and Bob **visited** a friend yesterday.
 - (d) Last year, Jack **tried** very hard to learn to play the guitar, but he couldn't.

As we see in these examples, inflection can be organized PWd-internally in non-target-like fashion in the phonological contexts mentioned earlier (see Section 2.2.3.2): as an onset in 'travelled' (20a), PWd-internally in 'buys' or 'sells' in (20b), and as a coda in 'visited' in (20c). Inflection can only be organized in target-like fashion (i.e., via the affixal-clitic structure) in 'tried' in (20d).

Based on the PTH, Kahoul predicted that the ALEs in his study would use the internalclitic structure from Arabic to host the target inflection in English. Since inflection can be incorporated into the PWd on short but not long stems, it follows that morpheme suppliance should be higher in the phonological contexts exemplified in (20a) to (20c) than in contexts in which the internal clitic cannot be used, as in (20d). The overall rates of morpheme production in Kahoul (2014) are shown in Table 22.

Table 22

	Past tense	Agreement
Low	55.3%	47%
Intermediate	66.3%	50%
High	92.6%	87%

Overall Suppliance Rates for the Past Tense and Agreement Morphemes by Proficiency Group

For the agreement morpheme, the analysis showed, using a Chi-square test, that there was no significant difference in the suppliance of morphemes on short vs. long stems for any of the three levels of proficiency. For the intermediate and high-level participants, it could be, according to Kahoul, that they were using minimal adaptation to build the affixal-clitic structure; if so, the results for these levels of proficiency confirm the predictions of the PTH. This could not be the case, according to Kahoul, for the lower-level participants, who were not predicted to use minimal adaptation. The low rate of morpheme suppliance at this level of proficiency, regardless of stem length, reflects a problem with producing the morpheme due to prosodic transfer. For the past-tense morpheme, the researcher was not able to make a comparison due to a paucity of elicited data.

Melhem (2016) examined the production of TAP inflection and the definite article by Syrian Arabic learners of English. Both Arabic and English are inflected for these syntactic features; hence, this study tested the possibility of prosodic transfer within the same construction. Ten advanced learners of English, who were overseas postgraduate students in a native-English-speaking country (i.e., England), did a combined task consisting of an interview phase followed by a story-telling phase. The interview was a conversation on topics of general interest that were also assumed to be familiar to overseas students. Melhem stressed that the main reason for the first task was to obtain unprompted and spontaneous L2 oral production of morphemes. The second phase consisted of two picture-based stories intended to elicit production of the morphemes under investigation.

Adopting Goad et al.'s (2003) analysis of the prosodification of inflection in English, Melhem took the position that English organises TAP morphemes using the affixal-clitic structure, and the definite article using the free-clitic structure. Applying the stress-assignment rule in Arabic as a diagnostic (similar to the approach I used in discussing prosodic structures in Arabic earlier; see Section 2.3.1), Melhem proposed that the TAP morphemes in this language are hosted by the internal clitic, and that the definite article is hosted by the affixal clitic. The prosodic structures available in Arabic and English, as proposed by Melhem, are given in Table 23.

Table 23

Prosodification of TAP Inflection and the Definite Article in Arabic and English

	Arabic	English
TAP inflection	Internal clitic	Affixal clitic
Definite article	Affixal clitic	Free clitic

Melhem predicted that the participants would successfully produce TAP morphemes in English because the affixal clitic can be built from structures available in the L1.²² Melhem based this prediction on the assumption that, as advanced L2 learners, the participants would be able to use minimal adaptation.²³ As for the definite article, Melhem argued that the free-clitic structure is not available in Arabic, and cannot be adapted from existing L1 structures for use in the L2. So, based on the PTH, Melhem predicted that the definite article is expected to be problematic for ALEs. The suppliance rates of TAP and definite morphemes are given in Table 24.

²² Melhem (2016) showed that Arabic has both PWd-PWd and PWd- σ . These structures can be used to build the affixal-clitic representation in the L2 via minimal adaptation (p. 147).

²³ Another prediction that might have been made in this scenario is that the ALEs could have used the affixal clitic from the Arabic definite-article construction to host agreement or plural inflection in English in target-like fashion. As advanced learners, the ALEs in Melhem's study should have been able to minimally adapt the affixal clitic from the left edge in Arabic to the right edge in English. Note, however, that this would have involved prosodic transfer across constructions within the same domain in the case of plurals, and across domains in the case of agreement. Perhaps Melhem was assuming that the transfer of structures across constructions or domains was not possible, as her study predates Austin et al. (2022).

Table 24

Morpheme	Rate of		
	suppliance		
Tense	95.7%		
Agreement	91.0%		
Plural	95.2%		
Definite article	96.9%		

Rates of Suppliance of the TAP Morphemes and Definite Article in Melhem (2016)

This result confirmed Melhem's prediction for the TAP morphemes in the L2. On the other hand, the ALEs in her study unexpectedly supplied the definite article at a high rate. The PTH could not provide an explanation for this, particularly in light of the absence of the free-clitic structure in Arabic.

2.4.2 Limitations and gaps

Previous research in the area relevant to this experiment has some limitations and gaps. Austin et al. (2022) showed that prosodic representations can be freely transferred from one construction to another within the same domain, or across domains (and therefore also across constructions). By contrast, I know of no study that has been explicitly concerned with determining if prosodic transfer is possible within the same construction: as shown in Section 2.4.1, what we have at this stage are a handful of studies that have yielded evidence which has implications for this issue. Thus, the overriding aim of the present study is to complete the work begun in Austin et al. (2022) on prosodic transfer within and across constructions and domains, by examining the one cross-linguistic scenario that was not covered in that study.

In addition, the present study focuses on ALEs. To date, only Kahoul (2014) and Melhem (2016) have investigated this learner group within research that bears on the issue of

prosodic transfer within the same construction. However, Kahoul examined only the production of verbal inflection, while Melhem addressed both the nominal and verbal domains but focused only on one proficiency level (i.e., advanced). In research concerned with ALEs, examining a new domain for morpheme production (namely, the nominal domain), as well as additional levels of proficiency, can be expected to yield further insight into the issue of prosodic transfer within the same construction for this learner group, and, by extension, for L2 learners more generally as well.

A major concern about Melhem's (2016) study is the sample size. A ten-participant sample is not large enough for the results to be readily generalized to the wider population. Accordingly, the current experiment uses a larger group. Another concern about Melhem (2016) and Kahoul (2014) studies is that the predictions of the PTH were tested in the four phonological contexts mentioned in Section 2.2.3.2. These are: (i) morpheme is attached to verbs/nouns that have only two segments in their rhymes; (ii) morpheme is attached to verbs/nouns which are sibiliant-final, where schwa epenthesis allows for the morpheme to be internally attached to the coda of the stem; (iii) verbs/nouns are followed by a vowel-initial word, so that the morpheme can be syllabified as an onset; and (iv) stems have no option for the morpheme to attach except as an affixal clitic. This is the same approach found in Goad et al.'s (2003) study. However, as indicated in Goad and White's (2019) latest commentary on the PTH, this approach is not the best way to test the assumptions of the PTH, especially if a picture description task is used (as was the case in Melhem's study). Goad and White (2019) indicated that this approach may result in considerable variation in the number of inflectional contexts that are produced by participants.

This approach was considerably rectified in Austin et al.'s (2022) study, where the production of inflection was controlled via the use of a sentence-construction task. In addition, all possibilities of resyllabifying inflection as an onset were ruled out, plus no sibilant-final

stimuli were used: note that the inflection can be incorporated into the PWd in words of this type (e.g., 'races' [reI.səz]PWd), thereby enabling the learner to circumvent the target affixalclitic structure. Austin et al.'s (2022) approach to materials and task design is adopted in the present experiment. By doing so, I will avoid the methodological problems that I have identified in both Kahoul's and Melhem's studies.

2.5 Predictions of Experiment One

Before I state the predictions of this experiment, I will recap the prosodic structures of the morphemes under scrutiny in Arabic and English. These are given in Table 25.

Table 25

Prosodic Structures for TAP Morphemes in Arabic and English

	Prosodic structure		
Type of morpheme	Arabic	English	
Verbal			
Tense	Internal clitic	Affixal clitic	
Agreement	Internal clitic	Affixal clitic	
Nominal			
Plural	Internal clitic	Affixal clitic	

As Arabic uses the internal clitic to host agreement and plurals in verbs and nouns respectively, there is only one prosodic structure in the L1 that can be used to host the target morpheme in the L2. Hence, the ALEs in this study are predicted to incorporate /s/ within the PWd where possible but delete it elsewhere. Based on this, the first prediction for agreement and plural morpheme production in the current experiment is given in P1.

(21) P1: The suppliance of agreement and plural inflection on long stems will be lower than on short stems.

To confirm that inflectional deletion is due to prosodic rather than articulatory factors, I will follow Goad and White's (2006) approach by testing the production of /s/ on monomorphemic parallels vs. short stems. This step is important because Jordanian Arabic has a ban on the production of final-consonant clusters (Abu-Abbas et al., 2011; Al-Deaibes, 2021),²⁴ which would be a non-prosodic reason for not producing the inflection in inflected forms or final /s/ in monomorphemic-parallel stimuli. To test this possibility, two predictions are made, as shown in (22).

(22) P2: /s/ will be supplied on short stems at a lower rate than in monomorphemic parallels.

P3: /s/ will be supplied at a low rate in monomorphemic parallels and on short stems.

It is worth noting that only one of P2 and P3 can be confirmed. If P2 is confirmed, then the possibility that the inflection is being omitted because of the CC-final constraint in Jordanian Arabic will be ruled out. If P3 is confirmed, then the reason for omitting the inflection will be the CC-final constraint, not prosodic transfer.

²⁴ In Jordanian Arabic, CC-final clusters are always broken up by inserting the epenthetic vowel /i/ or /u/ between the two consonants. For example, *bard* 'cold' becomes *barid*, *galb* 'heart' becomes *galib*, and *sagf* 'ceiling' becomes *saguf*.

2.6 Method

2.6.1 Participants

The L1 group are adult ALEs whose proficiency level is intermediate. Forty-one ALEs participated in this research project; they were a mix of females and males reasonably balanced in number (23 female and 18 male), aged between 20 and 28. Students from two public universities located in Irbid City (in Jordan) took part; all were undergraduate students with a variety of study majors (e.g., Business, Science, Engineering, Education, Arts). Participants were paid for their time and effort. Prospective participants did a language-proficiency test (Oxford Quick Placement Test) and then a comprehension test.²⁵ The proficiency test aimed at recruiting only intermediate participants. Each recruited participant did all of the experiments in the present project.

Three native English controls also did the tasks used in the experiments. The purpose of including the controls was to confirm that any errors made by the ALEs were not due to task effects, but rather to the reasons for morphological variability under study in this thesis.

2.6.2 Materials and task

Each participant did four experiments that featured self-paced sentence-completion tasks. In this chapter, we will consider only the first of these. The experiments were designed within PsychoPy, version 2019.3 (Peirce et al., 2019). The range of the time needed for most of the participants to complete each experiment was 30-45 minutes. Participants were allowed to do a maximum of two experiments per day to avoid fatigue. When the participant did two experiments on the same day, a break of one hour was always inserted between the first experiment and the second. The experiments were all conducted in a quiet computer lab.

²⁵ The comprehension test aimed at recruiting students who understood the target sentences that they were producing. This is further explained in Experiments Three and Four, where the results of the test become relevant.

Some remarks on the choice of a self-paced sentence-completion task for each experiment in this thesis seem required. In order to make comparisons between the experimental conditions under study in each experiment, I needed to obtain sufficient data in each condition. The most effective way to ensure this was to utilise a task in which there were a predetermined number of items in each experimental condition. For example, in the present experiment (Experiment One), for the purpose of making the required comparison, I needed to collect the same number of productions of verbs or nouns with short stems vs. long stems, and in the same ratio. A shortage of certain productions may have prevented me from making the comparison; consequently, the predictions of the PTH could not have been tested. One limitation of a self-paced sentence-completion task is that it tightly controls the context for language production, which may affect the spontaneous nature of the speaking process. However, I tried to mitigate this effect by using distractor targets. Also, this approach is widely adopted in the relevant research domain (e.g., Austin et al., 2022; Baek, 2012; Sun etal.,2023).

To determine the type of prosodic representation that was being used by the learners, I compared the production of inflection on short vs. long stems (cf. Austin et al., 2022; Goad & White, 2006). For this purpose, sets of short and long stimuli had to be created. The stimuli for the task were selected on the following basis. All the stimulus words were monosyllabic words, in order to minimize any effect of word length or stress assignment on morpheme suppliance. To rule out the effect of word frequency, I used the Corpus of Contemporary American English COCA (Davies, 2008). This helped with selecting stimulus words whose mean frequencies were approximately similar.²⁶ Uninflected forms of the nouns and verbs under scrutiny were used as distractors.

 $^{^{26}}$ Austin et al. (2022) used negative binomial regression to confirm that the frequencies of the two sets of stimulus items were comparable.

Attention was paid to the final sound of the stem, as this sound may obscure the aural perception of /s/ when the morpheme is produced. For example, in an audio recording, it might not be easy to hear the inflection in words like 'cats' [kæts] or 'hats' [hæts], as [t] and [s] have similar phonetic features (i.e., both are voiceless alveolar). I used stems that ended with the stop [p] or [k] or the sonorant [n] or [l] instead, as /s/ can be clearly perceived when it is attached to the stem, as in 'taps' [tæps], or 'knocks' [nɒks]. The full list of stimulus words is given in Table 26.

Table 26

			(Un)inflected	forms		Parallels	
Stem length	Stem-final consonant	Agr	eement	Plurals		N	V
Short	Stop						
	[p]	tap(s)	clap(s)	map(s)	cap(s)	copse	lapse
	[k]	knock(s)		rock(s)			relax
	Sonorant						
	[n]	win(s)	spin(s)	tin(s)	gun(s)	fence	dance
	[1]	drill(s)		bell(s)		pulse	
Long	Stop						
	[p]	help(s)	jump(s)	ramp(s)	scalp(s)		
	[k]	drink(s)		bank(s)			
	Sonorant						
	[n]	frown(s)	recline(s)	crown(s) mine(s)		
	[1]	smile(s)		tile(s)			

Full List of Stimulus Words

Each stimulus appeared in its own experimental sentence; examples of these sentences will be provided shortly. Stem words ending in a sibilant (i.e., /s/, /z/, /J/, /dz/) were

avoided in order to prevent the attachment of the morpheme internally to the coda of the stem (as in 'races' [re1.səz]Pwd, for instance). Also, the possibility of resyllabification of inflection was prevented by choosing words that start with [f] or [1]. With these sounds, resyllabifaction is discouraged, as in 'tanks for' *[tæŋk.sfɔ:], since [sf] is not a possible onset in the L2 (or indeed the L1); thus, when inflectional /s/ is produced, this can only be organized as an affixal clitic attached to the stimulus noun, as in [tæŋks.fɔ:].

The task consisted of 108 stimulus sentences: 48 sentences contained inflected stimuli, 48 contained uninflected stimuli, and 12 contained monomorphemic-parallel stimuli. Each set of 48 inflected or uninflected sentences consisted of 12 sentences with short-stemmed plurals, 12 with long-stemmed plurals, 12 with short-stemmed agreement, and 12 with long-stemmed agreement. For the full set of task sentences, see Appendix A.

2.6.3 Procedure

Instructions were given to the participants in their L1 throughout the task. Each stimulus sentence was first shown to the participant. Then, a recording of the sentence by a native speaker was played, and a written prompt was shown to the participant with the stimulus word blanked out except for the onset of the word; examples will be provided shortly. The last word in each sentence was also partly blanked out to ensure that the participant stayed focused toward the end of the sentence. After that, the participant was asked to orally produce the sentence with the missing stimulus word included. Their production was recorded using an mp3 device. The task was self-paced. A practice run was conducted, and its results were discarded. Examples of stimulus sentences and the corresponding written prompts are given in (23) and (24), respectively.

(23) Stimulus sentence (written/audio):

a. Before breakfast she <u>taps</u> very softly on this window. (Agreement, short stem)

- b. After breakfast he <u>helps</u> really willingly in that church. (Agreement, long stem)
- c. They check six <u>maps</u> for us every Monday really carefully. (Plural, short stem)
- d. They wash ten <u>scalps</u> for you every Friday very busily. (Plural, long stem)
- e. They mend one <u>fence</u> for you every Thursday very thoroughly. (Monomorphemic parallel stimulus)
- (24) Written prompt:
 - a. Before breakfast she t____ very softly on this win____.
 - b. After breakfast he h____ really willingly in that ch____.
 - c. They check six m____ for us every Monday really car____.
 - d. They wash ten sc____ for you every Friday very b____.
 - e. They mend one f_____ for you every Thursday very tho_____.

Before they were given any experimental sentences, the participants were shown the list of stimulus words, along with translations and pronunciation recordings. They were given time to go over the stimulus words, and they were advised to listen to and repeat the words that were new to them.

2.7 Results

For the control group, all the English natives supplied [s] in all obligatory contexts. This confirmed that any deletion of inflection in the production of the ALEs was not due to task effects, but could be attributed to the reasons for morphological variability under investigation in the relevant experiment. As they have served their intended purpose, the results for the controls will not be discussed any further.

Moving to the ALEs, there were a few cases of utterances by some participants which were not taken as 'morpheme supplied' or 'morpheme omitted'. These cases were unexpected linguistic items produced instead of the stimulus words (example: '**cr**y' instead of '**cr**owns'). Cases of this type were excluded; they constitute only 17% of the whole set of collected data.

Table 27 shows the mean rate of suppliance of agreement and plural /s/ in short and long stems, and the suppliance of final /s/ in monomorphemic parallel stimuli.

Table 27

Mean Suppliance of /s/ in Short Stems, Long Stems and Monomorphemic Parallel Stimuli

	Agree	ement	Plu	rals	Parallels
Stem length	Short stem	Long stem	Short stem	Long stem	NA
Suppliance	59%	48%	77%	61%	97%

The figures in Table 27 show that the ALEs in this study supplied the agreement and plural morphemes on short stems at a higher rate than they did on long stems. Also, they supplied /s/ in monomorphemic-parallel stimuli more accurately than they did on short stems.

To further analyze the results summarized above, I applied the Bayesian approach to data analysis. Hierarchical regression models were run using the R package *brms*, version 4.2.0 (Bürkner, 2018). First, I set up four regression models to investigate comparisons between stimuli of various types: short-stem agreement vs. long-stem agreement, short-stem plural vs. long-stem plural, monomorphemic parallel vs. short-stem agreement, and monomorphemic parallel vs. short-stem plural. The former level in each comparison was the reference level. The regression models were logistic (i.e., predicting a binary outcome) because the morphemes under study could be either supplied or omitted. I coded morpheme suppliance/omission as '1'/'0' respectively. The models computed the effect of stimulus type on the suppliance of /s/ by the participants.

The regression model is given in (25) (*brms* syntax).

(25) suppliance ~ 0 +Intercept + stimulus_type + (1 + stimulus_type | ID) + (1 | item)

The model included one fixed effect: *stimulus type*. The *suppliance* of the morpheme was the response variable. By-subject and by-item random intercepts, as well as by-subject random slopes, were also included. Note that *item* was crossed with *subject* because every participant responded to every item.

2.7.1 Short vs. long-stemmed agreement

Following the Bayesian workflow (Kruschke, 2015), I started by choosing the priors for this regression model. I used the estimates obtained by Austin et al. (2022) for the effect of stem length on agreement suppliance for this purpose: for the intercept, I used $\mu = 1.49$, $\sigma =$ 0.44; and for *stimulus type* I used $\mu = -1.45$, $\sigma = 0.59$. These priors were appropriate because the current experiment examines the suppliance of the same morpheme and uses the same predictor variable (i.e., stem length) for comparisons involving inflected forms as in Austin et al. (2022).

A prior predictive check (Gabry et al., 2019) was run in R. This checked if the observed data could be plausibly generated by the prior. The results showed that this prior was suitable. After checking the prior, the model was fitted using Markov-Chain Monte Carlo (MCMC) sampling, which consisted of four chains (4000 iterations each). The values of \hat{R} and the effective sample size (*ESS*) showed that the model converged; see Table 28. Note that stimulus type in this case implies stem length.

Table 28

values of K and LSS for the Effect of Sumalus Type on Agreement Suppliance. Short vs. Lo	Values o	f R and ESS	S for the Effect	of Stimulus Type on L	Agreement Suppliance:	Short vs. Lot
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Parameter	Ŕ	ESS
(Intercept)	1.00	4999.2
Stimulus type: long	1.00	6438.3

In Figure 1, I give the posterior distribution of estimated values of the parameter (i.e., the effect of stimulus type on inflectional suppliance). Posterior predictive checks (Gelman et al., 2014) showed that the model provided adequate fit. The bold line in the figure denotes the 89% highest density interval (HDI), which represents the range of the most probable values for the parameter estimate; the thin lines represent the tails of the distribution that lie outside the HDI. The small circle in the middle is the mean of the estimated values of the parameter.



Figure 1. Posterior Distribution for the Effect of Stimulus Type on Agreement Suppliance: Short vs. Long

We can see that the whole HDI lies to the left of zero, indicating a negative effect of stimulus type on the production of the agreement morpheme. Given that the reference level for this comparison was 'short', this result means that the agreement morpheme was produced less reliably in long-stem contexts than in short-stem contexts.

Table 29 provides a summary of the regression output.

Table 29

Regression Output for the Effect of Stimulus Type on Agreement Suppliance: Short vs. Long

Parameter	ĥ	SD	89% HDI
(Intercept)	0.95	0.29	[0.50, 1.42]
Stimulus type: long	-1.05	0.34	[-1.63, -0.52]

The HDI for the effect of stimulus type on agreement suppliance has a lower bound of -1.63 and an upper bound of -0.52. Numerically, \hat{b} (i.e., the mean of the estimated values of the parameter) represents the odds ratio for this effect, and is interpreted as follows: the odds of supplying over omitting the agreement morpheme were lower on long-stem verbs than on short-stem verbs by a factor of $e^{-1.05} = 0.35$. These results indicate that the ALEs were using the internal-clitic structure to host the agreement morpheme in English.

2.7.2 Short vs. long-stemmed plurals

Following the same approach as in the previous section, I started by choosing a prior for the regression model. I used the posterior distribution obtained by Austin et al. (2022), as explained previously, as a prior: these values were $\mu = 2.62$, $\sigma = 0.48$ for the intercept; for *stimulus type* (i.e., short vs. long stem), I used $\mu = -0.98$, $\sigma = 0.59$. The values of \hat{R} and *ESS* showed that the model converged; see Table 30. The posterior distribution of the model is shown in Figure 2.

Table 30

Values of \widehat{R} and ESS for the Effect of Stimulus Type on Plural Suppliance: Short vs. Long

Parameter	Ŕ	ESS
(Intercept)	1.00	5995
Stimulus type: long	1.00	8570



Figure 2. Posterior Distribution for the Effect of Stimulus Type on Plural Suppliance: Short vs. Long

For this particular comparison, we can see that the HDI lies entirely to the left of zero, indicating a negative effect of stimulus type on the production of the plural morpheme. This means that the plural morpheme was produced less reliably in the long-stem context than in the short-stem context. Table 31 shows a summary of the regression output.

Table 31

Regression Output for the Effect of Stimulus Type on Plural Suppliance: Short vs. Long

Parameter	ĥ	SD	89% HDI
(Intercept)	1.85	0.27	[1.44, 2.30]
Stimulus type: long	-1.15	0.32	[-1.66, -0.65]

The HDI has a lower bound of -1.66 and an upper bound of -0.65. This means that the odds of supplying the plural morpheme are lower on long-stem nouns than on short-stem nouns by a factor of $e^{-1.15} = 0.32$. To sum up, ALEs used the internal-clitic structure to host the plural morpheme in English.

2.7.3 Parallels vs. short-stemmed agreement and plurals

The coming two comparisons between monomorphemic-parallel stimuli and shortstemmed stimuli (for both agreement and plurals) aimed at ensuring that the ALEs in this study had no problem with producing consonant clusters in codas per se, regardless of whether they were codas of monomorphemic words or were created by attaching inflection to a stem. If this is confirmed, then we can conclude that the omission of the agreement and plural morphemes in this experiment was not a result of phonotactic reasons but rather prosodic reasons.

2.7.3.1 Parallels vs. short-stemmed agreement

Like in the previous sections, I started by choosing Austin et al.'s (2022) posterior distribution as a prior. I used $\mu = 5.06$, $\sigma = 1.25$ for the intercept; for *stimulus type* (i.e., parallel vs. short stem), I used $\mu = -2.18$, $\sigma = 1.29$. The values of \hat{R} and *ESS* showed that the model converged; see Table 32. The posterior distribution of the model is shown in Figure 3.

Table 32

Values of \hat{R} and ESS for the Effect of Stimulus Type on Agreement Suppliance: Parallel vs. Short

Parameter	Ŕ	ESS
(Intercept)	1.00	6839
Stimulus type: short	1.00	5711



Figure 3. Posterior Distribution for the Effect of Stimulus Type on Agreement Suppliance: Parallel vs. Short

For the short-stemmed agreement context, we can see that the HDI lies entirely to the left of zero, indicating a negative effect of stimulus type. This means that /s/ was produced in short-stemmed agreement contexts less reliably than in parallel-monomorphemic contexts. Table 33 shows a summary of the regression output.

Table 33

Regression Output for the Effect of Stimulus Type on Agreement Suppliance: Parallel vs. Short

Parameter	\hat{b}	SD	89% HDI
(Intercept)	4.62	0.63	[3.66, 5.68]
Stimulus type: short	-3.79	0.72	[-4.94, -2.67]

Based on this comparison, we can conclude that the ALEs omitted agreement inflection for prosodic reasons rather than phonotactic reasons. This means that, for agreement inflection, prediction P2 is upheld while P3 is rejected.

2.7.3.2 Parallels vs. short-stemmed plurals

For the priors in this comparison, I used $\mu = 5.02$, $\sigma = 1.21$ for the *intercept*; and for *stimulus type* (i.e., parallel vs. short stem), I used $\mu = -3.43$, $\sigma = 1.26$. These values were based
on the parameter estimates in Austin et al. (2022). The values of \hat{R} and *ESS* showed that the model converged; see Table 34. The posterior distribution of the model is shown in Figure 4.

Table 34

Values of \widehat{R} and ESS for the Effect of Stimulus Type on Plural Suppliance: Parallel vs. Short

Parameter	Ŕ	ESS
(Intercept)	1.00	8452
Stimulus type: short	1.00	5866



Figure 4. Posterior Distribution for the Effect of Stimulus Type on Plural Suppliance: Parallel vs. Short

For the short-stemmed plural context, we can see that all the values in the HDI are negative, indicating that /s/ was produced less reliably in the short-stemmed context than in the parallel-monomorphemic context. Table 35 shows a summary of the regression output.

Table 35

Regression Output for the Effect of Stimulus Type on Plural Suppliance: Parallel vs. Short

Parameter	ĥ	SD	89% HDI
(Intercept)	4.03	0.99	[2.49, 5.65]
Stimulus type: short	-3.53	0.77	[-4.84, -2.38]

As in the previous comparison, we can conclude that the ALEs in this study omitted plural inflection for prosodic reasons rather than phonotactic reasons. This means that prediction P2 is upheld while P3 is rejected for plural inflection.

2.8 Discussion and conclusion

In this experiment, I attempted to answer two research questions: 1) Can prosodic representations be transferred within the same construction; and 2) Do ALEs drop the agreement and plural morphemes due to prosodic reasons or to phonotactic reasons related to a final-CC ban in the L1?

I made different predictions for each question: P1 to answer the first question, and P2 vs. P3 to answer the second question. Then I tested the predictions using three main types of stimulus word: short-stemmed verbs/nouns, long-stemmed verbs/nouns, and monomorphemic parallel words. I restate the predictions in (26) below. Recall that P2 and P3 were mutually exclusive.

(26) P1: The suppliance of agreement and plural inflection on long stems will be lower than on short stems. If this prediction is upheld, then it means that the internal clitic structure is being transferred from the L1.

P2: /s/ will be supplied on short stems at a lower rate than in monomorphemic parallels. If this prediction is upheld, then it means that the ALEs in this study omit /s/ due to prosodic rather than phonotactic reasons.

P3: /s/ will be supplied at a low rate in monomorphemic parallels and on short stems. If this prediction is upheld, then it means that the ALEs omit /s/ due to a ban on final-CC clusters rather than prosodic transfer. The results showed that:

- the ALEs supplied the agreement and plural morphemes on long stems less accurately than they did on short stems. Based on this, P1 is upheld. We can conclude that the ALEs have transferred the internal clitic from their L1 to represent the agreement and plural morphemes in English; and
- 2) the ALEs supplied /s/ on short stem stimuli less accurately than they did in monomorphemic-parallel stimuli. Based on this, P2 is upheld. We can conclude that the ALEs omit /s/ due to prosodic rather than phonotactic reasons.

The results of this experiment are significant for the following reasons. First, it showed that the effect of L1 prosodic transfer on the production of L2 morphemes is credible. In the production of the agreement and plural morphemes, the ALEs in this experiment transferred the internal-clitic structure from their L1. In broad terms, this supports the PTH as a theory of morphological variability.

Secondly, even if the L1 has inflection for the target syntactic feature (e.g., agreement), differences between the prosodic structures in the L1 and the L2 can result in morphological variability in the L2, especially at non-advanced levels of proficiency. Both English and Arabic are inflected for agreement and plurals; however, the presence of the target inflection in Arabic did not enable the ALEs to 'overcome' the effect of prosodic transfer from their L1.

Also, the results showed that prosodic representations can be transferred within the same construction. Hence, they have a bearing on the broader question of how freely prosodic representations can be transferred within and across constructions and domains (cf. Austin et al., 2022), as I will explain. The current experiment has confirmed that the ALEs were unable to build the affixal-clitic structure absent from their L1 to represent the agreement and plural morphemes in the L2. This is in keeping with how minimal adaptation is assumed to operate, since this strategy is assumed to be available only to advanced learners (Goad & White, 2004).

Hence, the results of this experiment corroborate that, at non-advanced levels of language proficiency, L2 learners are confined by the prosodic structure they use within the same construction in their L1.

Now, if we compare the results of the current experiment to the results for the learners with the same L1 in Melhem's study, we can see that the present set of results were somewhat different. The learners in Melhem's study showed a high capacity for producing agreement and plural morphemes, regardless of stem length. This was attributed to the use of minimal adaptation (in the form of relicensing from the left to the right edge), as the Arabic learners in Melhem's study were advanced learners. Arabic, according to Melhem's study, does have the affixal clitic, but it is not used for agreement or plurals in this language. Rather, the affixal clitic is available only in the nominal domain, where it is used to host the definite article at the left edge. The results of Melhem's study suggest that, via the use of minimal adaptation, the ALEs in her experiment were transferring the affixal-clitic structure bidirectionally: across constructions to host plurals in the nominal domain, and across domains to host agreement in the verbal domain.

In short, the pattern of attaching inflection at a level higher than the prosodic word (i.e., in a non-internal pattern) is not familiar to ALEs from their L1, and this makes the realization of inflection in English more difficult for them. Arabic relies on changing the internal vocalic melody of the tri-consonant root to indicate inflection; and even when inflection takes the form of a suffix attached to the edge of the inflected word, it is attached internally to the PWd.

Also, the suffixes in Arabic verbs may look like number (or gender) markers, but at a syntactic level they are not. Rather, they assume the syntactic role of the subject of the verb they are attached to. For example, in the Arabic verb *yaktubu:n*, the suffix *-u:n* is not a marker of number, but rather the subject of the verb *yaktub*. The suffix *-u:n* is the counterpart of the subject 'they' in 'they write'. The same holds true for all 'number markers' in present-tense

verbs. This compact nature of the suffix (i.e., taking the role of the subject and, by default, showing its number) adds to existing L1/L2 differences, which may have affected the production of the morphology under study.

CHAPTER 3: EXPERIMENT TWO: DISTANCE IN PLURAL QUANTIFIER PHRASES

3.1 Introduction

The present experiment targets the plural morpheme in quantifier phrases (QPs) where the head of the QP is a number (e.g., 'nine slippery frogs'). In these phrases, there is a syntactic dependency between the quantifier and the quantified noun. Syntactic dependency is defined as a binary relation between two linguistic items, one of which acts as a controller and the other as a target. For example, in 'nine slippery frogs', the quantifier 'nine' is the controller and the quantified noun 'frogs' is the target.

In a long-distance dependency in general, the controller and target are non-adjacent; however, it is also possible for the distance between the controller and target in this type of dependency to vary. To explore the effects of distance in adjacent and long-distance dependencies, I will compare the suppliance of the plural morpheme /s/ in three contexts: adjacent context (e.g., 'nine frogs'), long-distance context (e.g., nine slippery frogs), and very long-distance context (e.g., 'nine slippery old crimson frogs'). In the first context, there are no intervening words between the controller and the target; thus, morpheme suppliance is not expected to be affected by distance. The second and third contexts both involve long-distance dependencies; in each case, distance effects are predicted to come into play. In the second context, one adjective comes between the controller and the target (i.e., 'slippery'), and three adjectives (i.e., 'slippery old crimson') intervene between these two elements in the last context.

The three contexts under study are also phrase-internal because both the controller and target are located within the same phrase (i.e., QP) in each case. Hence, the controller and target are local to the QP, even when they are non-adjacent. Thus, variability in morpheme suppliance

between the three contexts of interest, if confirmed in this experiment, would substantiate an effect of distance on the suppliance of plural inflection within the same phrase (i.e., locally).

This chapter is organized as follows. Some theoretical background on long-distance dependencies is given in Section 3.2. In the next section, previous studies on the effect of distance on the L2 acquisition of inflection are reviewed; these include comprehension-based studies (Section 3.3.1) and production-based studies (Section 3.3.2). Limitations and gaps in this research are identified in Section 3.3.3, followed by the predictions of the experiment in Section 3.4. The method is presented in Sections 3.5. The results and discussion follow in Sections 3.6 and 3.7, respectively.

3.2 Theoretical background

3.2.1 Types of distance

Two types of distance can be identified in controller-target structures: linear distance (LD) and structural distance (SD). In the first type, the distance between the controller and the target is approached in a linear pattern that does not take the syntactic complexity of the intervening material into consideration. One way to calculate the LD is to count the number of words between the controller and the target (Hawkins, 1989), as shown in (1) (adapted from O'Grady et al., 2003, p. 434).

(1) The man that likes the woman

The LD between 'man' and 'likes' in (1) equals 1 word, since these two words are separated by 'that'. Another way is to count only new discourse referents (e.g., new NPs and main verbs; NP = noun phrase) located between the controller and the target (Babyonyshez & Gibson, 1999). This is shown in (2).

- (2) a. the man that likes the woman
 - b. the man that the woman likes

In (2a), the LD between 'man' and 'likes' equals zero: although 'that' intervenes between 'man' and 'likes', this word does not introduce a new referent. In (2b), the LD between 'man' and 'is' equals two, as two new referents are located between 'man' and 'is' (i.e., 'woman' and 'likes'). In the present experiment, I will adopt the definition of LD according to which we count the number of intervening words, not intervening referents.

In the second type of distance, namely SD, attention is paid to the syntactic complexity of the path between the agreeing elements.²⁷ According to O'Grady (1997), SD is measured by counting the maximal projections (i.e., XPs) on the path between the linguistic items in question. For example, the SD between the filler 'man' and its corresponding gap in the subject relative clause (SR) 'the man that likes the woman' equals the number of XPs between the filler 'man' and the gap, as in (3) (adapted from O'Grady et al., 2003, p. 435; S = sentence).

(3) the man that [s __ likes the woman]

SD = number of XPs between the filler and the gap = 1 (S)

Similarly, the SD between the head 'man' and the gap in the object relative clause (OR) 'the man that the woman likes' is calculated as in (4) (O'Grady et al., 2003, p. 435; VP = verb phrase).

(4) the man that [s the woman [v_P likes _]]

SD = number of nodes between the filler and the gap = 2 (S, VP).

²⁷ More generally, it relates to the path between any two linguistic items (depending on the context under study).

3.2.2 Long-distance dependencies

The processing of the target requires access to the controller for the assignment of syntactic features (Hawkins 2003; Hudson, 2007). In a sentence like 'These happy active chubby boys like chocolate', 'these' is the controller and 'boys' is the target. The plural feature is assigned to 'boys' based on the number feature of the controller 'these'.

As foreshadowed in Section 3.1, a long-distance dependency occurs when a word, phrase or clause intervenes between the controller and the target. This intervention is expected to cause the omission of inflectional morphemes due to many reasons, like losing the track of the controller because of distance (Grodner & Gibson, 2005), overloaded working memory and the cognitive cost of handling disrupted agreement (Gibson, 2000; Pienemann, 1998), or a shallow rather than hierarchical representation of syntactic structures adopted by L2 learners (Clahsen & Fesler, 2006a, 2006b), among other reasons, as we shall see in the next section.

3.2.3 Theories on processing long-distance dependencies

According to Processability Theory (PT; Pienemann's, 1998),²⁸ second language (L2) learners can produce only the structures that they can process. It assumes that there is a hierarchy, or ordered stages, of what learners can process when they acquire a new language. This hierarchy starts from easy structures and moves down to more difficult structures; for example, processing agreement between two elements within the same phrase (as in the present experiment) is easier than processing agreement between two elements across two different phrases.

Spanish, for example, is a language that has a noun-adjective gender-agreement feature. According to PT, it is easier for Spanish learners to process this type of agreement for

²⁸ Although PT is a theory of L2 acquisitional sequence (i.e., easy structures are acquired before difficult ones), it links up with processing long-distance dependencies, especially with respect to processing inter-phrasal morphology, and morphology across clauses (cf. Table 36, stages 4 and 5).

attributive adjectives (i.e., local agreement) than predicative adjectives (i.e., non-local agreement). In the former case, the agreeing elements are located in the same phrase; in the latter, they are located in different phrases, as the adjective that modifies the noun occurs within a VP. This is illustrated in (5) (adapted from Lichtman, 2009, p. 233; controller and target underlined; MASC = masculine).

(5)	Un <u>chico</u> <u>simpatico</u>	a nice-MASC boy-MASC (local agreement)
	El chico es simpatico	the boy-MASC is nice-MASC (non-local agreement)

Table 36 shows the stages of processing functional morphology according to PT (Piennemann, 1998). In stages 3 through 5, L2 processing is affected by the distance between agreeing elements. Subsequent studies on processing morphemes over a distance (although they were not aimed at testing the PT) confirmed this hierarchy (e.g., Keating, 2010; Lichtman, 2009; Tuniyan, 2013; N = noun, ADJ = adjective).

Table 36

Hierarchy of Processing Functional Morphology in PT

Stage	Structure produced consistently by language learners
1	Words
2	Lexical morphology (e.g., word formation and derivation)
3	Phrasal morphology (e.g., agreement in attributive N-ADJ)
4	Inter-phrasal morphology (e.g., agreement in predicative N-ADJ)
5	Morphology across main and subordinate clauses (e.g., agreement
	across relative clauses [RCs] or prepositional phrases [PPs])

Another approach to investigating distance effects in language processing is found in Gibson (2000).²⁹ Gibson discussed distance in terms of the energy cost needed to process and then integrate the words that lie between the controller and the target. According to Gibson, one energy unit (1EU) is consumed for each new word relating to a new referent that is processed between the controller and target, which means that the longer the distance, the more the energy is required for processing. The speaker has a storage component which keeps the structure of the sentence in memory, and this includes incomplete dependencies. Naturally, it becomes difficult (i.e., more energy-consuming) for learners to retain information about the controller over a distance until the agreement features are checked. Gibson was able to compare the complexity of long-distance dependencies among sentences by comparing the number of energy units needed to process the sentences in question.

Below is an example that further illustrates Gibson's (2000) approach. In a sentence like 'The reporter who the senator attacks dislikes the editor' (adapted from Gibson, 2000, p. 105), 4EUs are consumed in integrating the target 'dislikes', where the inflection is dependent on the controller 'reporter'. This is shown in Table 37 (adapted from Gibson, 2000, p. 110).

Table 37

Type of cost	the	reporter	who	the	Senator	attacks	dislikes	the	editor
New referent	0	1	0	0	1	1	1	0	1
Structural	0	0	0	0	0	2	3	0	0
integration									
Total EUs	0	1	0	0	1	3	4	0	1

Word-by-Word Energy Cost of Processing a Sentence

²⁹ Gibson (2000) was concerned with native-speaker processing, but his approach to distance can be applied to L2 learners too.

Other scholars focused on the way L2 learners decompose (or parse) the syntax of a sentence containing long-distance dependencies. According to Clahsen and Felser (2006a), L2 learners adopt a shallow syntactic analysis of sentences such that they process fewer syntactic details than native speakers do. Clahsen and Felser (2006a), in their Shallow Structure Hypothesis (SSH), argued that L2 learners are not able to build hierarchically structural relations between linguistic items such as RCs or wh-movement structures. The SSH is relevant in the present context because distance between agreeing elements tends to increase hierarchical complexity. Not being able to build a hierarchical relation, due to distance, could make L2 learners pass over these relations, which in turns affects their accuracy in calculating agreement between controller and target.

3.3 Previous studies on the effect of distance on L2 inflection

In this review, I will summarize studies conducted on the L2 comprehension and production of long-distance dependencies involving different controller-target pairs. For comprehension, I will start with studies in which the L2 is a language other than English, and then I will summarize studies in which the L2 is English. After that, I will summarize studies on the L2 production of long-distance dependencies.

3.3.1 Comprehension-based studies

3.3.1.1 Non-English L2 studies

In his study on noun-adjective agreement, Keating (2009) showed that SD is a key reason for difficulties in processing agreement.³⁰ Forty-four English learners of Spanish performed an online sentence-comprehension task that investigated their sensitivity to grammatical mistakes in noun-adjective agreement over different SDs. Beginner, intermediate and advanced participants were asked to read equal numbers of grammatical and

³⁰ Keating (2009) used O'Grady's (1997) way of measuring SD.

ungrammatical sentences; their eye movements were tracked in order to examine the reading times (RTs) for critical regions in the sentence.³¹ If readers are aware of the inflection error, they will take a longer time to read the critical region because they will naturally slow down as they read ungrammatical input. Thus, a longer RT indicates sensitivity to disagreement.

Keating (2009) manipulated agreement relations in three different conditions for SD. The noun and adjective under study were located as shown in (6) (examples from Keating, 2009, pp. 505-506; DP = determiner phrase, FEM = feminine).

- (6) a. adjacent within a DP (as in *Una <u>casa pequena</u>* 'a small-FEM house-FEM')
 - b. non-adjacent across a VP (as in *La <u>casa</u> es bastante <u>pequena</u> 'the house-FEM is quite small-FEM')*
 - non-adjacent across a subordinate clause (i.e., if-clause, in this case) (as in *Una casa cuesta menos si es pequena* 'a house-FEM cost less if it is small-FEM')

The question driving the study was whether L2 learners would show native-like sensitivity to noun-adjective disagreement over SD (as in [6b] and [6c]). Keating predicted that L2 learners would not show this type of sensitivity in this situation.

The RTs for the L2 learners showed that, at the three levels of proficiency, they were not sensitive to agreement errors in sentences containing noun-adjective disagreement over SD ([6b] and [6c]), which supports the assumptions of the SSH (Clahsen & Felser, 2006a). Also, for the advanced L2 learners (but not for the beginners or intermediates), adjacent noun-adjective agreement errors elicited longer RTs than non-adjacent noun-adjective agreement errors. Noun-adjective agreement is not instantiated in the first language (L1; i.e., English); however, this difficulty was overcome by the advanced participants only when the noun and

³¹ The critical region is the agreement target (e.g., the matrix verb, in the case of subject-verb agreement). The inflection is correct in the grammatical form of the sentence, and incorrect in the ungrammatical form.

adjective were adjacent, as they were sensitive to errors in sentences in the context exemplified in (6a).

In his study, Keating (2009) aimed at investigating the effect of SD on disagreement sensitivity. However, this can only be done if the SD is isolated from any effect of LD on this type of sensitivity. Keating acknowledged that, for the contexts in (6), the effects of LD and SD were intertwined: as Keating increased the SD in (6b) and (6c), more words were inevitably added between the agreeing elements. Even in the context in (6c), the LD ranged from five to seven words,³² which results in variation in LD within the same context. Keating admitted that it was not possible to increase the SD while controlling the LD in the structures he was investigating.

In Keating (2010), LD was the focus of the study. Thirteen advanced English learners of Spanish performed a reading comprehension task, and their eye movements were tracked to detect their sensitivity to noun-adjective agreement errors in the same fashion as in Keating (2009). This time, however, Keating succeeded in controlling for SD while manipulating LD. Adjectives were one, four or seven words away from their noun controllers, as shown in Table 38 (IP = inflection phrase). The SD in each of the three cases was kept at 1, as only one node is on the path between the noun and the adjective, namely, the VP node.³³

³² I referred to the list of stimuli used in the study task (Keating, 2009, pp. 534-35).

³³ Keating (2010) applied O'Grady's (1997) metric for measuring SD.

Table 38

Example	Gloss of controller-target relation	SD	LD
	(in bold)		
[IP La tienda [VP está abierta/*Abierto]]	The store-FEM is open-FEM	1	1
[IP La mochila de la estudiante [VP está	The backpack-FEM of the girl is	1	4
<u>llena/*lleno</u> de libros de texto]]	filled-FEM with textbooks		
[19 La <u>falda</u> en la tienda de ropa femenina	The skirt-FEM in the store of	1	7
[vp es roja/*rojo]]	women's clothing is red-FEM .		

Example Stimuli from Keating (2010)

The L2 learners showed sensitivity to noun-adjective agreement errors when the LD was at one word, but not when it was at four or seven words. This result supported the assumption that increasing the LD leads L2 learners to engage in shallow processing of syntactic structure, since increasing the LD increases hierarchical complexity in this case.

Lichtman (2009) investigated error sensitivity in adjective-noun agreement over LD and SD. Thirty-eight low- and intermediate-proficiency English learners of Spanish completed an acceptability-judgment task. The subjects were given grammatical and ungrammatical sentences, and were asked to accept or reject the sentences using a judgment scale. Four structures were studied, each at four levels of distance, to investigate noun-adjective agreement; these levels were: 1) attributive adjective (i.e., adjacent adjective-noun); 2) predicative adjective; 3) predicative adjective with a PP inside the noun phrase (NP); and 4) predicative adjective with an RC as a head modifier in an NP. The four categories are shown in Table 39, along with stimulus examples.

Lichtman's study addressed two questions: a) Are non-advanced L2 learners more sensitive to attributive-adjective agreement errors (i.e., intra-phrasal morphology) than they are

to predicative adjective agreement errors (i.e., inter-phrasal morphology)?; and b) Are they more sensitive to agreement errors when the adjective is linearly closer to the noun? The former question addresses SD, and the latter addresses LD.³⁴

Table 39

Example Stimuli from Lichtman (2009)

Level	Examples	Gloss of controller-target relation (in bold)	LD
1	En mi clase, hay un chico simpatico	In my class, there's a nice-MASC boy-	0
		MASC	
2	En mi oficina, el director es simpatico	In my office, the director-MASC is nice-	1
		MASC	
3	El chico en mi apartamento es	The boy-MASC in my apartment is nice-	4 (PP)
	antipático	MASC	
4	El profesor que trabaja conmigo es	The professor-MASC that works with me is	4 (RC)
	simpatico	nice-MASC	

The results showed that the intermediate learners were accurate in accepting grammatical sentences; furthermore, they showed sensitivity to agreement errors at all levels of distance mentioned above by rating ungrammatical sentences as 'ungrammatical'.³⁵ Beginners, on the other hand, were less accurate in accepting grammatical sentences, and they were not sensitive to agreement errors at all distance levels. Thus, the answer to the question in (a) was 'no' while the answer to the question in (b) was 'yes'.

Lichtman also studied the individual performance of the subjects, and suggested five stages of ability to distinguish between grammatical and ungrammatical sentences, as in shown

³⁴ The attributive vs. predicative adjective distinction was explained with an example in Section 3.2.3. The difference between the two types of adjectives implies a difference in SD.

³⁵ Ratings were on a Likert scale (i.e., 1 'highly ungrammatical', 2 'ungrammatical', 3 'grammatical', 4 'highly grammatical').

in Table 40 (adapted from Lichtman, 2009, p. 244).³⁶ The majority of intermediates (i.e., 12 out of a total of 19) were able to make distinctions between grammatical and ungrammatical sentences at all levels (i.e., they were at stage 5), while, at beginner level, only two participants were at stage 5.

Table 40

Stages of Error Sensitivity Corresponding to Levels of Distance

Stage	Error sensitivity over level of distance
1	No detection of agreement errors over all levels of distance
2	Learner only detects agreement errors at $LD = 0$ (attributive adjectives)
3	Learner can detect agreement errors at $LD = 0$ and 1
4	Learner can detect agreement errors at $LD = 0$, 1 and 4 for the PP but not for the RC
5	Distinction between grammatical and ungrammatical can be made at all distance levels

Lichtman's results support the idea that both LD and SD have an effect on morphological processing.

Lago and Felser (2018) tried to determine whether SD has a stronger influence on L2 agreement processing than LD does. They conducted a forced-choice experiment to study the processing of subject-verb agreement in German by Russian learners. Forty participants at advanced level were asked to choose the correct verb continuation for a given subject NP.

³⁶ The stages were based on Pienemann's (1998) PT.

Stimuli were presented to participants on the screen for a short while (i.e., 700 milliseconds); then participants were asked to choose the correct form of the verb.

Lago and Felser used preambles consisting of double-modifier constructions (i.e., a head noun with double-genitive postmodifiers), as in (7) (adapted from Lago & Felser, 2018, p. 626). Lago and Felser manipulated the plurality of the second and third nouns to determine which case yields more subject-verb agreement errors by German learners.

(7) a. Der Geruch / der Ställe / des LandwirtsThe smell of the stables of the farmer

b. Der Geruch / des Stalls / der Landwirte The smell of the stable of the farmers

This structure of two postmodifying nouns in a complex NP (for which Lago and Felser used the term '2nd-3rd-noun') was previously tested for subject-verb agreement in native speakers (Franck et al., 2002). The results of this study showed that native speakers make more agreement errors in (7a), which has a singular noun adjacent to the verb (i.e., the genitive *des Landwirts*), than they did in (7b), which has a singular noun farther away from the verb in linear terms (i.e., the genitive *des Stalls*). This result supported the assumption that native speakers are more affected by the structural relationship (i.e., the SD) between linguistic items than by the LD (Bock & Cutting, 1992; Gillespie & Pearlmutter, 2011; Solomon & Pearlmutter, 2004). In (7a), the 2nd noun (which is plural) is structurally closer to the head noun, which makes it more likely to determine the number of the NP, resulting in more subject-verb agreement errors.

Lago and Felser investigated whether this was also the case for L2 learners. According to the SSH (see Section 3.2.3), L2 learners are assumed to have a shallow representation of the syntactic relations between items; thus, they are predicted to make more mistakes in (7b) than

in (7a). Lago and Felser compared the pattern of errors for the L2 learners in their study to the pattern of errors made by their native German-speaking participants. They assumed that if the L2 learners showed the same sensitivity to syntactic relations as the native speakers, then the L2 learners were being affected more by the SD between the subject and the verb than by the LD between these items.

The results of the study showed that the L2 learners, like the native speakers in Franck et al. (2002), made more mistakes in (7a) than in (7b), which means that they were more affected by the SD between the 2nd noun and the head noun, than by the LD between the singular noun in the post-modifying genitive structure and the verb. This pointed to a stronger influence of SD than LD in L2 agreement processing.

3.3.1.2 English L2 studies

Wen et al. (2010) tested L2 learners' sensitivity to number disagreement using demonstrative-noun structures in which the agreeing elements were separated by an adjective, as in 'these beautiful house*/houses' (asterisk indicating ungrammaticality). Intermediate (20 Chinese and 28 Japanese) and advanced (14 Chinese and 13 Japanese) learners of English did a self-paced reading sentence-comprehension task. The RT was recorded for each word; Wen et al. focused on the RT for the stimulus word (e.g., 'houses/house' in [8]).

- (8) a. Jill sold these beautiful houses to her niece every evening.
 - b. Jill sold these beautiful house to her niece every evening.*

The agreeing elements in the structure 'demonstrative-adjective-noun' are only linearly separated because they are located within a single DP. For example, the controller and target in 'these beautiful houses' are separated by an adjective, but they are both dominated by the same DP node, as shown in (9) (AP = adjective phrase).



The results showed that, for the advanced learners in both L1 groups, RTs were significantly longer at the target words, which means that these learners were sensitive to number disagreement. The intermediate learners in both L1 groups, on the other hand, did not have significantly longer RTs for disagreeing targets; thus, no sensitivity to number disagreement was inferred. These results indicate that, even when items are linearly but not structurally distant, advanced L2 learners are sensitive to number disagreement, but intermediate learners are not.

Song (2015) studied sensitivity to plural errors on the part of Korean learners of English, where the L1 in this case lacks plural inflection. Song investigated two structures: a DP structure containing an AP, as in 'those long Latin words', and a partitive DP structure, as in 'many of her books'. He assumed that the DP structure containing the AP is easier to process than the partitive DP because the former has a shorter number-checking dependency than the latter, as shown in (10) (adapted from Song, 2015, p. 245). In (10a), the dependency occurs across only one node (i.e., NP; circled) while in (10b) it occurs across three nodes (i.e., PP, DP, NP; circled). In both structures, the LD between the controllers ('those', 'many') and the targets ('words', 'books') was kept constant at 2.

Song used the terms 'simple' condition vs. 'partitive' condition to refer to the structures in (10a) and (10b), respectively.

Thirty-five advanced native Korean learners of English did an online self-paced reading task. Contrary to Song's predictions, the participants showed sensitivity to plural errors in both structures, but they took more time to realize the error in the partitive condition than the simple condition, as I will explain shortly. Song focused on the region at which the learners realized that the sentence was ungrammatical. He divided each stimulus sentence into regions by numbering the words in the sentence. The target region (where the inflection was investigated) was Region 6 for both simple and partitive conditions. In the simple condition, the learners immediately realized that an inflectional morpheme was missing, because they slowed down at the word with the missing inflection (i.e., Region 6). By contrast, in the partitive condition, the learners did not become aware of the error in plural inflection until they reached Region 8, two words after the word with the missing plural inflection. Although delayed, this recognition of plural formation indicated that the learners were able to construct a hierarchical representation of the agreeing items in the partitive condition. In short, Song's findings showed that SD affects learners' sensitivity to plural errors.

Bannai (2011) investigated sensitivity to subject-verb agreement errors in lower- to upper-intermediate Japanese learners of English. The participants did a judgment task. The RT at the critical region in the sentence (i.e., the region where the inflection was incorrect) was recorded. The structures under study included an adjacent subject and verb, (11a), an adverb between the subject and the verb, (11b), and a complex subject containing a PP. The PP was presented in two conditions: one with a singular local NP, (11c), and one with a plural local NP, (11d).

- (11) a. The doctor drinks/*drink a lot of coffee.
 - b. The mother often cooks/*cook a lot of rice.
 - c. The student with a large bag carries/*carry a lot of books.
 - d. The teacher with the cute earrings drinks/*drink a lot of tea.

The results showed that L2 learners were not affected by the intervening material in any of the structures in (11). This was inferred from the fact that the RT at the critical region in ungrammatical sentences was not significantly longer than the corresponding time in grammatical sentences. Even in (11a), where the subject and the verb were adjacent, the learners did not show sensitivity to the missing agreement morpheme. In keeping with Hawkins and Casillas (2008; see Section 3.3.2), Bannai explained the results in the conditions exemplified by (11b), (11c) and (11d) by indicating that the learners were affected by the intervening elements between the subject and the verb, so they did not show sensitivity to grammatical errors in these cases.

3.3.2 Production-based studies

Hawkins and Casillas (2008) investigated the oral production of the subject-verb agreement morpheme by ten Chinese and ten Spanish intermediate learners of English. The study tackled the effect of the separation between the noun that determines the number agreement, and the tense feature (T) associated with the verb. Hawkins and Casillas argued that the production of the agreement morpheme by L2 learners is not the result of computing an agreement operation between the subject and the verb (as it is for native speakers), but rather the result of context-sensitive morpheme attachment. They summarized this distinction between natives and L2 learners using the vocabulary entries for third-person singular inflection shown in (12).

a. /s/ → [V, -past, 3p, +sing] + ____ (morpheme suppliance for natives)
b. /s/ → / [V] + ____/[T, -past] ____ / [N, +sing, 3p] ____ (morpheme suppliance for L2 learners)

According to Hawkins and Casillas (2008, p. 602), (12b) should be read as follows: "insert /s/ in the context of a verb which is in the context of a non-past T, itself in the context of a 3rd person, singular N." Hence, the larger the number of terminal nodes that are required to specify the context in which a given vocabulary item is inserted, the more likely it becomes that the item will not be retrieved. In other words, L2 learners are not sensitive to the features of terminal nodes, but rather to the number of terminal nodes separating the subject noun and the verb. Specifically, if the subject and the verb are separated by extraneous nodes, retrieval of the morpheme for the purpose of insertion will be negatively affected.

Admittedly, Hawkins and Casillas did not directly address the effect of distance on morpheme suppliance: their focus was to propose the distinction in the vocabulary entries for verb morphology between natives and L2 learners in (12). Even so, they used two structures in which some material intervenes between the subject and the verb. This distinction is relevant to the present experiment. Hawkins and Casillas studied the oral production of the agreement morpheme in the following contexts:

- (13) a. Adjacent subject-verb (simple subject) (as in 'My brother owns a house')
 - b. Non-adjacent subject-verb (subject + PP) (as in 'The brother of my best friend owns a house')
 - c. Adjacent subject-verb (complex subject, possessive) (as in 'My best friend's brother owns a house')

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They proposed that L2 learners will supply the morpheme in (13a) more accurately than in (13b) because, in (13b), a PP complement intervenes between the noun which determines the agreement, and the verb. On the other hand, Hawkins and Casillas predicted that there will be no difference between (13a) and (13c) because, in (13c), the noun and the verb are adjacent, even though the subject is a complex NP.

In addition, Hawkins and Casillas did not refer to the type of distance (i.e., linear vs. structural) involved in the three structures they used for testing morpheme suppliance: they focused only on whether the subject noun (which determines the agreement relation) is adjacent or non-adjacent to the verb. However, the three structures in (13) have some bearing on the effect of distance type, as I will explain shortly. I will first provide tree representations for these structures. Then I will calculate the LD and SD between subject and verb in each one, and relate these distances to Hawkins and Casillas's findings.³⁷

The structures are presented in (14) (Pron = pronoun, PDP = possessive determiner phrase).

(14) a. My brother owns a house.



(LD = 0, SD = 3: NP, DP and VP)

³⁷ For the sake of simplicity, I do not assume a T projection in (14). The distance calculations will not be affected by this.



b. The brother of my best friend owns a house.'

(LD = 4, SD = 3: NP, DP and VP)

c. My best friend's brother owns a house.



(LD = 0, SD = 4: NP, DP, PDP and VP)

Although there is a PP intervening between the subject and the verb in (14b), this PP is not counted structurally because neither the subject 'brother' nor the verb 'owns' is inside the PP. In counting SD, only the nodes that are crossed when drawing a path from the controller to the target are counted (Keating, 2010). Thus, in both (14a) and (14b), the SD between subject and verb is the same, but they vary in terms of the LD between these elements: 0 and 4, respectively. On the other hand, the SD in (14c) is one node greater than that in (14a) and (14b). Despite this extra node in (14c), Hawkins and Casillas report that morpheme suppliance was high in this case, suggesting that LD is what gave rise to variability, rather than SD. Alternatively, it is possible that one extra node was not enough to cause a significant decrease in the suppliance rate.

Returning to Hawkins and Casillas study, the predictions for the three contexts in (14) were based on the LD between the agreeing items, as follows: if the LD is zero, as in (14a) or

(14c), morpheme suppliance will be high; however, if the LD is not zero, as in (14b), morpheme suppliance will be negatively affected.

Table 41 shows the suppliance rates for the agreement morpheme in the three contexts in (14). Consistent with Hawkins and Casillas's predictions, the rate of morpheme production was higher in the adjacent subject-verb condition in (14a) than in the non-adjacent subject-verb in (14b). The results also show that, even when the subject was a complex DP, as in (14c), morpheme production was higher than in (14b) because the subject and verb were adjacent in (14c).

Table 41

Morpheme Suppliance in Three Contexts in Hawkins and Casillas (2008)

	Chinese	Spanish
Simple DP	80%	81%
DP of DP	60%	61%
DP's DP	79%	82%

Tuniyan's (2013) study was a replication of Hawkins and Casillas (2008), but involving two levels of proficiency: lower and upper intermediate. There were five participants at each level. Tuniyan compared the suppliance of the subject-verb agreement morpheme in two contexts: where the LD was zero, and where the LD was 3. The speech of Chinese and Russian learners of English was studied in simple DPs (i.e., determiner + noun) versus complex DPs (i.e., determiner + noun + PP). The two nouns in the complex DP (i.e., the head noun, and the object of the PP) were singular or plural as follows: 'DP of DP', as in 'the guest of the singer'; or 'DP of DPs', as in 'the friend of the teachers'. Tuniyan predicted that the learners in both L1 groups would omit the agreement morpheme on the verb more frequently after a complex

DP subject than a simple DP subject. This prediction was borne out for both L1 groups at both proficiency levels. It was also noted that, for each L1 group, the rate of morpheme suppliance increased as proficiency increased.

The results are summarized in Table 42.

Table 42

Rates of Agreement Morpheme Omission by Chinese and Russian Learners of English in Tuniyan (2013)

	Chinese		Russian		
	Lower	Upper	Lower	Upper	
Simple DP	40%	15%	20%	5%	
DP of DP	75%	30%	40%	5%	
DP of DPs	90%	65%	50%	40%	

This result confirms the assumptions of both the SSH, which holds that the domain of processing agreement relations is limited to local elements for L2 learners, and the negative effect of LD, which implies that an increase in LD entails more difficulty in computing a dependency.

In a study by Ma and Zou (2018), subject-verb agreement in the oral production of Chinese learners of English was investigated. The focus of Ma and Zou was to establish if L2 learners are affected by attraction errors when they produce the agreement morpheme. Attraction happens when a verb fails to agree with its controller because agreement is disrupted by a nearby noun with which the verb agrees instead. This nearby noun is called the 'attractor'. For example, in a complex subject DPs such as 'the key to the cabinets', the plural attractor 'cabinets' may cause the speaker to incorrectly produce a plural verb, instead of producing a singular verb that agrees with 'the key'. Although Ma and Zou's study addressed attraction errors rather than distance effects, this phenomenon still has some bearing on the effects of LD, as I will show shortly.

Ma and Zou (2018) elicited agreement in complex subject DPs (determiner + noun + PP) containing different combinations of singular or plural head noun and local noun.³⁸ Thirty Chinese learners of English (22 intermediate and 8 advanced) and fifteen native English controls did an elicited oral sentence-production task. The production of the subject-verb agreement morpheme was compared in sentences containing simple vs. complex subject DPs. The subjects consisted of singular and plural combinations of head and local noun, as shown in (15).

- (15) a. the guest of the student
 - b. the guests of the student
 - c. the guest of the students
 - d. the guests of the students

What distinguishes Ma and Zou's (2018) study from Tuniyan's (2013) study is that Ma and Zou grouped the four combinations of singular and plural head noun and local noun into two categories: the first combination (DP of DPs) vs. the three remaining combinations (DP of DP, DPs of DP, DPs of DPs). This dichotomy isolates the combination 'DP of DPs': in this case, the local plural noun (i.e., the attractor) masks the number of the head noun; hence, Ma and Zou expected a higher rate of agreement errors after 'DP of DPs' subjects than in the remaining three combinations.

The results of Ma and Zou's (2018) study are given in Table 43.

³⁸ The local noun is the object noun of the PP, which is linearly closer to the main verb than the head noun is.

Table 43

Sul	bject-verl	b Agreement	Error	Rates in	Ma and	Zou	(2018)	ł
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	Intermediate	Advanced	Control group
DP of DPs	55%	15%	14%
All other complex DPs	9%	4%	0%

These results confirmed the prediction that L2 learners are more likely to produce subject-verb agreement errors when the PP object (i.e., the attractor) is plural and the head noun is singular (as in 'DP of DPs'), than for the remaining three types of complex subject DP. Although this result supported an effect of attraction on subject-verb agreement, it also showed the effect of LD on the production of the agreement morpheme. Distance is necessary for an attraction error to occur because attraction needs an attractor that comes between the controller and the target. Thus, attraction inevitably involves LD. In this sense, the result showed that the adjacency (LD = 0) between the noun of the PP, and the verb, made L2 learners move the dependency relation to the noun that is closer to the verb, which resulted in more agreement errors.

Also, the results for simple vs complex subject DPs showed that intermediate L2 learners made fewer subject-verb agreement errors after simple DPs (total error rate: 3%) than after complex DPs (total error rate: 20%). Advanced-level participants made no mistakes in producing subject-verb agreement after simple DPs, compared to 7% after complex DPs. The accuracy of both groups in producing agreement inflection after simple DPs was significantly higher (p < .001) than after complex DPs, which supported the effect of LD on producing the morpheme.

In a recent study, Austin et al. (2023) sought to determine if morpheme omission is conditioned by adjacency or locality. They pointed out that subject-verb agreement in previous studies by Hawkins and Casillas, Tuniyan (2013) and Ma and Zo (2018) was non-local because the subject and the verb were in different phrases. Therefore, the omission of the agreement morpheme could be attributed either to the effect of non-adjacency or to the effect of nonlocality. Austin et al. (2023) suggested that the effect of adjacency can be isolated from that of non-locality by studying structures whose agreeing elements are local to their domain, as in QPs. For example, in '<u>nine</u> courageous <u>bats</u>', the agreeing elements are not adjacent, but they are within the same phrase (i.e., QP) and are therefore local.

Sixty-four intermediate Vietnamese learners of English (VLEs) did a sentencecompletion task. Two QP contexts for obligatory plural suppliance were investigated: adjacent quantifier-noun, as in '<u>two bats</u>'; and non-adjacent quantifier-adjective-noun, as in '<u>nine</u> courageous <u>bats</u>'. Using a Bayesian approach, Austin et al. (2023) demonstrated that the plural morpheme was supplied at a lower rate in non-adjacent than adjacent contexts ($\hat{b} = -0.95$, 89% HDI [-1.47,-0.47]; HDI = highest density interval). As the regression model was logistic, it is possible to derive the odds ratio: the participants were 40% less likely to produce the plural morpheme in the non-adjacent context than the adjacent one.

3.3.3 Limitations and gaps

Different controller-target pairs, involving both local and non-local dependencies, are found in the literature concerned with the comprehension and production of long-distance dependencies in the L2. These include noun-adjective agreement (Keating, 2009, 2010); feature-checking unification between a quantifier and a noun, as in 'several coins' (Jiang, 2007); agreement between a determiner and a noun, as in 'these houses' (Dowens et al., 2010; Wen et al., 2010); subject-copula agreement (Chen et al., 2007; Jiang, 2004); and subject-verb agreement inflection on regular verbs (Bannai, 2011; Hawkins & Casillas, 2008; Tuniyan, 2013). So, for comprehension at least, research has been widely conducted on both L2 English and non-English. However, the other modality of language acquisition (i.e., language production), has been largely overlooked in this area: to my knowledge, only Hawkins and Casillas (2008) and Tuniyan (2013) fall into this category. Comprehension and production are quite distinct in language processing (Segaert et al., 2012); thus, more studies on the production of long-distance dependencies are needed.

In addition, one concern with studies on the production of morphemes in long-distance dependencies is the small size of the samples: ten participants in Hawkins and Cassillas (2008), and only five participants at each proficiency level in Tuniyan (2013). Thus, studies with larger samples are necessary to allow generalizing the results with confidence.

There is also the issue of negative transfer of L1 morphosyntax. In Ma and Zou (2018), where the sample size was 30, the L1 (i.e., Chinese) does not instantiate number inflection; rather, singularity and plurality are interpreted based on contextual factors. Thus, negative transfer from the L1 could be expected; as a result, the suppliance of plural inflection in the L2 is likely to be depressed in general (i.e., regardless of the distance between the controller and the target). The same applies to Austin et al.'s (2023) study, where the L1 (i.e., Vietnamese) again lacks number inflection on nouns. In this light, we need a study in which the effect of distance on L2 plural suppliance cannot be confounded by transfer effects.

3.4 Predictions of Experiment Two

Recall that, in the current study, we are interested in the adjacent context (e.g., 'nine frogs'), the long-distance context (e.g., 'nine slippery frogs'), and the very long-distance context (e.g., 'nine slippery old crimson frogs'). The tree representations in (16) to (18) indicate the LD and SD associated with each context. Note that as the LD increases, the SD also increases.





(LD = 1, SD = 3: NP, AP, DP)



(LD = 3, SD = 5: NP, AP, AP, AP, DP)

As we can see from these tree representations, the LD and the SD in the adjacent context are each less than the LD and the SD in the long-distance context, while the LD and the SD in the long-distance context are each less than the LD and the SD in the very long-distance context. Based on the complexity associated with longer LDs and SDs between the controller and the target, the predictions for this experiment will be:

(19) P1: The plural morpheme will be supplied in long-distance contexts at a lower rate than in adjacent contexts.

P2: The plural morpheme will be supplied in very long-distance contexts at a lower rate than in long-distance contexts.

3.5 Method

The participants, task and procedure were the same as in Experiment One, except that the stimulus items and sentences were different. The task consisted of 72 stimulus sentences: 36 contained inflected stimuli (i.e., plural nouns); and 36 contained uninflected (i.e., singular nouns), which were used as distractors. The whole task consisted of 24 sets of three sentences each, representing the three types of distance (i.e., adjacent, long, and very long), as shown in (20a), (20b), and (20c), respectively. I used numeral quantifiers to create obligatory contexts for plurality and, in the case of the uninflected forms, singularity. For the full set of the stimulus sentences, see Appendix B. In (20d), I show the written prompt that corresponds to (20a).

(20) Stimulus sentences:

- a. She hears nine frogs very infrequently near the deep and beautiful streams.
- b. She hears nine slippery frogs very infrequently near the deep and beautiful streams.
- c. She hears nine slippery old crimson frogs very infrequently near the streams.

Example written prompt:

d. She hears nine fro_____ very infrequently near the deep and beautiful str_____.

One stimulus noun appeared in each stimulus sentence; the stimulus was always the object of the verb. The stimulus sentence ended in a PP whose embedded DP was used to balance the word counts across the three conditions. Specifically, as I added adjectives as modifiers of the stimulus noun, postmodifying adjectives were dropped from the DP inside the PP. The full set of 36 plural stimuli is given in Table 44.

Table 44

Adjacent	Non-adjacent	
Short distance	Long distance	Very long distance
nine frogs	nine slippery frogs	nine slippery old crimson frogs
eight bats	eight horrible bats	eight horrible young silvery bats
five snakes	five dangerous snakes	five dangerous old turquoise snakes
two pigs	two powerful pigs	two powerful young brown pigs
ten rams	ten courageous rams	ten courageous old white rams
nine dogs	nine aggressive dogs	nine aggressive young yellow dogs
eight bears	eight intimidating bears	eight intimidating old orange bears
five cats	five overweight cats	five overweight fluffy young cats
two birds	two delightful birds	two delightful old maroon birds
ten worms	ten enormous worms	ten enormous wriggly young worms
three whales	three marvelous whales	three marvelous old grey whales
three bulls	three ferocious bulls	three ferocious strong young bulls

Full Set of Plural QP Stimuli

As in the previous experiment, there were some cases that needed to be excluded. These constituted 6.7% for adjacent contexts, 6.5% for long contexts, and 7.9% for very long contexts.

3.6 Data analysis and results

The same approach and the same regression model were used to analyze the data for the current experiment as in Experiment One. The effect of distance was investigated in the adjacent, long-distance and very long-distance contexts. The regression model included a fixed effect *stimulus type* which compared the production of the plural morpheme in adjacent contexts vs. long-distance contexts, and then in long-distance contexts vs. very long distance contexts. The former level was the reference level in both cases.

Table 45 gives the mean rates of plural suppliance in all three contexts. It shows that the ALEs supplied the plural morpheme in the adjacent context at a higher rate than they did
in the long-distance context, and in the long-distance context at a higher rate than in the very long-distance context.

Table 45

Rates of Plural Morpheme Suppliance in All Three Contexts

Context	Rate of suppliance
Adjacent	77.1%
Long	56.9%
Very long	51.6%

For the statistical analysis, I will start with the first comparison: adjacent vs. long distance. The priors that I used for the intercept and for stimulus type were based on the estimates in the posterior distributions obtained by Austin et al. (2022) for these parameters. For the intercept, I used $\mu = 2.62$, $\sigma = 0.48$, and for stimulus type I used $\mu = -0.98$, $\sigma = 0.59$. The prior predictive check results showed that these priors were suitable. The values of \hat{R} and *ESS* showed that the suggested model converged (see Table 46).

Table 46

Values of \widehat{R} and ESS for the Effect of Distance on Plural Suppliance: Adjacent vs. Long Distance

Parameter	Ŕ	ESS
(Intercept)	1.00	3916
Stimulus type: long distance	1.00	7035

The posterior distribution for the effect of stimulus type in adjacent vs. long distance is shown in Figure 5.



Figure 5. Posterior Distribution for the Effect of Stimulus Type on Plural Suppliance: Adjacent vs. Long Distance

We can see that the whole HDI (in fact, the whole posterior distribution) consists of negative values, indicating a negative effect of long distance relative to adjacent. This means that the plural morpheme was produced less reliably in the long-distance than adjacent context. Therefore, P1 in (19) is upheld.

Table 47 provides the output of the regression analysis.

Table 47

Effect of Stimulus Type on Plural Suppliance: Adjacent vs. Long Distance

Parameter	ĥ	SD	89% HDI
(Intercept)	1.90	0.28	[1.47, 2.36]
Stimulus type: long distance	-1.33	0.27	[-1.77, -0.91]

 \hat{b} represents the log-odds ratio for the effect of stimulus type, and is interpreted as follows: the odds of supplying the plural morpheme were lower in the long-distance context than the adjacent context by a factor of $e^{-1.33} = 0.26$.

Now, we move on to comparing the production of the plural morpheme in long vs. very long contexts. The priors that I used for the intercept and for stimulus type were the same as the ones that were used for the adjacent vs. long distance comparison above. The values of \hat{R} and *ESS* showed that the suggested model had converged (see Table 48).

Table 48

Values of \hat{R} and ESS for the Effect of Distance on Plural Suppliance: Long vs. Very longdistance

Parameter	Ŕ	ESS
(Intercept)	1.00	4247
Stimulus type: very long-distance	1.00	7614

The posterior distribution of the effect of stimulus type in long vs. very long distance is shown in Figure 6.



Figure 6. The Posterior Distribution for the Effect of Stimulus Type on Plural Suppliance: Long vs. Very long-distance

For the very long-distance context, we can see that the HDI lies to the left of zero, indicating a negative effect of very-long distance relative to long distance. This means that the plural morpheme was produced less reliably in the very-long distance context than in the longdistance context. Hence, prediction P2 in (19) is confirmed.

Table 49 provides the output of the regression analysis.

Table 49

Parameter	\widehat{b}	SD	89% HDI
(Intercept)	1.4	0.31	[0.67, 1.65]
Stimulus type: very long	-0.81	0.28	[-1.26, -0.38]

Effect of Stimulus Type on Plural Suppliance: Long vs. Very Long-Distance

The odds of supplying the plural morpheme were lower in the very-long distance context than the long-distance context by a factor of $e^{-0.81} = 0.44$.

3.7 Discussion and conclusion

In this experiment, I tested two predictions:

P1: The plural morpheme will be supplied in long-distance contexts at a lower rate than in adjacent contexts.

P2: The plural morpheme will be supplied in very long-distance contexts at a lower rate than in long-distance contexts.

The results showed that:

- 1) The ALEs supplied the plural morpheme in long-distance contexts less accurately than they did in adjacent contexts. This means that P1 is upheld.
- 2) The ALEs supplied the plural morpheme in very long-distance contexts less accurately than they did in long-distance contexts. This means that P2 is upheld.

To recap, the results of this experiment confirmed that the oral production of the plural morpheme in QPs by ALEs is affected by the LD and/or SD between the controller and the target.

This result is significant for the following reasons. First, there has been a shortage of research on the effect of distance on the oral production of inflection by L2 learners. Thus, the results of this experiment add to existing research in this area.

Also, at the intermediate level of proficiency (which was targeted in this experiment), there have been contradictory results on the effect of distance on morpheme acquisition. For example, Keating (2009, 2010) showed that L2 learners were sensitive to disagreement over long distance, while Jiang (2004, 2007) showed that L2 learners were not sensitive to long-distance disagreement. It is true that these studies targeted comprehension rather than oral production; still, the phenomenon under study was the same as the current experiment: processing dependencies over distance. Thus, the present experiment may, along with future research, help provide a clearer picture of how intermediate L2 learners process agreement over distance in both written and oral contexts.

Also, it is instructive to compare the results of the current experiment with those of Wen et al. (2010). In both cases, in terms of LD and SD, the structures under study were parallel: compare 'demonstrative-adjective-noun' in Wen et al.'s study, and 'numeral-adjective-noun' (i.e., the long-distance context) in the current study. Also, the participants in both studies were at intermediate level. However, in Wen et al., the participants did not show sensitivity to number disagreement in the long-distance context, while in the present experiment the participants showed sensitivity to the distance between controller and target in their oral production.

This discrepancy may be attributed to the difference between the L1s in both studies: in Wen et al., Chinese and Japanese lack plural inflection, while in this study, Arabic is inflected for noun plurality. The effect of distance in the L2 is not expected to depend on the characteristics of the L1; in other words, negative transfer should not come into play. Even so, one cannot completely discount this possibility, especially at non-advanced stages of learning. Thus, in a study like Wen et al.'s (2010), the learners' insensitivity to number disagreement might not be solely the result of distance, while in the present study we are certain that the effect is solely attributable to distance.

It is also relevant to compare the results of the present experiment with those of Austin et al. (2023). For the short-distance condition (Q-N) versus the long-distance condition (Q-ADJ-N), both the ALEs and the VLEs in the present study and in Austin's et al.'s study respectively showed a significant decrease in morpheme production in the long-distance condition compared to the short-distance condition, which means that the results of the current experiment are in line with those of Austin et al.'s study — at least, for this distance condition.

For the very long distance condition (Q-ADJ-ADJ-ADJ-N), which was not tested in Austin et al. (2023), we can see that the HDI interval for this condition ([-1.26, -0.38] in the present experiment) overlaps greatly with that in Austin's et al.'s study (HDI: [-1.47, -0.47]) for the long-distance condition. This is evidence for a negative effect of distance on morpheme production. At the same time, based on distance alone, it may have been expected that the negative effect in the very long-distance condition in the present study would be stronger than in the long-distance condition. However, this does not take into account the fact that the L1 inflection has for plurality. In this light, even though the approach used in the analysis in the present experiment was very similar to the one used in Austin et al. (2023), it might not be wise to compare the HDI intervals in the present experiment and those in Austin et al.'s study.

One more issue can be raised here: the morphological properties of adjectives in the L1. Although distance is not an L1-based reason for morphological variability, the L1 might be expected to have an influence on L2 learners' production of inflection in general, especially at non-advanced levels of proficiency. In Arabic, adjectives are inflected for plurality (unlike English; Wright, 1995). Adjectives in Arabic are inflected for number, gender, and definiteness

(Benmamoun, 2000). This could have led the ALEs to refer to the adjective, as they are used to do in their L1, to help recall the number feature of the head noun, even over distance, because the number feature in their L1 is overtly realised on the adjective that modifies the noun. The singular form of the adjective in Arabic is the base form that receives the inflection (Wright, 1995); hence, if an adjective has no markers in Arabic, the head noun must be singular. This may have affected the rate at which the morpheme was dropped after a sequence of adjectives that did not carry any indication of plurality.

Also, the task of recollecting the missing target noun in the stimulus sentence may have put added pressure on the ALEs' memory in a situation in which they had already been distracted by the sequence of adjectives that preceded the head noun. An increase in omission in these circumstances is in keeping with the Missing Surface Inflection Hypothesis (Prévost & White, 2000), which assumes that learners struggle to recall morphological inflection under the pressure of language production, and resort to uninflected forms. According to Prévost and White (2000), this behaviour on the part of L2 learners does not indicate an impairment in the representation of the morpheme; hence, in the present experiment, the distance between the controller and the target increased the computational load involved in producing the inflection which in turn led to the production of uninflected forms. This seems especially plausible given that the ALEs here were still in the process of acquiring the L2.

Finally, and admittedly, there is a limitation in this experiment that should be acknowledged. Adding more intervening items between the target and the controller in our case led to an increase in both LD and SD. Therefore, this experiment did not distinguish between the effects of these two types of distance. It would be worth conducting a follow-up study on plural suppliance in QPs in which LD and SD can be teased apart.

CHAPTER 4: EXPERIMENT THREE: PROCESSING ANIMACY

4.1 Introduction

In this chapter, I address the effect of semantic information, namely animacy, on the production of the subject-verb agreement morpheme. The structures under investigation involve both types of relative clause (RC): the subject relative clause (SR) and the object relative clause (OR). The experiment primarily focuses on the effect of the animacy status of the matrix subject on agreement suppliance, but it also considers how animacy interacts with SR vs. OR asymmetries. To explore this, I compare the suppliance of the agreement morpheme in the four contexts exemplified in (1) (adapted from Traxler et al., 2005; AI = matrix subject is animate, RC object is inanimate; IA = matrix subject is inanimate, RC object is animate).

- (1) a. The manager that signs the contract looks very strange. (SR, AI)
 - b. The manager that the contracts confuse looks really strange. (OR, AI)
 - c. The contract that confuses the managers looks really strange. (SR, IA)
 - d. The contract that the manager signs looks very strange. (OR, IA)

As we can see in (1), the animacy of the matrix subject, the SR object and the OR subject is manipulated in a permutation that covers the two RC types (i.e., SR vs. OR), with two contexts of animacy for each type (i.e., AI vs. IA). Thus, the SR in (1a) has the animate matrix subject 'manager' and the inanimate SR object 'contract', whereas the SR in (1c) has the inanimate matrix subject 'contract' and the animate SR object 'manager'. Likewise, the OR in (1b) has the animate matrix subject 'manager' and the inanimate oR subject 'contract', while the OR in (1d) has the inanimate matrix subject 'contract' and the animate OR subject 'contract', while the inanimate or subject the effect of animacy on agreement suppliance on the matrix verb, I will also study how this may affect the processing of SRs vs. the processing of ORs, as the

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latter structure is associated with more difficulty than the former (further explained in Section 4.2.2).

This chapter is organized as follows. In Section 4.2, I provide some theoretical background to the experiment; this includes how syntactic and semantic information are combined in sentence analysis. Reasons why ORs pose processing difficulties are given in Section 4.2.2. In Section 4.2.3, I show how, under certain conditions, this difficulty is reduced. In Section 4.3, I survey previous studies on the animacy status of the matrix subject in sentences based on SRs and ORs. On this basis, I identify the gap that will be filled in this experiment. The predictions of the experiment are given in Section 4.4, followed by the method in Section 4.5. The results of the experiment are stated in Section 4.6, and the discussion and conclusion are provided in Section 4.7.

4.2 Theoretical background

4.2.1 Syntactic and semantic information in second language sentence processing

For native speakers, it has been shown that different sources of information operate together in sentence comprehension and production. These include syntactic as well as semantic information (e.g., Gibson & Pearlmutter, 1998; Traxler et al., 2005). For second language (L2) learners, studies are still trying to answer the following questions: What types of information do L2 learners use to process and produce sentences? Is syntactic information involved? What about semantic information? Or do L2 learners use both types? The contrast between SRs vs. ORs is a syntactic issue, while the animacy of the matrix subject is a semantic issue; hence, both types of information are relevant to the current experiment. In Sections 4.2.2 and 4.2.3 respectively, I compare the processing of SRs vs. ORs per se, and then look at animacy effects in sentences based on these structures.

4.2.2 Reasons for the OR disadvantage

The processing of SRs vs. ORs has long been discussed in the literature concerned with both first-language (L1) and L2 processing (Chen, 2006; Gass, 1979; Gordon et al., 2004; Hakes et al., 1976; Hu & Liu, 2007; Traxler et al., 2005; Warren & Gibson, 2002). According to the noun-phrase (NP) accessibility hierarchy (Keenan & Comrie, 1977), the RC type in which the head noun is the subject of the RC (i.e., the SR) is the easiest to process.

This advantage can be viewed in terms of structural distance (SD; see Section 3.2.1). A longer SD between the gap and the filler in the OR, compared to the SR, means that the filler must be held in memory for a longer time until the gap is reached (Gibson, 1998), as shown in example (2) (adapted from O'Grady et al., 2003, p. 435; S = sentence, VP = verb phrase).

- (2) a. The man that $[s _ likes the woman] SD = 1 (S)$
 - b. The man that [s the woman $[v_P \text{ likes }]]$ SD = 2 (S, VP)

Traxler et al. (2002) expanded this notion of delayed processing by referring to a strategy used by the listener/reader called the Active Filler Strategy (Frazier & Flores d'Arcais, 1989; Stowe, 1986). This has been supported for both the L1 (Frazier, 1987; Lee, 2004; Pickering & Traxler, 2003; Stowe, 1986) and the L2 (Jackson & Dussias, 2009; Juffs, 2005; Williams et al., 2001). According to this strategy, the listener/reader is motivated to assign the filler to the first possible gap, so that the filler is not kept for a long time in memory. In the SR in (2a), for example, the subject position of the RC is the gap located directly after the relative pronoun 'that'. Thus, the listener/reader assumes that the filler of this gap is the subject of the RC (i.e., 'the man'). In the case of SRs, this analysis happens to be correct; however, this is not the case for ORs, where a determiner phrase (DP) already exists in the RC subject position.³⁹ In the OR in (2b), for example, the subject position in the RC is filled by the DP 'the woman'. As a result,

³⁹ In this thesis, I treat structures like 'the man' as DPs. The NP accessibility hierarchy can be readily applied to DPs.

the listener/reader needs to link the filler 'the man' referentially with the gap in the position of the RC object. This backtracking, which occurs in ORs, is a reason for the well-known asymmetry in SR-OR processing difficulty (or 'OR disadvantage') in both the L1 and the L2.

Another account of this disadvantage is found in Van Dyke and Lewis (2003), who focus on the interference between pending constituents that are held in memory (see also Gordon et al., 2001). In the case of the SR, there is only one noun that precedes the RC verb, compared to two nouns in the case of the OR. The difficulty in OR processing comes from having multiple DPs that are activated simultaneously in memory. In terms of syntactic and semantic information, one of these DPs needs to match the newly-integrated word (i.e., the RC verb). The interference between the syntactic and semantic features of these nouns causes the delay in processing OR compared to SR structures, which have only one noun preceding the verb.

MacWhinney and Pleh (1988) took another approach to explaining the OR disadvantage by referring to shifting perspectives, which occurs in the OR but not the SR. They held that as the listener/reader moves through the clause, the perspective or focal point (i.e., the subject) can be maintained or shifted. MacWhinney and Pleh postulated that structures which maintain the same perspective are easier to process than structures which shift it. An example is given in (3) (adapted from MacWhinney and Pleh, 1988, p. 97).

(3) a. The boy who sees the girl chases the policeman. (SR)

b. The boy who the girl sees chases the policeman. (OR)

In (3a), the perspective of the matrix clause (i.e., 'the boy') is maintained as we move to the subordinate clause, because the subordinate clause has the same perspective as the matrix clause. However, in (3b), the focus is shifted from 'the boy' to 'the girl' as we move to the subordinate clause. This causes a conflict in focus because the listener needs to split the

assignment of focus between clauses. In turn, this increases the processing demands in the OR compared to the SR.

4.2.3 Reduction of the OR disadvantage

Despite the processing difficulty associated with OR compared to SR structures, it has been found that this difficulty can be reduced when certain features of the nouns in the RC are changed. For example, when the OR head is definite and the RC subject is a proper name or a pronoun like 'I' or 'you', the difficulty of processing the OR is reduced (Gordon et al., 2001, 2004). On the other hand, when the OR head is definite and the RC subject is indefinite or a generic plural, the processing difficulty remains. Examples are shown in (4).

- (4) a. The student that a teacher helps comes early.
 - b. The student that the teacher helps comes early.
 - c. The student that you help comes early .

According to the Givenness Hierarchy (Gundel et al., 1993), the structure in (4a) is more difficult to process than the structure in (4b), which, in turn, is more difficult to process than (4c). The Givenness Hierarchy compares DP types on a scale from 'central' to 'peripheral' according to the accessibility of their referents. According to this hierarchy, a definite DP is more accessible than an indefinite DP because the definite DP represents a uniquely identifiable referent. This is not the case in an indefinite DP; hence, a lower processing load is expected in (4b) compared to (4a). As for (4c), 'you' is more accessible than 'the teacher' in (4b) because pronouns are 'central': they do not introduce a new referent. Another reason for the relative ease of processing an OR with a pronoun RC subject is that a pronoun usually describes a topical referent. This makes it a good candidate for taking the role of the subject (Warren & Gibson, 2002).

Varying the morphosyntactic features of the nouns in the RC has also been found to reduce the difficulty of processing OR structures. According to Featural Relativized Minimality (Friedmann et al., 2009; Villata et al., 2016), if the head of the RC and the subject of an OR differ in syntactic features (e.g., number), then the processing difficulty associated with the OR is expected to decrease. I illustrate this in (5) (adapted from Xia, 2022, p. 3).

- (5) a. I know the king (i) who the boy pushed (i). 40
 - b. I know the king (i) who the boys pushed (i).

In (5a), the matrix object 'the king' and the RC subject 'the boy' are both singular; in (5b), by contrast, the matrix object is singular but the RC subject 'the boys' is plural. According to Featural Relativized Minimality, this variation in the number feature is assumed to mitigate the difficulty of processing (5b) compared to (5a). The mismatch in number between the nouns in (5b) reduces the likelihood of taking 'the boys' to be a local filler for the gap (i).

4.3 Review of relevant previous research

In Section 4.3.1, I summarise previous studies dealing with the effect of subject animacy on the comprehension of RC sentences. I will start by summarising three studies which focused on native speakers of English, namely Traxler et al. (2002), Weckerly and Kutas (1999) and Traxler et al. (2005). Then I consider research on L2 English learners. I will begin with native-speaker studies because the approach used in these studies was adopted in studies on L2 learners. In Section 4.3.2, I identify the research gap that is relevant to the present study.

4.3.1 Animacy effects in RC sentences

By manipulating animacy, Traxler et al. (2002) questioned the long-standing view that SR sentences are easier to process than OR sentences. In OR sentences, Traxler et al. (2002)

⁴⁰ The symbol '(i)' indicates the coindexation of the filler with its corresponding gap.

proposed that the reader/listener initially assumes that the DP at the beginning of the sentence is the subject, and that the following relative pronoun is a subject relative pronoun. Soon after encountering the RC subject, the reader/listener is forced to scrap this initial analysis and formulate another. If the DP at the beginning of the sentence is animate, then it will resist the shift from the subject role to the object role, especially if the new input DP (i.e., the RC subject) is inanimate, because inanimate nouns make bad candidates for the subject role.

Also, by manipulating animacy, Traxler et al. were able to test the effect of this property on the processing of SR sentences. An SR with an animate matrix subject is expected to be processed more easily than an SR with an inanimate matrix subject. This is illustrated in (6) (adapted from Traxler et al., 2002, p. 88):

- (6) a. The plumber that dropped the wrench was found near the back door. (AI/SR)
 - b. The plumber that the wrench bruised was found near the back door. (AI/OR)
 - c. The wrench that bruised the plumber was found near the back door. (IA/SR)
 - d. The wrench that the plumber dropped was found near the back door. (IA/OR)

In (6b), the initial noun 'plumber' is animate, which resists reassignment of role from subject to object, while in (6d) the initial noun 'wrench' is inanimate, which facilitates reassignment of roles because inanimate nouns are good candidates for the object role. Also, in (6a), the SR sentence has an animate matrix subject 'plumber'; by contrast, (6c) has an inanimate matrix subject 'wrench', which makes the former structure easier to process than the latter. Based on this argument, Traxler et al. (2002) proposed their account of the effect of animacy on processing RCs.

Weckerly and Kutas (1999) investigated the effect of animacy on the comprehension of OR sentences by English natives using event-related brain potentials (ERPs), a psycholinguistic approach that studies brain responses to cognitive activities. They argued that animacy may accelerate the processing of ORs in certain cases, as illustrated in (7) (adapted from Weckerly & Kutas, 1999, p. 560).

(7) The student that the dissertation baffled swore to the heavens she would never utter a complex structure again.

In this OR structure, the reader/listener has to process two adjacent verbs, 'baffled' and 'swore'. Weckerly and Kutas argued that semantic information can make processing easier, as a 'dissertation' cannot 'swear' but a student can. They argued that the processing of the OR syntax in (7) allows for the role assignment processes to overlap in time with the syntactic processing, which accelerates the comprehension of the structure in (7).

Weckerly and Kutas (1999) went further to compare the comprehension of two types of OR after manipulating the animacy of the matrix subject and the RC subject (IA vs. AI), as illustrated in (8).

(8) a. The poetry that the editor recognised depressed the publisher. (IA)

b. The editor that the poetry depressed recognised the publisher. (AI)

As we can see, the lexical information in (8a) and (8b) is controlled, in that the same nouns and verbs are used in the two sentences. Both sentences are also syntactically parallel. Where they differ is in the positions of the nouns and the verbs in the sentences. In (8a), the OR subject is animate ('editor'), and is followed by a verb 'recognise' whose subject is naturally animate. On the other hand, (8b) has an inanimate OR subject followed by a verb 'depress' that can take either an animate or inanimate subject. The consistency of semantic information in (8a) is predicted to give an advantage to this sentence over the one in (8b) in processing terms.

The participants did a reading-for-comprehension task which consisted of IA vs. AI sentences, as exemplified in (8a) and (8b), respectively. Their ERPs were recorded. The results

showed that the animacy status of the matrix subject and the RC subject was noted as soon as it was available,⁴¹ and that, due to rapid role assignment, the OR in an IA sentence was associated with a lower memory load than the OR in an AI sentence. In (8a), the participant quickly took the noun 'editor' to be the subject of the matrix verb 'recognise' due to its animacy status, thus freeing up memory for other role assignment tasks; in (8b), this information was held in memory longer until the matrix verb 'depress' was reached. This result confirmed that animacy affects the processing of OR sentences.

Using a similar approach, Traxler et al. (2005) attempted to assess the effect of animacy on the processing of SR and OR sentences by conducting three eye-tracking experiments. The eye-tracking method allows the researcher to follow the eye movements made by the participant while reading, and to identify the points of gaze, and the durations of gazing at these points. The experiments in Traxler et al. (2005) are of special interest because they served as prototypes for subsequent studies on the L2 processing of RC sentences.

Traxler et al. (2005) started by demonstrating that OR sentences are more difficult to process than SR sentences when animacy is controlled. They predicted that, under certain conditions, the difficulty of processing OR sentences could be reduced or even diminished. According to Traxler et al. (2005), the animacy status of the nouns in these sentences can be used to facilitate thematic and grammatical-role assignment; for instance, an animate noun is likely to have the role of subject, while an inanimate noun is likely to have the role of object (see also Trueswell et al., 1994), as shown in Table 50.

⁴¹ This was observed through recording quantitatively significant fluctuations in the readings of the ERPs at the matrix subject and the OR subject regions.

Table 50

	Thematic role	Grammatical role
Animate noun	Agent	Subject
Inanimate noun	Theme	Object

Likely Thematic and Grammatical Roles for Animate/Inanimate Nouns

The example in (9) further illustrates this two-way contrast.

- (9) a. The dancer that the singer watches is old.
 - b. The movie that the singer watches is old.

According to Traxler et al. (2005), the reader needs to pay more attention when assigning the RC subject and RC object roles in (9a) than (9b), because both possible arguments of the verb 'watch' in (9a) are animate. In (9b), the processing load is lower because 'movie' is inanimate, so that it cannot take the role of agent for the verb 'watch'. Hence, (9b) is easier to process than (9a), as it needs less time to assign the thematic and grammatical roles. A noteworthy point here is that the predicate 'is old' is a plausible predicate for both 'the dancer' and 'the movie'; thus, the reader cannot use 'is old' to help to decide what the subject of the sentence is. The only source of semantic information comes from the animacy status of each of the matrix-verb arguments (i.e., 'dancer' and 'singer' in [9a], and 'movie' and 'singer' in [9b]).

Based on the argument above, Traxler et al. (2005) designed three experiments.⁴² In the first experiment, they controlled animacy and in the second and third they manipulated it. By controlling or manipulating animacy, they were able to test three predictions: 1) only structural

⁴² I will only review the first and the second experiments in Traxler et al. (2005). The third experiment was similar to the second one, and adopted the same animacy manipulation; however, it served another purpose irrelevant to the current review.

(i.e., syntactic) information is used in processing RCs; 2) only semantic information is used; and 3) both syntactic and semantic information are used.

In the first experiment, Traxler et al. (2005) compared the processing of SRs vs. ORs in sentences like the ones in (10) (AA = matrix subject is animate, RC object is animate).

(10) a. The editor (i) that (i) angered the writer fired the entire staff. (SR/AA)

b. The editor (i) that the writer angered (i) fired the entire staff. (OR/AA)

In (10), both nouns in each RC sentence (i.e., 'editor' and 'writer') are animate (AA), which means that both make good agents for either the matrix verb or the RC verb. The participants (91 English natives) performed a reading-aloud task and then answered questions to check their comprehension. Traxler et al. found a significantly longer eye gaze at the RC region in OR sentences compared to SR sentences, which confirmed that SR sentences are easier to process than OR sentences. In the context of the first experiment, participants relied only on syntactic information to process the sentence: no semantic information was involved because animacy was controlled.

In the second experiment, Traxler et al. (2005) manipulated animacy as shown in (11).

- (11) a. The musician that witnessed the accident phoned the police. (SR/AI)
 - b. The musician that the accident frightened phoned the police. (OR/AI)
 - c. The accident that frightened the musician caused a lot of injuries. (SR/IA)
 - d. The accident that the musician witnessed caused a lot of injuries. (OR/IA)

Traxler et al. predicted that the SR sentences in (11a) and (11c) would be easier than the OR sentences in (11b) and (11d). In keeping with this expectation, the participants gazed longer at the RC region in (11b) compared to the the RC regions in all three conditions in (11a), (11c) and (11d). Based on this, Traxler et al. concluded that the participants were using syntactic information to process the sentence. Turning to the OR condition in (11d), Traxler et al. 115

predicted that the RC region would be processed more easily in (11d) than in (11b). Both (11b) and (11d) are structurally identical: they only differ in animacy status. Unlike the matrix subject in (11d), the matrix subject in (11d) is inanimate, and so it makes a poor candidate for the subject role. Because of the consistency between the animacy status of the nouns and its thematic role assignment, the analysis in (11d) took less time. Based on this experiment, Traxler et al. concluded that the participants were using both syntactic and semantic information in processing RC sentences.

Traxler et al.'s (2005) approach, which was based essentially on Traxler et al.'s (2002), was extended in subsequent studies on L2 learners. The aim was to test if these learners showed the same tendency to utilize semantic information in processing RC sentences. An example is Omaki and Ariji's (2005) study, as I shall explain. In their study, Omaki and Ariji (2005) attempted to test the three predictions in Traxler et al. (2005); for convenience, they are restated here: 1) only syntactic information is used in L2 processing, 2) only semantic information is used, and 3) both syntactic and semantic information are used. Two groups of advanced Japanese learners of English (JLEs), 24 of whom were fully immersed in an English-speaking environment (JLEs1) and 44 of whom were not (JLEs2), performed a task which involved rating sentences for complexity. Both groups were at an advanced level of proficiency. A group of sixteen native English-speaking controls also performed the task. The subjects were asked to rate the complexity of each type of RC sentence, as shown in (12). The subjects were allowed to read each sentence only once.

- (12) a. The musician that witnessed the accident angered the policeman a lot. (AI/SR)
 - b. The musician that the accident terrified angered the policeman a lot. (AI/OR)
 - c. The accident that terrified the musician angered the policeman a lot. (IA/SR)
 - d. The accident that the musician witnessed angered the policeman a lot. (IA/OR)

According to Omaki and Ariji, if the first prediction was correct (i.e., only syntactic information was used), then the participants would not make use of the animacy status of the nouns 'musician/accident', and they would be solely affected by the complexity of the RC (i.e., SR vs. OR). Thus, SR sentences (as in [12a] and [12c]) should be easier to process than OR sentences (as in [12b] and [12d]). If the second prediction was correct (i.e., only semantic information was used), then the participants would not be affected by the RC type, but rather by the animacy status of the matrix subject, and of the RC subject or RC object. Thus, they would find (12a) and (12d) easier than (12b) or (12c), because, in each of the former sentences, the noun 'musician' that immediately precedes the RC verb 'witness' is animate, and is therefore a natural agent. By comparison, the inanimate noun 'accident' that immediately precedes the RC verb in (12b) and (12c) is an an unnatural agent. For the third prediction (i.e., both syntactic and semantic information was used), the participants would not have difficulty processing the RCs in (12a) and (12c), or the OR sentence with an inanimate matrix subject in (12d). Hence, the only difficult sentence would be (12b).

Twenty experimental sentences were chosen from Traxler et al.'s (2002) study. The participants were asked to rate the sentences on a scale from 1 'easy to understand' to 5 'hard to understand'. Both groups of Japanese learners rated the sentences in the four conditions in the same way as the native speakers: (12b) was the most difficult condition, while the other three conditions were found to be similar in difficulty. The results are shown in Table 51. I give the average rating of complexity for each condition out of five.

Table 51

	AI/SR	IA/OR	AI/SR	IA/OR
Natives	1.9	3.0	1.8	1.9
JLEs1	1.9	2.4	1.8	1.8
JLEs2	1.8	2.7	1.8	1.8

Results of the Complexity Rating Task in Omaki and Ariji (2005)

In short, the results of Omaki and Ariji (2005) confirmed that advanced JLEs, like natives, used both syntactic and semantic information in processing RC sentences.

Chen (2006) tested the three predictions in Traxler et al. (2005) stated earlier using data from Chinese learners of English. The contexts for animacy and RC complexity were the same as in Traxler et al (2002) and in Omaki and Ariji (2005). Examples of stimuli are shown in (13) (copied from Chen, 2006, p. 5).

(13) a. The girl that saw the accident upset the boy. (AI, SR)

- b. The girl that the accident terrified upset the boy. (AI, OR)
- c. The accident that terrified the girl upset the boy. (IA, SR)
- d. The accident that the girl saw upset the boy. (IA, OR)

The participants were at two levels of proficiency: advanced and less advanced.⁴³ They did a sentence-complexity judgment task by giving each stimulus sentence a rating from '1 very easy' to '5 very difficult'. The non-advanced group found (13a) and (13d) easier than (13b) or (13c), while they did not think that (13a) and (13c) were significantly easier than (13b) or (13d). This result supported the second prediction: less advanced learners group were using only

⁴³ 'Less advanced' is the label used by Chen (2006) to describe the second group of participants in his experiment. It refers to a group of graduate students who were, at the time the research was conducted, studying at a non-English speaking country. The 'advanced' group consisted of participants who had received their university degrees in an English-speaking country, and were living in it at the time of the research.

semantic information in processing RCs. For the advanced group, Chen found that (13a) and (13c) were significantly easier than (13b) or (13d), and that (13b) was easier than (13d), which supported the third prediction: both syntactic and semantic information were being used by the advanced group in processing RCs.

Baek (2012) conducted three experiments on the effect of animacy on the L2 processing of SRs and ORs. Using the same approach (and stimulus sentences) as Traxler et al. (2005), Baek (2012) controlled for animacy in the first experiment, and manipulated it in the second and third experiments.⁴⁴ The study compared the performance of 84 English natives to that of 32 Korean learners of English (KLEs), twenty at a higher proficiency level and twelve at a lower proficiency level. Both groups did a self-paced reading task. The comprehension accuracy of participants was also checked.

In the first experiment, two conditions based on the SR vs. OR contrast were compared while the animacy status of the matrix subject was held constant. Animate matrix subjects, SR objects, and OR subjects were chosen to rule out any effect of animacy on the processing of SRs vs. ORs, as shown in (14) (Baek, 2012, p. 73).

(14) a. The banker that irritated the lawyer played tennis every Saturday. (AA/SR)

b. The banker that the lawyer irritated played tennis every Saturday. (AA/OR)

Each sentence was paired with a verification statement that tested the participants' comprehension of the sentences. For example, for 'The banker that irritated the lawyer played tennis every Saturday', the verification statement was 'The banker irritated the lawyer'. The participants were prompted to decide if the statement was true or false.

⁴⁴ The first and second experiments in Baek's (2012) study were modelled on Traxler et al.'s (2005) study, but the third experiment was different from Traxler et al.'s (2005).

For this experiment, it was predicted that OR sentences would be harder to comprehend than SR sentences. Table 52 shows the rate of comprehension accuracy for both groups.

Table 52

Comprehension Accuracy in SR vs. OR Conditions in Baek (2012)

	SR accuracy	OR accuracy
English natives	86.0%	77.7%
KLEs	81.8%	74.0%

Using mixed-effects modeling, the results showed that, for both groups at p < .001, there was a negative effect of OR compared to SR; hence, OR sentences were more difficult to comprehend. The analysis of the reading times (RTs) for both groups also showed that the ORs were read slower than SRs, especially at the matrix verb region.

In the second experiment, the interaction between syntactic and semantic information was explored by varying the animacy of the nouns, as in Traxler et al. (2005). An example is given in (15) (Baek, 2012, p. 78). The RTs were recorded, and verification statements were used to check comprehension accuracy.

- (15) a. The director that didn't praise the movie received a prize at the film festival.(SR/AI)
 - b. The director that the movie didn't please received a prize at the film festival.
 (OR/AI)
 - c. The movie that didn't please the director received a prize at the film festival.(SR/IA)
 - d. The movie that the director didn't praise received a prize at the film festival.(OR/IA)

Baek predicted, for syntactic reasons, that (15b) would be more difficult to comprehend than (15a), while (15d) would not be more difficult than (15c). Specifically, because the matrix subject is inanimate in both (15c) and (15d), the effect of the syntactic contrast between these two sentences is weakened. The comprehension accuracy results as well as the RT results confirmed these predictions for both natives and KLEs. These results also showed that the accuracy rate in (15b) was low compared to the other three conditions for both natives and KLEs, and that the participants read this condition slower than the other conditions as well.

In experiment three, the goal was to test the effect of the animacy of the RC noun (i.e., either the RC subject or the RC object) on the processing of RC sentences. Accordingly, the matrix-subject noun was controlled for animacy (i.e., it was animate in all stimuli), while the RC noun was manipulated as shown in (16) (Baek, 2012, p. 90).

- (16) a. The teacher that applauded the actor was invited to the film festival. (AA/SR)
 - b. The teacher that the actor surprised was invited to the film festival. (AA/OR)
 - c. The teacher that applauded the movie was invited to the film festival. (AI/SR)
 - d. The teacher that the movie surprised was invited to the film festival. (AI/OR)

Baek predicted that (16b) would be more difficult than (16d) because both of the animate nouns in (16b) (i.e, 'teacher' and 'actor') are good candidates for the subject role in semantic terms. The results for the native group confirmed this prediction; however, for the KLEs, the situation was different. These learners behaved in the opposite way to the natives: they found the AA condition easier than the AI condition. That is, they were not able to make use of the animate subject when the head noun was also animate (AA condition), as though the animate head was blocking their access to the animate subject.

Suda (2015) attempted to study how animacy affected RTs in RC sentences for JLEs. Learners at two stages of proficiency were involved: elementary and intermediate. Suda used stimulus sentences in which the animacy of the noun was varied, to see if L2 learners used semantic information in the comprehension of SR and OR sentences. The subjects did a self-paced reading task. Example stimulus sentences from Suda's study are given in (17) (Suda, 2015, p. 151).

(17) a. The girls that climbed the trees stood behind the house. (AI, SR)

- b. The girls that the trees shaded stood behind the house. (AI, OR)
- c. The trees that shaded the girls stood behind the house. (IA, SR)
- d. The trees that the girls climbed stood behind the house. (IA, OR)

In (17), two sentences have animate nouns in the sentence-initial position, and two have inanimate nouns. In addition, the RC type is varied: we have two SR sentences and two OR sentences. Suda postulated that if L2 learners have the same way of processing RCs as native speakers, then they are expected to have more difficulty comprehending (17b) and (17d) than (17a) or (17c). The same pattern is also predicted for the RTs. Suda tested the comprehension of the subjects, and recorded the RTs for the critical regions in the sentences. For the latter, Suda divided each sentence into three critical regions: the matrix subject region, the RC verb region, and the matrix verb region.

The results for comprehension accuracy are presented in Table 53. These show that the participants were the most accurate at comprehending the RC in a sentence like (17a) (i.e., animate-headed SR), followed by the RC in a sentence like (17d) (inanimate-headed OR).

Table 53

Percentage of Accurate Responses in the Comprehension Task in Suda (2015)

RC structure	Animate SR	Animate OR	Inanimate SR	Inanimate OR
Accuracy	80.0%	58.3%	66 7%	73.9%
Tieedidey	00.070	50.570	00.770	13.770

These results aligned with those of the complexity-judgment task in Traxler et al.'s (2002) study with native speakers of English, and with those of the complexity-based sentencerating task in Omaki and Ariji (2005) study. Also, the RT results obtained by Suda confirmed the effect of animacy. For the first region (i.e., the matrix subject), the RTs for animate nouns were shorter than for inanimate nouns, which signifies the advantage of animate subjects over inanimate subjects in terms of processing load. Moving to the verb region, which is considered important because it is the region where the grammatical and thematic roles are allocated, the RTs for (17a) and (17d) were shorter than the ones for (17b) or (17c). What is common between (17a) and (17d) is that the doer of the RC verb is the animate 'girl', while in (17b) and (17c) the doer is the inanimate 'tree'. As indicated by the short RTs in these regions, the animate status of the doer of the verbs in (17a) and (17d) may have accelerated the comprehension of the sentence in each case. As for the matrix-verb region, the participants took less time to read the main verb when the matrix subject was animate than when it was inanimate. Suda concluded that the JLEs were depending on animacy information in their comprehension of the RCs in this study.

Sun et al. (2023) investigated language comprehension and production in order to explore the role of animacy and filler-gap dependencies in L2 production. They conducted two experiments. In the first experiment, 35 Chinese learners of English (CLEs) did a sentence-completion task intended to elicit production of RCs. The stimuli were sets of incomplete sentences taken from previous studies (e.g., Traxler et al., 2002), with a few modifications. The participants were asked to read the sentences and complete the missing parts. An example is shown in (18) (Sun et al. 2032, p. 4).

(18) a. The banker that_____ (irritated, lawyer) played tennis every Sunday.
(Animate N)
b. The banker that_____ (lawyer, irritated) played tennis every Sunday.
(Animate N)
c. The book that ______. (Inanimate N)

In (18a) and (18b), the stimuli had animate head nouns in both conditions, but the order of the embedded noun and verb was reversed. In (18c), gated sentence-completion was employed, in which only the head noun (i.e., inanimate) was given. The participants were asked to complete the sentence with an RC.

The results showed an effect of the animacy of the head noun on the production of the RC. When the head noun was animate, the use of SRs was predominant, compared to ORs (74% for the former, 15% for the latter). When the head noun was inanimate, the use of ORs significantly increased (from 15% to 44%).

In the second experiment, 38 CLEs did a word-by-word self-paced reading task. The participants pressed the space bar in order to read the words in the sentence one by one. Each time the bar was pressed, the next word appeared, and the preceding word turned into dashes. The time between keypresses was recorded, which was the RT for each word. After reading the sentence, a comprehension question about the meaning of the sentence appeared. The participants were asked to judge whether the statement was true or false. Only RTs with the correct responses to the comprehension questions were analysed.

The task sentences were developed from those in Traxler et al. (2005). The animacy of the head noun and the embedded noun was investigated using a combination of animate and inanimate nouns in sets of six RC sentences (three SRs and three ORs). An example is given in (19) (Sun et al., 2023, p.6).

- (19) a. The gardener that trimmed the plants was made more beautiful. (A, SR)
 b. The gardener that the plants pleased was made more beautiful. (A, OR)
 c. The gardener that the trees shaded was made more beautiful. (A, OR)
 d. The plant that pleased the gardener was made more beautiful. (I, SR)
 e. The tree that shaded the gardener was made more beautiful. (I, SR)
 - f. The plant that the gardener trimmed was made more beautiful. (I, OR)

The RTs for SRs and ORs were compared using ANOVAs. The results showed a significant effect of animacy on the comprehension of the RCs under study. SRs with animate head nouns (as in [19a]) were the easiest, followed by ORs with inanimate head nouns (as in [19f]). SRs with inanimate head nouns (as in [19d] and [19e]) and ORs with animate head nouns (as in [19b] and [19c]) were the most difficult to comprehend. In other words, when the head noun was animate, SRs were easier to process than ORs; however, when the head noun was inanimate, the processing of the OR became easier than that of the SR.

In a recent study, Tanaka and Cherici (2023) investigated the production of RCs by English learners of Chinese (ELCs). Tanaka and Cherici aimed at investigating whether the ELCs preferred SRs over ORs, and whether they showed animacy effects in their production of RCs. Thirty ELCs did a picture-description task. Tanaka and Cherici compared SR and OR production while also manipulating the animacy of the object.

The task was implemented as follows. The participants were shown the task items. In each item, two pictures appeared in a panel. The participant was asked to produce an RC that described the event in the picture. In each trial, the participant first heard a description introducing two entities in the picture using declarative clauses. Then an arrow appeared pointing to one of the entities in the picture, and the participant was asked to describe it using an RC. Half of the pictures showed events involving animate subjects and animate objects (AA condition (e.g., the picture showed a boy (animate) waiting for the servant (animate)), and the other half had animate subjects and inanimate objects (AI condition (e.g., the picture showed a boy (animate) making a cake (inanimate)).

The data were submitted to a logistic mixed-effects model. This model predicted higher accuracy for SRs than ORs, and for animate-inanimate items than animate-animate items. The results showed a preference for SRs over ORs (the production rates for SRs and ORs were 66% and 51%, respectively). Also, the effect of animacy in both SRs and ORs was reported: both types of RC were easier to produce when the object was inanimate than animate (the production rate for the AA condition was 49.5%, and for the AI condition it was 68%).

Tanaka and Cherici interpreted the results for an SR preference over OR based on the SD between the gap and head in both types. ORs have more XP nodes, and thus are more deeply embedded than SRs (e.g., Collins, 1996). As for the effect of animacy, Tanaka and Cherici used similarity-based interference (Gordon et al., 2001), which postulates that it is difficult to build a sentence around two similar NPs. Applying this principle to animacy, if there was dissimilarity in animacy between the head and the embedded NP, the RC would be easier to produce, which would make the AI condition easier than the AA condition for ELCs.

Rezaeian et al. (2018) investigated the comprehension of RCs with animate/inanimate NP referents by Iranian learners of English (ILEs). They conducted two experiments. The first investigated ORs and oblique RCs with inanimate NP referents, and the other investigated SRs and indirect ORs with animate referents. In both experiments, Rezaeian et al. predicted that animacy will affect the processing of the RC types under study.

Ninety-two ILEs did two multiple-choice comprehension tests. The first measured the comprehension of ORs versus oblique RCs, and the second measured the comprehension of

SRs versus indirect ORs. The participants were asked to read an RC sentence and then choose the correct statement based on the RC they had read, as shown in (20) (Rezaeian et al., 2018, pp. 15-16).

- (20) (Inanimate, OR): The book that a boy is putting on a box is mine.
 - a. The book is on a box.
 - b. The box is mine.
 - c. The boy is putting a box.
 - d. The book is not mine.

(Inanimate, oblique OR): The notebook that a boy is placing a bag on is torn.

- a. The boy is placing a bag on the notebook.
- b. The notebook is on the bag.
- c. A bag is torn.
- d. The notebook is not torn.

(Animate, SR): The man that knows Bob killed his brother.

- a. The man killed his brother.
- b. Bob killed his brother.
- c. The brother killed Bob.
- d. The man killed Bob.

(Animate, OR): The boy who Bob is handing a cup to broke the glass.

a. Bob broke the glass.

- b. Bob is not handing a cup.
- c. The boy is handing a cup to Bob.
- d. The boy broke the glass.

The results showed that the animacy/inanimacy status of the referent affected the acquisition of RCs by ILEs. There was no difference in the comprehension of ORs versus oblique RCs, because the referents were inanimate. However, there was a significant difference in the comprehension of SRs versus indirect ORs, due to the animacy of the referents.

4.3.2 Research gap

Much research on the comprehension of long-distance dependencies using semantic cues has been conducted. As we saw in Section 4.3.1, these studies included eye-movement tracking (Traxler et al., 2005), collecting RTs (Baek, 2012; Suda, 2015), answering comprehension questions and complexity rating tasks (Omaki & Ariji, 2005). The studies in Section 4.3.1 provide compelling evidence for the effect of animacy on the comprehension of RC sentences by L2 learners. However, the effect of animacy in this type of sentence within the productive modality has been neglected. The present experiment aims to fill this gap by examining the oral production of Arabic learners of English (ALEs) in this type of structure.

4.4 Predictions of Experiment Three

Based on the work of Traxler et al. (2002, 2005), and on subsequent studies which extended their work to L2 learners (Baek, 2012; Chen, 2006, Omaki & Ariji, 2005; Suda, 2015), the predictions of this experiment are:

(21) P1: The agreement morpheme will be supplied in RC sentences with inanimate subjects at a lower rate than in RC sentences with animate subjects.

P2: The agreement morpheme will be supplied in OR sentences at a lower rate than in SR sentences.

4.5 Method

The participants, task and procedure were the same as in Experiment One, except that the stimulus sentences were different. Also, for this experiment, the participants did a comprehension test prior to the PsychoPy3 experimental task. The comprehension test (which I designed based on the stimulus sentences in this experiment) aimed at checking the participants' comprehension of the sentences they would be producing in the experiment. This test (see Appendix C) was important because the output of the experimental task made it possible to study the spoken suppliance of the subject-verb agreement morpheme, but it did not check whether the participant understood the sentence or not. Understanding the sentence is related to the animacy feature which I investigate in this experiment. By conducting the comprehension test, I was able to choose only participants who were aware of both the structure and the meaning of the stimulus sentences they were producing.

The test consisted of twelve multiple-choice questions. In each one, the participant had to obtain two correct answers out of four choices, based on their understanding of the sentence. The score for each item was either 1 or 0. Only participants who obtained a score of at least 10/12 went on to do the experimental task (see Appendix G for the results).

The experimental task consisted of 96 stimulus sentences: 48 were inflected and 48 were not inflected. The whole task consisted of 24 sets of quadruplets representing the two types of RC and the two animacy patterns for the matrix subject, as shown in (22) below (for the full set of task sentences, see Appendix D).

- (22) Stimulus sentence (written/audio):
 - a. The manager that signs the contract looks very strange. (SR, AI)
 - b. The manager that the contracts confuse looks really strange. (OR, AI)
 - c. The contract that confuses the managers looks really strange. (SR, IA)
 - d. The contract that the manager signs looks very strange. (OR, IA)

As indicated earlier, the present experiment targets subject-verb agreement suppliance on the matrix verb. Four verbs were used: 'seem', 'look', 'smell', and 'sound'. It is worth mentioning here that the LD between the controller and the target is fixed at 4 in all the stimulus sentences (cf. Experiment Two, where this property was manipulated). The prompts corresponding to the sentences in (22) are shown in (23).

(23) Written prompt:

- a. The manager that signs the contract loo____ very stra____.
- b. The manager that the contracts confuse loo____ really stra____.
- c. The contract that confuses the managers loo____ really stra____.
- d. The contract that the manager signs loo____ very stra____.

4.6 Data analysis and results

The same approach as in Experiment One was used to analyze the data in the current experiment. As in the previous experiments, there were cases of production that were not considered as supplied '1' or not supplied '0'; in these cases, unexpected linguistic items were produced instead of the stimulus item (e.g., '**loo**se' was produced instead of '**loo**ks'). These cases constitute only 3.8% of the whole set of collected data.

I used the model in (24) to compute the effect of *subject type* (animate vs. inanimate; the former was the reference level) and the effect of *RC type* (SR vs. OR), plus the interaction between these variables. The *suppliance* of the agreement morpheme was the response variable. The variables *item* and *participant* were random effects. *Item* was crossed with *participant* because every participant responded to every item.

(24) suppliance ~ 0 + Intercept + subject_type * RC_type + (1 + subject_type * RC_type |
 ID) + (1 | item)

Table 54 shows the mean rate of agreement suppliance by subject type and RC type. As we can see, the ALEs supplied the agreement morpheme in ORs at a lower rate than they did in SRs, and in inanimate contexts at a lower rate than they did in animate contexts.

Table 54

Suppliance Rates for the Agreement Morpheme by Subject Type and RC Type

	Anim SR	Inanim SR	Anim OR	Inanim OR	
Suppliance	61.2%	50.5%	54.3%	42.3%	

The priors were based on the posterior distributions obtained by Austin et al. (2022). Their study addressed the suppliance of the agreement morpheme in two contrasting contexts, as they tested the Prosodic Transfer Hypothesis (see Section 2.4.1). For the *intercept*, I used $\mu = 1.49$, $\sigma = 0.44$, and for each of *subject type* and *RC type* I used $\mu = -1.45$, $\sigma = 0.59$. To further check the suitability of these priors, a prior-predictive check was conducted. This performs sampling to check the correspondence between the prior and the data. The results showed that these priors were suitable. The values of \hat{R} and *ESS* showed that the model converged (see Table 55).

Table 55

Values of \widehat{R} and ESS for the Effects of Subject Type and RC type on Agreement Suppliance

Parameter	Ŕ	ESS
(Intercept)	1.00	3181
Subject type: inanimate	1.00	8756
RC type: OR	1.00	11935
Subject type x RC type	1.00	5410

Next, the posterior distribution was obtained, as shown in Figure 7.



Figure 7. Posterior Distribution for the Effects of Subject Type and RC Type on Agreement Suppliance

Let us describe the posterior distributions represented in Figure 7. For the effect of subject type, the highest density interval (HDI) lies to the left of zero, confirming a negative effect of this variable on the production of the morpheme. This means that the agreement morpheme was produced less reliably in inanimate than animate contexts. Thus, P1 in (21) is upheld. For the effect of RC type, the HDI again lies to the left of zero, confirming a negative effect of this variable on the production of the morpheme. This means that the agreement morpheme was produced less reliably in OR sentences than SR sentences. Thus, P2 in (21) is upheld. In addition, there is an interaction between these two variables such that the effect of inanimate subject relative to animate subject was greater in the OR condition than the SR condition.

The full output is presented in Table 56.

Table 56

Parameter	\widehat{b}	SD	89% HDI
(Intercept)	0.97	0.31	[0.50, 1.47]
Subject type: inanimate	-0.83	0.18	[-1.11, -0.54]
RC type: OR	-1.25	0.17	[-1.53, -0.98]
Subject type x RC type	1.52	0.28	[1.09, 1.97]

Effects of Subject Type and RC Type on Agreement Suppliance

For the two main effects in this regression output, \hat{b} can be interpreted as follows: the odds of supplying the agreement morpheme were lower in the inanimate context than the animate context by a factor of $e^{-0.83} = 0.44$, and lower in the OR context than the SR context by a factor of $e^{-1.25} = 0.29$.

4.7 Discussion and Conclusion

In this experiment, I attempted to test the effect of animacy on the production of the agreement morpheme in RCs. Two predictions were tested:

P1: The agreement morpheme will be supplied in RC sentences with inanimate subjects at a lower rate than in RC sentences with animate subjects. If this prediction is true, then we can infer that ALEs use semantic information in the processing of RCs.

P2: The agreement morpheme will be supplied in OR sentences at a lower rate than in SR sentences. If this prediction is upheld, then we can infer that producing the agreement morpheme in OR is more difficult than in SR for ALEs.

I also probed the possibility of an interaction between subject type and RC type. The results showed that:
- 1) The ALEs supplied the agreement morpheme in inanimate-subject contexts less accurately than they did in animate-subject contexts. Based on this, P1 is upheld, which means that the animacy of the matrix subject in an RC sentence affects morpheme production. Processing long-distance dependencies between the subject and the verb is more difficult when the subject is inanimate than processing this type of dependency when the subject is animate.
- 2) The ALEs supplied the agreement morpheme in OR contexts less accurately than they did in SR contexts. Based on this, P2 is upheld, which means that the type of RC affects morpheme production. Processing long-distance dependencies between the subject and the verb is more difficult in OR sentences than in SR sentences.
- There was an interaction between subject type and RC type such that the effect of inanimate subject relative to animate subject was greater in the OR condition than the SR condition.

The results of this experiment are significant for the following reasons. First, they confirmed the effect of semantic features on the oral production of agreement in RC structures, which means that intermediate ALEs use semantic information when they process sentences. This was evidenced by the low suppliance of the agreement morpheme when the subject was inanimate compared to when the subject was animate.

Second, the results confirm the disadvantage of the OR condition over the SR condition in processing agreement in oral production. Third, the results confirm the effect of SD on the oral production of the agreement morpheme. The LD in the RCs in the SR and OR sentences in this experiment was fixed at 4, but the SD in ORs was greater than the SD in SRs. Also, there have been no previous studies on the effect of processing animacy in RC sentences in terms of morphological variability. Previous studies have focused on language comprehension, complexity judgment, measuring RTs, or tracking eye movements instead. Hence, this experiment has added to the current available research on subject animacy in RC structures.

Now, I will move on to compare the results of the present experiment with those of previous studies. I will start with the effects of RC type and animacy on the processing of inflection by native speakers. After that, studies conducted on L2 learners will be considered.

Similar to the native speakers in Traxler et al. (2002) and Weckerly and Kutas (1999), who had longer gazing times for OR sentences compared to SR sentences, the ALEs in the present experiment were negatively affected by the difficulty associated with ORs, based on the fact that rates of inflectional omission in OR sentences were higher. Also, as in Traxler et al. (2002) and Weckerly and Kutas (1999), the ALEs in the present experiment were affected by the animacy of the head NP. In Traxler et al., the subjects took less time to process ORs that had animate subjects and inanimate objects (Trueswell et al., 1994). The same held true for the ALEs in the present experiment, as they exhibited an improvement in morpheme production in OR sentences that had animate subjects.

I will now consider Baek (2012). Admittedly, Baek's study was more comprehensive than the present experiment in the sense that it started, in the first experiment, by controlling the stimuli for animacy. Even so, the overriding goal was the same: to demonstrate that SRs are more difficult to process than ORs. After confirming this preference for SRs over ORs, Baek proceeded to test the effect of animacy by manipulating the animacy status of the nouns in these two RC structures. The results of Baek's second experiment were consistent with the results of my own experiment in that, like the ALEs, the KLEs in Baek's study found the inanimate-subject condition more difficult to comprehend than the remaining conditions. By contrast, the results of Baek's third experiment were somewhat unexpected. Unlike the ALEs in the present experiment, the KLEs were not able to make use of the animacy status of the nouns in the RC. Omaki and Ariji's (2005) results were partially consistent with the finding of the present experiment. The Japanese subjects in Omaki and Ariji's study rated the OR sentences with inanimate subject-animate objects, (25b), as the most difficult sentences among the quadruplets shown in (25). The three remaining conditions were found to be similar in difficulty.

- (25) a. The musician that witnessed the accident angered the policeman a lot. (AI/SR)
 - b. The musician that the accident terrified angered the policeman a lot. (AI/OR)
 - c. The accident that terrified the musician angered the policeman a lot. (IA/SR)
 - d. The accident that the musician witnessed angered the policeman a lot. (IA/OR)

Omaki and Ariji's results align with the findings of the present experiment in terms of the negative effect of having an inanimate subject, which the JLEs in Omaki and Ariji's study rated as the most difficult condition. However, these learners did not give any indication of the effect of animacy for the remaining three conditions; specifically, they rated the three conditions as 1.8 out of 5 in a scale of difficulty (see Table 51). For the ALEs in the present experiment, on the other hand, having an animate subject in an OR had a positive effect on inflectional production, since morpheme suppliance was higher in this case.

Sun et al. (2023) showed that animacy has an effect on the comprehension of CRs by CLEs: ORs with inanimate NP-heads, as in 'The plant that the gardener trimmed was made more beautiful', were easier to comprehend than ORs with animate NP-heads, as in 'The gardener that the plants pleased was made more beautiful' (Sun et al., 2023, p. 6). This result was consistent with the findings of the present experiment. In the production part of Sun et al.'s study, the results showed a significantly higher preference for SRs compared to ORs when both nouns in the RC were animate. However, this result was different when the object was inanimate. An increase of about 30% in the production of ORs was observed when the head noun was inanimate: this is not surprising given that inanimate nouns are more suitable for the object role in semantic terms, as explained earlier (Trueswell et al., 1994). The present

experiment also showed the same effect of having an inanimate referent as the object, as the ALEs were more likely to produce the agreement morpheme in this case.

In Tanaka and Cherici's (2023) study, the L2 learners were more inclined to produce SRs than ORs in contexts in which there were equal numbers of SRs and ORs. This aligns with the findings of the present experiment: ALEs were more accurate with morpheme production in SRs than in ORs. Also, an effect of animacy was reported in Tanaka and Cherici's study, which I will compare to the effect of animacy in the present experiment. As Tanaka and Cherici were trying to test for effects of similarity-based interference (Gordon et al., 2001), they included an AA animacy condition in their study. However, this condition was absent from my experiment because it was not within the scope of the study. Still, the results of Tanaka and Cherici's study show that the production of ORs was higher when the object was inanimate, which is consistent with the effect of animacy I found in the present experiment.

CHAPTER 5: EXPERIMENT FOUR: PROCESSING PLAUSIBILITY

5.1 Introduction

In this experiment, I address the effect of semantic plausibility on the production of the subject-verb agreement morpheme in long-distance dependencies by Arabic learners of English (ALEs). Plausibility in this experiment is concerned with the effect of having a plausible vs. implausible filler of the gap at the relative clause (RC) verb, as in (1).

- (1) a. <u>The ladder</u> that the workers <u>repair</u> the roof with seems very weak. (plausible filler at RC verb)
 - b. <u>The girl</u> that the workers <u>repair</u> the roof for seems very weak. (implausible filler at RC verb)

In each sentence, we have a 'garden path' effect (Carroll, 2000; Hu, 2001; Jay, 2004) when the RC verb 'repair' is assigned an object; however, this effect operates differently depending on the plausibility of the semantic relationship between the matrix subject and the RC verb. Initial analysis of each sentence leads the reader to assume that the filler (i.e., the ladder in [1a] or the girl in [1b]) is the object of the verb 'repair'. In (1a), this misanalysis is identified when the reader encounters the RC object 'the roof'. However, in (1b), the misanalysis is identified earlier, when the reader reaches the verb 'repair'. The reason for this contrast is that, in (1a), 'the ladder' is a plausible object for 'repair', while in (1b) 'the girl' is not. The verb 'repair' imposes a lexical-semantic selectional restriction on its object, such that it must be 'repairable' in some sense. This restriction is not respected in (1b), as a girl cannot be repaired.⁴⁵ In this

⁴⁵ Plausibility can also be pragmatic. For example, consider a sentence like 'The man bit the dog'. Although this is possible, it is unlikely to actually occur in the real world. The present experiment is not concerned with this type of plausibility.

sense, (1a) is a plausible context while (1b) is an implausible context. The present experiment focuses on the suppliance of agreement inflection on the matrix verb (e.g., 'seems' in [1]) in these two contrasting contexts.

This chapter is organized as follows. In Section 5.2, I give some theoretical background about plausibility in sentence processing in the first language (L1) and the second language (L2). In Section 5.3, I summarise previous studies on plausibility, and then identify the research gap I intend to fill in this experiment. The predictions are given in Section 5.4, followed by the method in Section 5.5. The data analysis and results are given in Section 5.6, and then the discussion and conclusion in Section 5.7.

5.2 Theoretical background

The process of judging the plausibility of a sentence involves referring to commonsense knowledge and real-world convention. Drawing upon these two sources of information, the reader/listener gradually, and continually, updates their interpretation of the sentence as each word is processed (Kintsch, 1988). Hence, plausibility is expected to affect sentence analysis.

Studies have shown that L2 learners, like native speakers, rely on lexical-semantic information (including plausibility) during sentence comprehension. Consequently, such information can strongly impact their analysis and reanalysis of the sentence (Felser et al., 2003; Juffs, 1998; Roberts & Felser, 2011; Schriefers et al., 1995; Williams, 2006; Williams et al., 2001). Like native speakers, L2 learners face more processing difficulties when they analyse sentences containing implausibility, even when this is eliminated in later stages of sentence processing. An example is given in (2) (adapted from Williams, 2006, p. 49).

(2) Which hill did the farmer chase the very lively sheep up early this morning?

Here, an analysis conflict arises because there are multiple gaps in this sentence. One gap is created after the RC verb 'chase', when the role of RC object is assigned to a possible gap coindexed with the matrix subject 'which hill'. However, this turns out to be an incorrect gap, because the object position is already filled by the DP 'the very lively sheep'. This incorrect gap is created according to the Active Filler Strategy (Frazier & Flores d'Arcais, 1989; Pickering & Barry, 1991; Stowe, 1986), which assumes that the reader will actively search for a gap position for the filler, and will coindex the filler with the first possible gap position that they encounter in the sentence. Filling this incorrect gap with the filler gives rise to an implausible condition: in (2), for example, a hill cannot be chased. The second gap in this sentence is located after the preposition 'up', and this one is the correct gap for the filler (i.e., the matrix subject).

Using Fodor's (1978) term, the incorrect gap after the RC verb 'chase' is called a 'doubtful' gap. Stowe (1986) showed that the reader pauses at doubtful gaps, even if the gap turns out to be incorrect or is occupied by an explicit item. In (2), even when the reader realizes that 'which hill' is implausible as the object of the verb 'chase', this does not prevent a gap from being suggested in this location; therefore, the presence of this doubtful gap affects the processing of the sentence (Stowe et al., 1991). Specifically, Stowe et al. found that the reader required more time to read the sentence when a particular determiner phrase (DP) was implausible as the filler of a possible gap, than when it was plausible.

5.3 Review of previous studies

This section reviews key studies concerned with processing plausibility over longdistance dependencies. In Section 5.3.1, I summarize these studies. In Section 5.3.2, I identify the research gap I intend to fill in this experiment.

5.3.1 Processing of plausibility by natives and L2 learners of English

I will start this review by summarizing a study that investigated the effect of plausibility on sentence processing with native speakers of English (i.e., Traxler & Pickering, 1996). Then I move on to research on L2 learners of English. The reason why I do this is that Traxler and Pickering's (1996) study was the prototype for subsequent studies on how L2 learners of English process plausibility.

Traxler and Pickering (1996) conducted an eye-tracking experiment to examine how English speakers processed long-distance dependencies, as in (3).

- (3) a. We like the city (i) that the author wrote unceasingly and with great dedication about (i) while waiting for a contract. (implausible filler)
 - b. We like the book (i) that the author wrote unceasingly and with great dedication about (i) while waiting for a contract. (plausible filler)

The participants were asked to read the sentences, and their reading times (RTs) were measured. In a sentence such as (3), Traxler and Pickering focused on two regions in the sentence: the RC verb region 'wrote', and the preposition region 'about'. They manipulated the plausibility of the filler 'the city/book' as an object of the RC verb 'wrote' to test whether participants would immediately assume that, in keeping with the Active Filler Strategy, this filler was the object of the RC verb, or would wait until the correct gap location was reached.

Semantically speaking, the filler 'the city' is not plausible as an object for the RC verb 'wrote', but 'the book' is. Traxler and Pickering found that the participants gazed longer at the RC verb 'wrote' in (3a) than they did in (3b) (i.e., the RT was higher in the former case). This meant that they gazed more when the filler was an implausible filler of the potential gap. According to Pickering and Barry (1991), the reader immediately associates the verb with its arguments, so once the verb 'wrote' is reached, the participant immediately interprets 'the city/

book' as a possible object of the RC verb. However, in doing so, the participant encounters implausibility earlier in the sentence in (3a) than in (3b). In (3a), they start reanalysing the sentence immediately after reaching the RC verb; by contrast, in (3b), the plausibility-mismatch effect does not occur at the RC verb. Consequently, the reader continues with the wrong analysis until the preposition 'about' is reached, because this is where the mismatch effect becomes evident. The results confirmed that the participants computed plausibility at the RC verb region in (3).

Following the same approach as Traxler and Pickering (1996), Williams et al. (2001) studied how a group of L2 learners of English, consisting of 21 Korean, 18 Chinese and 18 German participants, processed wh-questions, as exemplified in (4).

- (4) a. Which girl (i) did the man push the bike into (i) late last night? (plausible-at-verb)
 - b. Which river (i) did the man push the bike into (i) late last night? (implausible-atverb)

The filler 'which girl' is a plausible object for the RC verb 'push' in (4a), while the filler 'which river' in (4b) is not. These conditions are denoted as 'plausible-at-verb' and 'implausible-atverb', respectively. The participants were asked to do a word-by-word self-paced reading task. While reading each sentence, the participants were asked to immediately indicate when the sentence stopped making sense to them by pressing the space bar, thereby recording the position in the sentence at which the decision was made. The participants continued the task by clicking the mouse.

The critical region was the RC verb (e.g., 'push' in [4]). Following Traxler and Pickering (1996), Williams et al. (2001) predicted that the participants would create a doubtful gap immediately after the verb 'push'. The results showed that the effect of plausibility at the

RC verb region was significant for L2 learners, as a high rate of stop-making-sense decisions was observed at this region in implausible sentences. This means that the L2 learners were computing the plausibility of the sentence immediately after reaching this region. As for the RTs, the participants responded to the stop-making-sense decision earlier in the implausible condition than in the plausible one. To conclude, the L2 learners in Williams et al. (2001) used non-structural information, such as plausibility, during sentence processing.

Dussias and Pinar (2010) studied how Chinese learners of English processed plausibility in the structures exemplified in (5) (adapted from Dussias & Pinar, 2010, p. 470).

- (5) a. Who (i) did the principal remember (i) annoyed the student? (plausible)
 - b. Who (i) did the principal remember the student annoyed (i)? (plausible)
 - c. Who (i) did the principal conclude (i) annoyed the student? (implausible)
 - d. Who (i) did the principal conclude the student annoyed (i)? (implausible)

The participants did an online reading task, and the RT for the region following the matrix verb (i.e., 'annoyed the student' in [5a] and [5c], and 'the student annoyed' in [5b] and [5d]) was measured. In (5a) and (5b), the context is plausible because the matrix verb 'remember' takes an animate object; thus, 'who' is a plausible filler. In other words, if the reader stops at the verb 'remember', then the question 'who did the principal remember?' is plausible. However, in (5c) or (5d), the matrix verb 'conclude' does not take an animate object; thus, if the reader stops at the RC verb 'conclude', then the question '*who did the principal conclude?' is implausible.

Dussias and Pinar addressed the effect of plausibility on the process of reanalyzing the sentence when the mis-parse was identified. They did not focus on the critical region (i.e., the matrix-verb region) but rather on the region of reanalysis which comes after this verb. The RTs showed that the participants were faster at reanalyzing implausible than plausible sentences. The reason for this advantage, according to Dussias and Pinar, was that the participants were

easily able to abandon the initial analysis in implausible contexts, while in plausible sentences the initial analysis was not easily replaced with the correct one.

Fujita and Cunnings (2022) tested how native English and L2 English learners form filler-gap dependencies and process plausibility cues in sentences. A group of 80 L2 English learners at intermediate proficiency performed three experiments, each based on a different task: a reading task, a comprehension-question task, and a speeded-judgment task. The results showed that both natives and L2 learners recover information and experience interference of plausibility cues in a similar way, suggesting that they both use plausibility in processing sentences.

In the first experiment, Fujita and Cunnings collected RTs; sentences from the reading task are exemplified in (6) (Fujita & Cunnings, 2022, p. 705):

a. Mary saw the beeri that the man with the wine very happily drank ei during the party. The night was fun. (Plausible filler, plausible distractor)

b. Mary saw the beer_i that the man with the food very happily drank e_i during the party. The night was fun. (Plausible filler, implausible distractor)

c. Mary saw the cake_i that the man with the wine very happily drank e_i during the party. The night was fun. (Implausible filler, plausible distractor)

d. Mary saw the cake_i that the man with the food very happily drank e_i during the party. The night was fun. (Implausible filler, implausible distractor)

The sentences in (6) contain a filler ('the beer/the cake') that is either a plausible or implausible object for the verb ('drank'). Each sentence also contains a distractor ('the wine/the food') that is either a plausible or implausible filler of the gap e. Fujita and Cunnings predicted that the RTs in (6b) and (6d) will be longer than in (6a) and (6c) because, at the surface level, the

distractor is linearly closer to the gap than the filler is. So, L2 learners are predicted to take the distractor to be a filler for the gap. This filler (i.e., 'the wine') is plausible in (6a) and (6c), but implausible (i.e., 'the food') in (6b) and (6d).

Fujita and Cunnings divided the experimental stimuli into two regions: one was the critical region, which includes the verb ('drink'), and the other region was the rest of the sentence that comes after the verb. To analyse the RTs, Fujita and Cunnings implemented linear mixed-effect models that contained both regions for each RT. In the regression model, there was a significant effect of the condition of the filler, which showed longer RTs for implausible fillers than for plausible fillers. This result demonstrated that L2 learners use the plausibility information of the filler as they encounter the gap.

In the third experiment,⁴⁶ Fujita and Cunnings aimed to theoretically replicate the findings of the first experiment using a speeded judgment task. They used the same stimuli sentences as in experiment one, but without the spillover region and wrap-up sentence 'The night was fun', as shown in (7) (Fujita & Cunnings, 2022, p. 710):

(7) a. Mary saw the beeri that the man with the wine very happily drank ei.(Plausible filler, plausible distractor)

b. Mary saw the beer_i that the man with the food very happily drank e_i.(Plausible filler, implausible distractor)

c. Mary saw the cake_i that the man with the wine very happily drank e_i. (Implausible filler, plausible distractor)

⁴⁶ The second experiment in Fujita and Cunnings (2022) is irrelevant because it compares plausibility over presence/absence of long-distance dependency (i.e., it addressed distance rather than plausibility0.

d. Mary saw the cake_i that the man with the food very happily drank e_i.(Implausible filler, implausible distractor)

The participants were asked to read the stimulus sentences word by word in an online speeded fashion. After the last word, the participants judged whether the sentence is plausible or not within a limited time (1.5 second). The participants were not given feedback about the correctness of their answers.

Using mixed-effect linear regression (logistic in this case, as the outcomes in this experiment were binary: plausible vs. implausible), Fujita and Cunnings analysed the data. The result showed longer RTs at the verb 'drank' in the implausible condition, (7b), than the plausible condition, (7a). This implausibility effect was reduced in (7b) when the distractor was a plausible object of the verb ('the wine') compared to when it was not ('the food'). The distractor did not, however, influence RTs in plausible sentences, suggesting a 'pure' effect of plausibility for L1 and L2 speakers. No significant L1/L2 differences in the interference effect were observed.

In a very recent study, Fujita and Cunnings (2024) conducted two experiments⁴⁷ that employed self-paced reading to measure RTs over plausible/implausible conditions. Two groups took part in the study: 96 English natives, and 96 German learners of English (GLEs) at a high level of proficiency. The study aimed at testing theoretical claims about potential L1/L2 differences in using plausibility in the formation of subject-verb dependencies. An example is shown in (8) (Fujita & Cunnings, 2024, p. 87):

(8a) Plausible target, Plausible distractor

'The thief that the robber was near in the bank calmly stole the diamond last night.'

⁴⁷ There were actually six experiments, two of which are relevant to the present review.

(8b) Plausible target, Implausible distractor

'The thief that the locker was near in the bank calmly stole the diamond last night.'

(8c) Implausible target, Plausible distractor

'The table that the robber was near in the bank calmly stole the diamond last night.'

(8d) Implausible target, Implausible distractor

'The table that the locker was near in the bank calmly stole the diamond last night.'

The head NP in (8a) and (8b) is animate, and a plausible agent of the critical verb 'stole', whereas, in (8c) and (8d), it is inanimate and an implausible actor. The distractor in the sentences is also either animate ('the robber' in [8a] and [8c]) or inanimate ('the locker' in [8b] and [8d]).

Due to implausibility effects, native speakers were predicted to have longer RTs in (8c) and (8d) than in (8a) and (8b). Also, based on Fujita and Cunnings (2022), L2 learners were also predicted to show an implausibility effect; and if this effect was more intense for L2 learners, they were predicted to report longer RTs than natives. RTs were analysed at the critical region 'calmly stole' using linear mixed-effects models. The results showed a significant main effect of plausibility, with longer RTs in (8c) and (8d) than in (8a) and (8b), as predicted for both L2 learners and natives. However, the results did not show a significantly higher effect of implausibility for L2 learners than natives.

In the second experiment, the same stimuli were used as in experiment one, but with a slight change: the distractor was embedded within a prepositional phrase, as shown in (9) (Fujita & Cunnings, 2024, p. 13).

(9a) Plausible target, Plausible distractor

'The thief that was near the robber in the bank calmly stole the diamond last night.'

(9b) Plausible target, Implausible distractor

'The thief that was near the locker in the bank calmly stole the diamond last night.'

(9c) Implausible target, Plausible distractor

'The table that was near the robber in the bank calmly stole the diamond last night.'

(9d) Implausible target, Implausible distractor

'The table that was near the locker in the bank calmly stole the diamond last night.'

The same predictions as in the first experiment were made. The results showed that, for both natives and L2 speakers, there was a significant effect of plausibility, which was manifested by longer RTs in (9c) and (9d) compared to (9a) and (9b). Also, there was no significant evidence that L2 are more susceptible to plausibility effects than natives, which is consistent with the results of the first experiment.

5.3.2 Research gap

As we have seen in Section 5.3.1, research on the effect of plausibility on L2 sentence processing has addressed only the receptive modality (specifically, reading only). Studies have tackled the comprehension of plausibility by eliciting plausibility judgments (Williams et al., 2001), and measuring RTs and gaze durations (Dussias & Pinar, 2010; Traxler & Pickering, 1996). As far as I am aware, no study has addressed the effect of plausibility on the production of functional morphemes in the L2. This experiment aims to fill this gap.

5.4 Prediction of Experiment Four

As a consequence of applying the Active Filler Strategy, the ALEs in this experiment are expected to have more difficulty in processing (and, consequently, in producing the agreement morpheme for) sentences in the implausible condition. Thus, the prediction for this experiment (P1) is as shown in (10).

(10) P1. The subject-verb agreement morpheme will be supplied on the matrix verb at a lower rate in implausible contexts than in plausible contexts.

5.5 Method

The participants, task and procedure were the same as in Experiment One, except that the stimulus sentences were different. Also, for the current experiment, the participants did a comprehension test before doing the main (i.e., experimental) task. The comprehension test (which I designed based on the stimulus sentences in this experiment; see Appendix E) aimed at checking the participants' comprehension of the sentences (as explained in Experiment Three; see Section 4.5). In each one, the participant had to obtain two correct answers out of four choices, based on their understanding of the sentence. Unlike the test in Experiment Three, if one of the two correct answers was correct and one was wrong, the score for that item was 0.5; this was because the difficulty of the structure in this experiment was taken into consideration. Only participants who obtained a score of at least 8/12 went on to do the experimental task (see Appendix G for the results).

The main task consisted of 48 stimulus sentences; of these, 24 were inflected and 24 were not inflected, while half were plausible and half were implausible (for the full set of task sentences, see Appendix F). In all the sentences, the matrix verb phrases (VPs) were controlled for plausibility, so that the plausibility effect came into play only at the RC verb region. For example, in (11a) and (11b), the matrix VP 'seem very/really weak' is a plausible predicate for

either 'the ladder' or 'the girl'.⁴⁸ By contrast, the RC verb 'repair' gives rise to implausibility in (11b) but not in (11a).

- (11) a. <u>The ladder that the worker repairs the roofs with seems very weak</u>. (plausible)
 - b. <u>The girl</u> that the worker repairs the roofs for <u>seems really weak</u>. (implausible)

Five matrix verbs were used: 'seem', 'look', 'smell', 'sound', and 'break'. The plausible and implausible conditions differed only in terms of the filler noun (e.g., 'the ladder' vs. 'the girl'); respectively, this noun matched or mismatched the plausibility restrictions of the RC verb in the sentence (i.e., 'repair'). In (12), I exemplify a pair of stimulus sentences (i.e., plausible in [12a] vs. implausible in [12b]), plus the associated pair of written prompts in (12c) and (12d), respectively.

- (12) Stimulus sentence (written/audio):
 - a. The ladder that the worker repairs the roofs with seems very weak.
 - b. The girl that the worker repairs the roofs for seems really weak.Written prompt:
 - c. The ladder that the worker repairs the roofs with see _____ very wea _____.
 - d. The girl that the worker repairs the roofs for see____ really wea____.

5.6 Data analysis and results

The same approach used in previous experiments was used to analyze the data for the current experiment. NAs (i.e., 'not applicable' cases) constituted only 5.8% of the whole set of collected data. The regression model from Experiment One was used to analyze the data for the current experiment. The effect of distance was investigated in plausible vs. implausible

⁴⁸ The contrast between 'very' in (7a) and 'really' in (7b) was introduced for the sake of variety. I do not believe that this contrast had a significant bearing on the production of subject-verb agreement inflection in this study.

contexts. The regression model included a fixed effect *stimulus type* which compared the production of the agreement morpheme in plausible contexts vs. implausible contexts. The former level was the reference level.

Table 57 gives the mean rates of agreement suppliance in the contexts under study. It shows that the ALEs supplied the agreement morpheme in both contexts at very similar rates.

Table 57

Agreement Morpheme Suppliance in Plausible vs. Implausible Contexts

Stimulus type	Plausible	Implausible
Suppliance rate	37.6 %	37.3 %

The priors that I used for the intercept and for the target type were based on the estimates for agreement inflection obtained by Austin et al. (2022): for the intercept, I used $\mu = 1.49$, $\sigma = 0.44$, and for *stimulus type* I used $\mu = -1.45$, $\sigma = 0.59$. The prior predictive-check results showed that these priors were suitable. The values of \hat{R} and *ESS* confirmed that the suggested model converged (see Table 58).

Table 58

Values of \hat{R} and ESS for the Regression Model for the Effect of Stimulus Type on Agreement-Morpheme Suppliance: Plausible vs. Implausible

Parameter	R	ESS
(Intercept)	1.00	2259
Stimulus type: implausible	1.00	7153

The posterior distribution for the effect of target type in plausible vs. implausible contexts is shown in Figure 8.



Figure 8. Posterior Distribution for the Effect of Stimulus Type on Agreement-Morpheme Suppliance: Plausible vs. Implausible

As we can see in Figure 8, not all of the values in the highest density interval (HDI) are negative. This means that part of the HDI for the implausible context has positive values, which goes against our prediction that plausibility has a negative effect on morpheme suppliance.⁴⁹ This means that the ALEs did not produce the agreement morpheme less reliably in implausible than in plausible contexts. Therefore, P1 in (10) is not confirmed.

Table 59 provides the output of the regression analysis. It shows that the upper and lower bounds of the HDI for the estimate of the effect of stimulus type were [-0.56, 0.06]. Notice that this interval contains some positive values, as mentioned above. The table also shows the estimate of the effect, \hat{b} .

⁴⁹ It might be argued, though, that most of the probable values of the estimated effect are negative, which may be taken as (weak) evidence for a negative effect. In my view, this cannot be the case, given how close the suppliance rates are in both contexts (see Table 57). I would ascribe the situation shown in Figure 8 to the choice of the prior, which assumed an effect that was far from the actual data. In other words, the posterior distribution was more driven by the prior than by the data.

Table 59

Effect of Stimulus Type on Agreement-Morpheme Suppliance: Plausible vs. Implausible

Parameter	ĥ	SD	89% HDI
(Intercept)	0.80	0.56	[-0.12, 1.67]
Stimulus type: implausible	-0.24	0.19	[-0.56, 0.06]

5.7 Discussion and conclusion

In this experiment, I attempted to determine if plausibility affects the suppliance of the subject-verb agreement morpheme for ALEs. I tested the following prediction to answer this question:

P1: The subject-verb agreement morpheme will be supplied on the matrix verb at a lower rate in implausible contexts than in plausible contexts.

If this prediction was upheld, then this would mean that the ALEs' production of the agreement morpheme was being affected by the plausibility of the semantic relationship between the filler and the gap.

The morpheme suppliance rates, and, more importantly, the results of the regression analysis, showed that the ALEs did not show a credible difference in the suppliance of the agreement morpheme in plausible filler-gap contexts compared to implausible filler-gap contexts. Based on this, P1 was disconfirmed, which means that plausibility does not affect agreement-morpheme production. Thus, ALEs are insensitive to plausibility as a semantic clue in the processing of contexts containing filler-gap dependencies.

This result goes against those of previous studies conducted on processing filler-gap dependencies by L2 learners of English. This might be attributed to the following reasons. First, the structure under scrutiny in this experiment may have been difficult for learners at this level

of proficiency (namely the intermediate level). The ALEs in this study may have been overwhelmed by the complexity of the structure itself to the degree that they were not aware of the plausibility clue in the sentence; consequently, they were not affected by it. The difficulty of this structure for the participants in this experiment can be inferred from the rate of morpheme suppliance in both plausible and implausible contexts combined. This rate was remarkably low compared to the suppliance of the agreement morpheme in the previous experiments concerned with this morpheme in this thesis (i.e., Experiments One and Three), as shown in Table 60.

Table 60

Suppliance of the Agreement Morpheme in Experiment One (PTH), Experiment Three (Animacy) and Experiment Four (Plausibility)

	PTH	Animacy	Plausibility
Suppliance rate	53.5%	52.1%	37.5%

It is true that comparing the rates of suppliance in this crude fashion is not the best way to judge the easiness or difficulty of the structures of interest; however, the discrepancy between Experiments One and Three, on one hand, and Experiment Four, on the other hand, gives a hint about the difficulty associated with the latter experiment. Advanced ALEs may possibly show a different response to the same task. A future study could explore this possibility.

In addition, the present experiment investigated the oral production of functional morphemes in two conditions of plausibility/implausibility. Previous studies, on the other hand, investigated the effect of plausibility by collecting the RT or the gazing time, or by using reading-comprehension tasks, as we saw in Section 5.3. Approaches to investigating RTs or gazing times may be more accurate for checking if the L2ers are affected by plausibility, than production based approaches. RTs are naturally a direct manifestation of the learners' sensitivity to the (im)plausibility condition. Unlike morpheme production, utterance planning

is not involved in reading comprehension, since the comprehender updates the sentence analysis (parsing) as the course of reading proceeds. In light of this, it may not be surprising that L2 sensitivity to plausibility clues, if any, was not evident in the morpheme production of the learners in this experiment. A reading task could have been more informative in this regard. In other words, accuracy in morpheme production in the present experiment was not an indicator of the ALEs' (un)appreciation of plausibility. Still, this does not prove that the ALEs were unaware of the plausibility condition in the sentences.

Also, a comparison between the stimuli in the present experiment and the one conducted by Fujita and Cunnings (2022) may be relevant. In Fujita and Cunnings (2022), the stimuli in the implausible condition were in a state of continuing implausibility (i.e., this implausibility was not diminished as the reader continues reading the rest of the sentence). Recall the example from Fujita and Cunnings (2022, p. 705):

(13) a. Mary saw the beer_i that the man with the wine very happily drank (i) during the party. The night was fun. (Plausible filler, plausible distractor)

b. Mary saw the beer_i that the man with the food very happily drank (i) during the party. The night was fun. (Plausible filler, implausible distractor)

c. Mary saw the cake_i that the man with the wine very happily drank (i) during the party. The night was fun. (Implausible filler, plausible distractor)

d. Mary saw the cake_i that the man with the food very happily drank (i) during the party. The night was fun. (Implausible filler, implausible distractor)

The filler ('the cake') in (13c) and (13d), is a semantically implausible filler for the gap. As the reader continues reading, this implausibility persists. This may have resulted in longer RTs in Fujita and Cunnings' experiment. This is not the case for the stimuli of Experiment Four, as

implausibility is completely diminished once the reader reaches the preposition (i.e., 'with' in [14]).

(14) a. The ladder that the workers repair the roof with seems very weak. (plausible)b. The girl that the workers repair the roof with seems very weak. (implausible)

Based on this, the stimuli in the present experiment might have been less effective for promoting sensitivity to plausibility, compared to the stimuli in Fujita and Cunnings' experiment.

CHAPTER 6: CONCLUSION AND FUTURE RESEARCH

6.1 Conclusion

This thesis has investigated some reasons for morphological variability in the production of inflectional /s/ in English by Arabic learners of English (ALEs), specifically, Arabic speakers from a Jordanian background. Two morphemes with this phonological shape were examined: subject-verb agreement and the regular plural. I focused on these morphemes in four experiments, as shown in Table 61. Each experiment tested one reason for morpheme omission. The results of this research mostly confirmed the predictions that I made for each experiment.

Table 61

Experiments Conducted in the Present Stu	d	-	1)	ļ	ŕ	2
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Experiment	Reason for morpheme omission
1: Prosodic Transfer Hypothesis (PTH)	Representational differences between the first
	language (L1) and the second language (L2)
2: Quantifier Phrase (QP) structure	Distance between agreeing elements
3: Animacy	Animacy status of the subject
4: Plausibility	Plausibility of the sentence

The overarching research questions (RQs) of this project are given below. They are stated in order to encapsulate the essence of each experiment, and they will be answered as I summarize each experiment in this chapter.

RQ1: Do ALEs drop the agreement and plural morphemes due to differences between the prosodic structures of English and Arabic? (Experiment One) RQ2: Do ALEs drop the plural morpheme due to the effect of the distance between the controller and the target? (Experiment Two)

RQ3: Do ALEs drop the agreement morpheme because of the semantic features (specifically, animacy) of the matrix subject? (Experiment Three)

RQ4: Do ALEs drop the agreement morpheme because of the semantic features (specifically, plausibility) of the relationship between the matrix subject and the relative clause (RC) verb? (Experiment Four)

In the first experiment, the role of the L1 was explored, particularly from a prosodic perspective. The similarities and differences between Arabic and English made it possible to test the PTH as a reason for morphological variability. The prosodic structures used in Arabic for agreement and plural inflection did not match those used to host the corresponding morphemes in English. According to the PTH, this mismatch was expected to negatively affect the production of these two morphemes by ALEs. Specifically, the prediction was that the ALEs in the present study would use their L1 prosodic structure (i.e., the internal clitic) to host each of the morphemes, rather than the target structure in the L2 (i.e., the affixal clitic), as the latter structure is absent from the L1. The results of the first experiment showed that the ALEs were using their L1 prosodic structure to represent agreement and plural inflection in the L2. Thus, the results confirmed the predictions of the PTH for this group of L2 learners.

Another phonological phenomenon relevant to testing the PTH is the reduction of final consonant-clusters (CCs). In this experiment, it was necessary to determine if the ALEs' capacity to produce /s/ in inflected words in English was due to a ban on final CCs in Jordanian Arabic, rather than to a problem which was prosodic in nature. This was done by comparing the production of /s/ in inflected forms with its production in monomophemic-parallel forms (e.g., 'caps' cf. 'lapse'). The results showed that the ALEs did not have a phonological constraint that was preventing them from producing either of the target morphemes, as they

were able to produce final /s/ in words with CC codas at a significantly higher rate than in inflected words. Thus, the answer to RQ1 was 'yes': ALEs drop the agreement and plural morphemes due to differences in prosodic structure between the L1 and the L2.

In the second experiment, I attempted to test the effects of distance on the production of the plural in quantifier phrases (QPs). I did so by increasing the distance between the controller (i.e., the quantifier) and the target (i.e., the noun). In one type of sentence, there was no distance between the controller and target , as in 'nine frogs'. In a second type, the distance was increased by adding an adjective between the controller and the target, as in 'nine slippery frogs'. In a third type, three adjectives were added, as in 'nine slippery old crimson frogs'. These were the adjacent, long-distance and very long-distance contexts, respectively.

It was predicted that morpheme suppliance would decrease as the distance increased; that is, the plural would be supplied in the long context at a lower rate than in the adjacent context, and at a lower rate in the very long context than in the long context. The results confirmed the predictions for both comparisons: the ALEs supplied the morpheme less accurately in the long-distance than in the adjacent contexts, and less accurately in the verylong distance than in the long-distance contexts, which answers RQ2 in the affirmative.

One drawback to the second experiment was that I did not control for one type of distance vs. the other type for the contexts under study. In increasing the linear distance (LD) between the controller and the target, the structural distance (SD) also increased. As a result, I was not able to tell if the differential omission of the plural morpheme in the QPs of interest was due to an increase in LD or in SD, or in both, as illustrated in (1) (NP = noun phrase, DP = determiner phrase, AP = adjective phrase).

(1) a. [nine [DP [NP frogs]]

LD = 0; SD = 2 (DP, NP)

b. [nine [DP [AP slippery[NP frogs]]]

LD = 1 (slippery); SD = 3 (DP, AP, NP)

c. [nine [(DP) [(AP) slippery[(AP) old [(AP) crimson [(NP) frogs]]]]]

LD = 3 (slippery); SD = 5 (DP, AP, AP, AP, NP)

In the third experiment, I addressed the effect of animacy on the suppliance of the agreement morpheme in sentences containing RCs, as illustrated in (2).

(2) a. The manager that signs the contract looks very strange.

b. The manager that the contracts confuse looks really strange.

c. The contract that confuses the managers looks really strange.

d. The contract that the manager signs looks very strange.

Following Traxler et al. (2005), I manipulated the animacy of the matrix subject, and tested the effect of this on the suppliance of the agreement morpheme on the matrix verb (i.e., 'looks' in [2]). I based the prediction of this experiment on grammatical and thematic-role assignment (Trueswell et al., 1994), which holds that an animate noun is likely to have the role of subject, while an inanimate noun is likely to have the role of object. I predicted that an RC with an inanimate subject would be harder to process than an RC with an animate subject; hence, the suppliance rate for agreement inflection on the matrix verb was expected to be lower in the former condition. The results confirmed this prediction, which means that the ALEs drop the agreement morpheme because of the animacy status of the matrix subject. The results also showed that there is an interaction between animacy and RC type as follows: the effect of

inanimate subject relative to animate subject was greater in the object-relative condition than the subject-relative condition.

The agreement morpheme was again the focus of the fourth experiment. Here, I investigated the role of sentence plausibility in L2 processing (Dussias & Pinar, 2010; Traxler & Pickering, 1996; Williams et al., 2001). I studied the effect of plausibility on morpheme production on the matrix verb, as shown in (3).

- (3) a. The ladder that the workers repair the roof with seems very weak. (plausible)
 - b. The girl that the workers repair the roof for <u>seems</u> very weak. (implausible)

Based on the Active Filler Strategy (Frazier & Flores d'Arcais, 1989; Stowe, 1986), an initial analysis takes the matrix subject 'the ladder/girl' to be the object of the RC verb 'repair'. This initial analysis, which turns out to be wrong later, creates implausibility in (3b) because 'girl' is an implausible object for the RC verb 'repair'. This condition was expected to cause processing difficulty, as the ALEs had to reanalyse the sentence and assign the filler 'the ladder/ girl' to its correct gap (namely, before the matrix verb 'seems').

It was predicted that the plausibility of the matrix subject would affect the production of the agreement morpheme on the matrix verb, but the results did not support this prediction. Instead, the ALEs produced the agreement morpheme at nearly the same rate in both conditions of plausibility, which meant that these learners were not affected by plausibility. This answers RQ4 in the negative.

For this experiment, I proposed that the task could be replicated with advanced-level ALEs to see if the task yielded different results, especially as I noticed that this experiment, out of the four in this thesis, had the lowest rate of inflection production, regardless of plausibility context. This low rate of morpheme production, compared to the rates in the preceding experiments in this study, gives a hint about the intrinsic difficulty associated with

the structure under scrutiny, especially for students at intermediate level. I think that the difficulty of the structure may have blocked the plausibility effect which the experiment aimed to reveal.

Taken together, the results of all four experiments suggest that some of the reasons for the omission of the agreement and plural morphemes by ALEs are L1-based (i.e., a problem at the level of representation, which in this case was prosodic), while other reasons are related to difficulties in processing due to the distance between the controller and the target, or the animacy of the subject.

Moreover, unlike most previous research on the effects of prosodic transfer, distance and semantic plausibility, this thesis targeted the oral modality within L2 production; apart from Experiment One, this modality has been noticeably under-researched in work concerned with these phenomena. Hence, the current thesis helps to reduce a key deficit in L2 research.

The thesis also differs from previous studies in this area in that it targeted an L1 (namely Arabic) which has garnered less attention than many other languages in research on the acquisition of L2 inflection. Hence, in conducting this study, I have extended the coverage of research concerned with prosodic transfer, distance and semantic plausibility in the L2.

A final significant aspect of this thesis is that both of the inflectional morphemes under investigation are instantiated not only in the L2 but also in the L1. In each experiment, this property of the L1 meant that the results could only be attributed to the sources of variability that were under investigation (e.g., distance effects in Experiment Two): these results could not have been due to L1 negative transfer at the syntactic level.

6.2 Implications for future research

All the experiments that have been conducted in this thesis aimed at explaining the phenomenon of variability in the suppliance of functional morphology in the interlanguage of ALEs. The results revealed that some L1 characteristics (namely, prosodic) as well as other factors (long-distance dependencies, and animacy) affect the accuracy of morpheme production in L2 learners.

According to the PTH, which was investigated in Experiment One, the prosodic differences between the L1 and the L2 can be overcome at high levels of proficiency. In this thesis, I focused on intermediate ALEs. The results of Experiment One do not demonstrate that the effect of prosodic differences in the L1 and the L2 is permanent; instead, they show that, at non-advanced level of proficiency, the prosodic characteristics of the L1 may have an effect on L2 production. Awareness of this obstacle to morpheme production may be helpful for understanding how ALEs produce inflection in English. Unlike the situation in their L1, ALEs need to attach inflection outwardly to inflected forms in the L2. This process also involves the production of complex final-consonant clusters (-CCC) (as in 'helps/jumps/banks' etc.), which is not allowed in their L1. This is not to say that ALEs cannot, phonologically, produce these clusters; rather, this difficulty adds to the burden of maintaining grammatical accuracy.

As for the effects of distance and animacy, which were addressed in Experiments Two and Three, respectively, the results pointed to an effect of both these factors on the production of morphology. Regarding distance in the Q-ADJ-N and Q-ADJ-ADJ-ADJ-N structures, in the L1, adjectives are number-inflected; this helps ALEs keep track of agreement relations even over a long distance in their L1. To ALEs (especially at non-advanced levels of proficienc,y where the effect of the L1 would be more influential), an adjective, which is normally not inflected for number in English, would mask the number feature carried by the quantifier. ALEs usually do not realize this discrepancy until they have their attention drawn to it, in which case they would be less affected by distance. As for the effect of animacy, Experiment Three has confirmed the influence of semantic features on grammatical accuracy, which is not surprising given that semantic features are usually universal.

Building on what has been said, variability in supplying functional morphology in the interlanguage of ALEs does not reflect actual L2 competence, because L2 learners omit functional morphology due to a wide range of factors that cannot be captured at once. Even when resemblances and shared features are available in the L1 and the L2, the interlanguage grammar is manifested in non-native like utterances. This is further accentuated due to the pressure of 'oral' communication. Moving forward, it would be worth carrying out a follow-up study related to each of the experiments in this thesis with learners at other levels of proficiency, especially advanced learners, to determine if the effects of prosodic transfer, distance and semantic plausibility still manifest themselves at these levels.

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APPENDIX A: EXPERIMENT ONE: TASK SENTENCES

Set 1: Monomorphemic parallels

They clear one copse for you every Tuesday very tidily. They clear one copse for him every Sunday really tidily. Before midday they lapse really badly in this classroom. After breakfast they lapse very badly in that classroom. Before midnight they relax very gladly in this nightclub. After dinner they relax really gladly in that nightclub. Before lunch they dance really beautifully in this house. After sunset they dance very beautifully in that house. They mend one fence for you every Thursday very thoroughly. They mend one fence for us every Friday really thoroughly. They take one pulse for us every Monday really gently.

Set 2: Short-stemmed agreement (inflected forms)

Before breakfast she taps very softly on this window. After midnight she taps really softly on that window. Before sunset he claps really joyfully in this concert. After lunch he claps very joyfully in that concert. Before dinner he knocks very politely at this door. After midday he knocks really politely at that door. Before midday she wins really easily in this contest. After dinner she wins very easily in that contest. Before lunch she spins very rapidly on this carpet. After sunset she spins really rapidly on that carpet. Before midnight he drills really deeply in this ocean. After breakfast he drills very deeply in that ocean.

Set 3: Long-stemmed agreement (inflected forms) Before lunch she jumps really excitedly in this room. After dinner she jumps very excitedly in that room. Before midday he helps very willingly in this church. After breakfast he helps really willingly in that church. Before midnight he drinks really happily in this café. After sunset he drinks very happily in that café. Before sunset she reclines very lazily on this bed. After lunch she reclines really lazily on that bed. Before breakfast she frowns really angrily at this mirror. After midday she frowns very angrily at that mirror. Before dinner he smiles very sweetly in this meeting. After midnight he smiles really sweetly in that meeting.

Set 4: Short-stemmed plural (inflected forms)

They check five maps for you every Friday very carefully. They check six maps for us every Monday really carefully. They sell ten caps for us every Saturday really quickly. They sell two caps for him every Sunday very quickly. They break three rocks for you every Thursday very messily. They break eight rocks for him every Tuesday really messily. They fire eight guns for you every Sunday really loudly. They fire three guns for him every Thursday very loudly. They fill two tins for us every Saturday very slowly. They fill eight tins for him every Tuesday really slowly. They ring six bells for you every Monday really noisily. They ring five bells for us every Friday very noisily.

Set 5: Long-stemmed plural (inflected forms)

They build three ramps for you every Tuesday really crudely. They build two ramps for him every Monday very crudely. They wash ten scalps for you every Friday very busily. They wash six scalps for you every Saturday really busily. They fill five tanks for you every Thursday really cheaply. They fill eight tanks for him every Sunday very cheaply. They steal eight crowns for you every Sunday very sneakily. They steal five crowns for him every Thursday really sneakily. They draw six mines for us every Monday really patiently. They draw ten mines for us every Friday very patiently. They make two tiles for you every Saturday very smoothly.

Set 6: Short-stemmed agreement (non-inflected forms)

Before breakfast they tap very softly on this window. After midnight they tap really softly on that window. Before sunset they clap really joyfully in this concert. After lunch they clap very joyfully in that concert. Before dinner they knock very politely at this door. After midday they knock really politely at that door. Before midday they win really easily in this contest. After dinner they win very easily in that contest. Before lunch they spin very rapidly on this carpet. After sunset they spin really rapidly on that carpet. Before midnight they drill really deeply in this ocean. After breakfast they drill very deeply in that ocean.

Set 7: Long-stemmed agreement (non-inflected forms)

Before lunch they jump really excitedly in this room. After dinner they jump very excitedly in that room. Before midday they help very willingly in this church. After breakfast they help really willingly in that church. Before midnight they drink really happily in this cafe. After sunset they drink very happily in that cafe. Before sunset they recline very lazily on this bed. After lunch they recline really lazily on that bed. Before breakfast they frown really angrily at this mirror. After midday they frown very angrily at that mirror. Before dinner they smile very sweetly in this meeting. After midnight they smile really sweetly in that meeting.

Set 8: Short-stemmed plural (non-inflected forms)

They check one map for you every Friday very carefully. They check one map for us every Monday really carefully. They sell one cap for us every Saturday really quickly. They sell one cap for him every Sunday very quickly. They break one rock for you every Thursday very gladly. They break one rock for him every Tuesday really gladly. They fire one gun for you every Sunday really loudly. They fire one gun for him every Thursday very loudly. They fire one gun for him every Thursday very loudly. They fill one tin for us every Saturday very slowly. They fill one tin for him every Tuesday really slowly. They ring one bell for you every Monday really noisily.

Set 9: Long-stemmed plural (non-inflected forms)

They build one ramp for you every Tuesday really crudely. They build one ramp for him every Monday very crudely. They wash one scalp for you every Friday very busily. They wash one scalp for you every Saturday really busily. They rob one bank for you every Thursday really cleverly. They rob one bank for him every Sunday very cleverly. They steal one crown for you every Sunday very sneakily. They steal one crown for him every Thursday really sneakily. They set one mine for us every Monday really patiently. They set one mine for him every Friday very patiently. They make one tile for you every Saturday very smoothly. They make one tile for him every Tuesday really smoothly.

APPENDIX B: EXPERIMENT TWO: TASK SENTENCES

Set 1: Inflected forms

She hears nine frogs very infrequently near the deep and beautiful streams. She hears nine slippery frogs very infrequently near the beautiful streams. She hears nine slippery old crimson frogs very infrequently near the streams. I hear eight bats very clearly in the spooky and fascinating caves. I hear eight horrible bats very clearly in the fascinating caves. I hear eight horrible young silvery bats very clearly in the caves. He sees five snakes very clearly in the fiery and sandy deserts. He sees five dangerous snakes very clearly in the sandy deserts. He sees five dangerous old turquoise snakes very clearly in the deserts. We see two pigs very infrequently on the huge and wonderful farms. We see two powerful pigs very infrequently on the wonderful farms. We see two powerful young brown pigs very infrequently on the farms. She hears ten rams very easily in the dark and leafy forests. She hears ten courageous rams very easily in the leafy forests. She hears ten courageous old white rams very easily in the forests. I hear nine dogs very frequently near the new and attractive gardens. I hear nine aggressive dogs very frequently near the attractive gardens. I hear nine aggressive young yellow dogs very frequently near the gardens. He sees eight bears very frequently near the spacious and impressive tents. He sees eight intimidating bears very frequently near the impressive tents. He sees eight intimidating old orange bears very frequently near the tents. We see five cats very often in the modern and magnificent houses.

We see five overweight cats very often in the magnificent houses. We see five overweight fluffy young cats very often in the houses. She hears two birds very often near the shiny and elaborate windows. She hears two delightful birds very often near the elaborate windows. She hears two delightful old maroon birds very often near the windows. I see ten worms very easily near the dirty and disgusting bins. I see ten enormous worms very easily near the disgusting bins. I see ten enormous wriggly young worms very easily near the bins. They see three whales very distinctly in the calm and peaceful oceans. They see three marvellous whales very distinctly in the peaceful oceans. They see three marvellous old grey whales very distinctly in the oceans. I hear three bulls very distinctly in the large and sturdy pens. I hear three ferocious bulls very distinctly in the sturdy pens. I hear three ferocious strong young bulls very distinctly in the pens.

Set 2: Non-inflected forms

She hears one frog very infrequently near the deep and beautiful stream. She hears one slippery frog very infrequently near the beautiful stream. She hears one slippery old crimson frog very infrequently near the stream. I hear one bat very clearly in the spooky and fascinating cave. I hear one horrible bat very clearly in the fascinating cave. I hear one horrible young silvery bat very clearly in the cave. He sees one snake very clearly in the fiery and sandy desert. He sees one dangerous snake very clearly in the sandy desert. He sees one dangerous old turquoise snake very clearly in the desert. We see one pig very infrequently on the huge and wonderful farm. We see one powerful pig very infrequently on the wonderful farm. We see one powerful young brown pig very infrequently on the farm. She hears one ram very easily in the dark and leafy forest. She hears one courageous ram very easily in the leafy forest. She hears one courageous old white ram very easily in the forest. I hear one dog very frequently near the new and attractive garden. I hear one aggressive dog very frequently near the attractive garden. I hear one aggressive young yellow dog very frequently near the garden. He sees one bear very frequently near the spacious and impressive tent. He sees one intimidating bear very frequently near the impressive tent. He sees one intimidating old orange bear very frequently near the tent. We see one cat very often in the modern and magnificent house. We see one overweight cat very often in the magnificent house. We see one overweight fluffy young cat very often in the house. She hears one bird very often near the shiny and elaborate window. She hears one delightful bird very often near the elaborate window. She hears one delightful old maroon bird very often near the window. I see one worm very easily near the dirty and disgusting bin. I see one enormous worm very easily near the disgusting bin. I see one enormous wriggly young worm very easily near the bin. They see one whale very distinctly in the calm and peaceful ocean. They see one marvelous whale very distinctly in the peaceful ocean. They see one marvelous old grey whale very distinctly in the ocean. I hear one bull very distinctly in the large and sturdy pen.

I hear one ferocious bull very distinctly in the sturdy pen.

I hear one ferocious strong young bull very distinctly in the pen.

APPENDIX C: COMPREHENSION TEST (PART ONE)

Dear participant, thank you for completing the language proficiency test. Now, you are kindly requested to do the following short test. There is no time limit for completing the test, but please try to do it reasonably quickly. The test consists of two parts. This is Part One. There are two examples at the beginning for you to follow.

Here is some vocabulary that you need for this test. Please study it for a few minutes.

Vocabulary list: gardener مزارع, water حوض ورد flowerbed بيسقي, smell مزارع, bad له رائحة, banana موز, runner مقزز stinky بيأكل stinky بيك , sign مدير sign مدير, sign مقزز stinky بيأكل stinky موز, novie مقزز neighbour بيناه , watch بيأخذ دواء , at مريض novie منها , neighbour بيانه , watch بياه , sound بيدو sailor بريب, take مريب , take بيأخذ دواء seem بيانه , ange novie منه , ange novie مريض , ange معنا , seem بيانه , sound بيندو , seem بيانه , seem بيانه , seem بيندو , seem بيندو , seem بيندو , seem بيدو , ange , ange , ange , ange , ange , ange , sailor بريب , pofessor , ange , seem , يستمتع , professor , معنا , neighbour , ange , and , angerous , ange , and , ange , an

Test

Example (1): Read the sentence below, and then answer the following question.

"The gardener that waters the flowerbed smells very bad".

Which TWO of the following statements about this sentence are correct? Circle the correct answers.

a) The gardener waters the flowerbed.

- b) The flowerbed smells very bad.
- (c)) The gardener smells very bad.

Example (2): Read the sentence below, and then answer the following question.

"The bananas that the runners eat smell very stinky".

Which TWO of the following statements about this sentence are correct? Circle the correct answers.

- a) The runners eat the bananas.
- b) The bananas smell very stinky.
- c) The runners smell very stinky.

Now please answer the following 12 questions in the same way.

- 1. "The manager that signs the contract looks very strange".
 - a) The manager signs the contract.
 - b) The manager looks very strange.
 - c) The contract looks very strange.
- 2. "The movies that the neighbours watch sound very weird".
 - a) The neighbours sound weird.
 - b) The movies sound very weird.
 - c) The neighbours watch the movies.
- 3. "The patient that takes the tablet seems very dangerous".
 - a) The patient seems very dangerous.
 - b) The tablet seems very dangerous.
 - c) The patient takes the tablet.
- 4. "The oceans that the sailors enjoy seem very calm".
 - a) The sailors enjoy the oceans.
 - b) The oceans seem very calm.
 - c) The sailors seem very calm.

- 5. "The professor that the textbooks bore sounds really dull".
 - a) The textbooks bore the professor.
 - b) The professor sounds really dull.
 - c) The textbooks sound really dull.
- 6. "The projects that inspire the researcher sound really good".
 - a) The projects inspire the researcher.
 - b) The researcher sounds really good.
 - c) The projects sound really good.
- 7. "The manager that the contracts confuse looks really strange".
 - a) The contracts look really strange.
 - b) The manager looks really strange.
 - c) The contracts confuse the manager.
- 8. "The patient that the tablets harm seems really dangerous".
 - a) The patient seems really dangerous.
 - b) The tablets seem really dangerous.
 - c) The tablets harm the patient.
- 9. "The movies that frighten the neighbour sound really weird".
 - a) The movies sound really weird.
 - b) The movies frighten the neighbour.
 - c) The neighbour sounds really weird.
- 10. "The oceans that relax the sailor seem really calm".
 - a) The sailor seems really calm.
 - b) The oceans relax the sailor.
 - c) The oceans seem really calm.
- 11. "The projects that the researchers lead sound very good".
 - a) The researchers lead the projects.
 - b) The projects sound very good.
 - c) The researchers sound very good.

- 12. "The professor that uses the textbook sounds very dull".
 - a) The professor uses the textbook.
 - b) The professor sounds very dull.
 - c) The textbook sounds very dull.

APPENDIX D: EXPERIMENT THREE: TASK SENTENCES

Set 1: Inflected forms

The manager that signs the contract looks very strange. The manager that the contracts confuse looks really strange. The contract that confuses the managers looks really strange. The contract that the manager signs looks very strange. The patient that takes the tablet seems very dangerous. The patient that the tablets harm seems really dangerous. The tablet that harms the patients seems really dangerous. The tablet that the patient takes seems very dangerous. The professor that uses the textbook sounds very dull. The professor that the textbooks bore sounds really dull. The textbook that bores the professors sounds really dull. The textbook that the professor uses sounds very dull. The gardener that waters the flowerbed smells very bad. The gardener that the flowerbeds disgust smells really bad. The flowerbed that disgusts the gardeners smells really bad. The flowerbed that the gardener waters smells very bad. The mountaineer that wears the jacket looks very old. The mountaineer that the jackets warm looks really old. The jacket that warms the mountaineers looks really old. The jacket that the mountaineer wears looks very old. The teenager that prefers the cookie smells very nice. The teenager that the cookies tempt smells really nice. The cookie that tempts the teenagers smells really nice. The cookie that the teenager prefers smells very nice. The hunter that climbs the tree seems very impressive. The hunter that the trees hide seems really impressive. The tree that hides the hunters seems really impressive. The tree that the hunter climbs seems very impressive. The robber that carries the knife looks very scary. The robber that the knives injure looks really scary.

The knife that injures the robbers looks really scary. The knife that the robber carries looks very scary. The runner that eats the banana smells very stinky. The runner that the bananas satisfy smells really stinky. The banana that satisfies the runners smells really stinky. The banana that the runner eats smells very stinky. The researcher that leads the project sounds very good. The researcher that the projects inspire sounds really good. The project that inspires the researchers sounds really good. The project that the researcher leads sounds very good. The sailor that enjoys the ocean seems very calm. The sailor that the oceans relax seems really calm. The ocean that relaxes the sailors seems really calm. The ocean that the sailor enjoys seems very calm. The neighbor that watches the movie sounds very weird. The neighbor that the movies frighten sounds really weird. The movie that frightens the neighbors sounds really weird. The movie that the neighbor watches sounds very weird.

Set 2: Non-inflected forms

The managers that sign the contracts look very strange. The managers that the contract confuses look really strange. The contracts that confuse the manager look really strange. The contracts that the managers sign look very strange. The patients that take the tablets seem very dangerous. The patients that the tablet harms seem really dangerous. The tablets that harm the patient seem really dangerous. The tablets that the patients take seem very dangerous. The professors that use the textbooks sound very dull. The professors that the textbook bores sound really dull. The textbooks that bore the professor sound really dull. The textbooks that the professors use sound very dull. The gardeners that the flowerbed disgusts smell really bad. The flowerbeds that disgust the gardener smell really bad. The flowerbeds that the gardeners water smell very bad. The mountaineers that wear the jackets look very old. The mountaineers that the jacket warms look really old. The jackets that warm the mountaineer look really old. The jackets that the mountaineers wear look very old. The teenagers that prefer the cookies smell very nice. The teenagers that the cookie tempts smell really nice. The cookies that tempt the teenager smell really nice. The cookies that the teenagers prefer smell very nice. The hunters that climb the trees seem very impressive. The hunters that the tree hides seem really impressive. The trees that hide the hunter seem really impressive. The trees that the hunters climb seem very impressive. The robbers that carry the knives look very scary. The robbers that the knife injures look really scary. The knives that injure the robber look really scary. The knives that the robbers carry look very scary. The runners that eat the bananas smell very stinky. The runners that the banana satisfies smell really stinky. The bananas that satisfy the runner smell really stinky. The bananas that the runners eat smell very stinky. The researchers that lead the projects sound very good. The researchers that the project inspires sound really good. The projects that inspire the researcher sound really good. The projects that the researchers lead sound very good. The sailors that enjoy the oceans seem very calm. The sailors that the ocean relaxes seem really calm. The oceans that relax the sailor seem really calm. The oceans that the sailors enjoy seem very calm. The neighbours that watch the movies sound very weird. The neighbours that the movie frightens sound really weird. The movies that frighten the neighbour sound really weird.

The movies that the neighbours watch sound very weird.

APPENDIX E: COMPREHENSION TEST (PART TWO)

Dear participant, thank you for completing the language proficiency test and the Comprehension Test - Part One. Now, you are kindly requested to do Part Two. There is no time limit for completing the test, but please try to do it reasonably quickly. There are two examples at the beginning for you to follow.

Here is some vocabulary that you need for this test. Please study it for a few minutes.

Vocabulary List: ladder , worker , alad , عامل , repair , يسلح , roof قري , seem , يبدو , weak , مساعد , assistant , مساعد , feed , بقرة , cow , يطعم , smell , مساعد , bad , bad , له رائحة , box , boy , ولد , boy , ولد , boy , ولد , boy , مندوق , dusty , meal , meal , aduld , aduld , acomputer , aduld , adul

Example (1): "The ladder that the workers repair the roofs with seems very weak".

- a)) The ladder seems very weak.
- b)) The workers repair the roofs.
- c) The workers repair the ladder.
- d) The roofs seem very weak.

Example (2): "The container that the assistant feeds the cows from smells really bad".

- a) The cows smell really bad.
- b) The container smells really bad.
- c) The assistant feeds the container.
- d)) The assistant feeds the cows.

- 1. "The shop that the teenagers buy the meal from smells very clean".
 - a) The teenagers buy the meal.
 - b) The meal smells very clean.
 - c) The shop smells very clean.
 - d) The teenagers buy the shop.
- 2. "The box that the boy carries the computer in seems really dusty".
 - a) The computer seems really dusty.
 - b) The boy carries the box.
 - c) The boy carries the computer.
 - d) The box seems really dusty.
- 3. "The problem that the author writes the chapters about seems really new".
 - a) The author writes the problem.
 - b) The chapter seems really new.
 - c) The problem seems really new.
 - d) The author writes the chapters.
- 4. "The balls that the robber smashes the windows with break really easily".
 - a) The balls break really easily.
 - b) The robber smashes the balls.
 - c) The windows break really easily.
 - d) The robber smashes the windows.
- 5. "The eggs that the chefs fry the steaks with break very unexpectedly".
 - a) The chefs fry the eggs.
 - b) The steak breaks very unexpectedly.
 - c) The chefs fry the steaks.
 - d) The eggs break very unexpectedly.

- 6. "The tool that the mechanic fixes the car with looks really big".
 - a) The car looks really big.
 - b) The mechanic fixes the car.
 - c) The tool looks really big.
 - d) The mechanic fixes the tool.
- 7. "The girl that the worker repairs the roofs for seems really weak".
 - a) The roofs seem really weak.
 - b) The worker repairs the roofs.
 - c) The girl seems really weak.
 - d) The worker repairs the girl.
- 8. "The rooms that the helper loads the packages in look really small".
 - a) The rooms look really small.
 - b) The packages look really small.
 - c) The helper loads the packages.
 - d) The helper loads the rooms.
- 9. "The table that the ladies design the shirts on sounds very strong".
 - a) The shirts sound very strong.
 - b) The ladies design the shirts.
 - c) The ladies design the table.
 - d) The table sounds very strong.
- 10. "The dogs that the teenagers buy the meals for smell very clean".
 - a) The dogs smell very clean.
 - b) The teenagers buy the dogs.
 - c) The teenagers buy the meals.
 - d) The meals smell very clean.

- 11. "The princesses that the servants read the poem to look very old".
 - a) The poem looks very old.
 - b) The servants read the poem.
 - c) The servants read the princesses.
 - d) The princesses look very old.
- 12. "The books that the author writes the chapter for seem really new".
 - a) The books seem really new.
 - b) The author writes the chapters.
 - c) The author writes the books.
 - d) The chapter seems really new.

APPENDIX F: EXPERIMENT FOUR: TASK SENTENCES

Set 1: Inflected forms

The tool that the mechanic fixes the car with looks really big. The garage that the mechanics fix the car in looks very big. The ladder that the workers repair the roofs with seems very weak. The girl that the worker repairs the roofs for seems really weak. The brick that the robber smashes the window with breaks really easily. The ball that the robbers smash the window with breaks very easily. The table that the ladies design the shirts on sounds very strong. The customer that the lady designs the shirts for sounds really strong. The dog that the teenager buys the meal for smells really clean. The shop that the teenagers buy the meal from smells very clean. The page that the servants read the poems from looks very old. The princess that the servant reads the poems to looks really old. The box that the boy carries the computer in seems really dusty. The office that the boys carry the computer to seems very dusty. The book that the authors write the chapters for seems very new. The problem that the author writes the chapters about seems really new. The van that the helper loads the package into looks really small. The room that the helpers load the package in looks very small. The truck that the drivers park the taxis near sounds very large. The payment that the driver parks the taxis for sounds really large. The egg that the chef fries the steak with breaks really unexpectedly. The pan that the chefs fry the steak in breaks very unexpectedly.

The tiger that the assistants feed the cows to smells very bad. The container that the assistant feeds the cows from smells really bad.

Set 2: Non-inflected forms

The tools that the mechanics fix the cars with look very big. The garages that the mechanic fixes the cars in look really big. The ladders that the worker repairs the roof with seem really weak. The girls that the workers repair the roof for seem very weak. The bricks that the robbers smash the windows with break very easily. The balls that the robber smashes the windows with break really easily. The tables that the lady designs the shirt on sound really strong. The customers that the ladies design the shirt for sound very strong. The dogs that the teenagers buy the meals for smell very clean. The shops that the teenager buys the meals from smell really clean. The pages that the servant reads the poem from look really old. The princesses that the servants read the poem to look very old. The boxes that the boys carry the computers in seem very dusty. The offices that the boy carries the computers to seem really dusty. The books that the author writes the chapter for seem really new. The problems that the authors write the chapter about seem very new. The vans that the helpers load the packages into look very small. The rooms that the helper loads the packages in look really small. The trucks that the driver parks the taxi near sound really large. The payments that the drivers park the taxi for sound very large. The eggs that the chefs fry the steaks with break very unexpectedly.

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The pans that the chef fries the steaks in break really unexpectedly.

The tigers that the assistant feeds the cow to smell really bad.

The containers that the assistants feed the cow from smell very bad.

APPENDIX G: PARTICIPANT AGES AND TEST SCORES

The following table shows the participants IDs, ages, and their test scores on the Oxford Placement Test (place. Score, out of 40), comprehension test part 1 (G1,out of 12), and comprehension test part 2 (G2, out of 12). The Intermediate level is chosen based on Oxford assessment scale (lowest score is 24, highest score is 40).

Participant ID	Age	Place. Score	G1	G2
ALE 1	21	32	12	9.5
ALE 2	21	38	12	12
ALE 3	27	35	12	10.5
ALE 4	21	25	12	11
ALE 5	22	38	12	10
ALE 6	27	28	11	9
ALE 7	20	30	12	11
ALE 8	24	34	10	8
ALE 9	20	32	12	12
ALE 10	21	37	12	10
ALE 11	22	28	11	8
ALE 12	25	33	11	8
ALE 13	22	31	12	11.5
ALE 14	24	35	12	12
ALE 15	28	30	11	9.5
ALE 16	22	34	10	8
ALE 17	22	38	11	9.5
ALE 18	22	25	12	12
ALE 19	25	26	10	8
ALE 20	23	37	10	8
ALE 21	22	24	11	11
ALE 22	23	34	11	9.5
ALE 23	28	24	11	9.5
ALE 24	28	25	11	8.5
ALE 25	22	27	12	11
ALE 26	26	29	12	11
ALE 27	22	30	12	12
ALE 28	24	30	10	8
ALE 29	22	34	12	11
ALE 30	22	26	12	9.5
ALE 31	28	33	12	11
ALE 32	22	38	12	11.5
ALE 33	20	39	12	11
ALE 34	21	36	11	11
ALE 35	27	36	10	9
ALE 36	28	35	11	9.5

Participant ID	Age	Place. Score	G1	G2
ALE 37	27	30	12	9.5
ALE 38	20	39	12	11
ALE 39	23	27	12	12
ALE 40	23	37	11	8.5
ALE 41	25	38	12	12