

**Abstract Syntactic Representation in  
a Second Language: Processing and  
Acquisition of Wh-dependencies and  
Definiteness in L2 English**

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## Abstract

This thesis investigates the second language (L2) processing and acquisition of English wh-dependencies and definiteness. Two studies were conducted to test whether adult L2 learners can process and acquire L2 properties that are not present in their first language (L1). The first study replicates Canales (2012) to compare L2 real-time processing of filler-gap dependencies in English wh-sentences by speakers of two typologically different languages, Jordanian Arabic and Mandarin, which both lack wh-movement. The results show that the L2 participants can process filler-gap dependencies incrementally in real-time and provide evidence that L2 processing exploits the same syntactic knowledge (wh-constraints) as L1 processing. These results challenge the predictions of the Shallow Structure Hypothesis (Clahsen & Felser, 2006, 2018) which states that adult L2 learners are 'shallow processors' who rely less heavily on morpho-syntactic knowledge during real-time processing than on lexical semantic knowledge.

The second study investigates the acquisition of definiteness in English relative complementizers by L1 Jordanian speakers. The appearance of relative complementizers in Jordanian Arabic is the phonological reflex of the [+definite] feature of the head noun, unlike English relative complementizers which are not specified for definiteness. This study examines whether adult L1 Jordanian Arabic L2-English speakers will transfer the [+definite] feature to English relative complementizers, by investigating their acceptance of null and overt relative complementizers in definite and indefinite English relative clauses. These combinations are all grammatical in English, but in the participants' L1, null complementizers are incompatible with a definite marker and overt complementizers are incompatible with indefiniteness. The results show evidence of L1 transfer since the L2 participants had significantly lower ratings for definite relative clauses with a null complementizer and indefinite relative clauses with an overt relative complementizer. Further, the size of this apparent L1-transfer effect was bigger in participants with lower L2 English proficiency but attenuated with increased proficiency, suggesting that the higher proficiency participants were able to acquire the target representation of definiteness with relative complementizers. These results are compatible with the Feature Reassembly Hypothesis (Lardiere, 2008, 2009) which argues that learners can acquire L2 features that would be incompatible with their L1 features.

Overall, the results of both investigations do not support models of L2 processing and acquisition that propose shallower syntactic representation (the Shallow Structure Hypothesis). Instead, they support models which argue that adult L2 learners can acquire full syntactic processing and representation of L2 properties that are absent in their L1 (e.g., the Feature Reassembly Hypothesis).

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## **Dedication**

**To my lovely sister Dana Al-Maani and her  
husband Belal Al-Momani**

**I will never forget what you both have done form me!**

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## **Author's Declaration**

I declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for an award at this, or any other, university. All sources are acknowledged as References.

Some of the information contained in this thesis was presented at the 25<sup>th</sup> University of Edinburgh Linguistics and English Language Postgraduate Conference (LELPGC19), 4-7 June 2019 and as a poster presentation at the 29<sup>th</sup> Conference of the European Second Language Association (EuroSLA 29) at Lund University, Sweden, 28-31 August 2019. Some of the information in this thesis will be presented at EuroSLA 30 conference at the University of Barcelona, Spain in July 2021.

# Chapter 1

## Introduction

### 1.1 Introduction

A key question in generative second language research is whether adult second language (L2) learners are able to acquire L2 properties that are absent in their first language (L1). This thesis investigates this issue from two perspectives, namely, real-time processing and feature reassembly.

The first study, to be reported in Chapter 5, examines the L2 processing of English *wh*-sentences by speakers of two typologically different languages, Jordanian Arabic and Mandarin, both of which lack *wh*-movement. This study involved two self-paced reading experiments to examine (i) whether upon encountering a filler (such as *who* in 1), L2 learners of English will start actively to search for a gap to associate the filler with (the Active Filler Strategy); (ii) whether L2 processing of *wh*-movement makes the same use of syntactic constraints as L1 processing, and (iii) whether proficiency has an effect on the L2 real-time processing.

1. The teacher wondered *who* Harry would seat Ann by \_\_\_ in the class.  
*filler* *gap*

The motivation for investigating these two groups is that Jordanian Arabic is a head-initial language which is similar to English in that the filler precedes the gap in *wh*-sentences.<sup>1</sup> By contrast, Mandarin is a head-final language in which the gap precedes the filler in *wh*-structures. If there is L1 influence, the Jordanian Arabic group may demonstrate a more robust filled-gap effect during filler-gap dependency processing than the Mandarin speakers of English. Specifically, this study seeks answers to the following questions:

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<sup>1</sup> The gap is filled with a resumptive pronoun in all types of Jordanian Arabic relative clauses except the subject relatives. More details are provided in Chapter 2 (Section 2.3.1).

2. **Research Question 1.** Do Jordanian Arabic and Mandarin L2 speakers of English, whose L1s lack *wh*-movement, use the Active Filler Strategy in their real-time sentence processing?

3. **Research Question 2.** Do Jordanian Arabic and Mandarin L2 speakers of English make use of abstract syntactic knowledge in their real-time processing of English *wh*-sentences?

The second investigation in this thesis, to be reported in Chapter 6, is related to possible transfer of the feature specification of the relative complementizer in Jordanian Arabic to L2 English. One group of L2 learners took part in this study, namely, Jordanian Arabic speakers of English, in addition to a control group of English native speakers. In English, the relative complementizer can follow definite (4a) and indefinite head nouns (4b). This suggests that the English complementizer is not specified for [definiteness].

4. a. I answered the question **that** was in the exam.  
 b. I answered a question **that** was in the exam.

By contrast, the relative complementizer in Jordanian Arabic, *illi*, can only follow definite heads (5a). Indefinite head nouns cannot be followed by *illi* (5b). The overt use of the complementizer with indefinite heads renders sentence (5b) ungrammatical, as illustrated by (5c).

5. a. halli-t        is-suʔa:l        **illi**    kan    bil-li-mtifa:n]  
                       answered-I    the-question    that    was    in-the-exam  
                       'I answered the question that was in the exam.'
- b. halli-t        suʔa:l        kan    bil-li-mtifa:n]  
                       answered-I    question        was    in-the-exam  
                       'I answered a question in the exam.'
- c. halli-t        suʔa:l        (\*illi)    kan    bil-li-mtifa:n]  
                       answered-I    question        that    was    in-the-exam



Al-Momani (2010) argues that the relative complementizer in Jordanian Arabic bears a [+def] feature, and that the presence of *illi* is the phonological reflex of the [+def] feature on the relative complementizer *illi*. In order for Jordanian Arabic speakers to acquire English relative clauses, they should know that relative markers in English are not specified for definiteness, and thus, can follow indefinite heads and can be null after definite heads. Therefore, their acquisition task will be to delete the [+def] feature on relative markers in L2 English. This study addresses the following research question:

**6. Research Question 4.** Will the relationship in the participants' L1 between definiteness and the use of a null or overt relative complementizer transfer to the L2 English?

The results of this study test the predictions of the Feature Reassembly Hypothesis. According to the Feature Reassembly Hypothesis, L2 acquisition involves two mechanisms, namely, mapping and feature reassembly. At an initial stage of L2 acquisition, based on similarity in meaning or grammatical function, L2 learners map the features from the closest morpholexical items in the L1 to items in the L2. If the features on both L1 and L2 morpholexical items match, then no further configuration of the feature set is required. If the feature set of the property to be acquired in the L2 does not match its closest equivalent in the L1, L2 learners are predicted to determine the appropriate specification of the features on the L2 morpholexical items only if evidence in the input motivates this, and then reassemble the L1-based feature set accordingly. The reassembly can only take place if input in the evidence motivates it. According to this account, Jordanian Arabic L2 learners are expected to transfer the [+def] feature of their L1 relative complementizer *illi* to their initial abstract representations of English relative markers. However, evidence in the input may motivate removal of this feature. In other words, if learners encounter English definite relative clauses with null relative markers and indefinite relative clauses which include overt relative markers, they could come to know that English relative markers are not specified for definiteness, and reassemble the feature sets accordingly.

## 1.2 Background of the study

Language processing is essential for grammar building. According to Felser, Marinis and Clahsen (2003, p.2), successful language parsing enables the parser to “segment an input string into grammatically meaningful chunks, to assign appropriate category labels to each segment, and to determine hierarchical relationships and intra-sentential dependencies among constituents”. Processing filler-gap dependencies (such as 7) is a main concern in second language research. Filler-gap dependencies are interesting to investigate because they provide clues about the parser’s ability to identify a gap.

7. Who<sub>i</sub> [do you think that John called<sub>i</sub>]

Hawkins (1999, p.246) provides a clear expression of the challenge of filler-gap comprehension:

8. Identifying the gap is not easy. It is an empty element with no surface manifestation and its presence must be inferred from its immediate environment. At the same time, the filler must be held in working memory, and all other material on the path from filler to gap must be processed simultaneously, and the gap must be correctly identified and filled.

Previous studies on L1 real-time filler-gap processing have revealed that the L1 parser processes wh-sentences incrementally and makes use of abstract syntactic constraints during real-time processing of filler-gap dependencies. On the other hand, there is an ongoing debate about whether real-time sentence processing in an L2 exploits the same use of syntactic constraints as L1 processing. Some studies (e.g., Clahsen & Felser, 2006; Marinis, Roberts, Felser & Clahsen, 2005) claimed that L2 learners underuse syntactic information used by native speakers and instead rely heavily on semantic or pragmatic cues to process sentences in real time. Based on such findings, Clahsen and Felser (2006, 2018) posited the Shallow Structure Hypothesis, which proposes that L2 processing underuses abstract syntactic structures in real time. Instead, this account posits that L2 real-time parsing is

primarily guided by semantic, pragmatic, probabilistic, or surface-level information.

By contrast, other studies (e.g., Aldwayan, Fiorentino & Gabriele, 2010; Canales, 2012; Omaki & Schulz, 2011; Williams et al., 2001) have provided counter evidence to the Shallow Structure Hypothesis that L2 learners are able to process wh-sentences in real time similarly to native speakers. For instance, Canales (2012) investigated whether L1 learners of English whose L1 has wh-movement and island constraints process wh-sentences in a native-like fashion. His study examined how Spanish-speaking L2 learners of English process wh-movement in English sentences using a self-paced reading task. The results of Canales' study indicated that Spanish-speaking L2 learners of English process wh-movement incrementally, and that they respect the syntactic constraints in their real-time processing.

The discussion so far has pointed out that the results of previous studies are not conclusive yet. Thus, further research is needed before making any generalizations about the possibility of L2 learners having native-like attainment in their real-time processing of English sentences that include syntactic structures like wh-movement. Klein (1999, p.210) recommended that "we must replicate recent L2 processing studies to support the validity and reliability of this research" and that "we must study speakers from various L1s to see the effect of similarities and differences in parsing strategies cross linguistically". Therefore, the present study responds to the call for more replication studies in L2 and conduct a replication with L1s not previously investigated, of an L2 study (i.e., Canales, 2012) that itself partially replicated a seminal L1 study on filler-gap processing (i.e., Stowe, 1986). The current study investigates two groups of adult L2 learners of English: Jordanian Arabic speakers of English and Mandarin speakers of English whose L1s are not subject to wh-movement and so do not have the island constraints found in English.

The investigation of L2 processing of filler-gap dependencies by L1-Jordanian Arabic and L1-Mandarin speakers aims to contribute to the theory of second language acquisition by testing the predictions of the Shallow Structure Hypothesis (Clahsen & Felser, 2006, 2018). Clahsen and Felser (2018, p.704)

stated that “We hope that the number of linguistically and psycholinguistically informed L2 processing studies will continue to rise, so that we can obtain a more comprehensive and nuanced picture of L1/L2 processing differences and similarities that will inform theory building or theory refinement”. The present study responds to this call. Its importance lies in its focus on new data from Arabic speakers, a less commonly investigated language in the field of second language processing and acquisition. The investigation of adult L2 learners’ sensitivity to island constraints in real-time processing of filler-gap dependencies can offer valuable implications for understanding the characteristics of L2 sentence processing by L1 speakers of both head-initial and head-final languages. If L2 learners show sensitivity to island constraints during real-time processing, this would suggest that they have access to abstract syntactic representations required to process syntactic structures.

With respect to the second investigation in this thesis, focusing on the possible transfer of a definiteness feature, previous research has shown that the definiteness system in the English language is not straightforward for L2 learners, whether their L1 has an article system (García Mayo, 2009) or not (Hawkins, Al-Eid & Almahboob, 2006; Ionin, Zubizarreta & Bautista Maldonado, 2008; Lopez, 2019; Snape, 2009). However, there are also some cases where L2 learners were able to show success in the acquisition of the definiteness system that is not found in their L1 (e.g., Lopez, An and Marsden, (forthcoming); among others). Although the L2 acquisition of definiteness in English has been extensively investigated in previous research (Hawkins et al., 2006; Ionin, Ko and Wexler, 2004; Snape, 2009; Trenkic, 2008; among many others), the extent and nature of L1 transfer in this area remain unclear.

A key contribution of the present study is that it investigates the L2 acquisition of definiteness in a new context, namely, relative clauses. The definiteness effect in Jordanian Arabic relative clauses presents a potentially promising new avenue for research into L1 transfer of definiteness. The study also aims to provide experimental evidence relevant to the Feature Reassembly Hypothesis by means of investigation of cross-linguistic phenomenon not previously investigated in L2 acquisition research.

Overall, the studies conducted in the present thesis are designed to further the understanding of the characteristics of L2 processing and acquisition of L2 properties that are not present in the participants' L1. Both studies can help to examine the transfer of L1 properties related to wh-movement and definiteness on the L2 grammar. The results of the two investigations are discussed in relation to the theories that the present thesis tests (the Shallow Structure Hypothesis and the Feature Reassembly Hypothesis).

### 1.3 Hypotheses

The results of the two studies will be discussed in light of the following hypotheses:

9. **Hypothesis 1.** Jordanian Arabic L2 speakers of English and Mandarin L2 speakers of English make use of the Active Filler Strategy in their real-time processing of English wh-sentences.

10. **Hypothesis 2.** The Jordanian Arabic and Mandarin speakers of English will demonstrate sensitivity to wh-island constraints during processing.

11. **Hypothesis 3.** The Jordanian Arabic speakers of English may demonstrate a more robust filled-gap effect during filler-gap dependency processing than the Mandarin speakers of English, due to L1 influence.

12. **Hypothesis 4.** Jordanian Arabic L2 speakers of English will transfer the definiteness aspect of relative clauses in their L1 to their acquisition of English relative clauses.

### 1.4 Outline of the thesis

This thesis is organised as follows. The second chapter presents the linguistic background of the wh-structures under investigation in the three languages involved, namely, English, Jordanian Arabic and Mandarin, respectively. Chapter 3 provides an overview of key generative second language acquisition models. Then, the chapter reviews off-line L2 studies that have investigated the acquisition of wh-movement and island constraints in

English. Chapter 4 describes the structure of filler-gap dependencies and discusses key proposals related to their real-time processing in L1 and L2. It then proceeds to review related studies on the English L1 and L2 real-time processing of filler-gap dependencies, then it provides an overview of research on the processing of gap-filler in L1 Mandarin. This chapter serves as the basis for the thesis' investigation of L2 processing of filler-gap dependencies by L1 speakers of Jordanian Arabic and Mandarin. Chapter 5 describes the present study of the L2 real-time processing of filler-gap dependencies in English by L2 learners whose first languages lack *wh*-movement. Chapter 6 shifts to report on the investigation of a possible effect of definiteness in the L2 acquisition of the English relative complementizer by adult Jordanian Arabic speakers. Finally, Chapter 7 discusses the general conclusions of the two investigations in relation to the theories that the present thesis tested (the Shallow Structure Hypothesis and the Feature Reassembly Hypothesis). The chapter then presents the limitations of the study and some recommendations for further research.

## Chapter 2

# Linguistic background: the structure of relativization and embedded wh-questions

### 2.1 Introduction

The present thesis investigates the L2 real-time processing of wh-dependencies in English embedded wh-questions and island constraints, and the L2 acquisition of the English relative complementizer. This chapter describes the wh-structures under investigation in the three languages involved, namely English, Jordanian Arabic and Mandarin, respectively. This chapter aims to outline the key similarities and differences in the wh-structures in these languages.

### 2.2 Wh-dependencies in English

#### 2.2.1 The structure of English relative clauses

Relative clauses are subordinate clauses which act as DP modifiers. They belong to the syntactic category called Complementizer Phrase (CP) and are embedded in a complex nominal expression (DP) (e.g., Rizzi, 1990). In English, relative clauses function as post-modifiers of the nominal element (NP/DP), following the head noun (the antecedent) they modify (Carnie, 2013; De Vries, 2002; Radford, 2004). The underlined phrase in (13) is a relative clause that modifies the antecedent *the book*.

13. I read the book [<sub>CP</sub> that the teacher recommended].

Based on the function of English relative clauses, two main types of relative clause can be identified in English: restrictive and non-restrictive relative clauses (e.g., Carnie, 2013; Radford, 2004). Restrictive relative clauses restrict the range of possible referents referred to by the nominal head and provide essential information about their antecedent (14a). Non-restrictive relatives, on the other hand, provide extra information which could be omitted without affecting the antecedent's identity (14b). The non-restrictive (appositive) reading is typically marked by prosody (pauses) in speaking or commas in writing to indicate that this information is extra.

14. a. The guy who is wearing the red hat just hit me!  
b. That guy, who I think might be drunk, just hit me!

(Carnie, 2013, p.373)

The relative clause in (14a) is used to restrict the antecedent's referent to indicate that *the guy* of concern here is the unique individual wearing a red hat, not some other guy. Thus, it is called a restrictive relative clause. The function of the restrictive relative clause is to give essential information to uniquely identify the antecedent in a context. However, this restriction is not found in (14b), where the type of relative clause provides extra information that could be deleted without affecting the possibility to uniquely identify the antecedent (*the guy*). However, the use of restrictive vs. non-restrictive relative clauses depends on the common knowledge shared between the speaker and the hearer in a specific context. For example, if *the guy* in (14) is known to the speaker and the hearer, the relative clauses in both sentences (14a-b) will be non-restrictive.

English relative clauses are typically introduced by a relative marker that marks the relative clause within the sentence. Three types of relative markers can be used to introduce a restrictive relative clause in English: *wh*-type, which includes relative clauses that are headed by a *wh*-word such as *who*, *which*, etc. (15a), *that*-type, which refers to relative clauses starting with *that* as their relative marker (15b), and *Zero* or *null* type, which stands for relative clauses whose relative marker is omitted (15c) (e.g., Guy and Bayley, 1995).

15. a. I read the newspaper *which* you bought.  
b. I read the newspaper *that* you bought.  
c. I read the newspaper  $\emptyset$  you bought.

Restrictive relative clauses can be formed using any of the three relative markers variation (15a-c). Non-restrictive relative clauses, on the other hand, require a relative marker (16).

16. a. The movie, *which I watched yesterday*, was great.  
b. \*The movie, *I watched yesterday*, was great.



Zero relative marking in English relative clauses can only take place when the relativization is on the object position (17). Thus, the deletion of the relative marker in other positions (such as subject position in 18) renders the sentence ungrammatical.

17. This is the dress  $\emptyset$  I want to wear.

18. \*This is the dress  $\emptyset$  is on sale.

Therefore, although three types of relative marker can be found in English relative clauses, the choice of the relative marker is constrained by the function of the relative clause (restrictive vs. non-restrictive) and the position of the relativized head.

Six positions can be relativized in English: subject, direct object, indirect object, object of preposition, genitive, and object of comparison relative clauses. Table 1 provides examples of each type of relative clause in English.

**Table 1.** Examples of English relative clauses.

Type of relative clauses	Example
Subject	the student <u>who called me</u>
Direct Object	the student <u>who John met</u>
Indirect Object	the student <u>who John gave a book to</u>
Object of Preposition	the student <u>who John sat near</u>
Possessive	the student <u>whose friends were absent</u>
Object of Comparison	the student <u>who John is taller than</u>

In order to achieve relativization, languages may use two strategies, namely a gap strategy or a resumptive retention strategy. Relative clauses in English use the gap strategy (19). By contrast, in other languages such as Greek, Arabic and Mandarin, relative clauses include a resumptive pronoun (such as *-uh* in 20 from Jordanian Arabic). According to Sells (1987), resumptive pronouns are bound pronouns that refer back to previously

mentioned antecedents. The function of resumptive pronouns is to facilitate the identification of the grammatical relation of the antecedent within the clause (Keenan and Comrie, 1977).

19. a. I bought the house that I saw \_\_\_ in the ad.

b. 'I bought the house that I saw *\*it* in the ad.'

20. a. *ijftre-t*      *il-beit*      [*illi* *ʃuf-t-uh* *bil-iʃlan*]

bought-I    the-house    [that saw-I-*it*    in-the ad]

'I bought the house that I saw *\*it* in the advertisement.'

b. *\*ijftre-t*      *il-beit*      [*illi* *ʃuf-t-\_\_* *bil-iʃlan*]

bought-I    the-house    [that    saw-I-\_\_ in-the ad]

As illustrated in (19), only the gap strategy is used in English relative clauses (19a), as it can be noticed that the use of a resumptive pronoun (such as *it* in 19b) is ungrammatical. By contrast, example (20a) shows that Jordanian Arabic relative clauses follow the resumptive pronoun strategy, and the use of the gap in the relative clause is ruled out (20b). Languages differ in the exact way in which these strategies alternate. In English, for instance, the gap strategy is used in all types of relative clause, whereas in Mandarin both strategies are used.

Generative syntactic theory proposes that different operations can be involved in the derivation of *wh*-constructions. According to Chomsky (1977, 1981, 1986), *wh*-constructions in English are derived through *wh*-movement because they involve three basic properties: a gap, long-distance relations, and sensitivity to relevant island constraints. The first two properties are illustrated in sentence (21) from Aoun and Li (2003, p.99).

21. The boy [*who*<sub>i</sub> Mary thinks [*t*<sub>i</sub> is the smartest]]

As can be noticed in (21), the relative clause in English includes a gap (*t* in 21) which is associated with the relative pronoun *who* in a long-distance relation (across clause boundaries). Besides, as illustrated in (19b), the gap in English cannot be filled by a resumptive pronoun. This provides a piece of evidence

that the structure of English relative clauses involves wh-movement. The next section presents the derivation of embedded wh-questions in English and provides further evidence for wh-movement in English related to island constraints on movement.

### 2.2.2 English embedded wh-questions and island constraints

An embedded question is a question that appears as a subordinate clause in a declarative sentence or in another question. English main wh-questions include subject-auxiliary inversion (22b), whereas in embedded wh-questions no subject-auxiliary inversion is involved (22c). Like English relative clauses, English embedded wh-questions are derived through wh-movement (Chomsky, 1977, 1981, 1986).

22. a. This girl will dance with Mark.  
b. Who<sub>i</sub> will this girl dance with  $t_i$ ?  
c. I wonder [<sub>CP</sub> who<sub>i</sub> [<sub>IP</sub> this girl will dance with  $t_i$ ].

Sentence (22c) shows that similar to relative clauses, embedded wh-questions in English include a gap which is related to the relative pronoun *who* in a long-distance relation. This suggests that embedded wh-questions in English are also derived by movement.

It has been observed that wh-movement is not free. Instead, it is governed by syntactic constraints (Ross, 1967). That is, wh-phrases cannot be extracted (moved) from certain syntactic domains, known as islands. According to Radford (2004, p.175), this metaphor means that “any constituent which is on an island is marooned there and can’t be removed from the island by any movement operation of any kind”. Islands include, among others, complex NPs (23), relative clauses (24), wh-island (25), and adjunct clauses (26).<sup>2</sup>

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<sup>2</sup> Islands are typically distinguished between *weak* and *strong*, this distinction does not relate to the degree of ungrammaticality but to the observation that some islands (e.g., complex NP) are absolute, i.e., never allow extraction, while others (e.g., wh-islands) allow extractions when certain conditions are met (for discussion see e.g., Cinque, 1990; Manzini, 1994; Rizzi, 1990; Ross, 1967; Starke, 2004; Szabolsci, 2006; among many others).

23. \*Who did you spread [a rumour that this girl danced with \_\_\_\_]?

24. \*Who did you meet a girl [that danced with \_\_\_\_]?

25. \*Who did you wonder [whether this girl danced with \_\_\_\_]?

26. \*Who did you meet this girl [after she danced with \_\_\_\_]?

(Belikova & White 2009:201)

In order to account for the ungrammaticality of island violation, Chomsky (1973) proposed the Subjacency Principle, which is considered a unified account of the violation of movement. It captures the different kinds of islands in a uniform way (Belikova & White 2009). According to this principle, a wh-phrase cannot move over two bounding nodes. These nodes are TP (or IP) and DP (or NP). In other words, a wh-phrase extracted from an embedded clause to the matrix clause should proceed in short steps and it cannot cross more than one bounding node at the same time. For example, based on this principle, the following sentence is ungrammatical because the wh-phrase *who* crosses two bounding nodes and thus violates the Subjacency Principle.

27. \*This is the man [<sub>CP</sub> who<sub>i</sub> [<sub>IP</sub> Mary told me [<sub>CP</sub> when [<sub>IP</sub> she will visit t<sub>i</sub>]]]] (wh-island)

(Hawkins & Chan, 1997, p.210)

As mentioned earlier, sensitivity to island constraints counts as evidence for wh-movement (Chomsky, 1977; Cinque, 1990; Hofmeister & Sag, 2010; Rizzi, 1990). Thus, the sensitivity of English wh-sentences such as (27) to the Subjacency Principle provides further evidence that English wh-sentences are derived through movement.

Wh-sentences have long been of interest to researchers in psycholinguistics due to the pattern of filler-gap dependencies they include (Hawkins, 1999). The relationship between the dislocated wh-phrase and its associated gap is known as a “filler-gap dependency”. The wh-phrase is the “filler”, in that this noun notionally “fills” the gap in a relative clause (28) or a wh-

question (29). The filler-gap dependency relationship is the same as the wh-word and trace relationship, but from the perspective of processing rather than syntactic structure.

28. I saw the thief [who the policeman arrested \_\_\_\_].

*filler*

*gap*

29. Who did the policemen arrest \_\_\_\_?

*filler*

*gap*

Fillers and gaps are dependent on each other as the interpretation of the gap is determined by the filler (e.g., Crain and Fodor, 1985; Fodor, 1989). For example, in (28), the thematic role standardly assigned locally to the gap position is interpreted in association with the filler *who*. Sentence processing research has focused on filler-gap dependencies to shed light on the psycholinguistic reality and underlying mechanisms of the proposed wh-movement structures described above (e.g., Frazier and Clifton, 1989; Gibson and Warren, 2004; Marinis et al., 2005). Moreover, successful establishment of filler-gap dependencies is bound to involve memory mechanisms of storage and/or retrieval and can thus shed light on fundamental issues of the interaction of grammatical restrictions and memory and processing mechanisms more generally (Cunnings, 2017; Gibson, 1998). For example, the fact that islands impose absolute limit on the possibility to establish intra-sentential relations between fillers and otherwise suitable thematic role assigners is of direct relevance for a theory of how structural representations are accessed and navigated when processing sentences and therefore of whether memory search is directly constrained by the grammar (e.g., Harrington and Sawyer, 1992). Some related studies will be presented in Chapter 4.

Since the first languages of the participants in the present thesis are Jordanian Arabic and Mandarin, the following sections provide a description of relative clauses and embedded wh-questions in these languages.

## 2.3 Wh-dependencies in Jordanian Arabic

### 2.3.1 The structure of relative clauses in Jordanian Arabic

Jordanian Arabic is one of the colloquial dialects of Modern Standard Arabic. It exhibits two word orders: SVO and VSO orders (e.g., El-Momani, 2010; El-Yasin, 1985; Jarrah, 2019).<sup>3</sup>

30. a. il-walad    hall                            is-suʔa:l            (SVO word order)  
      the-boy    answered.3sg.mas    the-question  
      ‘The boy answered the question.’

      b. hall                            il-walad    is-suʔa:l            (VSO word order)  
          answered.3sg.mas the-boy    the-question  
          ‘The boy answered the question.’

The VSO word order is considered by syntacticians to be the basic word order in Jordanian Arabic from which the SVO order is derived due to topicalization and pragmatic purposes such as contrastive emphasis (El-Yasin, 1985; Saidat, 2013; Suleiman 1985). Generally, VSO word order in Arabic is used when subjects have a dynamic or event-stating predicate, whereas SVO word order is commonly used when the predicate is descriptive of a state or circumstance (Holes, 2004).

Relative clauses in Jordanian Arabic can be formed using the two types of word order, namely, SVO (31a) and VSO (31b).

31. a. il-maʔal    [illi    abu-i            iftara                    is-saʕa    min-**nuh**]  
      the-shop    that father-my    bought.3sg.mas    the-watch from-it  
      ‘the shop that my father bought the watch from’

      b. il-maʔal    [illi    ifatra                    abu-i                    is-saʕa    min-**nuh**]  
          the-shop    that bought.3sg.mas father-my    the-watch from-it  
          ‘the shop that my father bought the watch from’

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<sup>3</sup> The judgments on Jordanian Arabic examples in this thesis are based on the researcher’s native intuition and were verified by other Jordanian Arabic speakers.

As can be noticed from (31a-b), relative clauses in Jordanian Arabic are head initial like English. They follow the antecedent they modify (*il-mahal* 'shop' in 31). In addition, the examples show that two word orders are allowed in relative clauses in Jordanian Arabic. Moreover, it can be noticed that in both word orders a resumptive pronoun (*-nuh*) that refers to the relativized head is attached to the preposition *min* 'from'. In brief, the SVO and VSO word orders can be used in Jordanian Arabic relative clauses.

Furthermore, similar to English, Jordanian Arabic allows both restrictive relative clauses (32) and non-restrictive relative clauses (33).

32. *il-ustath* [illi *bedars-na tari:x ghayeb elyom*]  
 the-teacher.mas that teaches-us history absent today  
 'The teacher who teaches us history is absent today.'

33. *hke-t mʕ Masa,* [illi *bt-akhod mʕ-i syntax*]  
 called-I with Masa, that she-studies.fem with-me syntax  
 'I called Masa who studies syntax with me.'

Like the case in English, the function of the restrictive relative clause (32) is to restrict the referent, whereas the function of the non-restrictive relative clause (33) is to provide a description or extra information that can be deleted without affecting the referent's identity.

As mentioned before (Section 2.2.1), six positions can be relativized in English: subject, direct object, indirect object, object of preposition, possessive, and object of comparison. All these positions can be relativized in Jordanian Arabic as well (34-39).

#### 34. Subject position

*il-ustath* [illi *kan ghayb*] *hidr il-idʒtimaʕ*  
the-teacher.mas. [that was.mas absent.mas.] attended the-meeting  
 'The teacher that was absent yesterday attended the meeting.'

### 35. Direct object position

iftre-t il-beit [illi fuf-t-**uh** bil-iʕlan]  
bought-I the-house [that saw-I-**it** in-the-ad]  
'I bought the house that I saw in the advertisement.'

### 36. Indirect object position

juft il-hadaia [illi aʕta-**ha** il-ustath l-t-taliba]  
saw-I the-present [that he-gave-**it** the-teacher to-the-student]  
'I saw the present that the teacher gave to the student.'

### 37. Object of preposition position

iftre-t il-kutub [illi hka-li ʕan-**hum**]  
bought-I the-books [that told.3ms-me about-**hum**]  
'I bought the book that you told me about.'

### 38. Possessive

iz-zalameh [illi saʕat-**uh** ghalia] haka mʕ-i  
The-man [whose watch-**his** expensive] talked.3ms. with-me  
'The man whose watch is expensive talked to me.'

### 39. Object of comparison

il-bint [illi Faris asraʕ minn-**ha**] farak b-il-sibaqa  
the-girl [that Faris faster than-**her**] participated.3fs. in-the-race.  
'The girl that Faris is faster than participated in the race.'

The examples (34-39) show all the possible positions that can be relativized in Jordanian Arabic. Additionally, the sentences show that resumptive pronouns (which were highlighted in bold in (35-39) are used in all types of relativization except subject position (34). The use of this pronoun is obligatory in all these positions. Consider the examples in (40-41), which are versions of (35-36) that omit the resumptive pronouns (indicated by Ø). The sentences are ungrammatical as a result.



40. \*iftre-t    il-beit        [illi    fuf-t Ø    bil-iʕlan]  
           bought-I    the-house    [that    saw-I    in-the-ad]

41. \*juft        il-hadia        [illi    aʕta Ø    il-ustath        l-t-taliba]  
           saw-I        the-present [that    he-gave the-teacher    to-the-student]

The resumptive pronoun in Jordanian Arabic is a clitic pronoun that can be attached to a verb (36), to a preposition (37), or to a noun (38). Besides, it can be noticed that only one relative marker is used in all positions in (34-39), namely, *illi*.

*illi* in Jordanian Arabic relative clauses is a complementizer that is used regardless of the number and gender of the relativized head. According to Al-Momani (2010), *illi* neutralizes case, number and gender so that it is used for masculine (e.g., *il-ustath* ‘the teacher.mas’ in 34) and feminine (e.g., *il-bint* ‘the girl’ in 39), singular and plural (e.g., *il-kutub* ‘the books’ in 37) and all different grammatical cases. Al-Momani also observed that the preceding noun heads in Jordanian Arabic relative clauses lose their structural cases. The agreement according to number and gender is shown between the noun head and the verb that follows the relative complementizer *illi*, as illustrated in (42) from Al-Momani (2010, p.233).

42.    fuft                    **l-walad**            illi        **gara**            l-ktab  
           saw.1ms            the-boy-3ms    that    read.3ms    the-book  
           ‘I saw the boy that read the book came.’

In sentence (42), it can be noticed that *l-walad* ‘the boy’ agrees with the verb *gara* ‘read’ in number (singular) and gender (masculine). It could be also noticed that the case is left unmarked in Jordanian Arabic. Al-Momani argued that the relative complementizer *illi* is neutralized for reasons of economy. Following the indefinite head noun in (43), inclusion of *illi* renders the sentence ungrammatical (in contrast to the definite version in (42)).

43.    fuft            **walad**        (\*illi) gara            l-ktab  
           saw.3ms boy-3ms    that    read.3ms    the-book  
           ‘I saw a boy that read the book.’

Al-Momani argued that the difference between the sentences in (42) and (43) is that the preceding DP is definite in (42), but indefinite in (43). Thus, Al-Momani concluded that the relative complementizer *illi* is the reflex of the definiteness feature [+def].

Because the relation between the preceding DP and the relative clause in Jordanian Arabic is a noun-modifier relation (i.e., the modifier has to agree with the modified DP in definiteness) the presence/absence of the relative complementizer *illi* in definite/indefinite cases can thus be attributed to agreement with the [+def] feature.

With respect to the derivation of relative clauses, crosslinguistically, the existence of resumptive pronouns in relative clauses is taken as evidence of lack of *wh*-movement in previous studies (Aoun, Benmamoun & Choueiri, 2010; Chomsky, 1977; Haegeman, 1994; Hawkins & Chan, 1997; Prentza, 2012). This is because as illustrated before, the surface word order in *wh*-sentences derived by *wh*-movement should include a gap in the position of the displaced *wh*-phrase (Chomsky, 1977, 1981, 1986). Following this account, Jordanian Arabic relative clauses are considered by syntacticians to be base generated with a resumptive pronoun in the extraction site (e.g., Al-Momani, 2010). Thus, no movement is involved in the derivation of relative clauses in Jordanian Arabic.

### 2.3.2 Embedded *wh*-questions and island constraints in Jordanian Arabic

Like relative clauses, embedded *wh*-questions in Jordanian Arabic can also be formed using the two word orders used in declarative sentences, namely, SVO and VSO.

44. a. il-ustath      saʔal    emta   il-walad   hall            is-suʔa:l    (SVO)  
          the-teacher    asked    when the-boy    answered   the-question  
          ‘The teacher asked when the boy answered the question.’

b. il-ustath      saʔal    emta    hall            il-walad   is-suʔa:l    (VSO)  
          the-teacher    asked    when    answered   the-boy   the-question  
          ‘The teacher asked when the boy answered the question.’

Embedded wh-questions in Jordanian Arabic include the particle *illi* when the wh-phrase functions as the subject or object of the clause (Al-Momani and Al-Saidat, 2010). Consider example (45) where the wh-phrase *mi:n* ‘who’ functions as the object of the verb *gabalat* ‘met’.

45. um-i            saʔlat mi:n illi il-binit    gabalat-uh  
 my-mother    asked    who    that the-girl    met-him  
 ‘My mother asked who the girl met.’

It can be noticed that in (46), the wh-phrase *mi:n* ‘who’ does not move from the object position of the verb *gabalat* ‘meet’ because this position is already filled by the obligatory resumptive pronoun (-uh). When the wh-phrase *mi:n* is fronted, the resumptive pronoun is obligatory (45). When the wh-phrase *mi:n* remains in situ as in (46), there is no need for the resumptive pronoun.

46. um-i            saʔlat il-binit    gabalat    mi:n  
 mother-my    asked    the-girl    met        **who**  
 ‘My mother asked who the girl met.’

As illustrated before (Section 2.2.1), wh-constructions that are derived through movement should include a gap in the position of the displaced wh-phrase (Chomsky, 1977, 1981, 1986). Therefore, similar to relative clauses in Jordanian Arabic, the obligatory use of resumptive pronouns in embedded wh-questions (such as 46) in Jordanian Arabic shows evidence that they are not generated by wh-movement. In their analysis of Lebanese Arabic and Standard Arabic, Aoun et al. (2010) also argued that wh-movement does not take place when Arabic questions include a resumptive pronoun.

Further evidence for the no-movement account in Jordanian Arabic comes from the absence of subjacency effects in wh-constructions. Jordanian Arabic contrasts strikingly with English in terms of Subjacency Principle. For instance, while sentence (47) is grammatical in Jordanian Arabic, its English counterpart is ungrammatical due to subjacency violation.

47. hatha il-mahal [illi hkt-li om-i emta rah t-zur-uh<sub>i</sub>]  
This the-shop that told-me mother-my when will she-visit-it  
'\*This is the shop that my mother told me when she will visit.'

This provides further evidence that there is no *wh*-movement in Jordanian Arabic. Therefore, it can be concluded that English *wh*-constructions and their counterparts in Jordanian Arabic are derived by different syntactic operations: in English, *wh*-movement is used, whereas in Jordanian Arabic no movement is involved.

In a nutshell, this section has discussed the structure of relative clauses and embedded *wh*-questions in Jordanian Arabic. It shows that relative clauses in Jordanian Arabic are right branching. They follow the antecedent and modify it. This section has also highlighted a distinctive feature of Jordanian Arabic relativization related to the overt use of the relative marker based on the definiteness of the relativized head. Finally, it has been illustrated that the obligatory use of resumptive pronouns and the absence of subjacency effects in the derivation of *wh*-dependencies are taken as evidence that Jordanian Arabic lacks *wh*-movement.

The next section describes *wh*-dependencies in Mandarin.

## **2.4 Wh-dependencies in Mandarin**

### **2.4.1 The structure of relative clauses in Mandarin**

Mandarin is a left-branching direction language. Thus, unlike English and Jordanian Arabic, Mandarin relative clauses are prenominal (head-final). They are left-joined to the antecedent that they modify (Chao, 1968; Hawkins & Chan, 1997; Huang, Li & Li, 2009; Li & Thompson, 1981). Yan and Matthews (2017) suggested that relative clauses have a left-joined position because they are derived and treated as adjectives or adverbial phrases which precede the head nouns in Mandarin and modify them. The basic structure of Mandarin relative clauses is schematized in (48) and illustrated in (49)<sup>4</sup>.

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<sup>4</sup> Mandarin examples listed in this chapter are either cited from previous research or created and checked by native Mandarin syntacticians.

48. Relative Clause + DE + Determiner Phrase (serving as head)

(Yang, 2016, p.11)

49. [Zhangsan kan guo de] na fu hua  
Zhangsan see ASP DE that CL picture  
'the picture that Zhangsan has seen'

(Yuan and Zhao, 2005, p.221)

In (49), the relative clause *Zhangsan kan guo de* 'that Zhangsan has seen' is placed before the antecedent *hua* 'picture'.

Mandarin relative clauses are marked by the complementizer *DE* which precedes the modified noun phrase (50) (Cheng, 1986; Downing, 1978; Li and Thompson, 1989). *DE* has a connective function, and it is always present after the relative clause, so its use in Mandarin relative clauses is obligatory. This means that there is no zero relativiser in Mandarin relative clauses (Li and Thompson, 1989, p.580).

50. [tamen zhong **de**] shuǐguǒ  
[they grow **DE**] fruit  
'the fruit that they grow'

To the best of the researcher's knowledge, there is no effect of definiteness on the use of the relative marker in Mandarin relative clauses, unlike Jordanian Arabic. Therefore, no more details about the definiteness in relation to Mandarin relative clauses will be provided.

Similar to English and Jordanian Arabic, two types of relative clause can be used in Mandarin, namely, restrictive and non-restrictive (Chao, 1968; Del Gobbo, 2010; Huang, 1982; Ming, 2010, 2012).

51. a. [dai yanjin de] na ge nianhai (Pre-demonstrative RCs)  
[wear glasses DE] that CL boy  
'the boy who wears glasses'  
b. na ge [dai yanjin de] nianhai (Post-demonstrative RCs)  
that CL [wear glasses DE] boy  
'the boy who wears glasses'

(Ming, 2010, p.323)

It can be noticed that a relative clause in Mandarin may appear in two positions in terms of its relation to a demonstrative expression (such as *na ge nianhai* ‘that boy in 51). It can either precede (51a) or follow demonstrative expressions (51b). Pre-demonstrative relative clauses (51a) are considered restrictive, while post-demonstrative relative clauses are non-restrictive (51b) (Chao, 1968; Huang, 1982; Ming, 2010). However, similar to English and Jordanian Arabic, the distinction between restrictive and non-restrictive relative clauses in Mandarin is also determined by the context (e.g., Hsu, 2017). For example, according to Hsu (2017), without context (52a) suggests that the speaker has more than one father, which is contrary to the intended interpretation.

52 a.\* wo [jianchi zhu zai xiangxia de] na-ge laoba  
 My [insist live at countryside DE] that-CL father  
 ‘my father who insists on living in the countryside’

b. wo [jianchi zhu zai xiangxia de] na-ge laoba bu  
 My [insist live at countryside DE] that-CL father not  
 zhi shenme-shihou yuanyi bandao chengli he women zhu!  
 know when willing move city with us live  
 ‘My father, who insists on living in the countryside, [I] don’t know  
 when he will be willing to move to the city to live with us!’

(Hsu, 2017, p. 73)

However, the same expression in (52b), with an intended non-restrictive interpretation, is considered acceptable within context (Hsu, 2017).

As far as the relativized positions in Mandarin are concerned, the six types of relative clause that are found in English and Jordanian Arabic can be relativized in Mandarin as well. Some Mandarin relative types include a resumptive pronoun that facilitates the specification of the head noun (such as *ta* in 53) (Huang et al., 2009; Li & Thompson, 1981).<sup>5</sup>

53. Wo jiao (ta) yingwen de na-ge xuesheng  
 I teach (her) English DE that-CL student  
 ‘the student that I teach English’

(Yang, 2016, p.17)

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<sup>5</sup> The brackets indicate that the use of the resumptive pronoun is optional.

However, the resumptive pronoun vs. gap strategies in Mandarin relative clauses are not in complementary distribution, as in the case of Jordanian Arabic. As explained before, resumptive pronouns occur in all relative clause types in Jordanian Arabic except subject relative clauses. In Mandarin relatives, on the other hand, the resumptive pronoun is optional in subject relatives (54) and object relatives (55 & 56), and obligatory in the object of preposition relatives (57), possessive relatives (58) and object of comparison relatives (59) (e.g., Chao, 1968; Huang et al., 2009; Li & Thompson, 1981).

**54. Subject relatives**

wo juede (ta) xihuan shuxue de na-ge xuesheng  
 [I think (he) like math DE] that-CL student  
 'the student that I think likes math'

**55. Direct object relatives**

wo taoyang (ta) de na-ge nanhai  
 [I hate (him) DE] that-CL boy  
 'the boy that I hate'

**56. Indirect object relatives**

na-ge laoban zhipai (ta) henduo gongzuo de mishu  
 [that-CL boss assign (her) many job DE] secretary  
 'the secretary that the boss assigns many jobs to'

**57. Object of preposition relatives**

Xiaoming gen ta chao-guo-jia de na-ge tongxue  
 [Xiaoming with him quarrel-PAST-fight DE that-CL] classmate  
 'the classmate that Xiaoming quarrelled with'

**58. Possessive relative clauses**

wo xihuan tade yangtai de na-dong gongyu  
 [I like its balcony DE] that-CL apartment  
 'the apartment that I like its balcony'

59. **Object of comparison relatives**

Xiaoming bi ta ai de na-ge nanhai  
 [Xiaoming than her short DE] that-CL boy  
 ‘the boy that Xiaoming is shorter than’

Two proposals have been put forward to account for the derivation of Mandarin relative clauses, namely, movement vs. no movement (also known as base generation). Some researchers (e.g., Aoun & Li, 2003; Huang et al., 2009) assume that Mandarin relative clauses are derived by wh-movement (60).

60. [NP[CP[IPWO mai [NP*t*] de]] [HeadShu]<sub>i</sub>]  
 I buy DE book  
 ‘The book which I bought’

(Aoun & Li, 2003, p.175)

Other researchers (e.g., Yang, 2008; Yang et al., 2020), by contrast, argue that movement is not involved in the derivation of relative clauses in Mandarin. According to Yang (2008) and Yang et al. (2020), English relative clauses include a wh-trace, whereas Mandarin counterparts involve an empty pronoun. In short, according to this account, Mandarin relative clauses are derived by external merge and what is assumed to be a gap in Mandarin relative clauses is an unexpressed (null) resumptive pronoun (*pro*). Consider example (61) from Yang et al. (2020, p.5) where the NP *na-ge ren* ‘the person’ is coindexed with a *pro* inside the relative IP.

61. [NP[CP[IP Lisi bu xihuan *pro*]<sub>i</sub> de] [NP na-ge ren]<sub>i</sub>]  
 not like De that-CL person  
 ‘the person<sub>i</sub> [that Lisi doesn’t like *t*<sub>i</sub>’

Other researchers (e.g., Hawkins & Chan, 1997; Huang, 1995) claim that Mandarin relative clauses share some properties with topicalized structures. They assume that in Mandarin relative clauses, a null topic is generated in situ in CP, and that the null topic is coindexed with the relativized head and binds a pronominal in the embedded clause. That pronominal can be optionally null, as in object position (62) or obligatorily null (as in subject position). Thus,



according to this account, Mandarin relative clauses do not involve wh-movement.

62. [CP Top<sub>i</sub> [IP wo xihuan pro<sub>i</sub>/tai] de] neige nuhai<sub>i</sub>  
 null topic I like pro/her DE the-girl  
 ‘The girl who I like’

(Hawkins & Chan, 1997, p.195)

In brief, different proposals provide different accounts regarding the derivation of relative clauses in Mandarin. In the present thesis, the non-movement analysis of relative clauses in Mandarin is adopted, supported by the absence of subjacency effects in Mandarin, as outlined in the following section.

#### 2.4.2 Embedded wh-questions and island constraints in Mandarin

Wh-phrases in Mandarin main-clause questions (63b) and embedded questions (63c) stay in situ (sentence 63c is from Huang, et al, 2009, p.262).

63. a. Lisi mai-le **shu**  
 Lisi buy- ASP **book**  
 ‘Lisi bought shoes.’
- b. Lisi mai-le **shenme**  
 Lisi buy- ASP **what**  
 ‘Lisi bought what?’
- c. Zhangsan xing-zhidao Lisi mai-le **shenme**  
 Zhangsan wonder Lisi buy- ASP **what**  
 ‘Zhangsan wonders what Lisi bought.’

As represented in (63), the wh-phrase *shenme* ‘what’ in the main-clause question (63b) and in the embedded question (63c) remains in its base position (the object position of the verb *mai-le* ‘bought’) and do not move to Spec-CP. This suggests that Mandarin is a wh-in-situ language.

Another piece of evidence which suggests that wh-movement does not operate in Mandarin is that Mandarin sentences whose English equivalents

would violate the Subjacency Principle are grammatical in Mandarin, as illustrated in (64) (Yang et al., 2020, p.19).

64. [e<sub>j</sub> jiao-guo ei de xuesheng<sub>i</sub> dou kaoshang-le daxue] de na-wei  
teach-ASP De student all be-admitted-ASP universityDe that-CL  
laoshi<sub>j</sub>  
teacher  
'the teacher<sub>i</sub> that [all the students<sub>j</sub> [whom \*(he<sub>i</sub>) had taught t<sub>j</sub>] were  
admitted to universities]'

The fact that a sentence like (64) which violates the Subjacency Principle is grammatical in Mandarin provides further evidence against a wh-movement analysis of wh-constructions in Mandarin.

The next section summarises the key similarities and differences between English, Jordanian Arabic and Mandarin wh-dependencies.

## **2.5 Summary of the key similarities and differences in wh-dependencies in the languages involved**

English, Jordanian Arabic and Mandarin are typologically unrelated languages. English is an Indo-European language, Arabic is a Semitic language, while Mandarin is a Sino-Tibetan language.

As far as the structure of relative clauses is concerned, English and Arabic relative clauses are head initial, they follow the antecedent they modify. By contrast, Mandarin relative clauses are head final; they precede the antecedent. Further, the relative marker in English relative clauses can be a relative pronoun or a relative complementizer; whereas the relative marker in Jordanian Arabic and Mandarin is a complementiser, and these languages lack a relative pronoun. However, it has been illustrated that only in Jordanian Arabic, the use of the relative complementiser is dependent on the definiteness of the relativized head.

With regard to the derivation of relative clauses and embedded wh-questions, in English, these constructions are derived by wh-movement, which is subject to the Subjacency Principle. By contrast, in Jordanian Arabic and Mandarin, they are base-generated, and they can include a resumptive

pronoun, unlike English. The use of resumptive pronouns and the absence of subjacency effects in Jordanian Arabic and Mandarin *wh*-dependencies are taken as evidence that there is no *wh*-movement in these languages. Table (2) compares *wh*-dependencies in the three languages.

**Table 2.** A summary of the comparison between English, Jordanian Arabic and Mandarin *wh*-dependencies.

	English	Jordanian Arabic	Mandarin
Head-initial (right branching)	Yes	Yes	No
Relative pronoun	Yes	No	No
Relative complementiser	Yes	Yes	Yes
Resumptive pronoun	No	Yes	Yes
Definiteness effect	No	Yes	No
Subjacency Principle	Yes	No	No
<i>Wh</i> -movement	Yes	No	No

## 2.6 Conclusion

This chapter has described the *wh*-dependency structures in English, Jordanian Arabic and Mandarin. It has presented the different types of relative clause and relative marker in each language and has discussed the strategies (gap vs. resumptive pronoun) used to form *wh*-dependencies in each language. In addition, the chapter has presented the derivational analysis provided for relative clauses and embedded *wh*-questions in the three languages with reference to island constraints. The chapter has provided evidence that English *wh*-dependencies involve *wh*-movement, whereas the equivalent structures in Jordanian Arabic and Mandarin do not. This key difference in structure plays an important role in the real-time processing experiments conducted in this study (to be reported in Chapter 5), and the interaction of definiteness with the presence or absence of the relative complementizer in Jordanian Arabic is important to the investigation of L1 transfer in relation to definiteness (to be reported in Chapter 6).

## Chapter 3

# Second language acquisition of the syntax of English wh-movement and island constraints

### 3.1 Introduction

The surface realization of wh-clauses (wh-questions, relative clauses) varies considerably across languages and is governed by structural restrictions which speakers are rarely, if ever, exposed to in an explicit form. For these reasons, the acquisition of wh-movement is connected to the foundational debate on the nature of grammatical knowledge and learnability and has therefore featured prominently in the L2 literature. This chapter provides a background of second language acquisition accounts and reviews a variety of hypothesis in generative linguistics that have been proposed to account for L2 acquisition. Then, the chapter reviews L2 studies that have investigated the acquisition of English wh-movement and island constraints. The chapter then provides a general discussion of the findings of previous research.

### 3.2 Second language acquisition theories

According to Chomsky (1981, 1986), there is an innate biological language faculty to human being called Universal Grammar (UG). Chomsky (1976, p.29) defined UG as “the system of principles, conditions, and rules that are elements or properties of all human languages”. This innate linguistic faculty guides the process of language acquisition and constrains the grammar of all languages (Chomsky, 1981, 1986). It also explains how children can develop a productive system that goes beyond the limited input they receive.

A key conceptualization of UG in the language acquisition context is via the Principles and Parameters model. According to this model, principles are universal structural features that can be applied to all languages, whereas parameters are options along which languages vary. Thus, parameters are responsible for the crosslinguistic variation among languages (Chomsky, 1981). A well-known example is the head parameter, which offers two options:

[head-initial] for languages where the head of the phrase structure precedes the complement (e.g., English) and [head-final] for languages where the head follows the complement (e.g., Mandarin). According to the Principles and Parameters model, a child is born with principles that apply to all languages, and the values of the parameters are developed when the child acquires his/her first language. Thus, a child acquiring L1 English will encounter abundant examples of head-initial phrases in the input, and will thus (unconsciously) set the headedness parameter to [head-initial], accordingly.

Generative second language acquisition research is concerned with the mental representations that underlie L2 production and comprehension. Generative second language acquisition theories have different predictions about whether UG is accessible in L2 acquisition about in the same way as in L1 acquisition. Partial access accounts propose that UG is partially available after puberty, so L2 learners who have passed a critical age of acquisition do not attain native-like competence in L2 acquisition (e.g., Flynn, 1987; Schachter, 1989; White, 1986). According to this account, partial access could be the reason for the observable fact that most L2 learners do not attain native-like competence. However, while non-native like attainment in L2 is typically observed, there is still a lot of debate about (i) what the critical age of second language acquisition is, and (ii) whether the grammar learning ability declines precipitously once the critical age of acquisition is attained, or steadily throughout adulthood. While some studies have reported a rapid discontinuity in the ability of L2 grammar learning beyond puberty (e.g., DeKeyser, 2000; Hyltenstam and Abrahamsson, 2003; Johnson and Newport, 1989; Schachter, 1989), other studies argue that native-like attainment in adult L2 language learning is still possible after puberty (e.g., Birdsong, 2007; Flynn, 1987; Hartshorne, Tenenbaum and Pinker, 2018). For example, a recent study by Hartshorne et al. (2018) suggests that L2 grammar learning ability remains active until the age of 17 approximately and then declines gradually.

A number of accounts fall into the category of the partial access hypothesis to UG. For example, the Failed Functional Features Hypothesis (Hawkins & Chan, 1997) proposes that the interlanguage grammar of L2

learners is permanently impaired and L2 properties (functional categories, such as CP, IP, DP, and relevant features such as a [+wh] feature) that are not instantiated in the L1 are claimed to be difficult to set in the L2. Similarly, the Representational Deficit Hypothesis argues that there is a critical period for the acquisition of any functional features, such as wh-feature, that differ between the L1 and L2 (Hawkins & Chan, 1997). Moreover, the Interpretability Hypothesis (Tsimpli and Dimitrakopoulou, 2007; Tsimpli and Mastropavlou, 2008) proposes that adult L2 learners can only acquire interpretable (semantic) features, which play a role in the semantic interpretation of lexical items (e.g., the plural feature on the noun in English such as *schools*). On the other hand, uninterpretable features, which affect the realization of syntactic structures, such as case and agreement, cannot be acquired if such features are absent in the learner's L1.

By contrast, accounts that propose full access to UG argue that adult L2 acquisition does indeed have access to the principles and parameters of UG. For example, the Full Transfer/Full Access Hypothesis (Schwartz and Sprouse, 1996) and the Feature Reassembly Hypothesis (Lardiere, 2008, 2009) argue that at the initial state of L2 grammar, L2 learners unconsciously transfer all the L1's properties (functional categories, such as CP, IP, DP, and relevant features) to the L2. Then, the L2 input leads L2 learners to gradually restructure their grammar and acquire the target L2 functional categories and features. This means that L2 development is based initially on the L1, and that, even in adulthood, subsequent development is guided by UG. According to this account, advanced L2 learners can, in principle, acquire L2 structures even if these structures are not available in their L1. Thus, there is no critical age for L2 acquisition. However, the Full Transfer/Full Access Hypothesis and the Feature Reassembly Hypothesis do not guarantee convergence on a fully target-like L2 grammar. The L2 grammar may retain non-target-like properties if there is no input to motivate changing the L1-based grammar. Potentially relevant input may be obscured due to the presence of the L1 grammar.

L2 acquisition of wh-movement and island constraints have been of interest to researchers concerned with the accessibility of Universal Grammar

to adult L2 learners. Sensitivity to island constraints on wh-movement by adult L2 learners would be via access to UG (White, 2003). Therefore, sensitivity to island constraints on wh-movement, in particular from native speakers of languages in which wh-elements appear *in situ*, has been taken as evidence for UG accessibility in L2 acquisition. If L2 learners do not show knowledge of these constraints, this may suggest that they do not have access to UG.

Generative second language acquisition theories have different predictions about the ability of L2 learners of English to acquire English wh-movement and island constraints. For example, partial access theories such as the Failed Functional Features Hypothesis and the Interpretability Hypothesis predict that post-critical-period L2 learners whose L1s lack the wh-feature cannot acquire syntactic island constraints on wh-movement because they did not acquire the wh-feature during the critical period. By contrast, proposals related to full access to UG (e.g., the Full Transfer/Full Access Hypothesis) argue that L2 learners can acquire this feature, regardless of their L1, if appropriate input is available. This chapter reviews a number of L2 English studies that have investigated the acquisition of English wh-movement and island-constraints in terms of two proposals related to the availability of UG access: the Partial Access Hypothesis and the Full Access Hypothesis.

### **3.3 Studies supporting the Partial Access Hypothesis**

#### **3.3.1 Bley-Vroman, Felix and Ioup (1988) (L1-Korean)**

Bley-Vroman et al. (1988) examined the acquisition of wh-movement and island constraints by native speakers of Korean, a language which does not exhibit syntactic wh-movement. Ninety two advanced adult Korean learners of English, who had learned English in the USA, completed a grammaticality judgement task. In addition, 34 native speakers of English completed the task as a control group. The grammaticality task included 32 sentences (17 ungrammatical and 15 grammatical). The grammatical sentences included adherence to wh-movement constraints and were used as a control. The ungrammatical sentences exemplify violations of wh-movement constraints such as wh-islands (65a), relative clauses (65b), and coordinate structures (65c).

65. a. \*What does Mary want to know [whether John has already sold \_\_\_]?  
b. \*Who did John buy the house [that \_\_\_ had recommended to him]?  
c. \*What does John like to eat [tomatoes and \_\_\_]?

Sensitivity to island constraints on wh-movement by adult Korean L2 learners would be considered as evidence for UG accessibility in L2 acquisition since wh-movement is not instantiated in their L1. According to White (1989, p. 46), "if learners attain knowledge which could not have come via their mother tongue, and which could not have been induced from the input alone, arguments for a role for UG in L2 acquisition are strengthened". Therefore, the argument of Bley-Vroman et al's study and the related studies reviewed below is as follows: L2 knowledge of syntactic constraints on wh-movement that goes beyond the L2 learners' L1 and the L2 input suggests that L2 acquisition is constrained by UG because there is not any other source for such knowledge.

The results of Bley-Vroman et al's study showed that L2 learners' performance on subjacency violations was less accurate than native speakers' performance; however, it was above chance. Bley-Vroman et al. considered this outcome to indicate that UG still operates in the L2, but in an attenuated form. They argued that the differences between L1 acquisition and L2 acquisition are due to two fundamentally different mechanisms applied in the linguistic development for each group. While child language acquisition has direct access to UG, adult L2 learners have indirect access to UG through the grammar of their L1. According to Johnson and Newport (1991), although Bley-Vroman et al's study provided evidence that UG may not be fully available to adult L2 learners, their study should be expanded before making a generalization about the access of UG because it used a limited set of test items (only 8 items were used to test subjacency).

### **3.3.2 Johnson and Newport (1991) (L1- Chinese)**

Johnson and Newport (1991) examined whether Chinese speakers' acquisition of the Subjacency Principle declines with age. Their study explored Chinese speakers' L2 knowledge of English wh-movement and their ability to detect subjacency violations to see if Chinese speakers obey subjacency even though they have never seen it apply in their L1. Therefore, if adult Chinese



speakers have access to UG, they should observe restrictions on wh-movement. Chinese speakers who had arrived in the USA between the ages of 4 and 38, adults at the time of testing, completed a grammaticality judgement task. The participants had been exposed to English at different ages, ranging from age 4 to adulthood. Those who arrived in the USA as adults had lived there for at least five years with daily exposure to the L2.

The grammaticality judgement task included ungrammatical wh-questions that involved violations of the Subjacency Principle and their grammatical counterparts. Three types of subjacency violations were tested: NP complements (66), relative clauses (67), and wh-islands (68).

- 66. a. The teacher knew the fact that Janet liked math.  
b. \*What did the teacher know the fact that Janet liked?
  
- 67. a. The policeman who found Cath should get a reward.  
b. \*Who should the policeman who found get a reward?
  
- 68. a. Sally watched how Mrs Gomez makes her cookies.  
b. \*What did Sally watch how Mrs Gomez makes?

The sentences in the grammaticality judgement task were presented aurally and the participants were asked to make a judgment about each sentence's grammaticality. As explained previously, the assumption that underlies this study and all of the studies reviewed in this chapter is that L2 learners of English should not demonstrate knowledge of subjacency constraints unless UG is still accessible. According to Johnson and Newport, if late arrivals, who arrived in the USA between the ages 18-38, did not show sensitivity to subjacency violations, it could be concluded that late exposure might lead L2 learners to violate language universals.

The results showed that the native controls rejected virtually all the sentences that included subjacency violations and occasionally rejected the control sentences. This distinction was much weaker in the Chinese group who arrived in the USA as adults. However, this group rejected the ungrammatical sentences more often than they rejected the control sentences and their

performance on subjacency was above chance. Overall, the results showed a non-native performance on subjacency for the Chinese participants of all ages of arrival. Johnson and Newport observed that there was a decline in the participants' performance according to the age of arrival. The earlier the Chinese learners of English had arrived in the USA, the better they were in detecting subjacency violations. Johnson and Newport argued that these results suggest that the human biological endowment for language acquisition seems to decline as the learners become increasingly mature. Based on this account, Johnson and Newport concluded that adult L2 learners do not have full access to UG because although they accepted control sentences that included grammatical extractions, they were inaccurate at rejecting subjacency violations. The acceptance of grammatical wh-movement controls that included fronting a wh-phrase does not necessarily provide evidence of access to UG because such knowledge could be acquired from the L2 input (e.g., White, 2003). As explained earlier, only sensitivity to wh-movement constraints can provide evidence of access to UG because this knowledge is unlikely to have come from the L1 or the L2 input including classroom instruction.

### **3.3.3 Hawkins and Chan (1997) (L1-Chinese/L1-French)**

Hawkins and Chan (1997) investigated the L2 acquisition of syntactic island constraints on wh-movement by Chinese and French speakers of English. A group of English native speakers participated in the study as controls. French is like English in that it exhibits wh-movement, whereas Chinese does not. Both Chinese and French speakers completed a grammaticality judgement task that tested their knowledge of the surface structure (69) and the underlying structure (70) of English relative clauses. The sentences in (69) compare grammatical use of gaps (69a) and ungrammatical use of resumptive pronouns (69b), and the sentences in (70) include subjacency violations in complex NP island (70a) and wh-island (70b).

69. a. The boy who I hit \_\_\_ broke the window.  
b. \*The actress I saw **her** was very famous.

70. a. \*This is the secretary who Peter heard [the news that the boss will marry \_\_\_].  
b. \*This is the lady who Richard told me [when he will meet \_\_\_].

Hawkins and Chan (1997) proposed that if Chinese learners of English acquired the wh-movement feature in English, they would be able to know that English relative clauses require gaps, not resumptive pronouns, in the surface structure. They should also know that subjacency violations are prohibited in the underlying structure of English relative clauses. However, Hawkins and Chan hypothesized that Chinese learners would not be able to acquire such knowledge because their L1 lacks wh-movement. On the other hand, they expected French learners to be able to acquire this feature in English, as French already has wh-movement. The results revealed that similar to the English native group, the French group had higher rates of rejection of the ungrammatical resumptive pronouns (69b) and a higher acceptance rate of the grammatical gaps (69a) than those of the Chinese group. The results also showed that the French group had high rates of rejection of the subjacency violations (70a-b), whereas the Chinese group had low rates of rejection. Moreover, the results indicated that unlike the Chinese group, the performance of the French group was not significantly different from English controls. Hawkins and Chan concluded that only the French group, whose L1 exhibits wh-movement, was sensitive to the subjacency constraints on wh-movement. Thus, Hawkins and Chan argued that these results show support to the Failed Functional Features Hypothesis which posits that beyond the critical period for language acquisition, functional features (such as [+wh]) that are absent from L1 would no longer be accessible for L2 acquisition.

### **3.3.4 Prentza (2012) (L1-Greek)**

Prentza (2012) explored the acquisition of English restrictive relative clauses by advanced Greek L2 speakers of English. Greek instantiates both movement and non-movement possibilities in restrictive relative clause formation, while English exhibits only movement structures. Greek allows resumptive pronouns and also structures that would result in subjacency violations in English. Based on this, Prentza predicted that Greek learners of English would not be able to acquire the [+wh] feature in English relative

clauses even at advanced stages. Adult Greek speakers (age range: 22-25) at an advanced level of English proficiency participated in this study in addition to a group of native speakers of English. The participants completed a grammaticality judgement task which consisted of 30 test items (20 grammatical and 10 ungrammatical) and 12 distractor items. The ungrammatical sentences included ungrammatical use of resumptive pronouns (71a) and subjacency violations (such as complex NP violation in 71b and wh-island violation in 71c).

71. a. \*I've heard the song [that the band asked their manager when they will record **it**].
- b. \*This is the employee whom Anna heard [the rumour that the boss will promote \_\_\_ ].
- c. \*I've just met the colleague [who(m) Michael asked me when Jenny argued with \_\_ ].

The results showed that Greek learners of English did not robustly reject the ungrammatical items in all the conditions in the task whereas the native English speakers' control did. Prentza argued that Greek learners' acceptance of items involving resumptive pronouns not only revealed the transfer of an L1 property of relative clause formation but also provided evidence that no movement is involved in the advanced Greek learners' L2 representations of relative clauses. The results suggested that advanced Greek learners fail to acquire the [+wh] feature specification of English relative clauses. Therefore, the findings of Prentza's study lend support to Hawkins and Chan's (1997) Failed Functional Features Hypothesis.

In brief, the work summarised above can be interpreted as evidence that adult L2 learners do not have full access to UG. Although L2 learners demonstrate knowledge of English word order in wh-questions and relative clauses as illustrated by their acceptance of grammatical wh-extraction, they still may accept violations of subjacency constraints. However, other studies provide counter evidence which suggests that L2 learners of English whose L1s lack overt wh-movement show similar performance to native speakers on

subjacency violations. Such evidence suggests that adult L2 acquisition is indeed constrained by UG. Below is a discussion of some of these studies.

### **3.4 Studies supporting the Full Access Hypothesis**

#### **3.4.1 Li (1998) (L1-Chinese)**

Li (1998) compared the performance of two groups of Chinese L2 speakers of English in their acquisition of English wh-movement. The first group had lived in China, whereas the second group had been in the USA for 3 years at least. A group of native speakers of English also participated in the study as a control group. The participants completed a grammaticality judgment task which involved wh-movement out of four types of island: sentential subjects (72a), wh-islands (72b), relative clauses (72c) and NP-islands (72d).

72. a. \*What would [for your daughter to give up \_\_] be a pity?  
b. \*What might your friend ask [where I hid \_\_\_ last month]?  
c. \*What did that man buy [a hat that matches \_\_\_ ] in our stores?  
d. \*What are you interested in [his articles on \_\_\_ ]?

The results revealed a significant difference between the accuracy rates of the two Chinese groups. The Chinese group living in the USA was more accurate in rejecting subjacency violations than those who lived in China. No significant differences were found between the USA Chinese group and the English native speakers group. Thus, Li argued that learners' language proficiency helps in fully actualizing UG principles. Based on her findings, Li (1998) concluded that interlanguage grammars are constrained by UG principles.

#### **3.4.2 White and Juffs (1998) (L1-Chinese)**

White and Juffs (1998) investigated whether Chinese L2 speakers of English can recognize subjacency violations and whether their performance is affected by the learning environment. Two Chinese groups completed a grammaticality judgement task and a question formation task. The first group (the China group) included 16 Chinese L2 learners of English at a Chinese University. This group had never been outside China and their first significant exposure to English was as adults at university, before that they had received

formal instruction in English in high school. The second group (the Canada group) involved 16 Chinese speakers of English who emigrated to Canada when they were adults. 19 native English speakers also completed the task as controls. Both Chinese groups had a high level of English language proficiency. As explained before, if the L2 acquisition is constrained by UG, and if the China group had acquired wh-movement constraints, they would show sensitivity to island constraints.

The test items in the grammaticality judgement task included 30 ungrammatical sentences that involved island violations (such as wh-movement out of a complex NP in (73a)) and 30 grammatical sentences with equivalent complexity (such as grammatical wh-movement out of an embedded clause in (73b)).

73. a. \*Which article did you criticize [the man who wrote]?  
b. Which man did Jane say her friends like?

The question formation task included 19 declarative sentences, each of which contained an underlined word or phrase. The participants were asked to read each sentence and form a question about the underlined word or phrase. The wh-movement required to form wh-questions from some declarative sentences was expected to result in grammatical questions (74a) is the declarative sentence and (74b) is a potential grammatical response). Other sentences (75a) cannot be turned into wh-questions because the questions would violate island constraints (75b). The rationale here is that if the participants' L2 acquisition is constrained by UG, they would rephrase the question in order to avoid violating island constraints.

74. a. Tom claimed that Ann stole his car.  
b. What did Tom claim that Ann stole?
75. a. Sam believes the claim that Ann stole his car.  
b. \*What does Sam believe the claim that Ann stole?

The results of the grammaticality judgment task showed that the accuracy of rejecting subjacency violations by the two Chinese groups was not significantly different from each other nor from the native speakers of English. This suggests that the L2 learners observed the subjacency constraints in English. The results also suggested that the environment where a second language is acquired may not play a key role in attaining proficiency. Moreover, the results of the question formation task showed that both groups used long-distance wh-movement and short-distance movement in their formation of wh-questions and that only 6% of all responses contained violations of island constraints. Such results are best explained by the full-UG-access account.

### **3.4.3 Kim (2004) (L1-Korean L2-English) (L1-English L2-Korean)**

Kim (2004) conducted a bi-directional study on the acquisition of L2 wh-movement in English and Korean by native Korean and English speakers. The study mainly focused on the interlanguage initial syntax concerning wh-question constructions. As mentioned earlier, English and Korean have different parametric values regarding the wh-movement as wh-constructions in Korean are derived via wh-in-situ. 44 English-speaking learners of Korean and 48 Korean-speaking learners of English completed an elicited written-production task. Both groups were in their early stage of L2 learning. Two competing hypotheses were tested regarding the L2 initial state from minimalist perspective: (i) the Minimal Initial Syntax Hypothesis (Platzack, 1996), which posits that since UG pursues economy in syntactic derivation, movement is delayed as long as possible.<sup>6</sup> According to this hypothesis, at the initial state of L2 development, both L2 learners groups would start out their L2 wh-questions formation with wh-in-situ questions because it is more economical than wh-movement to Spec-CP, (ii) L1 Transfer Hypothesis which predicts that L2 learners will start out with their L1's wh-feature, so Korean L2 learners will start

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<sup>6</sup> Within the Minimalist Program (Chomsky 1995), Merge is the structure-building operation that takes two syntactic objects and combines them to create a single syntactic object. In Minimalism, Merge-over-Move is one of the economy principles which says that if the computational system has a choice between merging one element or moving another element, the Merge option is preferred.

out with *wh*-in-situ questions, whereas English L2 learners of Korean will start out with *wh*-movement questions.

The analysis of the elicited written-production task showed that the L1-English L2-Korean group produced target-like Korean *wh*-questions more than non-target *wh*-questions. In other words, English L2 learners of Korean tended to keep the *wh*-word in the base position, which cannot be explained by L1 transfer. On the other hand, the L1-Korean L2-English group predominantly formed *wh*-questions with fronted *wh*-words; however, the majority of these questions did not include subject-auxiliary inversion. Only fronted *wh*-questions that included subject-auxiliary inversion were considered evidence of the acquisition of the [+*wh*] feature because as illustrated before fronting *wh*-words alone does not mean that participants have acquired the *wh*-movement and the related constraints. According to Kim, the absence of subject-verb inversion is related to the absence of *wh*-movement at the participant's initial L2 syntax.

Kim argued that the results are in agreement with the Minimal Initial Syntax Hypothesis since both groups, who were at a beginning level of L2 learning, followed the most economical form of syntax where no movement is involved. The results also show support to the claim that adult L2 development is constrained by UG that pursues economy in syntactic derivations. This means that the findings of this study suggest that UG is accessible to adult L2 learners.

#### **3.4.4 Aldosari (2015) (L1-Arabic)**

Aldosari (2015) investigated the acquisition of syntactic island constraints on *wh*-movement in English by speakers of Najdi Arabic. Najdi Arabic does not have *wh*-movement similarly to Jordanian Arabic, as already seen in Chapter 2. The study attempted to see whether it is possible for L2 learners to acquire syntactic constraints that are not instantiated in their L1. A group of 72 Najdi Arabic-speaking advanced learners of English and a group of 82 English native speakers completed a grammaticality judgement task.

In his study, Aldosari tested two theories in generative second language acquisition: The Interpretability Hypothesis (Tsimplici and Dimitrakopoulou,



2007) and The Full Transfer/Full Access Hypothesis (Schwartz and Sprouse, 1996). According to the Interpretability Hypothesis, Najdi Arabic L2 learners cannot acquire syntactic island constraints on wh-movement as the wh-feature responsible for movement was not acquired during the critical period. According to the Full Transfer/Full Access Hypothesis, on the other hand, advanced adult L2 learners can acquire this feature, regardless of their L1, if appropriate input is available. Aldosari's study used a revised version of the grammaticality judgement task devised by Sprouse, Wagers and Phillips (2012). The task contained 64 sentences designed to examine the effects of four island types: adjunct islands (76), subject islands (77), complex NP islands (78), and whether islands (79). To reduce the processing difficulty of ungrammatical sentences that include island violation, Aldosari introduced a declarative background sentence (such as sentence *a* in (76-79)) to the participants to set up a context for the test sentence before they were asked to provide grammaticality judgements.

76. a. The secretary worries if the lawyer forgets the yellow folder at the office.  
 b. \*Which folder does the secretary worry [if the lawyer forgets\_\_ at the office]?
77. a. The woman thinks the gift from the famous actor caused a difficult problem.  
 b. \*Which actor does the woman think [the gift from\_\_ ] caused a difficult problem?
78. a. The fisherman denied the fact that Laura caught the big fish.  
 b. \*Which fish did the fisherman deny [the fact that Laura caught\_\_ ]?
79. a. The detective wonders whether Paul took the gold necklace.  
 b. \*Which necklace does the detective wonder [whether Paul took\_\_ ]?

The results revealed that similar to English native speakers, Najdi Arabic learners of English showed lower acceptability judgments of ungrammatical island violation sentences as compared to higher acceptability ratings for the grammatical sentences. This suggests that they were sensitive to syntactic island constraints on wh-movement in English although their L1 is a wh-in-situ

language. These results are difficult to account for without appealing to UG access. The results provide support for the Full Transfer/ Full Access Hypothesis which argues that L2 learners are not ultimately constrained by the properties of their L1. In this way, Aldosari's findings are similar to those of Li (1998) and White and Juffs (1998), providing further evidence from a different L1 group of L2 acquisition of the syntactic constraints on wh-movement.

### **3.5 Summary and discussion**

This overview has so far focused on a number of L2 studies on the acquisition of constraints on wh-movement. The main aim of these studies is to test whether adult L2 learners can reset L2 parameters that differ from those in the L1 and if they can approach the level of knowledge of abstract constraints possessed by native speakers of English. This is typically assessed by testing whether L2 learners are able to recognize as ungrammatical violations of island constraints. It could be noticed that these studies share three common elements. First of all, there is an underlying assumption that if L2 learners of English whose native languages do not exhibit wh-movement demonstrate sensitivity to violations of Subjacency Principle in English sentences, then UG must be available during their L2 acquisition as they cannot obtain this linguistic knowledge from the input. Second, they compare an experimental group of L2 learners of English whose L1 lacks wh-movement to a group of English native speakers who acts as a control group. Third, they tested L2 learners' knowledge of grammatical and ungrammatical wh-movement sentences to examine L2 learners' intuitions about the acceptability of sentences included subjacency violations and to check whether their ability to acquire such knowledge is influenced by the nature of their L1 grammar. In some cases, these studies included an elicited production task (e.g., Kim, 2004) or a wh-question formation task (e.g., White and Juffs, 1998).

However, the results of these studies, regarding the ability of L2 learners to acquire English wh-movement and island constraints are contradictory. While some studies have suggested that adult L2 learners are inaccurate at rejecting subjacency violations, other studies have shown successful rejection. However, failure in rejecting subjacency violations may relate to factors other

than the L2 learners' access to UG. For example, while the Chinese speakers of English in Johnson and Newport's (1991) study appeared to have partial access to UG, the Chinese group in White and Juffs' (1998) were assumed to have full access to UG. The difference in these studies' results could be due to different levels in English proficiency across participants. For example, in Johnson and Newport's study, the Chinese speakers of English who had the earliest age of arrival to the USA and reported a native-like performance could have a higher proficiency level than that of the Chinese group who arrived in the USA as adults. As discussed by White (2003), in Johnson and Newport (1991), it was assumed that the late arrivals had a high proficiency level because they had been in the USA for five years and they were expected to use English daily at the university. However, their proficiency level was not assessed at the time of the study to see whether their end-state competence was really high. According to Bialystok and Hakuta (1994), the length of residence (minimum 5 years) may not have been enough for the late arrivals in Johnson and Newport's (1991) study to have gained an ultimate attainment level. By contrast, White and Juffs (1998) showed that very proficient Chinese L2 learners of English who had acquired English as adults in China rejected subjacency violations with a high degree of accuracy, suggesting that native-like competence can be attainable even when L1 differs from L2 in the relevant respects. According to Belikova and White (2009), while Johnson and Newport (1991) concluded that adult L2 learners do not have (full) access to UG, Bley-Vroman et al. (1988) were "more cautious" and argued that Korean L2 learners of English performed at a level above chance, suggesting that UG operates in an attenuated form.

In the case of L1-Greek L2-English learners examined by Prentza (2012), since L1 Greek allows both movement and non-movement structures, then it could be difficult to rule out the non-movement option from learners' grammar. Evidence from English input will always be compatible with the movement grammar. However, that would not necessarily trigger deletion of the non-movement grammar, so when it comes to judging ungrammaticality, the participants could apply the non-movement grammar.

Contradictory results could also be due to design-related issues. For example, White (2003) highlighted the importance of providing some kind of context for the interpretation of questions. For example, it was seen in Aldosari (2015), who included context sentences in the grammaticality judgement task, that Najdi Arabic L2 learners of English were sensitive to syntactic island constraints. The context sentences could play a role in the participants' performance because according to Aldosari, including background sentences makes the processing of the test sentences easier because it removes the pragmatic oddity of presenting questions without a context. Although Johnson and Newport (1991) also included context sentences, the non-native like performance of the late arrivals could be due to the proficiency level of the participants, as discussed above, or from using an aural grammaticality judgment task which could have led to processing difficulties.

Finally, a common element in the studies described in this chapter is their use of offline judgement tasks. While acceptability judgments are a valuable tool for investigating acquisition, they are an offline measure and as such they are susceptible to be influenced by a number of factors which go above and beyond grammar (as e.g., judgments of plausibility, effects of world knowledge, lexical knowledge and pragmatics) and in particular they might involve a strategic component which could obscure some important aspects of the acquisition process. Kim, Baek and Tremblay (2015, p.385) argue that "Successful grammar acquisition is a complex task that involves not only knowing which structures are possible and which are not but also being able to put the acquired knowledge into real-time use in language comprehension and production." Therefore, recently, there has been a shift to investigate sentence processing in real time. This topic has received much attention in order to see how L2 learners process L2 input in real time and whether their processing strategies could be similar to native speakers. The next chapter reviews a number of studies that investigate L1 and L2 real-time processing of English sentences involving wh-dependencies.

### **3.6 Conclusion**

This chapter has provided an overview of related studies on the L2 acquisition of wh-movement and island constraints. It has been illustrated that some previous research suggests that L2 learners cannot acquire the wh-feature in the L2 if this feature is not instantiated in their L1. Other studies, on the other hand, argue that new structures are available to adult L2 learners and provided evidence that adult L2 learners whose L1 lacks overt wh-movement could show similar performance to native speakers in terms of their intuitions about the acceptance of grammatical wh-extraction and the rejection of ungrammatical ones. The discussion of the previous research illustrated that factors other than unconscious grammatical competence could have led to results that suggest lack of acquisition of wh-constraints.

In sum, despite the observable contradiction in previous results regarding the sensitivity of L2 learners to subjacency violation, previous research has provided robust evidence that adult L2 grammars instantiate abstract knowledge about the L2 that can neither have come from their L1 nor from the L2 input. Such results question any claims for the unavailability of UG in L2 acquisition.

# Chapter 4

## Processing of filler-gap dependencies

### 4.1 Introduction

The question of how L2 learners process sentences in real time is an important focus of current second language acquisition research. Studies on sentence processing have paid growing attention to investigation of the characteristics of L2 processing and the information they make use of during real-time sentence interpretation (e.g., Clahsen and Felser, 2006; Felser and Roberts, 2007; Juffs, 2001; Marinis et al. 2005; Roberts, Marinis, Felser and Clahsen, 2007; Roberts, 2012). Research in this field has compared the real-time sentence processing of L2 learners to that of native speakers in order to see if L2 learners can show native-like processing mechanisms.

Establishing intra-sentential dependencies involves the interaction of universal structural restrictions on the accessibility of antecedents (i.e., c-command) with storage and retrieval processes operating on a variety of features (e.g., animacy, gender, wh) which potentially vary across languages. This raises the question of how L1 and L2 speakers compare in their ability to use these features in real time and puts research into dependency formation in L1 and L2 at the centre of the debate concerning the interaction of universal and language specific factors in language acquisition and processing.

This chapter will serve as the basis for the investigation of L2 processing of filler-gap dependencies by L1 speakers of Jordanian Arabic and Mandarin, which will be reported in Chapter 5. The next section describes the structure of filler-gap dependencies and discusses key proposals related to their real-time processing in L1 and L2. Sections 4.3 and 4.4 review related studies on the English L1 and L2 real-time processing of filler-gap dependencies respectively. Section 4.5 provides a discussion on the asymmetry in subject vs. object relative clause processing that has been found irrespective of typology. Section 4.6 discusses potential effects of ambiguities in the processing of Mandarin dependencies. Finally, Section 4.7 provides an overview of research on the processing of gap-filler in L1 Mandarin.

## 4.2 Key proposals on L1 and L2 real-time processing

### 4.2.1 Key proposals on L1 real-time processing of filler-gap dependencies

As illustrated earlier in Chapter 2 (Section 2.2.2), filler-gap dependencies are long-distance syntactic dependencies where a constituent is displaced from its canonical position (which is defined in this thesis as the position where a constituent is assigned a thematic role) to a non-canonical structural position (i.e., a position where a constituent receives an additional, typically discourse related interpretation such as question, topic, focus etc.). These dependencies are found in constructions like *wh*-questions (e.g., Who did you meet with \_\_\_ in the library yesterday?) and relative clauses (e.g., The man who my father visited \_\_\_ was sick). In the sentence processing literature, the displaced noun phrase is called a *filler* and its canonical position is known as a *gap*. The relationship between the displaced head noun (the filler) and its canonical position (the gap) is known as *filler-gap dependency*. The completion of filler-gap dependency is “motivated by the need to satisfy an interpretation requirement: a gap is a sentence element that has no semantic content, unless it is associated with a referential element” (Ng and Wicha, 2014, p.17).

The establishment of association between a filler and a gap is called “gap-filling” (Crain and Fodor, 1985; Fodor, 1978; Frazier and Flores d’Arcais, 1989; Stowe, 1986). This process can be achieved through linking the filler (*who* in (80)) directly to its thematic assigner, which is usually a verb (e.g., *called* in (80)). This procedure is motivated by lexical/semantic knowledge (see Marinis et al., 2005; Pickering, 1993; Pickering, Barton and Shillcock, 1994; Traxler and Pickering, 1996). Another slightly different approach to the underlying representation associates the filler with its trace which is an empty category (*e* in (81)) at the base position of the dislocated constituent (e.g., Love and Swinney, 1996; Nicol and Swinney, 1989).

80. Who<sub>i</sub> [do you think that Susan called e<sub>i</sub>]

81. Which movie<sub>i</sub> did you watch e<sub>i</sub> in the cinema?<sup>7</sup>

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<sup>7</sup> *e* is a silent copy of the displaced constituent *which movie*.

Fodor (1978) considered three potential alternative strategies the parser could use to identify the location of the gap. The first strategy, *gap as first resort*, presupposes that the parser initiates a search for a potential gap position upon encountering a filler. The second strategy is *gap as last resort*, which predicts that the parser may not postulate a gap until it finds clear evidence for it. In other words, according to the *gap as last resort* strategy, the parser will posit a gap only when the gap is grammatically required. The third strategy is the *lexical expectation* strategy. It presupposes that the parser could only postulate a gap after a verb that frequently takes an argument of the same type of the filler (e.g., noun phrase or prepositional phrase) and that argument does not appear immediately. However, among all these strategies, only *gap as first resort* strategy has gained support from many studies. One version of this strategy is called the Active Filler Strategy. Frazier and Clifton (1989, p.95) describe this strategy as follows:

#### 82. Active Filler Strategy

When a filler has been identified, rank the option of assigning it to a gap above all other options.

Evidence for the Active Filler Strategy has been found in many languages, including English (Crain and Fodor; 1985, Stowe, 1986; Wagers and Phillips, 2014); Japanese (Aoshima, Phillips and Weinberg, 2004); German (Felsler et al. 2003); Dutch (Frazier, 1987). Moreover, the use of this strategy was supported by different methods, including reading times (Frazier and Clifton, 1989; Omaki et al., 2015; Wagers and Phillips, 2014); speeded acceptability judgment tasks (Frazier; et al., 1989; McElree et al., 2003); and eye-tracking (Chow and Zhou, 2018; Traxler and Pickering 1996). The use of the Active Filler Strategy in processing filler-gap dependencies is considered an “ideal testing” ground to investigate incremental sentence processing (Atkinson et al. 2018, p.133). In other words, the use of the Active Filler Strategy in real-time sentence processing indicates that the parser processes sentences incrementally.

De Vincenzi (1991) proposed a re-interpretation of the Active Filler Strategy, i.e., the Minimal Chain Principle, which states: *avoid postulating unnecessary chain members, but do not delay postulating required chain*



*members*. Meseguer, Acuna-Farina, and Carreiras (2009: 767) informally defined a chain as “an anaphoric connection between two or more positions in syntactic trees, a sort of discontinuous constituent with a unitary thematic role (agent, patient, etc.) and a unitary function (subject, object, etc.)”. The “required” chain member in De Vincenzi’s principle refers to the identification of a moved element (e.g., *who* in 80) that is in a position without thematic-role or case. Thus, “it has to enter in a chain with an element that has both. The principle says that this postulation of the other member(s) of a chain should not be delayed” (De Vincenzi 1991: 94). De Vincenzi’s principle coincides with the Active Filler Hypothesis as it states that the processor does not delay postulating an unavoidable empty element; however, it treats fillers and gaps alike and posits active parsing for both: all filler-gap associations need to be completed as rapidly as possible in real-time processing. In this perspective, head initial and head final languages share a single mechanism for the processing of dependencies and the only variation is in the relative order of filler and gap.

The use of the Active Filler Strategy could be related to factors such as working memory. Dependency formation suggests that the filler (or at least some formal properties of the filler) is maintained in short-term memory until it is linked to its associated gap (see Gibson, 1998; King and Kutas, 1995; Kluender and Kutas, 1993). The longer the distance is between the filler and the gap, the greater is the memory cost of maintaining the filler (Gibson, 1998). Atkinson et al. (2018) posited that according to this account, participants with low working memory such as children may show a stronger tendency to complete filler-gap dependencies earlier in the structure than adults in order to reduce memory costs or interference.

Previous studies on L1 real-time processing of filler-gap dependency have also provided evidence that the parser avoids positing gaps in positions where gaps cannot grammatically occur such as within islands. As illustrated in Chapter 2 (Section 2.2.2), islands are syntactic structures from which wh-extraction is not allowed. Thus, predicting a gap inside an island will result in ungrammaticality. L1 processing studies found that when the parser encounters

a filler and then comes across an island structure, it puts the Active Filler Strategy on hold until it gets across the island. This suggests that grammatical constraints block the gap prediction (e.g., Stowe, 1986; Traxler and Pickering, 1996). This also suggests that L1 sentence processing is driven by grammatical knowledge. However, the nature of islands is an ongoing debate, with syntactic, semantic and processing based accounts. According to formal grammatical accounts, gap-filling inside islands is prohibited due to utilization of syntactic knowledge (e.g., Phillips, 2006; Stowe, 1986; Traxler & Pickering, 1996). Processing-based accounts, on the other hand, assume that the complex structure of islands leads to processing overload that increases difficulty in resolving filler-gap dependencies (e.g., Hofmeister & Sag, 2010; Kluender, 1991; 1998; 2004; Kluender & Kutas, 1993). However, as others have pointed out (Cunnings 2017; Kim, 2014; Omaki and Schulz 2011), even within a processing-based approach to islands, identification of an island is argued to require a deep and detailed representation. Therefore, whether one adopts a grammatical or processing account of the absence of filler-gap dependencies into islands, it seems that for the filler-gap effect to arise, the parser must identify an island structure. Following Cunnings (2017), the assumption in this thesis is that island effects are due to the presence of a complex syntactic structure, regardless of whether the effect itself arises because of a constraint imposed by the grammar, or by the processing difficulties incurred by the complex structure.

To conclude, filler-gap dependencies are considered interesting to examine because they provide clues for how the parser interprets sentences when the information required for full interpretation is not immediately available (Pablos, 2008), and because they inform us on the complex interplay of grammatical restrictions (c-command, islands) and parsing strategies. Previous studies on L1 processing of these dependencies have revealed that L1's parser uses the Active Filler Strategy to predict gaps in grammatical positions. In ungrammatical positions, on the other hand, the parser avoids gaps' postulation. This suggests that L1 parsing is governed by grammatical knowledge. Related studies that discuss these proposals are presented in Section 4.3.

The next section provides an overview of key proposals on L2 real-time processing of filler-gap dependencies.

#### **4.2.2 Key proposals on L2 real-time processing of filler-gap dependencies**

Whether L2 processing is fundamentally different from L1 processing has been a controversial issue. The long-standing debate on this issue has produced opposing proposals on L2 real-time processing. One of the influential proposals about L2 processing is the Shallow Structure Hypothesis (Clahsen and Felser, 2006). The Shallow Structure Hypothesis proposes that L2 processing is different from L1 processing. Whereas L1 processing relies on syntactic and lexical information, according to the Shallow Structure Hypothesis, L2 processing underuses abstract syntactic structures in real time. Instead, L2 real-time parsing is primarily guided by semantic, pragmatic, probabilistic, or surface-level information (Clahsen and Felser, 2018). The Shallow Structure Hypothesis argues that L2 learners, regardless of their L1 features, amount of L2 exposure, or L2 proficiency level, can be described as shallow processors because the L2 grammar is “incomplete, divergent, or of a form that makes it unsuitable for parsing.” (Clahsen and Felser, 2006, p.117).

The Shallow Structure Hypothesis was based on the results of previous studies which suggest that L2 learners rely less heavily on morpho-syntactic knowledge during real-time processing than on lexical semantics and plausibility knowledge (e.g., Felser, Roberts, Marinis and Gross, 2003; Juffs and Harrington, 1995; Marinis et al., 2005; Papadopoulou and Clahsen, 2003). For example, Felser et al. (2003) and Papadopoulou and Clahsen (2003) found that L2 learners ignore structural properties when resolving relative clause attachment ambiguities, unlike L1 speakers. Marinis et al. (2005) also found similar differences between L1 and L2 in processing filler-gap dependencies. Studies of ambiguity resolution as well as studies of syntactic dependencies, in L2 processing were part of the motivation for the Shallow Structure Hypothesis. Since the Shallow Structure Hypothesis was proposed, there has been considerable research to test it further. The results of such studies have been mixed. Some of the filler-gap dependency findings will be outlined in Section

4.4 including those that provide support for the Shallow Structure Hypothesis and those that contradict it.

Other studies that have found differences in the real-time processing between L1 and L2 provide alternative explanations to account for such differences, other than shallow syntactic processing. For example, Hopp (2014, 2018) argues that slower L2 lexical processing could lead to non-native-like syntactic processing, a phenomenon Hopp (2018) formalised as the Lexical Bottleneck Hypothesis. Thus, the non-target-like grammatical processing may arise from slower L2 lexical parsing that could overload the L2 parser's processing capacity, which in turn, can delay building grammatical structure or even prevent it.

Other factors can also influence L2 real-time processing such as L1 interference (e.g., Roberts et al., 2008), language proficiency (e.g., Frenck-Mestre, 2002; Hopp, 2010; McDonald, 2006), inhibition from L1 (Kim, 2018), or individual differences in working memory (Dussias and Pinar, 2010). For example, in his review of recent studies of L2 processing of syntactic dependencies, Cunnings (2017) proposes a memory-based model of L2 processing. Cunnings (2017) argues that L1 and L2 processing differences can be due to differences in the types of retrieval cues used during sentence processing: the L2 parser assigns more weight to discourse than to morphosyntactic information in parsing than does the L1 parser. Therefore, Cunnings assumes that the differences in native vs. non-native processing can be attributed to working memory and other cognitive resources allocations.

To conclude, different accounts have been proposed regarding the ability of L2 learners to make use of grammatical knowledge during real-time sentence processing like L1 processing. Whereas some researchers claim that L2 learners underuse syntactic information in real-time parsing, others argue that L2 learners can use grammatical knowledge in real-time processing and that the differences that can arise in L1 and L2 processing are caused by factors extraneous to grammatical processing.

The next section provides an overview of related studies on L1 real-time processing of filler-gap dependencies, followed by a discussion of L2 related studies on the processing of filler-gap dependencies in real time.

### 4.3 Previous studies of L1 real-time processing of English filler-gap dependencies

#### 4.3.1 Crain and Fodor (1985)

In an early study to investigate the processing of filler-gap dependencies, Crain and Fodor (1985) examined how native speakers of English process *wh*-sentences using a self-paced reading task. The sentences were presented word-by-word on a computer screen and the participants were asked to press a button to read the next word in each sentence. The sentences involved two conditions: a non-extraction condition (83a) and an extraction condition (83b).

83. a. The little girl had expected **us** to sing those stupid French songs for Cheryl at Christmas.
- b. Who had the little girl expected **us** to sing those stupid French songs for at Christmas?

The study compared the reading times of a potential object gap position in the *wh*-extraction condition (*us* in 83b) to the same region in the non-extraction condition. It was predicted that when the parser encounters a filler (such as *who* in 83b), it will start to search for the gap from which *who* originated. The first possible gap position it can check is the subject position; however, it will find this position filled by *the little girl*. Thus, the parser is expected to continue looking for a gap until it gets to the second possible gap position, which is the object of the verb *expected*. However, once again this gap is also filled by *us*. This disruption is predicted to result in longer reading times at the object filled-gap position in the extraction condition (83b) compared to the same position in the non-extraction condition (83a). On the other hand, if the parser posits a gap as a last resort, only when the gap is grammatically required, no such reading slowdown would be found at the critical region in the *wh*-extraction.

The results revealed longer reading times at the critical region in (83b) relative to the same region in (83a). This effect is called a 'Filled-Gap Effect' because the longer reading times at the critical region (*us* in 83b) is caused by

the presence of a noun phrase (*us*) in a potential gap position. As mentioned before, this has been taken as evidence of incremental processing.

Crain and Fodor's study provided evidence of filled-gap effect in object position. The next question is whether such effect can emerge in other noun phrase positions, namely, subject and prepositional object positions. Stowe (1986) conducted a study to examine this issue. Her study is described in the next section.

#### 4.3.2 Stowe (1986)

Stowe (1986) employed two self-paced reading experiments to examine how native speakers of English assign a grammatical meaning to wh-phrases in embedded questions. The first experiment replicates and extends Crain and Fodor's (1985) study to investigate if gaps are located in subject and prepositional object positions similar to the object position. It included 24 sentences, each of which had four versions: a declarative version (84a), a wh-subject gap version (84b), a wh-object gap version (84c), and a wh-object of preposition gap version (84d).

84. a. My brother wanted to know if **Ruth** will bring **us** home to **Mom** at Christmas.
- b. My brother wanted to know who\_\_\_ will bring us home to Mom at Christmas.
- c. My brother wanted to know who **Ruth** will bring \_\_\_ home to Mom at Christmas.
- d. My brother wanted to know who **Ruth** will bring **us** home to\_\_at Christmas.

Stowe compared the reading times of three critical regions in the declarative sentences (the embedded subject *Ruth*, the embedded object *us*, and the embedded object of preposition *Mom* in (84a)) with the reading times of the same regions in wh-sentences (84b-d). The object position was filled either by a pronoun or a proper name. The results revealed a significant reading slowdown only at the filled-object position (*us*) in the sentences that include an object of preposition gap (84d) relative to the reading times at the same region in declarative sentences. Stowe posited that the participants initially perceive the filler *who* as the direct object of the verb *bring*. However, when they reached

the direct object, *us*, they reanalyzed the sentence, which lead to an increase in the reading time. On the other hand, no significant differences in reading times were found at the subject position or at the object of preposition position in all sentence types. The findings of Stowe's first experiment replicate the object filled-gap effect revealed by Crain and Fodor (1985).

The second experiment tested whether native speakers of English use syntactic constraints in their real-time sentence processing, and thus, avoid expecting gaps where these gaps are not grammatically licensed. Generally, prepositions can potentially serve as gap licenser in non-island environments (e.g., *What is John talking about \_\_\_\_\_*, cf. also 84d). However, this possibility is prohibited if the preposition (e.g., *about* in 85b) is embedded within e.g., an NP island in sentences like (85b). This means that the extraction from within the prepositional phrase in (85b) is ruled out.

85. a. The teacher asked if the silly story about Greg's older brother was supposed to mean anything.

b. The teacher asked what [NP the silly story [PP about [NP **Greg**' older brother]]] was supposed to mean \_\_\_\_\_.

If the participants avoid positing gaps in positions where gaps are grammatically prohibited, they will show no reading time slowdown in processing the overt NP in the *wh*-extraction condition (*Greg's*) in (85b) relative to the non-extraction control condition (85a). Consequently, no evidence of filled-gap effect is expected in the position that follows the preposition in either sentence (*Greg's*) in (85a) and (85b). This expectation was met: no significant differences were found in reading times at the critical region, between the two conditions. This provides evidence that no processing difficulty occurred during parsing the overt noun phrase in this position. This result indicates that the native English speakers use abstract syntactic constraints on *wh*-movement to avoid positing gaps in positions where gaps are prohibited.

A key conclusion from Stowe's study is that the parser has difficulty processing filled-object position but not filled-subject position. To explain this, Stowe suggested that either the parser does not expect a gap in subject

position, or it may not have great difficulty in recovering from the misanalysis in subject position because it may expect to find an object gap ahead.

It can be concluded from Crain and Fodor's (1985) and Stowe's (1986) studies that the L1 parser process sentences including filler-gap dependencies in a different way from declarative sentences that do not include this structure. In sentences with filler-gap dependencies, the parser anticipates a gap using Active Filler Strategy. Stowe added to this that in real-time sentence processing, the parser respects island constraints by suppressing the Active Filler Strategy. Similar results were reported for other consequences of the Active Filler Strategy such as plausibility effect. The next section discusses one of these studies.

#### 4.3.3 Traxler and Pickering (1996)

While Crain and Fodor (1985) and Stowe (1986) investigated L1 processing using self-paced reading tasks, Traxler and Pickering (1996) investigated L1 real-time processing of long-distance dependencies by manipulating plausibility using an eye-tracking task. The test sentences contained relative clauses. Therefore, they triggered a search by the parser for a gap that the filler, namely, the head of the relative clause, relates to. The experiment used a plausibility mismatch paradigm and included four conditions: non-island / plausible (86a), non-island / implausible (86b), island / plausible (86c), and island / implausible (86d).

86. a. We like **the book** that the author *wrote* unceasingly and with great dedication about while waiting for a contract.
- b. We like **the city** that the author *wrote* unceasingly and with great dedication about while waiting for a contract.
- c. We like **the book** that the author who *wrote* unceasingly and with great dedication saw while waiting for a contract.
- d. We like **the city** that the author who *wrote* unceasingly and with great dedication saw while waiting for a contracting for a contract.

The experiment manipulated the plausibility of the filler as an argument of the first verb *wrote*. In sentence (86a), *the book* is a plausible argument of the



critical verb *wrote*, but in (86b) *the city* is not. The experiment also manipulated sentences' construction type: non-island construction (86a & b) vs. island construction (86c & d). When the parser encounters the verb *wrote* in non-island sentences, it is expected to analyse the object of the verb (*the book* in (86a) vs. *the city* in (86b)) as the filler. A plausibility mismatch effect in the form of longer eye-gaze duration was expected at the critical verb *wrote* in (86b) when the filler is an implausible object of the verb (*the city*) compared to sentence (86a) where the filler (*the book*) is plausible. By contrast, no mismatch plausibility effect was expected at the critical verb *wrote* in (86d) compared to (86c) because the critical verb was inside a relative clause island from which wh-extraction is prohibited.

The results showed that as soon as the parser encountered the verb *wrote* in non-island sentences (86a & b), it actively searched for a filler and analyses the object of the verb as the filler. Longer eye-gaze duration at the critical verb was found in (86b) relative to (86a) due to mismatch plausibility effect. On the other hand, the results revealed no significant differences in the eye-gaze duration at the critical verb *wrote* between sentences (86c) and (86d). This finding indicates that in L1 real-time processing, filler-gap dependency formation was constrained by relative clause island constraint.

Traxler and Pickering's study differs from the previous studies of filled gaps in that the stimuli in their study do not contain filled gaps. This is in line with their aim to push for a "gap-free" account of Active Filler effects (direct association between the antecedent and the verb), which according to them supports a non-transformational account of the underlying representation. Traxler and Pickering argue that the results support a 'direct association' account of the Active Filler effects, i.e., they claim that since the plausibility effects were already observable at the verb (that is, before the gap in their interpretation), the results support a perspective in which what counts is the link between the antecedent and the verb, rather than the gap in a transformational grammar.

Therefore, Traxler and Pickering's findings provided further evidence of using Active Filler Strategy that is sensitive to island constraints in L1 real-time

sentence processing. While the evidence provided by Crain and Fodor (1985) and Stowe (1986) involves word-by-word self-paced reading, Traxler and Pickering's evidence is based on normal reading because it tracked eye movements. For related findings on plausibility mismatch effect in L1, see Chow, Smith, Lau, and Phillips, 2018; Staub, 2007; Wagers and Phillips, 2014.

#### **4.3.4 Summary**

The studies reviewed in Section 4.3 revealed that native speakers of English postulate gaps in grammatical positions in their real-time sentence processing and that they process wh-sentences incrementally. Other studies that investigated L1 processing (e.g., Clahsen and Felser, 2006; Gibson and Warren 2004; McElree and Griffith, 1998; Wagers and Phillips, 2009; Yoshida, 2006) have also provided support to the Active Filler Strategy. Previous L1 research has also examined if the parser creates a gap in unlicensed positions such as islands. Real-time studies such as Stowe (1986) and Traxler and Pickering (1996) investigated whether the parser associates the filler with a potential gap position if the gap exists inside an island, in order to see if the Active Filler Strategy is suspended by island constraints. The results of such studies showed that the real-time sentence processing of English native speakers is governed by abstract syntactic constraints. These results were supported by self-paced reading and eye-tracking while reading. These findings of L1 real-time sentence processing have inspired a series of studies to examine if L2 real-time processing of English wh-dependencies could be similar to L1 real-time processing. An overview of these studies is presented in the next section.

### **4.4 Previous studies of L2 real-time processing of English filler-gap dependencies**

#### **4.4.1 Marinis et al. (2005) (L1 German/Greek/Chinese/Japanese)**

Marinis et al. (2005) investigated real-time processing of filler-gap dependencies by four groups of advanced L2 learners of English from languages with wh-movement (German and Greek) and wh-in-situ languages (Chinese and Japanese). In addition, a control group of English native speakers took part in the study. The participants completed a self-paced reading task that was modelled after Gibson and Warren's (2004) study which investigated if

adult native speakers of English make use of intermediate gaps during L1 processing of long-distance wh-dependencies. The experiment was a 2\*2 design with the extraction conditions (extraction vs. non-extraction) crossed by phrase type (VP vs. NP), as illustrated by (87-88).

87. a. Extraction across a VP+CP (+ intermediate gap)

The nurse *who<sub>i</sub>* / the doctor argued / *e'<sub>i</sub>* that / the rude patient / had angered *e<sub>i</sub>* / is refusing to work late.

b. Extraction across an NP+PP (- intermediate gap)

The nurse *who<sub>i</sub>* / the doctor's argument / about / the rude patient / had angered *e'<sub>i</sub>* / is refusing to work late.

88. a. Non-extraction, local subject-verb integration (VP)

The nurse thought / the doctor argued / that / the rude patient / had angered / the staff at the hospital.

b. Non-extraction, nonlocal subject-verb integration (NP)

The nurse thought / the doctor's argument / about / the rude patient / had angered / the staff at the hospital.

When a clause intervenes between the filler and the gap (87a), an intermediate trace is needed, but when a nominalized version of the clause is there, no trace is expected (87b). The experiment tested whether the availability of an intermediate gap site in segment 5 (*e'<sub>i</sub>* in 87a) could facilitate the processing of the trace that immediately follows the verb *angered*. The study also compared the reading time of segment 3 (*that*) in sentences that contain wh-extraction (87a) with the reading time of (*that*) in sentences that do not involve wh-extraction (88a) and thus do not involve traces to see whether L2 learners posit gaps in their processing of wh-sentences.

The results of the L1 group revealed an interaction between wh-movement and type of intervener, indicated by faster reading times at the verb when a clause intervenes between the filler and the gap than when a nominalized clause intervenes. This supports the idea that an intermediate trace is built when clauses are crossed which facilitates gap-filling processes. Following Gibson and Warren (2004), this facilitation can be understood as a

function of locality (defined as number of intervening new referents) between the last position in which the filler was activated and the gap. When an intermediate trace is built, the filler is reactivated at that position and thus its relation to the gap is more local (less intervening new referents) than when there is no intermediate trace. In contrast to what observed with L1 speakers, this interaction was not found in the L2 groups. Based on the results, Marinis et al. argued that English native speakers make use of intermediate syntactic gaps during sentence processing, whereas L2 learners do not use intermediate traces in cross-clausal extractions, whether their L1 has the subjacency constraint or not. Marinis et al. concluded that L2 learners underuse syntactic information in L2 processing, which prevents them from processing L2 input in a native-like fashion. As mentioned before, the Marinis et al's study was among the studies that motivated the development of the Shallow Structure Hypothesis.

However, a re-examination of Marinis et al's results by Dekydtspotter, Schwartz and Sprouse (2006) poses a challenge to Marinis et al's interpretation. Dekydtspotter et al. found evidence of intermediate traces at segment 4 with some delay in the parsing of two groups of L2 learners, namely, German-English group and the Japanese-English group. Therefore, Dekydtspotter et al. argued that the findings of Marinis et al. (2005) do not support the Shallow Structure Hypothesis (for more details see Dekydtspotter et al. 2006).

#### **4.4.2 Felser and Roberts (2007) (L1-Greek)**

Using a cross-modal picture priming task, Felser and Roberts (2007) reported a similar contrast between L1 and L2 real-time processing by native speakers of English and advanced Greek learners of English. The native English speakers' results were reported from an earlier study by Roberts et al. (2007) that used the same cross-modal picture priming task. The participants heard sentences that included indirect object relative clauses (89). At the pre-gap position ([1] in 89) or at the gap position ([2] in 89), the participants were presented with different types of pictures (animals and inanimate objects) on a computer screen.

89. Bob loved the monkey to which the fat squirrel showed his [1] excellent new trick [2] in the playground last month.

Two sets of stimuli were created: an identical set, where the picture displayed on the screen corresponded to the animal depicted in the filler of the sentence was played (e.g., a monkey for sentence 89); and an unrelated set, where the picture displayed depicted an animal unrelated to the filler in the sentence. The rationale of cross-modal priming is that (re)activation of the filler will speed up processing of the lexical properties of the animal depicted in the pictures (Shapiro, Swinney and Borsky, 1998).

The participants had to decide as quickly as they could whether the picture that appeared on the screen showed something that was alive or not alive, by pushing either the left or the right-hand button of a dual push-button box. Their response times were measured from the point at which the picture appeared on the screen to the point at which they pressed the response button. The study also examined potential effects of individual working memory differences on L2 processing using a reading span test (Harrington and Sawyer, 1992).

The results of native English speakers with high memory span revealed shorter response time for the identical picture at the gap position, than at the pre-gap position. This pattern indicates trace-based antecedent reactivation in L1 processing. On the other hand, the results of native speakers with low working memory span did not provide such evidence, which shows that L1 processing is influenced by individual working memory differences.

Felser and Roberts (2007) found that Greek L2 speakers of English processed the experimental sentences differently from the native speakers of English as they did not show any evidence of postulating intermediate syntactic gaps during the processing of long-distance wh-dependencies. The results also showed that the L2 learners' performance was not influenced by individual working memory differences. Felser and Roberts concluded that these findings support the Shallow Structure Hypothesis which assumes that the representations constructed during L2 processing lack abstract syntactic representations such as movement traces.

The findings of Marinis et al. (2005) and Felser and Roberts (2007) suggest that L1 and L2 sentence processing are different, which supports the Shallow Structure Hypothesis. However, the differences in the L1 and L2 behavioural differences could be due to methodological issues. For example, regarding the experimental designs, the stimuli used in both studies were complex, especially for L2 learners in the Felser and Roberts' study, in which the participants listened to the auditory sentences that were recorded at a normal speed. According to Kim (2014, p.17) "It is possible that the burden of phonological processing, together with the burden imposed by the dual task, might have prevented the learners from keeping up with the rapidly incoming auditory stimuli and building incremental representations of the input". Therefore, the differences in L1 and L2 performance in Marinis et al. (2005) and Felser and Roberts (2007) can be ascribed to the experimental designs.

While Marinis et al. (2005) and Felser and Roberts (2007) found non-native processing of filler-gap dependencies and showed support to the Shallow Structure Hypothesis, other studies showed that adult L2 learners can process this structure in a native-like fashion. Some of these studies are described below.

#### **4.4.3 Aldwayan, et.al. (2010) (L1-Najdi Arabic)**

Aldwayan, et.al. (2010) followed the design of Stowe's (1986) study to investigate the L2 processing of English *wh*-movement by native speakers of Najdi Arabic, a *wh*-in-situ language. A group of 40 advanced Najdi Arabic speakers of English in addition to a group of 40 native speakers of English completed two self-paced reading tasks.

Similar to Stowe (1986), the first experiment investigated whether L2 processing of filler gap dependencies is incremental. As discussed in Section 4.3.2, Stowe's first experiment included four conditions: a declarative version, a *wh*-subject gap version, a *wh*-object gap version, and a *wh*-object of preposition gap version. On the other hand, Aldwayan et al. included four conditions that derive from two binary variables: the type of embedded sentence (declarative (90a) vs. *wh*-extraction (90b)) and the type of embedded object (pronoun (*me* in 90) vs. proper name (*Liz* in 90)). Four Latin Square lists

were generated, so that every participant would read only one sentence from each set.

90. a. My cousin wondered if David will put me/Liz near Jack at the wedding.  
b. My cousin wondered who David will put me/Liz near \_\_\_ at the wedding.

As explained earlier, if parsing is incremental, the parser will posit a gap at each potential gap position in the *wh*-extraction condition (90b). The first possible gap position is the subject position, which is filled by *David*. The second possible gap position is the object of the verb *put* which is also filled by *me* or *Liz*. Previous L1 studies (e.g., Crain and Fodor, 1985; Stowe 1986) found that the disruption caused by finding these positions already filled is predicted to result in longer reading times at the object filled-gap position in the extraction condition (90b) compared to the same position in the non-extraction condition (90a). As already seen in the studies of L1 filler-gap processing detailed in Section 4.3, this has been taken as evidence of incremental processing. Similar to Stowe, Aldwayan et al. further investigated if there was evidence of a filled-gap effect at the subject position (*David in* (90b)) compared to the same position in (90a). Therefore, a slowdown in reading times was expected in the in the extraction condition (90b) for natives and L2 learners at the grammatical subject filled-gap position compared to the same position in the declarative condition (90a) evidencing sensitivity to a filled-gap effect.

Similar to Stowe (1986), the second experiment investigated whether Najdi speakers of English make use of syntactic constraints that prohibit positing gaps in unlicensed positions such as an NP-island in *wh*-sentences. This experiment also includes non-extraction condition (91a) and extraction condition that contains an NP-island in a *wh*-sentence (91b).

91. a. The principal questioned if the rude statement about Bob's falling grades was used to shock the class.  
b. The principal questioned who [NP the rude statement [PP about [NP Bob's falling grades]]] was used to shock\_\_\_\_\_.

When the parser encounters the filler *who* in (91b), it is expected to immediately start looking for the gap from which the filler has been extracted. The first

thematic role assigner it encounters is the preposition *about*, which is followed by its object (*Bob's falling grades*). However, if Najdi Arabic speakers' real-time processing is constrained by syntactic information, they will not slow down at this position because as discussed earlier in Section 4.3.2, the prepositional phrase is embedded in an NP island from which the extraction is ungrammatical. According to the Shallow Structures Hypothesis, a reading-time delay should be observed for both (90b) and (91b) as compared to (90a) and (91a) due to complexity of non-canonical order of arguments and because full syntactic structure (including the island) is not represented by L2 speakers.

The results showed that native English speakers and Najdi speakers of English reported a significant slowdown in reading times at the filled-object position (*me* or *Liz*) in *wh*-sentences relative to the same position in declarative sentences. Unlike Stowe (1986), Aldwayan et al. found a significant slowdown in reading times at the filled-subject position *David* in (90b) relative to the same position in (90a) for the Najdi Arabic group. This effect was marginal for native speakers.

In Experiment 2, no significant difference in reading times was found for either group at the filled-prepositional object position between the *wh*-extraction condition and the declarative condition. Thus, the findings revealed that Najdi Arabic learners of English tended to posit gaps in licensed positions (Experiment 1) and avoid positing gaps in positions where gaps are not grammatically licensed (Experiment 2). Following grammatical accounts of islands (e.g., Phillips, 2006), Aldwayan et al. interpreted these results to suggest that Najdi Arabic learners of English showed native-like incremental processing of *wh*-movement that is guided by syntactic constraints which are not present in their native language. Based on such accounts, Aldwayan et al.'s study provides counter evidence to the Shallow Structure Hypothesis.

However, one limitation in Aldwayan et al.'s study is that it used different types of gap licensors in the two experiments. The gap licensor in Experiment 1 was a verb (e.g., *put* in (90)), whereas in Experiment 2, the licensor was a preposition (e.g., *about* in (91)). Aldwayan et al.'s results could be due to differences in licensor type. Therefore, they suggested that further study uses



the same gap licenser type for both experiments. This issue, addressed in Canales' (2012) study on Spanish, remains a limitation of Aldwayan et al.'s study on Najdi Arabic.

#### 4.4.4 Omaki and Schulz (2011) (L1-Spanish)

In the same vein, Omaki and Schulz (2011) provided further evidence that L2 learners are sensitive to syntactic island constraints during real-time sentence processing. In their study, Omaki and Schulz investigated the extent to which advanced Spanish L2 speakers of English and native speakers of English obey relative clause island constraints while constructing filler-gap dependencies. Spanish is similar to English in that it has overt *wh*-movement that obeys the Subjacency Principle. The online self-paced reading task was adapted from Traxler and Pickering (1996). As mentioned before (Section 4.3.3), Traxler and Pickering's (1996) online self-paced reading task used a plausibility mismatch paradigm to probe for gap filling, and it included four conditions: non-island/ implausible (92a), non-island/ plausible (92b), island/ implausible (92c), and island/plausible (92d).

92. a. The city that the author *wrote* regularly about was named for an explorer.  
b. The book that the author *wrote* regularly about was named for an explorer.  
c. The city that the author who *wrote* regularly saw was named for an explorer.  
d. The book that the author who *wrote* regularly saw was named for an explorer.

As explained earlier in (Section 4.3.3), in non-island sentences, the parser is expected to analyse the object of the verb *wrote* (*the city* in (92a) and *the book* in (92b)) as the filler. This is expected to result in longer eye-gaze duration at the verb *wrote* in (92a) when the filler is an implausible object of the verb (*the city*) compared to sentence (92b) where the filler (*the book*) is plausible. In island sentences (92c & d), no difference in the eye-gaze duration was expected at the verb *wrote* in (92d) compared to (92c), because the critical verb was inside a relative clause island from which *wh*-extraction is not allowed.

The results revealed a reading-time slowdown for the implausible/ non-island sentences (92a) at the critical verb *wrote* compared to the same position in plausible / non-island conditions (92b). This can be interpreted as the result of plausibility mismatch. However, this evidence was not found in sentences like (92c vs. 92d), where the same verb was embedded in a relative clause island. This pattern of results is similar to the pattern reported for native English speakers in Traxler and Pickering's (1996) study. Omaki and Schulz (2011, p.563) concluded that the L2 processing is not deficient in its representational capacity and that "advanced L2 learners not only build abstract structural representations but also rapidly constrain the active search for a gap location".

An alternative way of interpreting Omaki and Schulz's finding, following a processing-based account of islands (e.g., Kluender, 1998; 2004), would be that the L2 learners build the complex abstract representation of the island structure, and then do not posit gaps within the structure due to the processing burden incurred by the complex structure. Either account entails that the learners build the structure, but in the grammatical accounts the island effect is a result of a grammatical constraint whereas in the processing account it is the result of processing overload.

#### **4.4.5 Canales (2012) (L1-Spanish)**

Building on Aldwayan et al. (2010) and Stowe (1986), Canales (2012) investigated the real-time processing of English wh-dependencies by Spanish L2 learners of English using two self-paced reading experiments. Experiment 1 was a partial replication of the first experiment in Aldwayan et al. (2010). It explored whether Spanish L2 learners of English process wh-dependencies incrementally by looking at wh-extraction from positions licensed by the grammar. Fifty four Spanish advanced L2 learners of English and 59 native speakers of English completed the self-paced reading experiments.

Experiment 1 included two conditions: a non-extraction condition (93a) and a wh-extraction condition (93b). Two Latin Square presentation lists were created, so that each participant would read only one version from each pair.

93. a. My cousin wondered if David will put Liz near Jack at the wedding.

- b. My cousin wondered who David will put Liz near \_\_\_\_ at the wedding.

Evidence for incremental processing of filler-gap dependencies was expected to emerge at the object filled-gap position in (93b). As a result, longer reading times were expected at this region (*Liz*) in the extraction condition (93b) relative to the non-extraction condition (93a).

Following Aldwayan et al. (2010) and Stowe (1986), Experiment 2 in Canales' study tested if the participants obey syntactic constraints in their L2 real-time sentence processing of wh-sentences that included relative clause islands. As mentioned above (Section 4.4.3), Aldwayan et al. (2010) recommended that further study uses the same gap licenser type for both experiments to avoid a possible effect of using different gap licenser types on the participant's behaviour in both experiments. Canales (2012) addressed this methodological issue by including relative clause islands in the second experiment, where the gap licenser is a verb (94), like Experiment 1.

94. a. My teacher wondered if the principal that suspended Jacob last spring disappointed the parents with the news.  
b. My teacher wondered who the principal [that suspended Jacob last spring disappointed] with the news.

It was expected that native speakers would not predict to find a gap at the filled-object position (*Jacob* in (94b)). Thus, no evidence of filled-gap effect was expected to emerge in this region. A similar prediction was made for Spanish L2 learners of English if they respect island constraints. If they are shallow processors who do not respect island constraints, they were expected to posit a gap in unlicensed positions. This would result in a significant slowdown in reading times at the filled-object position in wh-extraction condition (94b) relative to its counterpart in the non-extraction condition (94a).

The results of the Spanish group and Native English group showed longer reading times in the wh-extraction condition at the two regions following the critical region (*Liz at* in 93b) relative to the same regions in the non-extraction condition (93a). The results of the second experiment showed that there was no difference in reading times at the critical region (*Jacob* in 94) or at the

spillover regions (regions following the critical region). Following grammatical accounts of islands (e.g., Phillips, 2003), Canales interpreted these results to suggest that Spanish L2 learners of English process wh-dependencies in real time incrementally and that they respect grammatical constraints that prevent them from extracting a wh-element from a relative clause island. Following grammatical accounts of islands, the findings of Canales along with the L2 findings by Omaki and Schulz (2011) and Aldwayan et al. (2010) provided counter argument to the claim that adult second language learners are shallow processors who underuse abstract syntax during real-time parsing (Clahsen & Felser, 2006, 2018). However, as illustrated above there has been a debate whether island effects arise as a result of structure-building constraints (a position referred to as a “grammatical account”, Phillips, 2013), or whether they arise due to a processing failure or processing limitation (resource-limitation account, Kluender, 1998; 2004; Kluender and Kutas, 1993; Hofmeister et al., 2013). According to processing limitation account, Canales’ findings that L2 learners avoided positing gaps in a relative clause island could be due to processing overload due to the complexity of the structure, not due to applying syntactic knowledge. Under such an account, the findings may not directly counter the Shallow Structure Hypothesis proposal of underuse of syntactic structure, although, as argued earlier, it seems that syntactic complexity must still be involved as the source of the processing overload.

#### **4.4.6 Summary**

In brief, the results available so far regarding the capability of adult L2 learners to use syntactic information in online L2 sentence processing are contradictory. Some studies provided evidence that L2 processing can make use of syntactic knowledge employed in L1 processing. Other studies, by contrast, revealed behavioural differences between L1 and L2 processing of filler-gap dependencies. However, as illustrated in this chapter, L1 and L2 differences may not only suggest that L2 processing is shallow because other alternative interpretations can be also considered.

In Chapter 2 (Section 2.4.1), it has been indicated that unlike the order of filler-gap dependency in English and Jordanian Arabic, where the filler

precedes the gap, in Mandarin, the gap precedes the filler. The next section presents a discussion on the asymmetry in subject vs. object relative clause processing that has been found irrespective of typology. Section 4.6 discusses the potential effect of ambiguity in the processing of Mandarin dependencies. Section 4.7 reviews two studies on L1 real-time processing of Mandarin gap-filler dependencies. To the best of the researcher's knowledge, there is no related research on the L1 real-time processing of filler-gap dependencies in Arabic.

#### **4.5 Subject vs. object relative clause processing**

A pervasive line of research in psycholinguistics has shown that object relatives are harder to process than subject relative clauses. Evidence for this asymmetry comes from reading time measures, accuracy in comprehension questions and fixation durations in eye-tracking (King and Just 1991; Gibson 1998, 2000; Gordon et al. 2004; Van Dyke 2007; Van Dyke and McElree 2006 among many others). Relative clauses that involve different levels of extractions could produce different degrees of processing difficulties (e.g., Lin, 2008). There is a general agreement that in languages with head initial relative clauses, subject relative clauses (95a) are easier to process than object relative clauses (95b) (e.g., English: Weckerly & Kutas, 1999; Spanish: Betancort, Carreiras, & Sturt, 2009; German: Schriefers, Friederici, & Kühn, 1995).<sup>8</sup>

95. a. The guy who followed the first lady was a spy.  
b. The guy who the first lady followed was a spy.

(Lin & Bever, 2006 :254)

On the other hand, studies on languages with head final relative clauses reported mixed results (Korean: Kwon et al. 2006; Mandarin: Lin & Bever 2006, 2007; Japanese: Ueno & Garnsey 2008). Subject preference was observed in Japanese and Korean (Kwon, Polinsky, & Kluender, 2004; Miyamoto & Nakamura, 2003). In Mandarin, most previous research also showed that subject relative clauses are processed with greater ease than object relative

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<sup>8</sup> To the best of the researchers' knowledge, there is no previous research on the subject vs. object asymmetry in the processing of relative clauses in Arabic.

clauses (e.g., Lin & Bever 2006, 2007). However, some others showed greater ease of object relative clauses (e.g., Hsiao & Gibson, 2003; Wu & Gibson, 2008). Lin (2008: 831) reported that “the existent studies that claimed to have found an advantage for object relative clauses all have issues that are unresolved”. For example, Hsiao & Gibson’s (2003) experimental materials and results were contested by Lin and Bever (2006), who found a subject relatives preference in Mandarin. Thus, it seems that there is no clear support for a processing advantage for object relatives. Lin (2008) concluded that the preference for processing subject relatives that has been observed in both head-initial and to some extent head-final relative clauses supported a universal structure-based strategy for filler-gap processing, which proposes a universal subject preference because subject positions are universally higher in structure, and thus accessed more easily than object positions (Hawkins, 1999; Lin, 2006; O’Grady, 1997).

#### **4.6 Potential ambiguity in the processing of wh dependencies in Mandarin**

The basic word order in Mandarin is SVO. However, relative clauses in Mandarin are head final. This means that the surface word order in subject relative clauses is VOS (96a) and in object relative clauses is SVO (96b) (Mansbridge, Tamaoka, Xiong, and Verdonschot, 2017).

- 96. a. Subject RC: [<sub>RC</sub> e1 Verb Object-rel] filler1(subject)
- b. Object RC: [<sub>RC</sub> Subject e1 Verb-rel] filler1(object)

Since Mandarin does not mark the relative clause at the left boundary, temporary ambiguity of clause type exists during the initial reading of Mandarin relative clauses (Mansbridge, et al. 2017). This means that initially a relative clause is often incorrectly interpreted as a matrix clause. Such ambiguity could be partially resolved when the parser reaches the relativizer *de* because it would start to realize that the clause is not a matrix clause, but instead it is a relative clause or another clause that has a similar structure, e.g., appositives and pseudo-relative clauses (Mansbridge, et al. 2017). Consider example (97) from Wu, Kaiser, and Vasisht (2018: 1104):

97. Object-extracted relative clause

[<sub>RC</sub> shikuai zazhong t<sub>i</sub> de] jizhe<sub>i</sub>

stone hit t<sub>i</sub> DE reporter<sub>i</sub>

‘the reporter that the stone hit\_\_\_’

Wu, et al., (2018) reported that initially, the phrase ‘stone hit’ can be considered temporarily ambiguous between a simple main clause parse and a relative clause parse. Unlike the English relative marker *that* and the Jordanian Arabic relative complementizer *illi* whose presence clearly marks a relative clause boundary, *DE* might not be a reliable signal for an upcoming relative clause in Mandarin because (i) it occurs at the right-edge of the relative clause (immediately before the relativized head *jizhe* ‘reporter’), and (ii) it can occur in other structures like possessive, attributive, and noun-complements (Li & Thompson, 1981). Thus, the ultimate gapped relative clause structure can only be built when the parser reaches the disambiguating head noun *jizhe* ‘reporter’ (Wu, et al., 2018). Therefore, unlike English and Jordanian Arabic, where a relative clause can be interpreted as soon as the parser reaches the relative marker, a relative clause in Mandarin can be best interpreted at the head noun. This results in ambiguity in processing Mandarin wh-dependencies. For example, the V-NP1-DE NP2 structure in Mandarin is ambiguous between a subject relative clause reading (98a) in which *de* marks relativization, and a possessive reading in which *de* marks the possessive relation (98b):

98. a. [<sub>NP</sub> [e<sub>i</sub> V NP1 DE] NP2<sub>i</sub>] Relative clause parse

b. [<sub>VP</sub> V [NP1 DE NP2]] Verb-Object parse

Zhang, Zhang and Shu (2000, cite in Hsieh, Boland, Zhang and Yan, 2009) used a self-paced reading paradigm to investigate the processing of sentences that have balanced phrases (like 98a-b) where both analyses (a relative clause parse and a verb-object parse) are equally likely. In their study, the balanced phrases were embedded in a sentence context where the following NP2 would disambiguate the phrase to a relative clause analysis (99a) or a verb-object analysis (99b).

99. a. Zhuangdao xiaoming DE chezi feisu xingshi  
hit xiaoming DE car quickly drive...  
'The car that hit Xiaoming quickly drove away...'
- b. Zhuangdao xiaoming DE chezi zhihou  
hit xiaoming DE car after  
'After hitting Xiaoming's car...'

In (99a), '*quickly*' would confirm a relative clause analysis, whereas in (99b) '*after*' would confirm a verb-object analysis. The results found that disambiguating towards a verb-object analysis poses problems for the parser, as indicated by longer reading times at the disambiguating regions compared to the same regions in a control unambiguous condition. This suggests that this structure was not postulated by the parser in the initial stage of parsing. By contrast, no difference in reading times was found between the disambiguating regions and the corresponding unambiguous controls when the sentence is disambiguated towards a relative clause analysis. Zhang et al. (2000) argued that this result supports the principle of Minimal Attachment, since the relative clause interpretation would end up having all the arguments the parser needs for the verb '*hit*', whereas for the possessive interpretation, the parser will still need an agent for that predicate. Thus, the possessive structure is claimed to be more complex because of Minimal attachment. Zhang et al's (2000) study shows an example that identifying a wh-dependency in Mandarin is not a straightforward process.

## 4.7 L1 real-time processing of gap-filler dependencies in Mandarin

### 4.7.1 Hsu and Bruening (2003)

Hsu and Bruening (2003) investigated if there is an Active Gap strategy similar to the Active Filler Strategy (Frazier 1987) in L1 processing of Mandarin relative clauses. As discussed in Chapter 2 (Section 2.4), Mandarin is a head-final language; therefore, in Mandarin relative clauses, the gap precedes the



filler. Hsu and Bruening compared reading times of pairs of sentences like (100):

100. a. Na-wei lao-taitai zuotian bianzhile yi-jian maoyi  
songgei ta-erzi  
That-CL old-lady yesterday knitted a-CL sweater give-to her-son  
'That old lady knitted a sweater to give to her son yesterday.'
- b. Na-wei [e<sub>i</sub>zuotian bianzhile yi-jian maoyi songgei ta-erzi] de  
That-CL[e<sub>i</sub>yesterday knitted a-CL sweater give-to her-son] DE  
lao-taitai<sub>i</sub> shenbing-le.  
old-lady got-sick  
'That old lady who knitted a sweater to give to her son yesterday got sick.'

Sentence (100a) does not contain a filler-gap dependency. This sentence type serves as the baseline for comparison with sentences such as (100b), which includes a relative clause with a subject gap. The experiment examines if the parser shows evidence of a 'surprise' effect when it anticipates a head noun for a relative clause, but instead, finds other words that intervene before encountering it. It is expected that the parser will know that sentence (100b) contains a relative clause when it encounters the preceding demonstrative *Na* 'that' and classifier *wei* (a classifier that signifies a person), which introduce [+human] noun phrases. Therefore, if these components are followed by a word that is not compatible with the classifier (such as *zuotian* 'yesterday' in 100b), the parser will assume that the relative clause is embedded in a noun phrase. If the parser makes use of the Active Gap Strategy, it will predict to find *de* and the head noun after encountering *maoyi* 'sweater' to complete the relative clause. However, when the parser finds the optional adjunct clause *songgei ta-erzi* (give to her son), it will spend additional time integrating these words in the structure due to what Hsu and Bruening call a 'missing-filler effect'. The results showed that this expectation was met: longer reading times were found at *songgei ta-erzi* (give to her son) in the relative clause condition (100b) compared to its counterpart in the declarative condition (100a). Based on their findings, Hsu and Bruening concluded that the human parser uses an Active Gap Strategy that is analogous to the Active Filler Strategy.

However, Ng (2008) argued that the reading time slowdown results in Hsu and Bruening's (2003) study could have other interpretations. She claimed that the increase in reading times could be attributed to an increase in memory cost because in the processing of prolonged prenominal relative clauses, "the parser has to build the tree structure within the relative clause, and has to maintain the gap in working memory as it does so" (p. 946). Moreover, Ng maintained that lengthy relative clauses are not very common in Mandarin, so it could be the case that the parser expected the relative clause to terminate without including an additional clause inside of it. This could increase the load of processing the later part of the relative clause. As a result, Ng argued that using an Active Gap Strategy is only one possible explanation for Hsu and Bruening's (2003) findings, and thus, the validity of the argument for an Active Gap Strategy is still uncertain. Therefore, Ng (2008) conducted a study that is presented next, to address this issue further.

#### 4.7.2 Ng (2008)

Ng (2008) investigated a different Mandarin gap-filler construction from the relative clauses that were examined by Hsu and Bruening (2003). Her study examined if the parser tends to adopt the first possible filler after it identifies a gap instead of waiting for other or better alternatives later in the sentence and then choosing the 'strongest candidate'. Fifty six native Mandarin speakers completed a self-paced word-by-word reading experiment that included two conditions: condition 1 contains a plausible decoy filler (such as *xiaohaizi* 'child' in 101a) and condition 2 contains an implausible decoy filler (like *youeryuan* 'kindergarten' in 101b).

##### 101. a. **Plausible Decoy Filler**

[e; Nonghuile jige wanju] bingweishi **xiaohaizi de baomui, gengxiaoxin**  
 [e; broke a-few toy] not-CAU child DE nanny more careful  
 'Having broken a few toys did not make the child's nanny more careful.'

##### b. **Implausible Decoy Filler**

[e; Nonghuile jige wanju] bingweishi **youeryuan de baomui, gengxiaoxin**  
 [e; broke a-few toy] not-CAU kindergarten DE nanny more careful  
 'Having broken a few toys did not make the kindergarten's nanny more careful.'

As can be seen in (101a & b), the Mandarin counterpart of the clausal subject in English, *Having broken a few toys*, contains a null subject as it is not mentioned who broke the toys. Upon encountering the gap at the beginning of the sentence, the parser that makes use of Active Gap Strategy is expected to take *xiaohaizi* ‘child’ in (101a) to be the filler because it is the first possible plausible filler it encounters. However, when it reaches *baomu* ‘nanny’, it will realise that *xiaohaizi* ‘child’ is not the filler, instead, it is a modifier for the real filler *baomu* ‘nanny’. In (101b), by contrast, the first filler the parser encounters is *youeryuan* ‘kindergarten’; however, it cannot be a plausible filler for the verb *nonghuile* ‘break’. Thus, the parser will continue looking for a filler until it reaches *baomu* ‘nanny’, which it will consider a plausible filler. Therefore, an increase in the reading time is expected at *youeryuan* ‘kindergarten’ (or at *de* as a spillover region) in (101b) compared to *xiaohaizi* ‘child’ in (101a). The findings revealed a reading slowdown at the spillover region (*de* in 101b) for the sentences that contain an implausible decoy filler. Therefore, Ng’s study provided support for the Active Gap Hypothesis.

#### **4.7.3 Summary**

In sum, the studies discussed in this section provide evidence that in their L1 processing, Mandarin speakers use an Active Gap Strategy, which posits that when the parser encounters a gap first, it actively searches for a filler to interpret it. The next question is whether the use of this strategy will affect L1-Mandarin speakers’ real-time processing of filler-gap dependencies in English, where the use of an Active Filler Strategy is required instead. To the best of the researcher’s knowledge, this issue has not been examined before. Thus, it will be addressed in the present study.

#### **4.8 Conclusion**

This chapter has provided an overview of key proposals about L1 and L2 real-time processing of filler-gap dependencies and reviewed related studies. The work summarized in this chapter shows that different methods have been used to investigate the use of abstract syntactic knowledge in L2 real-time

sentence processing such as cross-modal priming, eye-tracking and self-paced reading tasks.

As discussed in Section 4.4, there has been a debate in the field of L2 sentence processing regarding the ability of adult L2 learners to make use of abstract syntax knowledge during real-time processing. Some show evidence that L2 learners underuse syntactic information during parsing. By contrast, other studies found that L2 processing is constrained by syntax in the same way as L1 processing. This contradiction motivates further testing of the ability of adult L2 learners to make use of abstract syntactic knowledge during real-time sentence processing.

Klein (1999) recommended replicating recent L2 processing studies with speakers from various L1s to see the effect of similarities and differences in parsing strategies cross linguistically. According to Canales (2012, p.79), “given that the Shallow Structures Hypothesis predicts no differences for the L2 learners, regardless of their L1, future studies could explore online processing of wh-dependencies in languages that are more typologically different than Spanish and English just to verify if the L1 plays a role or not”. Therefore, the present study attempts to extend Canales’ (2012) study by investigating contrasting groups of wh-in-situ languages (Jordanian Arabic and Mandarin), in contrast to the Spanish group examined by Canales whose L1 has wh-movement and respects island constraints. The inclusion of L1-Mandarin group allows testing for evidence for whether L1 Active Gap Strategy affects the use of L2 Active Filler Strategy in real-time processing of filler-gap dependencies.

## Chapter 5

# An investigation of the L2 processing of English filler-gap dependencies

### 5.1 Introduction

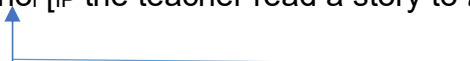
This chapter describes the methodology used to investigate whether second language learners of English whose first languages lack wh-movement (Jordanian Arabic and Mandarin) can process wh-dependencies incrementally like native speakers of English, and whether they respect syntactic constraints that regulate wh-extraction out of relative clause island in their real-time processing. This chapter is organized as follows: Section 5.2 presents the motivation of the study. Section 5.3 describes the design of the two self-paced reading experiments conducted in the present study, namely, the Filled-gap Experiment and the Relative Clause Island Experiment. Then, the section proceeds to report the data processing and analysis procedures. Section 5.4 report the results of the two experiments and compares the performance of the two L2 groups who completed both experiments. Section 5.5 provides a general discussion about the findings of both experiments.

### 5.2 Motivation of the study

As discussed in Chapter 2 (Section 2.5), English, Jordanian Arabic and Mandarin differ with regard to the derivation of wh-sentences. In English, relative clauses are generated through wh-movement. A standard account of English relative clauses (following Chomsky, 1977) assumes that in English relative clauses, a wh-phrase moves to the spec CP in the embedded clause whereby the surface word order contains a gap (102a), and the underlying word order involves wh-movement (102b).

102. a. I saw the boy [<sub>CP</sub> who [<sub>I</sub> the teacher read a story to \_\_\_]].

b. I saw the boy [<sub>CP</sub> who<sub>i</sub> [<sub>IP</sub> the teacher read a story to t<sub>i</sub>]]



In Jordanian Arabic and Mandarin, by contrast, no movement is involved in the derivation of relative clauses. Instead, relative clauses are base-generated with

a resumptive pronoun in the extraction site (e.g., Al-Momani, 2010; Yang et al., 2020). As discussed in Chapter 2, the use of resumptive pronouns and the absence of subjacency effects in Jordanian Arabic and Mandarin wh-dependencies are taken as evidence that there is no wh-movement in either language. Consider example (103) from Jordanian Arabic and example ((104) from Hawkins and Chan, 1997, p.195) from Mandarin.

103. [uf-t il-walad [illi aʕtet-uh ilflu:s]  
 saw-I the boy that gave.I-him the money  
 'I saw the boy who I gave some money.'

104. [<sub>CP</sub> Top<sub>i</sub> [<sub>IP</sub>wo xihuan pro<sub>i</sub>/ta<sub>i</sub>] de] neige nuhai<sub>i</sub>  
 null.topic [ I like pro/her DE] the-girl  
 'the girl who I like'

In addition, it can be noticed in the examples above that in English, the filler (*who* in 102) precedes the gap. The same order also applies to Jordanian Arabic, where the filler *illi* precedes the gap, which is filled with a resumptive pronoun (*-uh* in (103)). On the other hand, in Mandarin, the filler (the girl) follows the gap. Sentence (104) shows that a resumptive pronoun can fill the gap, or the gap can be an actual gap containing the null pronoun.

As illustrated in Chapter 4 (Section 4.3), previous research that investigated the real-time processing of wh-dependencies by native speakers of English (e.g., Crain and Fodor, 1985; Stowe, 1986) revealed that when English native speakers encounter a wh-phrase like *who* in (105a), they immediately begin to search for the position from which the wh-phrase originated.

105. a. Who had the little girl expected **us** to sing those stupid French songs for at Christmas?  
 b. The little girl had expected **us** to sing those stupid French songs for Cherry at Christmas.

Therefore, when they reach the verb *expected* in (105a), they try to posit a gap in the potential gap position that follows the verb. However, when they

encounter a filler in that position (*us* in 105a), their reading times show a Filled-Gap Effect in the form of longer reading times at the filled-gap position in *wh*-sentences compared to their reading time for the same position in the declarative sentence (105b). Based on such results, Crain and Fodor (1985) concluded that English native speakers process *wh*-sentences incrementally. Moreover, research on L1 real-time processing pointed out that native speakers avoid positioning gaps in unlicensed positions such as islands. This indicates that their L1 parsing is constrained by syntax.

However, research on L2 processing of *wh*-sentences reported mixed results. Some studies (e.g., Clahsen & Felser, 2006; Felser & Roberts, 2007; Marinis et al., 2005) found that L2 learners underuse syntactic information used by native speakers during parsing. On the other hand, other studies (e.g., Aldwayan et al., 2010; Canales, 2012; Omaki & Schulz, 2011; Williams et al., 2001) argued that L2 learners are able to process *wh*-sentences in the same way as native speakers of English and that they make use of knowledge of syntactic constraints during their real-time processing of these sentences. Nevertheless, as illustrated in Chapter 4 (Section 4.4), most of these studies have examined L2 learners of English whose L1 exhibits *wh*-movement or whose L1 has the same order of English filler-gap dependency. Therefore, the goal of the present study is to investigate if such findings are possible when the L1s lack *wh*-movement and have different orders of filler-gap dependency. Specifically, the present study replicates Canales' (2012) study in the sense that it uses the same experiment items but with different populations, to compare L2 processing of filler-gap in English *wh*-sentences by two groups of L2 learners whose L1s lack *wh*-movement (Jordanian Arabic and Mandarin speakers of English). The present chapter investigates the L2 real-time processing of *wh* dependencies in English embedded *wh*-questions. Examples 106-108 show the representation of indirect *wh*-questions in English (106 from Canales, 2012) and its parallel Jordanian Arabic (107) and Mandarin examples (108).

106. The manager asked who Ethan will meet Sam with outside the office.

107. il-mudi:r        sʔal   mi:n   illi   Ethan   rɦ   yqabil   Sam  
 The-manager asked who that Ethan will meet Sam  
 mʕ-uh    brra        il-maktab  
 with-him outside the-office.  
 ‘The manager asked who Ethan will meet Sam with outside the office.’
108. Jingli   wen   Ethan yao   zai   bangongshi   wai        gen   shui        yiqi  
 Jian        Sam  
 Jingli   ask   Ethan will   at   office        outside with who together  
 meet   Sam  
 ‘The manager asked who Ethan will meet Sam with outside the office.’

As can be noticed from (106-108), like English, in Jordanian Arabic the head of the dependency (*mi:n* ‘who’) precedes the indirect wh-question; whereas in Mandarin, the head of the dependency (*shui* ‘who’) follows the indirect wh-sentence. The differences in the derivation of wh-sentences and in the order of filler-gap dependencies are exploited in this experiment through the investigation of L2 sentence processing by Jordanian Arabic and Mandarin speakers of English. As illustrated above, the motivation for investigating these two groups is that their L1s differ with regard to filler-gap order. Jordanian Arabic is similar to English: the filler precedes the gap; whereas in Mandarin, the gap precedes the filler.

As illustrated from processing studies reviewed in Chapter 4 (Sections 4.3 and 4.5), there is experimental evidence of the Active Gap Strategy in L1 English and the Active Filler Strategy in L1 Mandarin. The present study follows De Vincenzi’s re-formulation of the Active Filler Strategy (the Minimal Chain Principle: *avoid postulating unnecessary chain members, but do not delay postulating necessary chain members*, De Vincenzi 1990) and argues that under this interpretation active gap processing should not differ from active filler processing. In this perspective, head-initial and head-final languages share a single mechanism for the processing of dependencies and the only variation is in the relative order of filler and gap. This small change of perspective on the processing of filler-gap dependencies has non-trivial consequences for learnability, as non-native speakers will have to reset a directionality parameter,



but will not have to acquire new types of dependencies or completely new processing strategies. One prediction of this account is that Mandarin speakers should display evidence of employing an incremental active filler strategy when processing L2 English, i.e., slow down at filled-gap positions; however, this depends on them identifying English embedded wh-questions as a filler-gap structure. Equivalents of English embedded wh-question in Mandarin are not filler-gap structures (or gap-filler structures) (108). Equivalents of English embedded wh-questions in Jordanian Arabic involve a dependency between the filler and the resumptive pronoun that is similar to the English filler-gap structure in embedded wh-questions (107). Consequently, the Jordanian Arabic group is expected to demonstrate a more robust filled-gap effect during filler-gap dependency processing than the Mandarin speakers of English, due to L1 influence.

The next section provides information about the self-paced reading experiments conducted in the present study.

### **5.3 Method**

Two self-paced reading experiments were used to collect the data: a Filled-gap Experiment and a Relative Clause Island Experiment. Following Stowe (1986) and Canales (2012), the two experiments were run within a single self-paced reading task. Thus, the stimuli used in the Filled-gap Experiment and the ones used in the Relative Clause Island Experiment were combined with a set of fillers and were presented in random order within a single self-paced reading task.

#### **5.3.1 The Filled-gap Experiment**

This experiment investigated whether L2 speakers of English posit a gap in a potential gap position, in the same way as native speakers of English. The question that this experiment attempted to answer is:

109. Do Jordanian Arabic L2 speakers of English and Mandarin L2 speakers of English whose L1s lack wh-movement use the Active Filler Strategy in their real-time sentence processing?

The Filled-gap Experiment involved 20 pairs of sentences. Each sentence had two conditions: a control if-condition (with no extraction) (110a); and a condition that included wh-extraction from one of the grammatically licensed positions in embedded wh-questions (110b), (region 10). Two Latin Square presentation lists were created so that every participant would read one instance from each pair, and no participant would read the two versions of the same sentence.

- |  |   |   |   |   |   |   |   |   |   |    |    |
|--|---|---|---|---|---|---|---|---|---|----|----|
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|--|---|---|---|---|---|---|---|---|---|----|----|
110. a. The manager knew if Katy will recommend **Joe** to Amy after the assembly
- b. The manager knew who Katy will recommend **Joe** to \_\_\_\_ after the assembly.

In the wh-extraction condition (110b), there are three potential gap sites: 1. subject position in region 5 (*Katy*); 2. object position site in region 8 (*Joe*), and 3. object of a preposition position in region 10 (gap). However, the filled-object position site in region 8 is the main region of interest in this experiment because previous studies (e.g., Aldwayan et al., 2010; Canales, 2012; Stowe, 1986) found evidence of incremental processing of wh-dependencies at this region. This means that when the parser encounters a wh-filler representing a displaced NP (i.e., *who* in 110b), it attempts to posit gaps after each gap licenser like a preposition or verb it encounters (i.e., *recommend* in 110b). If, however, such a position is already filled with an NP (such as *Joe* in 110b), the parser will be surprised and forced to reanalyse its predictions, thus causing a slowdown in its processing of that region of the sentence.

If the participants process wh-sentences incrementally, following parsing principles akin to the Active Filler strategy, they would show an object filled-gap effect in the form of slowdown at the critical region (region 8, *Joe*) and/or at the spillover region (region 9, *to*) in the wh-extraction condition (110b) relative to

the same position in the if-condition (110a).<sup>9</sup> The results obtained from the Filled-gap Experiment allowed testing Hypothesis 1:

111. **Hypothesis 1:** Jordanian Arabic and Mandarin speakers of English will process filler-gap dependencies incrementally, and will posit a gap at the object filled-gap site in embedded wh-questions.

A filled-gap effect might potentially also emerge in the subject position. This would be evident in longer reading times at the subject position (region 5) and/or the spillover region (region 6) in the wh-extraction condition compared to the if-condition. However, previous studies have found inconsistent evidence for a subject filled gap effect (e.g., Aldwayan et al., 2010; Canales, 2012; Stowe, 1986). While the results of Stowe (L1- English) and Canales (L1-English control group and L1-Spanish L2-English learners) showed an absence of a filled subject-gap effect, Aldwayan et al. (2010) found such an effect only for the Najdi-Arabic speakers but not for the native English group (like Stowe and Canales).

Following Canales (2012), the types of verbs used in region 3 were only verbs that take sentential complements (*know, reveal, wonder, guess, ask*), and each of these verbs was used four times. Moreover, all the verbs located in region 7 that precedes the critical region in the sentences require a direct object (*photograph, place, put, recommend, find, film, meet, introduce, discover, seat*). Ditransitive verbs and verbs which are optionally transitive were not used in this position because ditransitive verbs may lead to the prediction of another object gap, and the optionally transitive verbs may not trigger the prediction of an object gap. Moreover, the critical region (region 8) in each sentence was followed by a prepositional phrase which contains the gap position in the wh-extraction condition (e.g., *to \_\_\_\_\_* in 110b). The names used in region 5 and region 8 are considered common in English. In order to control for length, each proper name used in region 8 is three-letters in length (e.g., *Ted, Dan, Tom,*

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<sup>9</sup> A spillover region is the region that immediately follows the critical region (Jegerski, 2013). Longer reading times at the spillover region are assumed to indicate processing difficulty or reflect later phases of comprehension (Jegerski, 2013).

*Sue, Rob, Liz*). The full list of stimuli used in this experiment is provided in Appendix (1).

### 5.3.2 The Relative Clause Island Experiment

The Relative Clause Island Experiment investigated whether the L2 participants are aware of the syntactic constraints that do not allow wh-extraction out of relative clause islands. This experiment sought an answer to the following question:

112. Do Jordanian Arabic L2 speakers of English and Mandarin L2 speakers of English use abstract syntactic knowledge in their real-time processing of English wh-sentences?

This experiment contained 20 pairs of sentences that included relative clauses. The first sentence in each pair was the control if-sentence (113a), and the second one is the wh-extraction sentence (113b). Two Latin Square presentation lists were created for this experiment as well, so every participant would read only one sentence from each pair.

- |         |              |            |     |            |         |          |              |              |          |    |
|---------|--------------|------------|-----|------------|---------|----------|--------------|--------------|----------|----|
|         | 1            | 2          | 3   | 4          | 5       | 6        | 7            | 8            | <b>9</b> | 10 |
| 113. a. | The director | questioned | if  | the singer | that    | bothered | <b>Peter</b> | last         |          |    |
|         | season       | criticized |     | the        | pianist | after    | the          | concert.     |          |    |
| b.      | The director | questioned | who | the        | singer  | [that    | bothered     | <b>Peter</b> | last     |    |
|         | season]      | criticized |     | after      | the     | concert. |              |              |          |    |

In sentence (113b), *who* cannot be associated with the second potential gap position in region 9 (*Peter*), because it is contained within a relative clause island from which wh-extraction is prohibited. Following the Shallow Structure Hypothesis, one would expect L2 learners to allow the verb contained in the relative clause (*bothered*) to assign a thematic role to the wh-element *who*. This is not simply due to the fact that L2 speakers would ignore syntactic constraints, like the relative clause island restrictions while processing sentences like (113b), but more simply because they would represent a very impoverished, shallow structure which presumably would not even allow them to identify the presence of such island. The Shallow Structure Hypothesis, therefore, would predict reading time differences at the region of interest (*Peter*) to parallel those

observed in standard filled-gap experiments, i.e., longer reading times at the region of interest for (113b) than (113a).

Alternatively, if participants incrementally project 'deep' syntactic representations (i.e., syntactic representations which are detailed enough to establish that the verb *bothered* is contained in a relative clause island) and make use of knowledge of syntactic constraints, they would not posit a gap in an unlicensed position (*Peter* in 113b) because, as mentioned before, wh-extraction out of relative clause islands is not allowed in English. Thus, contrary to what predicted for the Filled-gap Experiment above, the L2 participants would not show a significant difference in reading times in the two conditions. This allowed investigation of whether Jordanian Arabic L2 learners of English and Mandarin L2 learners of English have access to abstract syntactic island constraints in real-time sentence processing. The results obtained from the Relative Clause Island Experiment allowed testing Hypothesis 2:

114. **Hypothesis 2:** Jordanian Arabic and Mandarin speakers of English will demonstrate sensitivity to wh-island constraints during processing, and will *not* posit a gap within an island when processing filler-gap dependencies

Following Canales (2012), all the verbs used in region 3 (*questioned, asked, wondered, investigated*) take sentential complements. Moreover, all the verbs used in region 8 as a gap licenser were also controlled for transitivity: only obligatorily transitive predicates were used, while ditransitive and optionally transitive verbs were excluded. All the proper names used in the critical region in this experiment (region 9) consist of five letters (*Tyler, Kylie, Henry, Jacob, Diana, Jenny, Maria*).

As discussed earlier (see Chapter 4, Section 4.2.1), the nature of islands is an ongoing debate, with syntactic, semantic and processing based accounts. According to formal grammatical accounts, gap-filling inside islands is prohibited due to utilization of syntactic knowledge (e.g., Phillips, 2006; Stowe, 1986; Traxler & Pickering, 1996). Processing-based accounts, on the other hand, assume that the complex structure of islands leads to processing

overload that increases difficulty in resolving filler-gap dependencies (e.g., Hofmeister & Sag, 2010; Kluender, 1991; 1998; 2004; Kluender & Kutas, 1993). However, identification of an island is argued also within a processing-based approach to islands (Cunnings 2017; Kim, 2014; Omaki and Schulz 2011). However, as others have pointed out (Cunnings 2017; Kim, 2014; Omaki and Schulz 2011), even within a processing-based approach to islands, identification of an island is argued to require a deep and detailed representation. Therefore, whether one adopts a grammatical or processing account of the absence of filler-gap dependencies into islands, it seems that for the filler-gap effect to arise, the parser must identify an island structure. Following Cunnings (2017), the assumption in this thesis is that island effects are due to the presence of a complex syntactic structure, regardless of whether the effect itself arises because of a constraint imposed by the grammar, or by the processing difficulties incurred by the complex structure.

### 5.3.3 Fillers

The fillers used in this study were the same as Canales' (2012). The fillers were 80 sentences that included various structures to distract participants' attention from the target sentences. However, they match the complexity and the length of the target items which make them indistinguishable. The ratio of fillers to the target sentences was 2:1.

Some fillers contained sentential complements introduced by complementizers other than *if* and *who* such as *whether* (115), *that* (116), and *what* (117). These fillers help with making *who* less salient.

115. My sister inquired *whether* Thomas would return after the long winter break.

116. The young boy said *that* Janet and Calvin sang very loudly at the wild party last night.

117. My cousin forgot *what* Bill will cook us next week at the celebration.

Other fillers contained ditransitive verbs like *buy* (118) and *bring* (119), or intransitive verbs that do not include extraction, e.g., *sleep* (120) and *study* (121).

118. My father asked who will *buy* me a new costume for the party.
119. My sister revealed who will *bring* me an expensive present on Saturday night.
120. The girl wondered whether Charles would *sleep* during the boring class lecture.
121. The new student revealed that Saad and Emad *studied* every day at the public library this week.

Other fillers included topicalized clauses (122 and 123), which were used to add some variations and different structures to the target sentences.

122. It was Christopher that predicted who Frank would bring to the wedding party.
123. It was Dennis that said who Bill would see before the big concert.

Some fillers included proper names that could not be coindexed with the *wh*-word displaced in the sentence as *what* in (124).

124. Laura and Paul finally revealed *what* their parents liked about the famous school in their small town.

Some filler sentences included a sentential subject, out of which extraction is not allowed (125-127). Thus, it is not necessary that whenever the participants read a *wh*-word, they would start searching for a gap.

125. My boss questioned who will report me to Martha after the meeting.
126. The teacher revealed who Beth will join with Paul at the cafeteria.
127. My mother wondered who will deliver me a large vase of fresh flowers.

In sum, different structures were used as fillers in the present study to deviate the L2 learners' attention from the target sentences. The complexity and the length of the fillers matched those of the target sentences, which made them indistinguishable.

### 5.3.4 Comprehension questions

The purpose of comprehension questions in a self-paced reading task is to let the participants be engaged in the task and divert their attention from it at the same time (Jegerski, 2013). Jegerski (2013) reported that there is a variation in the literature with regard to how often comprehension questions appear: after each stimulus or randomly after a fraction of stimuli. However, Jegerski (2013: 35) argued that “either method would be sufficient”. The comprehension questions in the present study were used to gain a measure of attention to the reading task. Unlike Canales’ study where a comprehension question followed each experimental sentence and filler, in the present study, there was a comprehension question after every experimental sentence, but after some of the fillers. The motivation of reducing the number of comprehension questions after fillers is to avoid making the task too long for the participants. Twenty Yes/No comprehension questions were formed for the Filled-gap Experiment (10 Yes/10 No), 20 Yes/No comprehension questions were created for the Relative Clause Island Experiment (10 Yes/10 No), and 10 questions for the fillers (5 Yes/5 No). Thus, half of the comprehension questions’ answers were Yes and the other half were No. Consider the comprehension question in (128b) that follows the target sentence (128a):

128. a. My grandmother knew who Adam will find Jen with at the mall.

b. Did the sentence suggest that Adam will be at the mall?

*Correct answer: Yes*

The comprehension question was displayed after the participant read the last word in the experimental sentence.

### 5.3.5 Hypotheses and predictions

Two hypotheses were presented above, in Sections 5.3.1 and 5.3.2, and these are repeated, for convenience in (129) and (130), below. The study also investigates a third hypothesis relating to L1 influence (131), based on the earlier discussion of the difference in the order of filler-gap dependencies in Jordanian Arabic and Mandarin (see Section 5.2).



129. **Hypothesis 1:** The Jordanian Arabic and Mandarin speakers of English will process filler-gap dependencies incrementally, and will posit a gap at the object filled-gap site in embedded wh-questions.
130. **Hypothesis 2:** The Jordanian Arabic and Mandarin speakers of English will demonstrate sensitivity to wh-island constraints during processing, and will *not* posit a gap within an island when processing filler-gap dependencies.
131. **Hypothesis 3:** The Jordanian Arabic speakers of English may demonstrate a more robust filled-gap effect during filler-gap dependency processing than the Mandarin speakers of English, due to L1 influence.

Taken together, Hypotheses 1 and 2 lead to a prediction for an interaction between the experiment and condition variables, as follows:

132. **Prediction 1:** There will be an interaction of Experiment by Condition at the object filled-gap regions, whereby reading times are longer in the wh-condition than the if-condition in the Filled-gap Experiment but not in the Relative Clause Island Experiment.

Hypothesis 1 refers to the object filled-gap position, based on previous L1 and L2 findings. However, as discussed in Sections 5.3.1 and 5.3.2, a filled-gap effect could potentially also arise at the subject filled-gap regions in either the Filled-gap Experiment or the Relative Clause Experiment. Though this has not been attested in L1 processing, there is some evidence for such an effect in L2 processing (Aldwayan, et al., 2010). The current L2 study thus also tests for a subject filled-gap effect through prediction 2:

133. **Prediction 2:** There will be a main effect of condition for the subject filled-gap regions, whereby in both the Filled-gap Experiment and the Relative Clause Island Experiment reading times will be longer in the wh-condition than in the if-clause condition.

Finally, by Hypothesis 3, L1 could interact with Condition at either the object filled-gap or the subject filled-gap positions. This is tested through Prediction 3:

134. **Prediction 3:** There will be an interaction of L1 with Condition at the object filled-gap or the subject filled-gap positions, whereby reading times are longer in the wh-condition than the if-condition only in the Jordanian Arabic group.

These hypotheses and predictions will be tested by the results of omnibus models to be reported in Section 5.4.4.

### **5.3.6 Participants**

Two groups of L2 learners of English participated in this study. The first group included 40 Jordanian speakers of English (23 males and 17 females) who ranged in age between 21 to 40 years old. The second group included 40 Mandarin speakers of English (18 males and 22 females) who ranged in age between 18 and 37 years old. The participants of both groups had normal vision.

All the participants in the present study completed the Oxford Quick Placement Test (2001) before they started the self-paced reading task. This test is widely used to measure participants' proficiency in English. The Oxford Quick Placement Test is a multiple-choice test that assesses reading, vocabulary and grammar. It includes 60 multiple questions and consists of two parts: part one (questions 1-40) and part 2 (questions 40-60). Part one is designed for all learners while part two is for higher-level learners. The participants in this study completed part one only, as none of them got higher than 38 in part one, and in order to limit the number of questions they needed to answer before they moved to the self-paced reading task. The results of part one of the Oxford Quick Placement Test are out of 40 and can be mapped onto levels of the Common European Framework. Based on the participants' scores on the Oxford Quick Placement Test, the participants can be classified as level B1, or intermediate, in the Common European Framework. The participants'

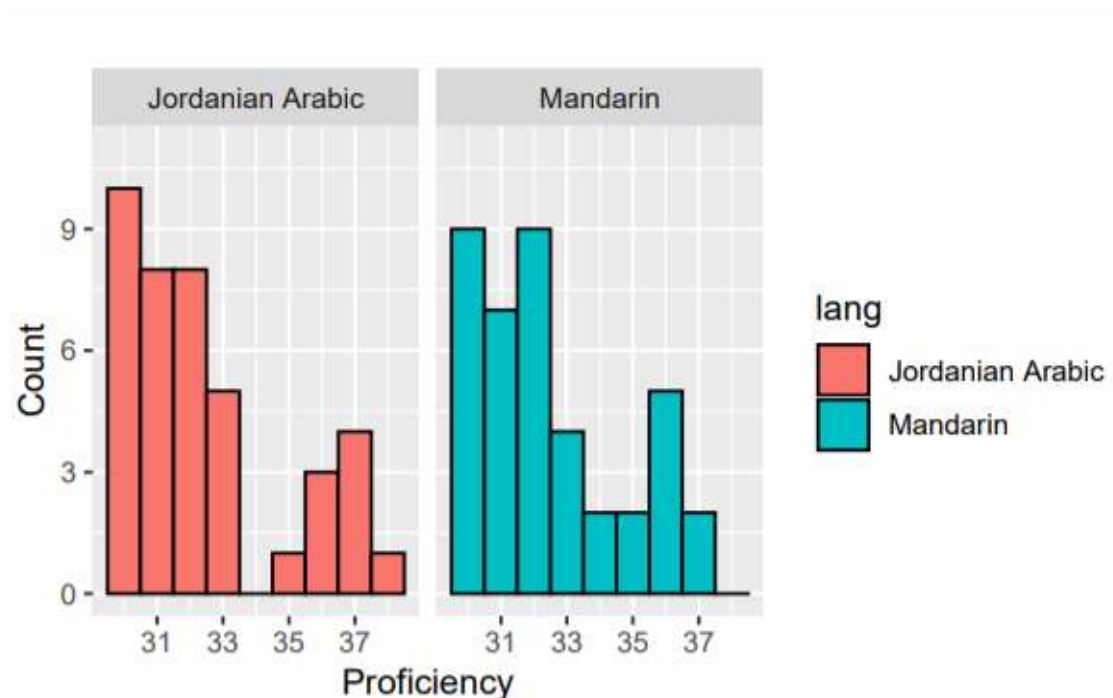
scores in the Oxford Quick Placement Test along with profiles of the two groups can be seen in Table 3.

**Table 3.** Characteristics of the participants of the self-paced reading experiments.

L2 Group	Age Range			Oxford QPT Score		
	Mean	SD	Range	Mean	SD	Range
Jordanian Arabic (n=40)	31.6	4.48	21-40	32.50	2.44	30-38
Mandarin (n=40)	25.6	4.43	18-37	32.48	2.20	30-37

Note. QPT = Quick Proficiency Task.

Figure 1 expands on standard deviation data in Table 3 to provide full detail of the distribution of proficiency scores by group.



**Figure 1.** The distribution of the self-paced reading experiments participants' proficiency task by L1.

The side-by-side comparison of the two groups shows that within the range of 30–38, both groups are skewed towards the lower end. A two-sample t-test that compared the two groups' proficiency scores showed no significant difference between the two groups scores ( $t = -0.047$ ,  $p = 0.96$ ).

There was no need to re-examine native speakers of English processing of wh-movement in the present study because this issue has been well examined by many studies (e.g., Aldwayan et al, 2010; Canales, 2012; Crain and Fodor, 1985; Stowe, 1986). There is a consensus across these studies that native speakers of English process wh-sentences incrementally. Moreover, Canales (2012) investigated the real-time processing of wh-dependencies by native speakers of English using the same experiment items employed in the present thesis.

### **5.3.7 Procedures**

Ethical approval for the data collection was obtained from the Ethics Committee in the Department of Language and Linguistic Science at the University of York in the UK. Jordanian Arabic participants were invited to take part in the study through a visit to their classes from the researcher to outline the project and describe the tasks they would need to complete. The students were informed that the findings would be used for research purposes only and that their individual responses would remain anonymous. An information sheet was provided in the same class and the opportunity to ask questions was given after the presentation. The students were allowed to ask questions in Arabic to ensure that they understood everything. Following that, an email was sent to all class members to invite them to sign up for participation if they wished to do so. Those who chose to participate were asked to sign the consent form. All testing took place individually in a quiet place under the researcher's supervision.

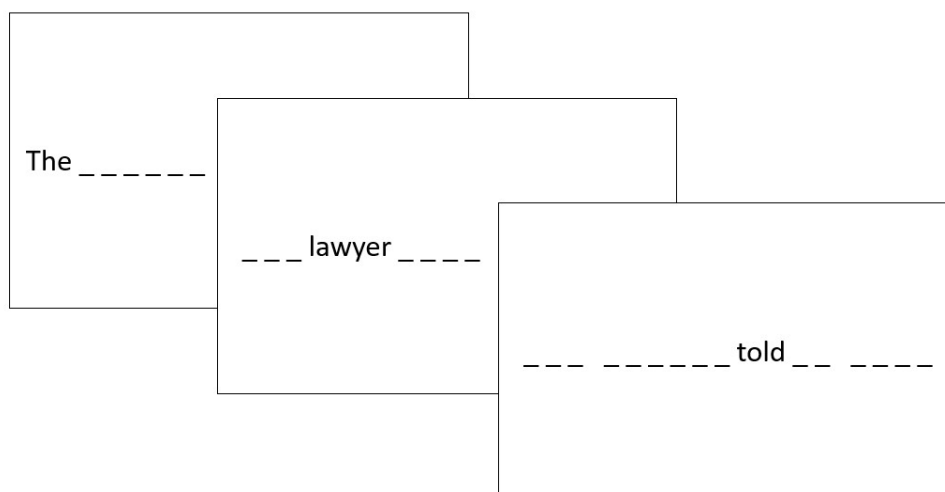
The experiment protocol for the investigation of Mandarin L2 learners of English was also approved by the University of York Department of Language and Linguistic Science ethics committee. Mandarin L2 learners of English were invited to participate in the study through an email that was sent out by two departments at the University of York, which invited native speakers of Mandarin to sign up for participation if they were interested. The email included the information sheet. Those who decided to take part in the study were asked to read the information sheet before they signed the consent form. Each participant completed the required tasks individually in a quiet environment at the University of York's library under the researcher's supervision.

Before taking part in the experiment, participants from both language groups were asked to complete the Oxford Quick Placement (2001) first. Only those who scored 30 or above (out of 40 in part one) in the test were allowed to participate in the study, in order to ensure that they have a general English level high enough to participate in this study. The Oxford Quick Placement Test was administered online using Qualtrics software ([www.qualtrics.com](http://www.qualtrics.com)) which automatically marked the test and gave an instant result to the researcher. The participants who obtained the required score in the placement test were asked to fill out an online background information questionnaire which included their age, gender, native language(s), other foreign languages learned, length of exposure to English, and years of English instruction. The background information questionnaire was also conducted using Qualtrics software.

After completing the background questionnaire, the participants were asked to take part in the self-paced reading experiment. Instructions for the task were provided in English on the screen at the beginning of the experiment and were summarized on a script so that the researcher would repeat them orally in English, to make sure that all the participants would have a clear understanding of how to complete the tasks as required. Participants were asked to read the sentences naturally comprehending what they read and to answer the comprehension questions as accurately as possible. Six practice items were provided before the actual experiment started: two examples to show the participants how they would read the sentences word by word by pressing the space bar, and 4 examples similar to the task sentences to show them how to answer the comprehension questions that follow some sentences using “F” if the answer is Yes and “J” if they think the answer is No. After the practice items, a message was displayed on the screen telling the participants that this is the end of practice trial and if they have any question, they could ask the experimenter before they moved to the main experiment.

The experiment was conducted using the *Linger* Software (<http://tedlab.mit.edu/~dr/Linger/>). The experimental method used was a non-cumulative moving window self-paced reading method (Just, Carpenter & Woolley, 1982). Each sentence was initially displayed as a sequence of dashes

covering each of the words in the sentence and the participants needed to press a button (the space bar on the keyboard) to reveal a new word, and every time a participant saw a new word, the previous one was re-masked as illustrated in Figure 2 (i.e., only one word was displayed at a time (which explains why the method is called non-cumulative)):



**Figure 2.** Illustration of non-cumulative moving window format in self-paced reading experiments.

The time taken for each button press was recorded, giving an indication of processing time. As mentioned before, some sentences were followed by a comprehension question to gain a measure of attention to the reading task. The comprehension question was displayed after the participant read the last word in the experimental sentence.

During the test, participants were also allowed to have a break if they needed to, but they were asked to do so after they finish reading the sentence, and before starting to read a new sentence; but not in the middle of reading a sentence. Each participant received 8 UK pounds in compensation for participating in the experiment.

As mentioned previously, the stimuli used in the Filled-gap Experiment (20 sentences) and the stimuli used in the Relative Clause Island Experiment (20 sentences) were combined with the 80 fillers and were presented in random order. Thus, each participant read 120 sentences in total. The total time taken

for completing both experiments differed individually according to different participants but, on average, it took approximately 40 minutes.

### **5.3.8 Data processing and analysis**

As mentioned above, 40 Jordanian Arabic speakers and 40 Mandarin speakers participated in the present study. The first step in the data analysis was to consider accuracy on the 50 comprehension questions. Canales (2012) excluded participants whose overall accuracy rate in the comprehension questions was lower than 70%. This resulted in excluding two L2 participants from his study. Following Canales' criteria in the present study would result in the exclusion of 9 Jordanian Arabic speakers and six Mandarin speakers. This means that almost 25% of the Jordanian Arabic group and almost 15% of the Mandarin group would be excluded. To address this point, this study investigated the relationship between overall proficiency represented by the Oxford Quick Placement Test scores and comprehension questions accuracy in order to check whether accuracy in the comprehension questions is predicted by general proficiency. If so, this would motivate using proficiency scores as a predictor in the main analysis of reading times, as an alternative to excluding participants on the basis of inaccurate comprehension question answers. An alternative cut-off of 60% accuracy in comprehension questions was considered to minimally exclude participants. This criterion would result in excluding 4 Jordanian Arabic speakers and 2 Mandarin speakers. This would reduce the amount of participants excluded to 10% of the original Jordanian Arabic group and 5% of the Mandarin group. However, this cut-off was ruled out on the grounds that the present study applies linear mixed-effects modelling to analyse the self-paced reading task data. This contrasts with Canales' study that used ANOVAs, where data trimming was more crucial in that case. According to Jegerski (2013), in linear mixed-effects models, data trimming should be very minimal or entirely unnecessary. Jegerski also argued that since mixed-effect models do not rely on aggregate means (do not require prior averaging), all the range of values can remain in the data and the presence of outliers is not a concern. Moreover, Baayen, Davidson and Bates (2008: 407) stated that:

Mixed-effect models have been developed to capture individual differences in a principled way, while at the same time allowing generalizations across populations. Instead of discarding individual differences across subjects and items as an uninteresting and disappointing nuisance, we should embrace them. It is not to the advantage of scientific progress if systematic variation is systematically ignored.

Therefore, it seems that the best practice in mixed effects models is to either keep all data or to exclude as little data as possible. Thus, the present study deviated from Canales' inclusion criteria, and included all the data, but (following the analysis of the relationship between proficiency scores and comprehension question accuracy reported in the next section) added the proficiency score as a predictor. Therefore, the statistical analysis of the results in this study was conducted based on the data of 40 Jordanian Arabic L2 speakers of English and 40 Mandarin L2 speakers of English.

The results section starts with presenting descriptive and inferential statistics for the investigation of the relationship between the proficiency scores and the comprehension question accuracy. Then, it moves on to present the descriptive results for the two experiments separately. The descriptive results for the Filled-gap Experiment are presented in Section 5.4.2, and those of the Relative Clause Island Experiment are presented in Section 5.4.3. For the inferential statistics, Section 5.4.4.1 reports the results of an omnibus model that was run for both experiment results together due to the fact that the two experiments were run within a single task, which means that the behaviour on one experiment could influence the behaviour on the other. The cumulative model takes any such influence into account. The model was run to test the experiment hypotheses (1-3) (highlighted in Section 5.3.5) and to test prediction 1 of an interaction between Experiment\*Condition at the object critical region and/or spillover region, and prediction 3 of an interaction of L1\*Condition at the object filled-gap region and/or spillover region. Section 5.4.4.2 then presents the results of a similar omnibus model that was conducted to test prediction 2 (presented in (133)) that there is a main effect of Condition at the subject critical region and/or spillover region and to test prediction 3 (presented in (134)) of an interaction of L1\*Condition at the subject filled-gap region and/or spillover region. All statistical analyses were run using the lme4 package (Bates 2005,

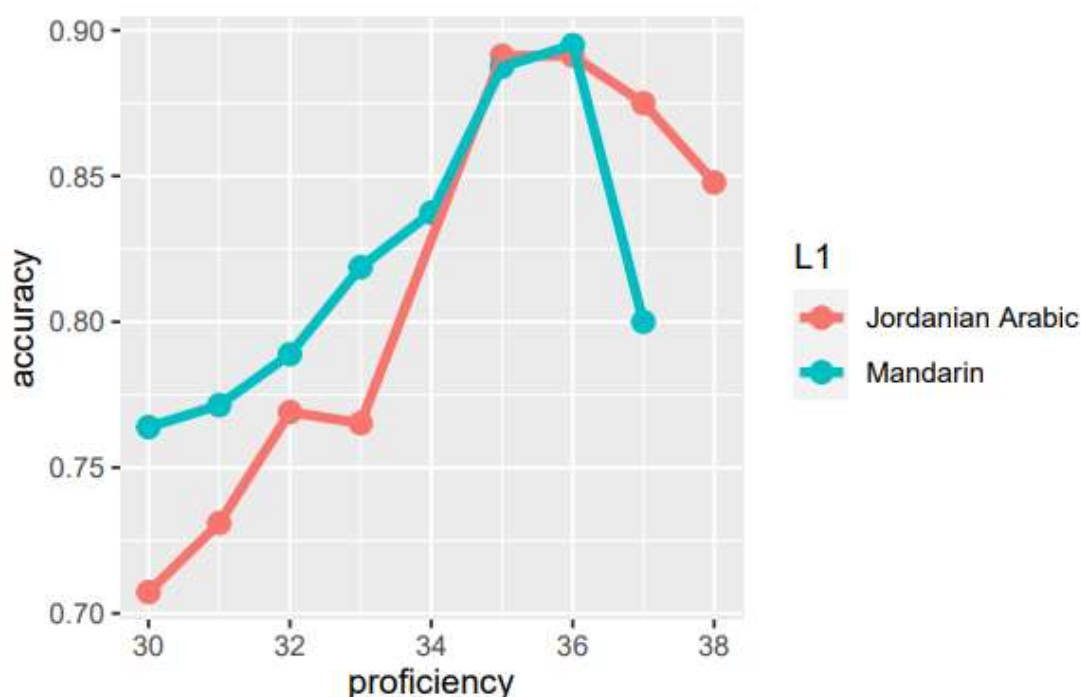


Bates and Sarkar, 2007) in R (the R statistical environment, R Core Team 2019).

## 5.4 Results

### 5.4.1 Comprehension question results

The mean accuracy (expressed as a proportion of correct responses) for the Jordanian Arabic participants in the comprehension questions was 0.77 (SD: 0.42), and for the Mandarin participants was 0.80 (SD: 0.40). Figure 3 shows the distribution of mean accuracy on comprehension questions by participants' proficiency score and L1.



**Figure 3.** The distribution of mean accuracy on comprehension questions by proficiency and L1.

As can be seen in Figure 3, in general, more proficient participants in each L1 group show higher accuracy on comprehension questions than less proficient participants.

To further investigate the relationship between general proficiency and comprehension question accuracy, a mixed-effects logistic regression model with random intercepts for subjects was run using the lme4 package (Bates 2005, Bates and Sarkar, 2007) in R to analyse question response accuracy as

a function of L1 and proficiency. The language predictor was sum-coded (Mandarin = -1, Jordanian Arabic = 1) and proficiency scores were centred around the means (following Cunnings, 2012). Wald's *z* and an associated *p*-value are reported. The results of the mixed-effects logistic regression model that investigates the effects of comprehension question accuracy and proficiency are presented in Table 4.

**Table 4.** Mixed-effects logistic regression model results for comprehension question accuracy.

<b>Coefficient names</b>	<b>Estimate</b>	<b>z</b>	<b>p</b>
L1: Jordanian Arabic	-0.098	-1.482	.138
Proficiency	0.140	4.747	<.001
L1 * Proficiency	0.022	0.727	.467

Note. The code used for this model is: `question.model = glmer (correct ~ L1*centerProf + (1|subject), family = 'binomial')`

The results showed that proficiency was a good predictor of comprehension question accuracy, with more proficient participants showing higher accuracy as illustrated by the strong main effect of proficiency ( $p < 0.001$ ). Moreover, there was no evidence that Jordanian Arabic participants were any more, or less accurate than Mandarin participants ( $p = 0.138$ ). The results also showed the absence of an interaction of L1 with proficiency ( $p = 0.467$ ). The main effect of proficiency on comprehension accuracy suggests that proficiency also could have an effect on processing of the target sentences. Therefore, it should be included as a predictor variable in the reading time analysis.

#### **5.4.2 The Filled-gap Experiment results**

Recall that the focus of the Filled-gap Experiment was to investigate whether the L2 learners of English whose L1s lack *wh*-movement make use of the Active Filler strategy in their processing of English *wh*-sentences in the same way as native speakers of English (Crain and Fodor, 1985; Stowe, 1986).

The experiment had two conditions: an if-condition and a wh-extraction condition as illustrated in (110a-b), repeated below as (135a-b).

135. a. The manager knew if Katy will recommend **Joe** to Amy after the assembly.  
b. The manager knew who Katy will recommend **Joe** to \_\_\_\_ after the assembly.

Also, recall that four critical regions were of concern: region 5 (subject filled-gap position), region 6 (the subject-gap spillover region), region 8 (object filled-gap position), and region 9 (the object-gap spillover region). If the participants apply the Active Filler Strategy and process wh-sentences incrementally, they would show evidence of sensitivity to the object filled-gap effect at region 8 (*Joe*) or at the object-gap spillover region 9 (*to*). The effect would appear in the form of longer reading time at the critical region(s) in the wh-extraction condition compared to the same region(s) in the if-condition. As mentioned earlier, a filled-gap effect might also emerge in the subject position which can be evident in longer reading times at the subject position at region 5 (*Katy*) or the subject-gap spillover region at region 6 (*will*) in the wh-extraction condition compared to the if-condition. The presentation of the results will highlight the object-gap position and its spillover region first, before the subject-gap region, because previous research has found effects predominantly at the object-gap region (e.g., Crain and Fodor, 1985; Stowe, 1986). The descriptive results for the Jordanian Arabic participants in the Filled-gap Experiment are presented in Table 5 and the descriptive results for the Mandarin group are presented in Table 6.

**Table 5.** Mean reading times at the embedded subject and object positions in the Filled-gap Experiment for Jordanian Arabic participants (ms).

Condition	Subject		Object	
	Critical (Region 5)	Spillover (Region 6)	Critical (Region 8)	Spillover (Region 9)
<b>If</b>	775.38 (269.14)	638.18 (148.53)	716.10 (266.43)	675.96 (195.73)
<b>Wh</b>	762.61 (247.16)	668.45 (161.56)	796.41 (328.29)	761.80 (209.26)

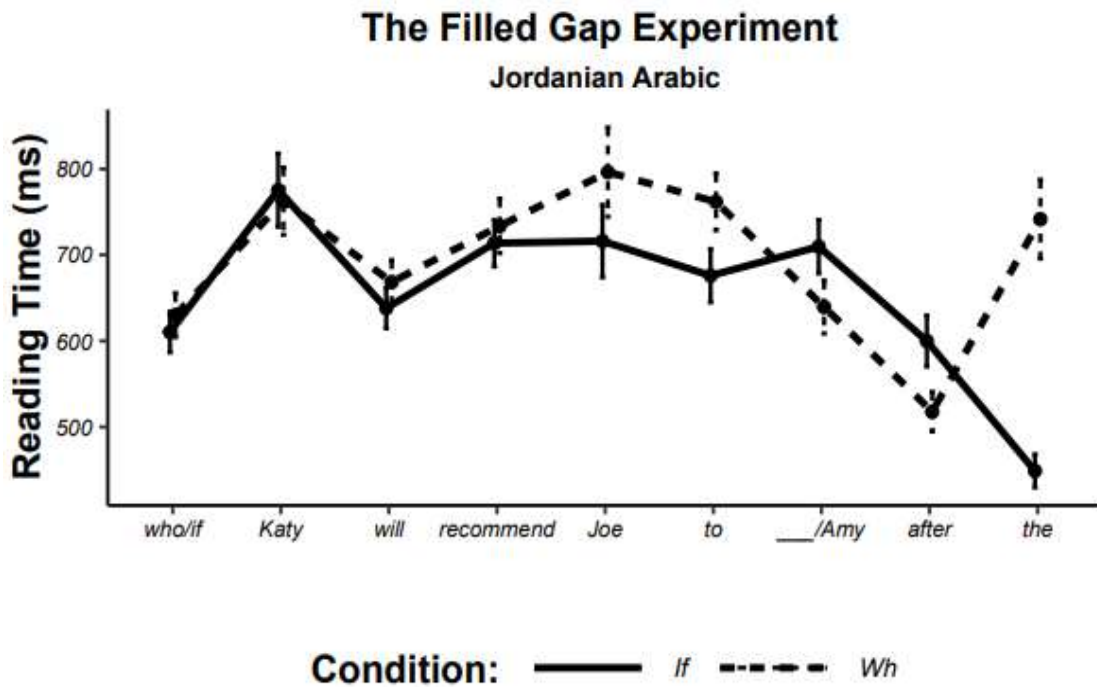
Note. SDs are in brackets.

**Table 6.** Mean reading times at the embedded subject and object positions in the Filled-gap Experiment for Mandarin participants (ms).

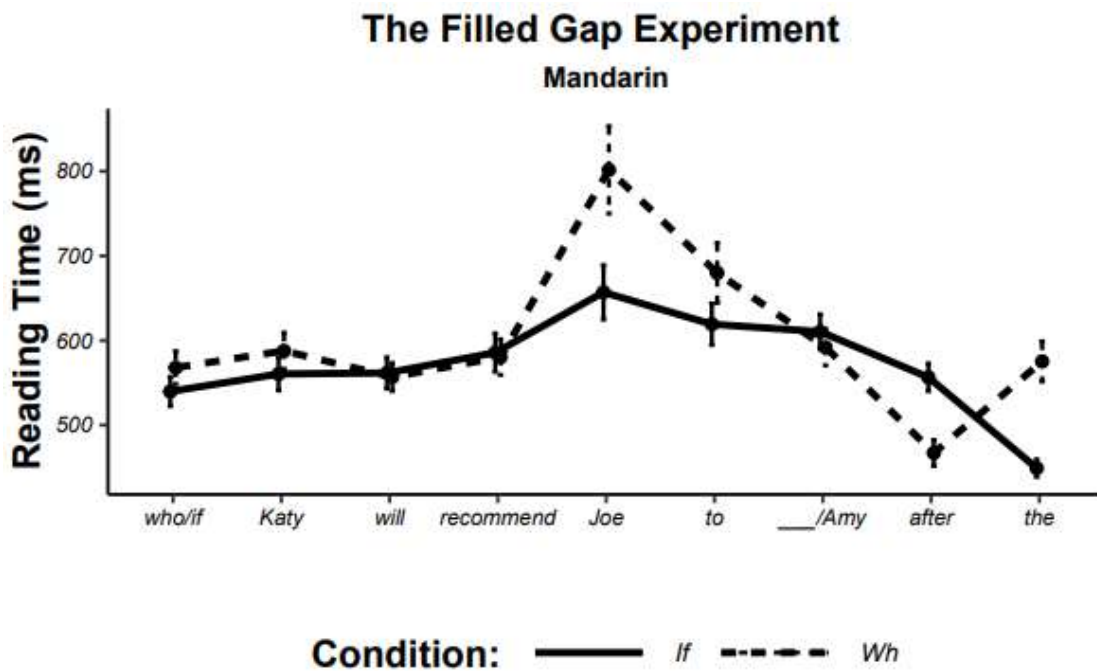
Condition	Subject		Object	
	Critical (Region 5)	Spillover (Region 6)	Critical (Region 8)	Spillover (Region 9)
<b>If</b>	560.43 (122.25)	561.62 (116.84)	656.97 (202.99)	619.23 (154.60)
<b>Wh</b>	587.790 (134.77)	556.90 (103.76)	801.62 (326.14)	679.82 (223.91)

Note. SDs are in brackets.

The segment-by-segment reading times for the Jordanian Arabic group and the Mandarin group are presented in Figure 4 and Figure 5, respectively.



**Figure 4.** Mean Reading Times in the Filled-gap Experiment by the Jordanian Arabic participants (ms). (The error bars represent standard errors).



**Figure 5.** Mean Reading Times in the Filled-gap Experiment by the Mandarin participants (ms). (The error bars represent standard errors).

From Tables 5-6 and Figures 4-5, it is clear that, descriptively, both groups appear to have considerably longer reading times at the critical region (*Joe*, region 8) in the wh-condition than in the if-condition. Reading times at the

associated object-gap spillover region (*to*, region 9) are also longer in the *wh*-condition. This is explored further through mixed-effects models, in Section 5.4.4.1. Turning to the subject-gap regions, the Jordanian Arabic group appeared to spend a little longer reading time at the subject-gap spillover region (*will*, region 6) and the Mandarin group showed a bit longer reading time at the subject critical region (*Katy*, region 5). This is explored further through mixed-effects models, in Section 5.4.4.2

### 5.4.3 The Relative Clause Island Experiment results

Recall that the Relative Clause Island Experiment was conducted in order to address the second question of the present study, concerning whether L2 learners of English whose L1s do not exhibit *wh*-movement, and thus, do not have the island constraints, are able to make use of syntactic constraints during their real-time parsing of English *wh*-sentences. This experiment consisted of two conditions: an *if*-clause condition and a *wh*-clause condition, both of which contained a relative clause island. As illustrated in example (113) repeated below as (136):

136. a. The director questioned if the singer [that bothered **Peter** last season] criticized the pianist after the concert.  
b. The director questioned who the singer [that bothered **Peter** last season] criticized after the concert.

Extraction out of a relative clause island in (136b) is not allowed. Thus, *who* cannot be associated with *Peter*. Therefore, if the participants have access to the relevant syntactic representation and have knowledge of island restrictions, they would not posit a gap after the verb *bothered*, and thus, they would not show longer reading times at the object critical region (region 9, *Peter*) or at the object-gap spillover region (region 10, *last*) in the *wh*-extraction condition relative to the *if*-condition. As in the case of the Filled-gap Experiment, there was a possibility of finding filled-gap effects in the subject position in the Relative Clause Island Experiment at the subject critical region (region 5, *the*) or at the subject spillover region (region 6, *singer*), which is the first potential gap site.

The mean reading times for the critical regions in each condition in the Relative Clause Island Experiment for the Jordanian Arabic group and the results of the Mandarin group are presented in Table 7 and Table 8, respectively.

**Table 7.** Mean reading times by the Jordanian Arabic participants at the embedded subject and object positions in the Relative Clause Island Experiment (ms).

Condition	Subject		Object	
	Critical (Region 5)	Spillover (Region 6)	Critical (Region 9)	Spillover (Region 10)
If	520.53 (130.92)	741.58 (275.66)	815.23 (335.14)	662.08 (170.49)
Wh	582.45 (143.61)	724.46 (214.44)	755.47 (227.92)	660.61 (141.80)

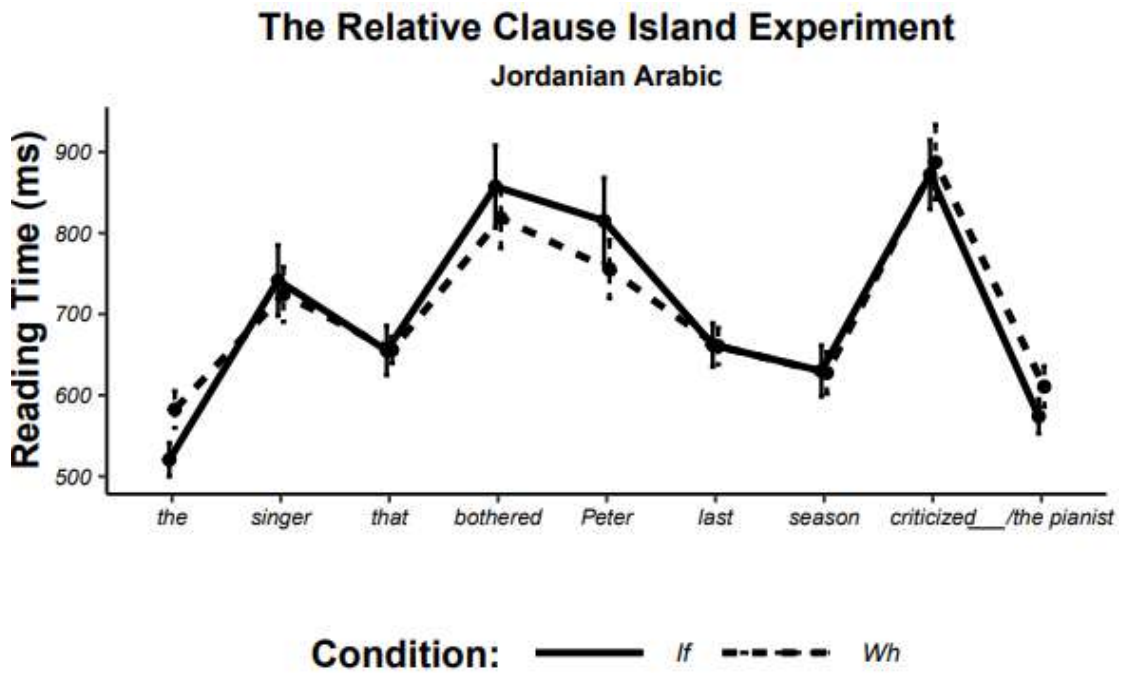
Note. SDs are in brackets.

**Table 8.** Mean reading times by the Mandarin participants at the embedded subject and object positions in the Relative Clause Island Experiment (ms).

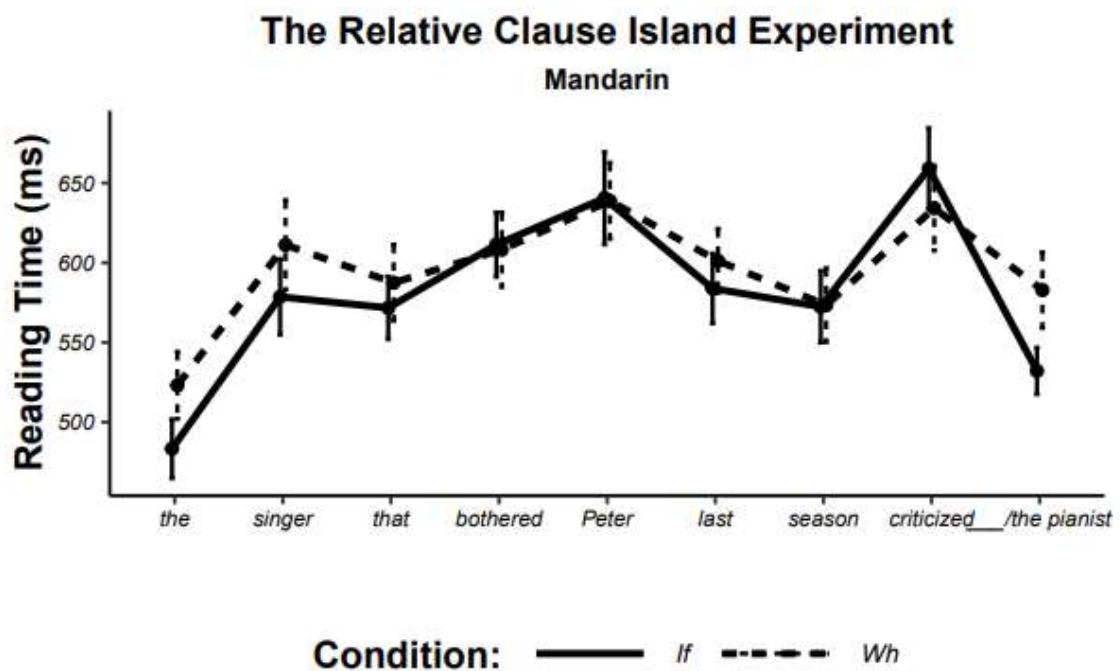
Condition	Subject		Object	
	Critical (Region 5)	Spillover (Region 6)	Critical (Region 9)	Spillover (Region 10)
If	483.38 (116.90)	578.57 (149.78)	640.43 (183.04)	583.83 (138.162)
Wh	523.12 (132.95)	611.18 (177.28)	638.79 (150.70)	601.11 (127.012)

Note. SDs are in brackets.

The segment-by-segment reading times for the Jordanian Arabic group and the Mandarin group are presented in Figure 6 and Figure 7, respectively.



**Figure 6.** Mean Reading Times in the Relative Clause Island Experiment by the Jordanian Arabic participants (ms). (The error bars represent standard errors).



**Figure 7.** Mean Reading Times in the Relative Clause Island Experiment by the Mandarin participants (ms). (The error bars represent standard errors).

Tables 7-8 and Figures 6-7 show that, descriptively, neither group appeared to spend considerably longer at the critical region (*Peter*, region 9) in the wh-condition than in the if-condition. Reading times at the associated object-gap



spillover region (*last*, region 10) show that the Mandarin group's reading time is slightly longer in the *wh*-condition. This result is explored further through mixed-effects models reported in Section 5.4.4.1. The descriptive results also show that both groups have a longer reading time at the subject critical region (region 5, *the*,) in the *wh*-condition, and that the Mandarin group spent longer reading times at the subject spillover region (region 6, *singer*). This result is explored further through mixed-effects models reported in Section 5.4.4.2.

## **5.4.4 Comprehensive results**

### **5.4.4.1 Statistical analysis of the object-gap and spillover results**

A cumulative analysis with data from both experiments (i.e., the Filled gap Experiment and the Relative Clause Island Experiment) was run for the object critical region and the object spillover region: Linear mixed effects models with experiment, L1, proficiency and condition as fixed effects and participants and items as random effects. Table 9 presents the results of the linear mixed effects models for the object critical region and the object spillover region. Following Barr, Levy, Scheepers, and Tily (2013), the maximal model supported by the data was fitted. Initially, random intercepts were included by item and subject, in addition to random slopes for condition, L1, and centred proficiency (and all interactions) by item, and random slopes for experiment, condition, L1, and centred proficiency (and their interaction) by subject. The language predictor was sum-coded (Jordanian Arabic = -1, Mandarin = 1), the experiment predictor was also sum-coded (The Filled-gap Experiment = -1, Relative Clause Island Experiment = 1), the condition predictor was sum-coded (if-condition = -1, *wh*-condition = 1) and proficiency scores were centred around the means (following Cunnings, 2012). As this model failed to converge, correlations among the random effects were excluded, and then random effects were sequentially removed until a best-fit model was identified. In case of a singular fit, random slopes with zero or near zero variance were excluded sequentially until convergence was reached. The best-fit model for the object critical region included random intercepts for both subjects and items, as well as random slopes for experiment and condition and their interaction by subject, and random slopes of condition and L1 with centred proficiency by item. The best-fit model for the object spillover region included random intercepts for both

subjects and items, as well as random slopes for experiment and condition and their interaction by subject, and random slopes of condition by item. Therefore, the results reported in Table 9 represent the most maximal possible non-singular linear mixed effects model. P-values estimates are reported using the Satterthwaite approximation (see Luke 2017), implemented in the lmer package in R (Kuznetsova et al. 2017). Following standard practice in linguistic research,  $p$ -values  $\leq 0.05$  are considered to indicate a statistically significant effect.

**Table 9.** Linear mixed effects model coefficients for reading times at the object critical region and the object spillover region.

Coefficient names	Critical Region*			Spillover Region**		
	Estimate	t	P	Estimate	t	P
L1: Mandarin	-0.021	-1.685	.096	-0.021	-2.011	.048
Experiment: RC Island	-0.002	-0.538	.593	-0.014	-3.807	<.001
Condition: wh-condition	0.010	3.066	.004	0.011	3.530	<.001
Proficiency	0.012	2.283	.025	0.012	2.595	.011
L1 * Experiment	-0.014	-3.237	<.001	-0.001	-0.365	.716
L1 * Condition	0.003	1.015	.314	-0.000	-0.164	.871
Experiment * Condition	-0.011	-2.759	.008	-0.009	-2.715	.010
L1 * Proficiency	0.002	0.287	.775	-0.002	-0.363	.717
Experiment * Proficiency	-0.009	-4.977	<.001	-0.002	-1.206	.236
Condition * Proficiency	0.005	3.660	<.001	0.003	2.521	.014
L1*Experiment*Condition	-0.002	-0.390	.698	0.003	1.047	.299
L1*Experiment*Proficiency	0.002	0.926	.359	-0.003	-2.038	.045
L1*Condition*Proficiency	-0.000	-0.187	.852	0.003	2.152	.035
Experiment*Condition*Proficiency	-0.005	-2.758	.007	-0.003	-2.529	.014
L1* Experiment*Condition*Proficiency	0.000	0.282	.779	0.000	0.162	.871

Note. Shading highlights estimates with a significant  $p$ -values  $\leq 0.05$ .

Note. The code used for this model at the critical region is: `lmer(LogRT ~ language*experiment*condition*centerProf + (1|subject) + (0+experiment|subject) + (0+condition|subject) + (0+experiment:condition|subject) + (1|item) + (0+condition|item) + (0+L1:centerProf|item)`

\*\*The code used for this model at the spillover region is: `lmer(LogRT ~ language*experiment*condition*centerProf + (1|subject) + (0+experiment|subject) + (0+condition|subject) + (0+experiment:condition|subject) + (1|item) + (0+condition|item) + (0+centerProf|item) + (0+condition:centerProf|item)`

As illustrated in Table 9, at the critical region, there was a significant main effect of the condition manipulation ( $b = 0.010$ ,  $t = 3.066$ ,  $p = 0.004$ ) indicating longer reading times in sentences with extraction than in if-sentences. There was also a main effect of proficiency ( $b = 0.012$ ,  $t = 2.283$ ,  $p = 0.025$ ), indicating longer reading times for more proficient participants than for less proficient participants. These main effects were qualified by a significant interaction of experiment type (Filled gap Experiment vs. Relative Clause Island Experiment) and condition (wh-condition vs. if-condition) ( $b = -0.011$ ,  $t = -2.759$ ,  $p = 0.008$ ), and a significant three-way interaction of these factors with proficiency ( $b = -0.005$ ,  $t = -2.758$ ,  $p = 0.007$ ). In addition, a significant interaction of the participants' L1 and the experiment was found ( $b = -0.014$ ,  $t = -3.237$ ,  $p < .001$ ). As illustrated by Figures 4-7, this significant difference is driven by the fact that Jordanian Arabic participants were a little slower overall in the Relative Clause Island experiment than in the Filled-gap Experiment, while the opposite is true for Mandarin participants.

Looking at Figures (4-7), in conjunction with the Experiment\*Condition interaction, it seems reasonable to argue that the predicted difference in reading times at the object-gap position is there in the Filled-gap Experiment but that, as predicted (see Section 5.3.5), there is no difference in the Relative Clause Island Experiment. Thus, prediction 1 (132) (*there will be an interaction of Experiment by Condition at the object filled-gap regions, whereby reading times are longer in the wh-condition than the if-condition in the Filled-gap Experiment but not in the Relative Clause Island Experiment*) is confirmed.

At the object spillover region, the results showed a main effect of L1 ( $b = -0.021$ ,  $t = -2.011$ ,  $p = 0.048$ ). From Tables (5-8) and Figures (4-7), it could be noticed that the Mandarin group's reading times were faster overall than the Jordanian Arabic reading times, which could explain the main effect of L1 at the object spillover region. The results also reveal a significant main effect of experiment, indicating faster reading times in the Relative Clause Island Experiment's sentences ( $b = -0.014$ ,  $t = -3.807$ ,  $p < .001$ ). Also, the results demonstrate a main effect of condition, which indicates longer reading times in the presence of a gap ( $b = 0.011$ ,  $t = 3.530$ ,  $p < .001$ ). A significant effect of

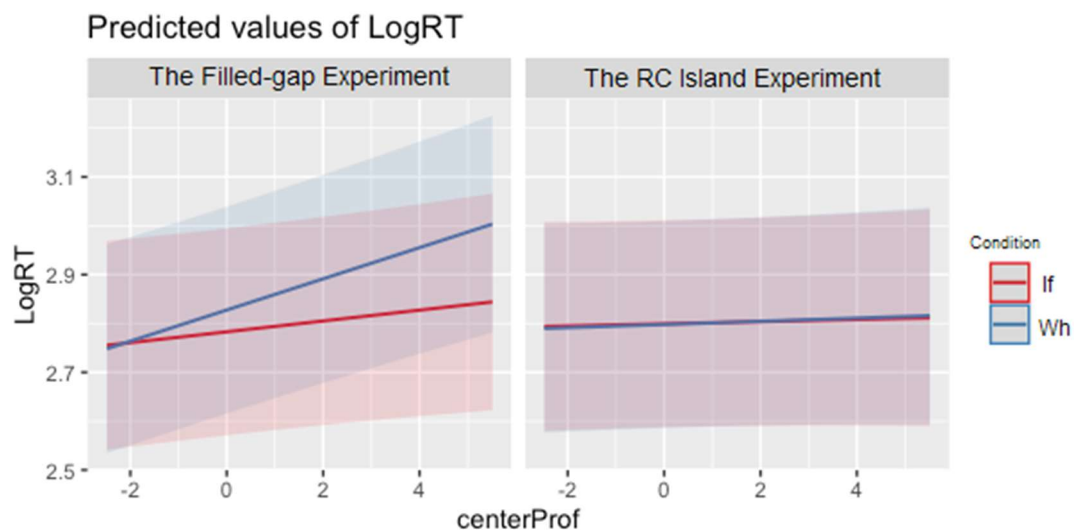
proficiency was also found ( $b = 0.012$ ,  $t = 2.595$ ,  $p = 0.011$ ), indicating longer reading times for more proficient participants than for less proficient participants. Further, as in the object-critical gap position model, a significant interaction of Experiment\*Condition ( $b = -0.009$ ,  $t = -2.715$ ,  $p = 0.010$ ), and a significant three-way interaction of these factors with proficiency ( $b = -0.003$ ,  $t = -2.529$ ,  $p = 0.014$ ) were also revealed. Finally, three-way interactions were revealed for L1\*Experiment\*Proficiency ( $b = -0.003$ ,  $t = -2.038$ ,  $p = 0.045$ ) and L1\*Condition\*Proficiency ( $b = 0.003$ ,  $t = 2.152$ ,  $p = 0.035$ ).

It is noteworthy that the analysis showed no three-way interaction of L1\*Experiment\*Condition at either the critical region ( $t = -0.390$ ,  $p = 0.698$ ) or the spillover ( $t = 1.047$ ,  $p = 0.299$ ) region. Further, Table 9 shows that the four-way interaction of L1\*Experiment\*Condition\*Proficiency was not significant at either the critical region ( $t = 0.282$ ,  $p = 0.779$ ) or the spillover ( $t = 0.162$ ,  $p = 0.871$ ) region. However, three of the three-way interactions were significant, at least at one of the two critical regions. In order to probe the source of the significant three-way interactions revealed by the omnibus model, follow-up models were run. The first follow-up models nested centred Proficiency within Condition within Experiment as fixed effects and participants and items as random effects. These models were run to probe the source of the three-way interaction of these fixed effects revealed by the omnibus model at the object critical and spillover region. The results of these models are presented in Table 10 and illustrated in Figure 8 for the critical region and Figure 9 for the spillover region.

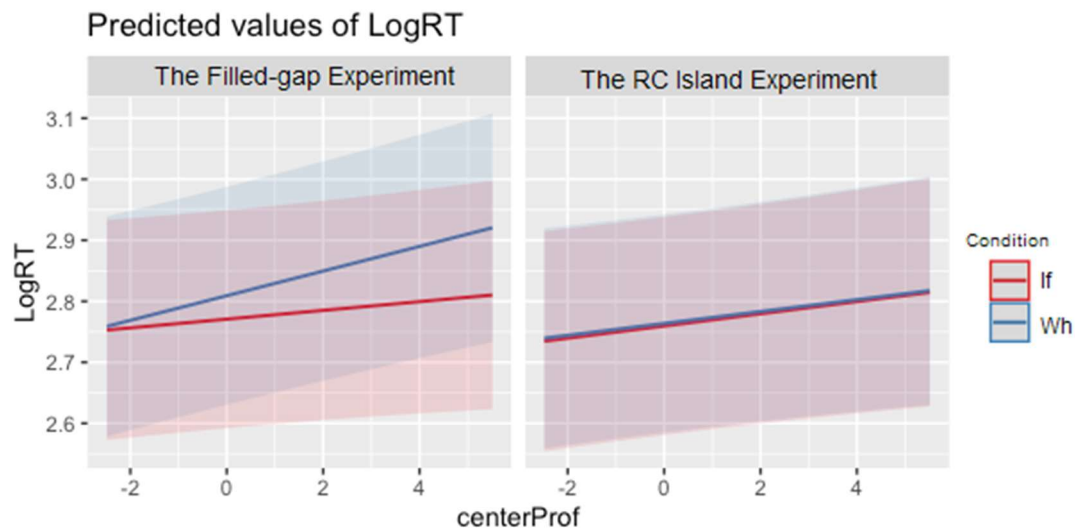
**Table 10.** The results of the nested models that probe the source of the significant three-way interaction of experiment/condition/centerProf revealed by the omnibus model at the object critical and spillover region.

Coefficient names	Critical Region			Spillover region		
	Estimate	t	P	Estimate	t	P
Experiment: RC Island	-0.003	-0.826	.414	-0.014	-4.245	<.001
Filled-gap*Condition	0.022	4.952	<.001	0.019	4.879	<.001
RC Island*Condition	-0.000	-0.053	.958	0.002	0.496	.620
Filled-gap*If*Prof	0.002	1.897	.060	0.007	1.496	.137
RC Island*If*Prof	0.032	0.313	.754	0.019	2.158	.033
Filled-gap*Wh*Prof	0.002	5.470	<.001	0.002	3.950	<.001
RC Island*Wh*Prof	0.003	0.475	.635	0.010	1.988	.049

Note. The code used for this model at the critical region and at the spillover region is:  
`lmer(LogRT ~ experiment/condition/centerProf + (1|subject) + (1|item))`



**Figure 8.** The interaction of experiment, condition, and proficiency at the critical region.



**Figure 9.** The interaction of experiment, condition, and proficiency at the spillover region.

The results of the nested models in Table 10 confirm that the Experiment\*Condition interactions in the omnibus models (Table 9) were due to an effect of condition in the Filled-gap Experiment. Specifically, reading times were higher in the wh-condition than the if-condition in just the Filled-Gap Experiment (Critical region:  $b = 0.022$ ;  $t = 4.952$ ,  $p < 0.001$ , Spillover region:  $b = 0.019$ ,  $t = 4.879$ ,  $p < 0.001$ ) but not the Relative Clause experiment (Critical region:  $b = -0.000$ ;  $t = -0.053$ ,  $p = 0.958$ , Spillover region:  $b = 0.002$ ,  $t = 0.496$ ,  $p = 0.620$ ). Furthermore, the significant Experiment\*Condition\*Proficiency interaction from Table 9, is shown to be driven by the difference in reading times between the wh-condition and if-condition in the Filled-gap Experiment increasing with increasing proficiency (Critical region:  $t = 5.470$ ,  $p < 0.001$ , Spillover region:  $t = 3.950$ ,  $p < 0.001$ ). A similar but smaller effect of proficiency on reading times by condition is also found in the spillover region for the Relative Clause Experiment ( $b = 0.010$ ,  $t = 1.988$ ,  $p = 0.049$ ). However, examination of the interaction plots in Figures 8–9 confirms that the effect of proficiency on condition is most striking in the Filled-gap Experiment at both regions. The proficiency effect at the spillover region in the Relative Clause Experiment is barely discernible in Figure 9.

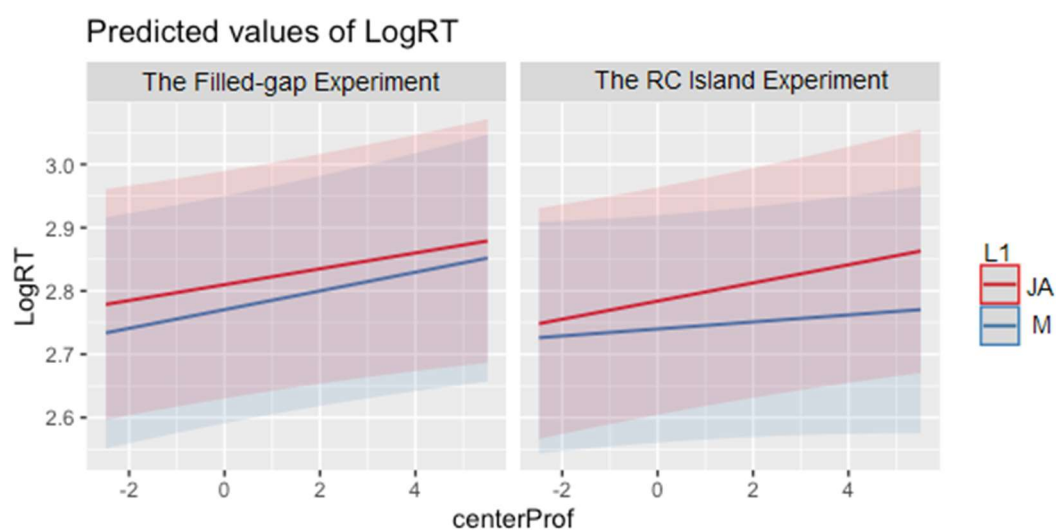
The second follow-up model was run to probe the source of the L1\*Experiment\*Proficiency significant interaction at the object spillover region. The model nested centred Proficiency within Experiment within L1 as fixed

effects, and participants and items as random effects at the spillover region. The results of this model are presented in Table 11 and represented in Figure 10.

**Table 11.** The results of the nested follow-up model that probes the source of the significant three-way interaction of language/experiment/centerProf at the object spillover region.

Coefficient names	Estimate	t	P
L1: Mandarin	-0.003	-2.009	.048
JA* Experiment	-0.013	-3.296	<.001
Mandarin*Experiment	-0.15	-3.934	.001
JA*Filled-gap*Prof	0.012	1.985	.050
Mandarin*Filled-gap*Prof	0.015	2.150	.034
JA*RC Island*Prof	0.014	2.298	.023
Mandarin*RC Island*Prof	0.006	0.806	.422

Note. The code used for this model is: `lmer(LogRT~ language/experiment/centerProf + (1 | subject) + (1 | item))`



**Figure 10.** The interaction of language, experiment, and proficiency at the spillover region.



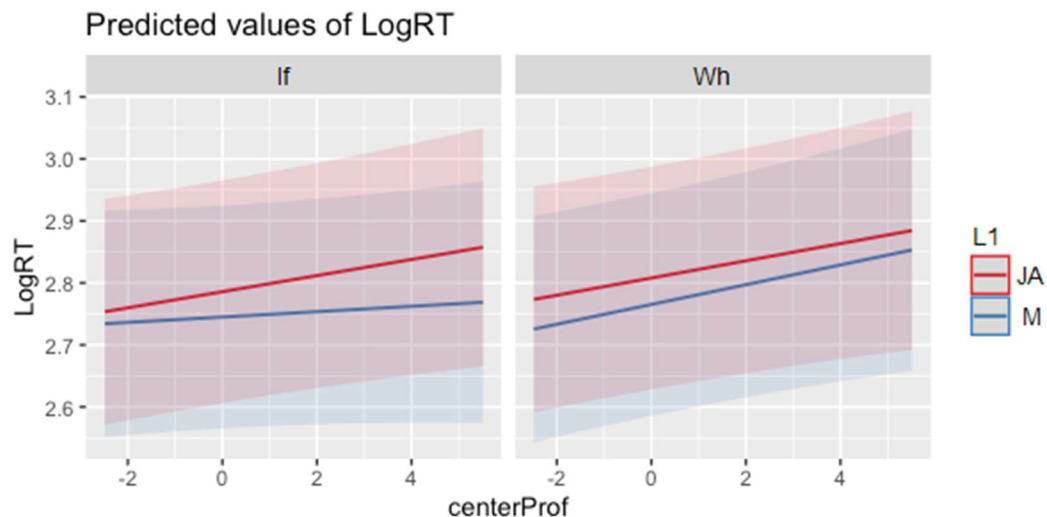
The results presented in Table 11 suggest that the interaction was because proficiency appeared to significantly affect both the Mandarin group's behaviour in the Filled-gap Experiment ( $t = 2.150, p = 0.034$ ) and the Jordanian Arabic group's behaviour ( $t = 1.985, p = 0.050$ ), which suggests that higher proficiency participants showed a stronger filled-gap effect. Also, proficiency appeared to affect the Jordanian Arabic group's behaviour in the Relative Clause Island Experiment ( $p = 0.023$ ), which suggests that the reading times were lengthened as proficiency increased in both conditions of the Relative Clause Island Experiment. The plots illustrate that it is in the Relative Clause Island Experiment that the two L1 groups differ most, with the Jordanian Arabic group exhibiting slower reading times as proficiency increases, though Table 11 shows a clear tendency towards longer reading times with increasing proficiency in both experiments ( $p \leq .05$ ), except by the Mandarin group in the Relative Clause Island Experiment.

The third nested model probed the source of the L1\*Condition\*Proficiency significant interaction at the object spillover region. The results of this model are presented in Table 12 and illustrated in Figure 11.

**Table 12.** The results of the nested model that probes the source of language/condition/centerProf significant interaction at the object spillover region.

<b>Coefficient names</b>	<b>Estimate</b>	<b>t</b>	<b>P</b>
L1: Mandarin	-0.003	-2.008	.048
JA*Condition	0.002	2.719	.007
Mandarin*Condition	0.010	2.552	.011
JA*If*Prof	0.013	2.084	.040
Mandarin*If*Prof	0.005	0.656	.514
JA*Wh*Prof	0.014	2.219	.029
Mandarin*Wh*Prof	0.016	2.305	.024

Note. The code used for this model is: `lmer (LogRT ~ language / condition/ centerProf + (1 | subject) + (1 | item)`



**Figure 11.** The interaction of language, condition, and proficiency at the spillover region.

The results of the third nested model suggest that the interactions were driven by longer reading times in wh-extraction sentences reported for both L1 groups (Jordanian Arabic:  $t = 2.219$ ,  $p = 0.029$ ; Mandarin:  $t = 2.305$ ,  $p = 0.024$ ). The results also showed that higher proficiency Jordanian Arabic participants reported longer reading times for the if-condition sentences ( $t = 2.084$ ,  $p = 0.040$ ). The plots represented in Figure 11 illustrate how the interaction appears to be driven by increasing reading times in the Jordanian Arabic group in the if-clause condition as proficiency increased.

To summarise, the results of the omnibus models at the object position revealed significant Experiment\*Condition interactions at both the critical and the spillover object-gap regions, and a significant interaction of these factors with proficiency. The exploration of these interactions through nested models and interaction plots confirmed that both L1 groups exhibited increased reading times in the wh-condition compared with the if-condition, but that this effect was largely due to the higher proficiency participants.

Beyond these group-level statistics, we can move to discuss individual subject, and item variation. Figures 12-13 presents the model estimates of by-item intercepts for the critical region and the spillover region, respectively. The vertical line in these plots represents the model estimate of the population mean.

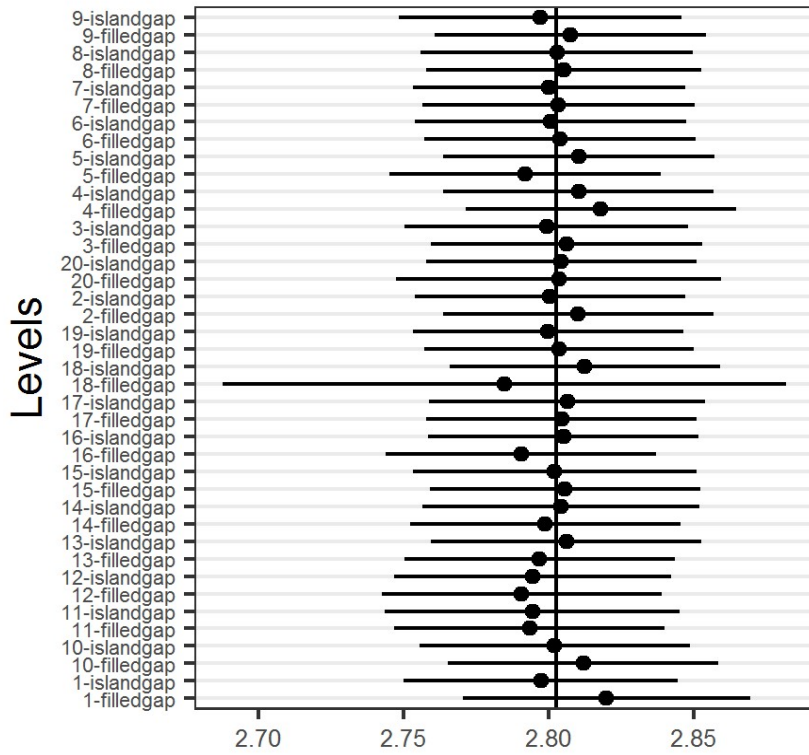


Figure 12. The model estimates of by-item intercepts at the critical region.

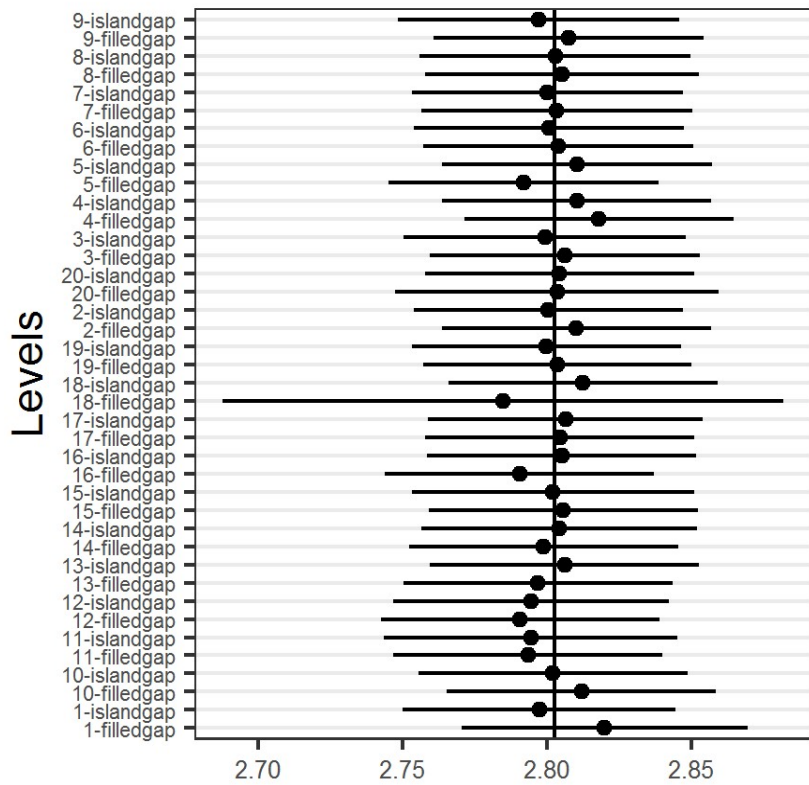
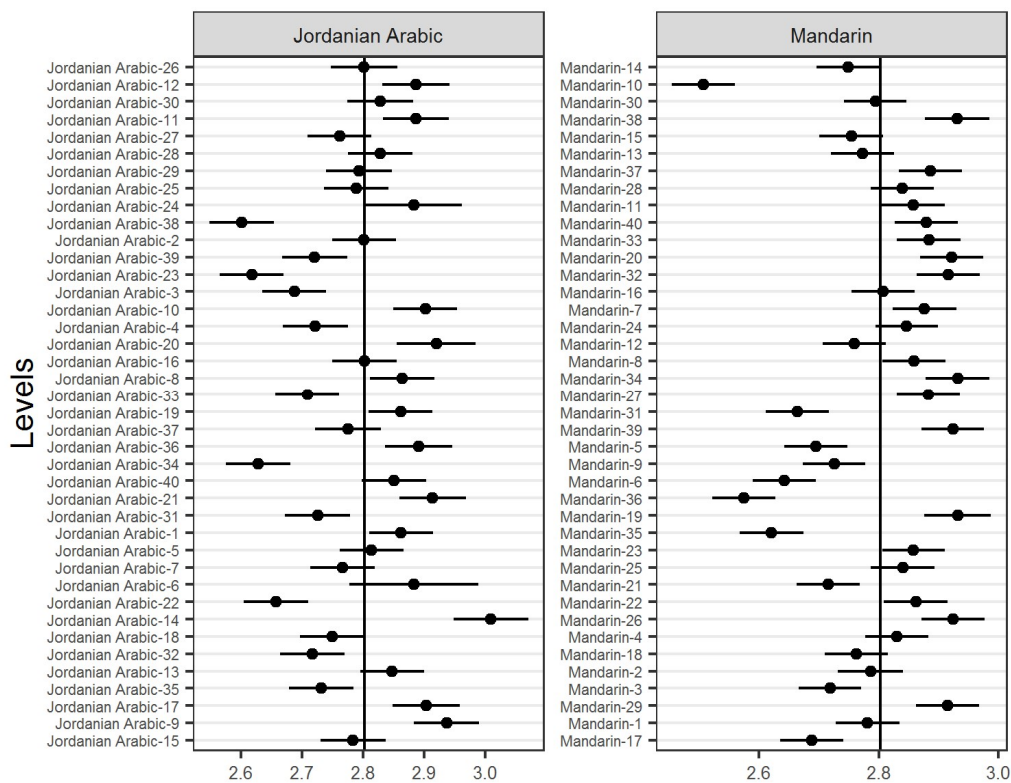


Figure 13. The model estimates of by-item intercepts at the spillover region.

A visual analysis of these plots suggests that there is relatively little variability in by-item mean response time at the critical region and the spillover region, with the possible exception of item 18 from the Filled-gap Experiment, which shows substantially more variability than the other items.<sup>10</sup> Consequently, it seems unlikely that variation in the mean reading times was affected by unevenness in item-related variation.

Figures 14-15 shows the by-subject estimates of the intercept at the critical region and the spillover region, respectively. Figures 16-17 represents the by-subject slope terms for the critical region and the spillover region, respectively. In all these plots (Figures 14-17), subjects are ordered on the basis of their proficiency score (bottom = least proficient, top = most proficient), and the vertical line represents the model estimate of the population mean.



**Figure 14.** The model estimates of by-subject random intercepts at the critical region.

<sup>10</sup> The sentence in Item 18 in the Filled-gap Experiment was: *The manager knew who Katie will recommend Joe to after the assembly.* It is not clear why this item should have a greater variability than any other. However, this variance is presumably taken account of in the models, through the inclusion of the random effects for items.

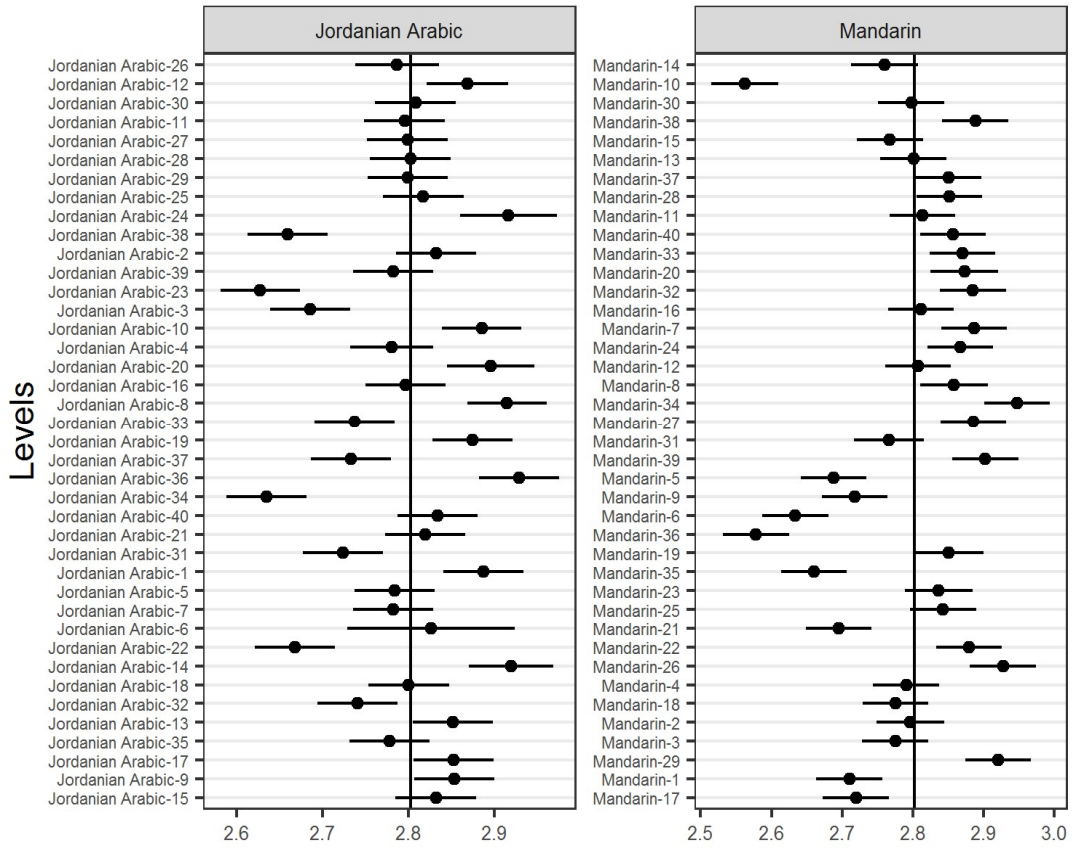


Figure 15. The model estimates of by-subject random intercepts at the spillover region.

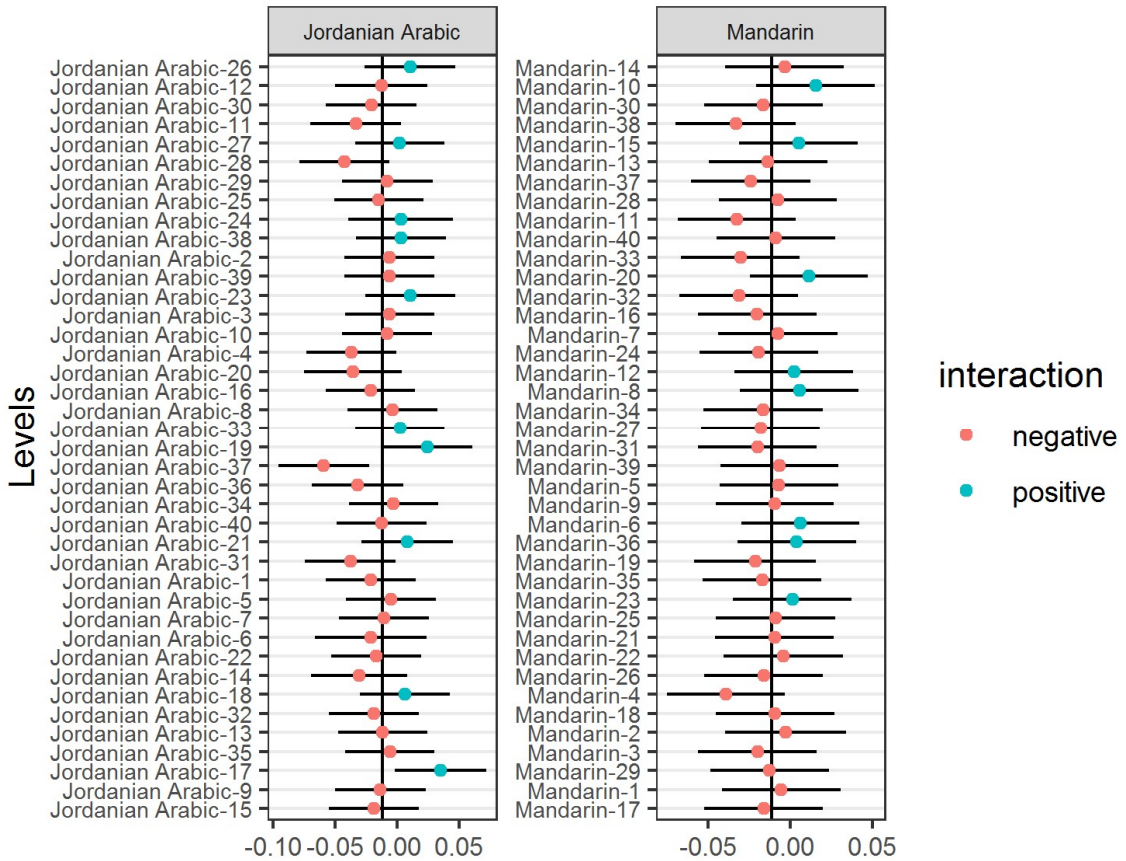
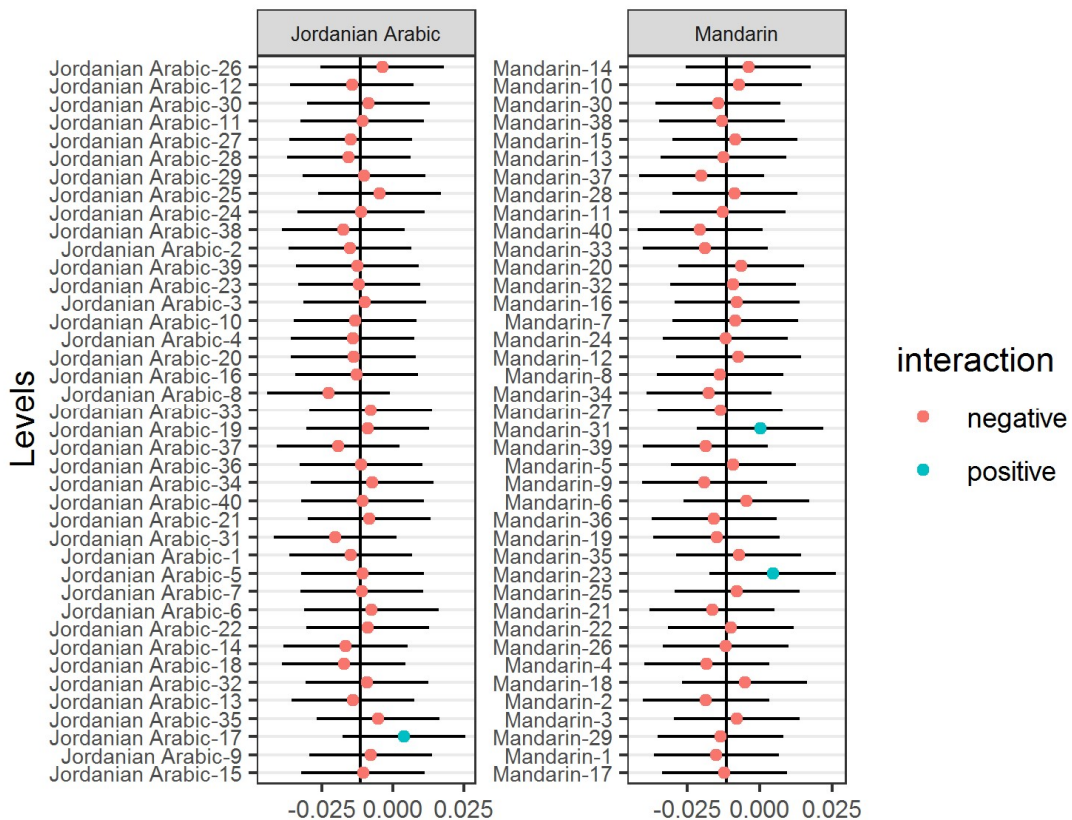


Figure 16. The model estimates of by-subject slope terms at the critical region.



**Figure 17.** The model estimates of by-subject slope terms at the spillover region.

The by-subject random intercept plots (Figures 14 & 15) suggest reasonable variability around the estimated intercept, but do not give evidence that this intercept varies with proficiency. There seems to be a trend in both languages but particularly the L1 Mandarin group, for the higher proficiency speakers to be slower than their less-proficient counterparts, as evidenced by the number of points to the right of the mean line, towards the top of each plot. Likewise, turning to Figures 16-17, there is no obvious *visual* relation between proficiency and the size of the Experiment\*Condition interaction (the significant three-way interaction in the model in Table 9 notwithstanding).

#### 5.4.4.2 Statistical analysis of the subject-gap and spillover results

Recall that a filled-gap effect might potentially also emerge in the subject position, which would be evident in longer reading times at the subject critical region and/or the subject spillover region in the wh-extraction condition compared to the if-condition. Therefore, similar to the analysis conducted for the object position, an omnibus model was run for both experiment results together to investigate if there was a main effect of condition for the subject-gap regions, which indicates the presence of a subject filled-gap effect. As

explained earlier, such analysis was conducted because the two experiments were run within a single task, which means that the behaviour on one experiment could influence the behaviour on the other. The cumulative model takes any such influence into account. Linear mixed effects models with experiment, L1, proficiency and condition as fixed effects and participants and items as random effects were run. Table 13 presents the results of the linear mixed effects models for the subject critical region and the subject spillover region. The predictor coding and the procedure for identifying the most maximal converging models were the same as for the object-gap regions (outlined in Section 5.4.4.1).

**Table 13.** Linear mixed effects model coefficients for reading times at the subject critical region and the subject spillover region.

Coefficient names	Critical Region			Spillover Region		
	Estimate	t	P	Estimate	t	P
L1: Mandarin	-0.032	-2.934	.004	-0.032	-2.992	.004
Experiment: RC Island	-0.043	-10.384	<.001	0.009	1.467	.147
Condition: wh-condition	0.013	3.880	<.001	0.007	2.058	.046
Proficiency	0.007	1.428	.157	0.003	0.608	.545
L1 * Experiment	0.017	4.074	<.001	-0.005	-1.113	.270
L1 * Condition	-0.015	-0.525	.601	-0.003	-0.794	.430
Experiment * Condition	0.006	2.030	.045	0.002	0.601	.553
L1 * Proficiency	-0.000	-0.020	.983	0.001	0.240	.811
Experiment * Proficiency	0.009	4.766	<.001	-0.002	-0.810	.420
Condition * Proficiency	0.000	0.427	.674	-0.001	-0.737	.466
L1*Experiment*Condition	-0.003	-1.132	.261	0.003	1.253	.214
L1*Experiment*Proficiency	-0.000	-1.698	.093	-0.000	-0.127	.899
L1*Condition*Proficiency	0.000	0.587	.559	0.000	0.004	.997
Experiment*Condition*Proficiency	-0.002	-1.443	.153	0.000	0.062	.951
L1* Experiment*Condition*Proficiency	0.000	0.422	.674	-0.000	-0.037	.970

Note. The code for the subject critical region and spillover region is: lmer(LogRT ~ L1\*experiment\*condition\*centerProf + (1|subject) + (0+experiment|subject) + (0+condition|subject) + (0+experiment:condition|subject) + (1|item) + (0+condition|item) + (0+L1:centerProf|item) + (0+condition:centerProf|item)



The results in Table 13 show a main effect of L1 at both regions (Critical region:  $p < .001$ , Spillover region:  $p = 0.004$ ). This is likely to be because overall, the Jordanian Arabic reading times are slower than the Mandarin reading times, as seen in the tables of mean reading times presented above (Tables 5–8) where the Jordanian Arabic mean reading times ranged from 520–775ms and the Mandarin mean reading times ranged from 483–611ms. Also, the results show a main effect of condition at both subject regions (Critical region:  $p < .001$ , Spillover:  $p = 0.046$ ), because overall reading times in the wh-condition are generally slower than in the if-condition. Further, a main effect of experiment appeared at the subject critical region. This might be because reading times are generally shorter in the Filled-gap Experiment than the Relative Clause Island Experiment at this region, as seen in the tables of mean reading times presented above (Tables 5–8) where the Jordanian Arabic mean reading times in the Filled-gap Experiment ranged from 762–775ms, while in the Relative Clause Island Experiment, they ranged from 520–582ms. The Mandarin mean reading times in the Filled-gap Experiment ranged from 560–587ms, and their mean reading times in the Relative Island Experiment ranged from 483–523ms. Moreover, the results in Table 13 show that there were no significant three-way or four-way interactions, but there were three two-way interactions at the subject critical region. In order to probe the source of these two-way interactions, follow-up nested models were run.

The first nested model probed the source of the L1\*Experiment interaction revealed by the omnibus model. This follow-up model nested Experiment within L1 as fixed effects, and participants and items as random effects. The results of this model are presented in Table 14.

**Table 14.** The results of the follow-up model that nested Experiment within L1 at the subject critical region.

<b>Coefficient names</b>	<b>Estimate</b>	<b>t</b>	<b>P</b>
L1: Mandarin	-0.033	-2.957	.004
Jordanian Arabic*Experiment	-0.061	-10.966	<.001
Mandarin*Experiment	-0.027	-4.882	<.001

Note. The code for this model is: `lmer(LogRT ~ language/experiment + (1 | subject) + (1 | item))`

The results of the first nested model showed that the L1\*Experiment interaction is due to both groups generally having longer reading times in the Filled-gap Experiment while additionally, the Jordanian Arabic group has longer reading times generally than the Mandarin group.

The second model probed the source of the Experiment\*Condition interaction revealed by the omnibus model. This follow-up model nested Condition within Experiment as fixed effects, and participants and items as random effects. The results of this model are presented in Table 15.

**Table 15.** The results of the follow-up model that nested Condition within Experiment at the subject critical region.

Coefficient names	Estimate	t	P
Experiment: RC Island	-0.043	-9.066	<.001
Filled-gap*Condition	0.007	1.917	.055
RC Island*Condition	0.018	4.762	<.001

Note. The code for this model is: `lmer(LogRT ~ experiment/condition + (1 | subject) + (1 | item))`

The results of the nested model reported in Table 15 suggest that the interaction was driven by longer reading times in the wh-condition than the if-condition in the Relative clause Island Experiment ( $p < .001$ ). The same trend is present in the Filled-gap Experiment, but it does not reach significance ( $p = 0.055$ ). Thus, prediction 2 (133) (*there will be a main effect of condition for the subject filled-gap regions, whereby in both the Filled-gap Experiment and the Relative Clause Island Experiment reading times will be longer in the wh-condition than in the if-clause condition*) is partially confirmed.

The third nested model probed the source of the Experiment\*Proficiency interaction revealed by the omnibus model. This follow-up model nested Proficiency within Experiment as fixed effects, and participants and items as random effects. The results of this model are presented in Table 16.

**Table 16.** The results of the follow-up model that nested Proficiency within Experiment at the subject critical region.

<b>Coefficient names</b>	<b>Estimate</b>	<b>t</b>	<b>P</b>
Experiment 1: RC Island	-0.043	-9.083	<.001
Filled-gap*Proficiency	-0.002	-0.329	.742
RC Island*Proficiency	0.016	3.082	.002

Note. The code for this model is: `lmer(LogRT ~ experiment/ centerProf + (1| subject) + (1 | item)`

According to Table 16, it seems that the strength of the experiment effect gets stronger with higher proficiency. This suggests that in both conditions in the Relative Clause Island Experiment, higher proficiency participants had longer reading times, whereas there was no effect of proficiency on reading times in the Filled-gap Experiment. The results reported in this section for subject-gap positions and in the previous section for the object-gap positions are discussed in relation to the hypotheses in the following section.

## 5.5 Discussion

Three hypotheses were investigated in this study (presented in Section 5.3.5). Section 5.5.1 discusses the first hypothesis in the context of the Filled-gap Experiment. Section 5.5.2 discusses the second hypothesis in the context of the Relative Clause Island Experiment. Section 5.5.3 discusses the third hypothesis in context of both experiments. Section 5.5.4 presents the implications of the results.

### 5.5.1 The Filled-gap Experiment

This section discusses the findings of the Filled-gap Experiment with respect to the prediction of the first research hypothesis outlined in Chapter 1 and developed in Section 5.3.5. Hypothesis 1 states the following:

*The Jordanian Arabic and Mandarin speakers of English will process filler-gap dependencies incrementally, and will posit a gap at the object filled-gap site in embedded wh-questions.*

The findings of the Filled-gap Experiment showed that Jordanian Arabic L2 learners of English and Mandarin L2 learners of English demonstrate an

object filled-gap effect. This effect emerged in the object critical and spillover regions in the wh-condition relative to the same regions in the if-condition. This finding indicates that the participants were expecting a gap in region 8 in (135b: *The manager knew who Katy will recommend Joe to after the assembly*) and that they were surprised when they found the position filled with an NP (*Joe* in 135b: *The manager knew who Katy will recommend Joe to after the assembly*) which led to initiating a reanalysis. Their sensitivity to object filled gaps shows that the participants were using the Active Filler Strategy which means that they attempted to posit a gap at each licensed possible gap position they encountered (Frazier, 1987). This behaviour seemed to be affected by proficiency, with more proficient learners showing stronger filled-gap effects. As highlighted in Chapter 4, the use of the Active Filler Strategy provides evidence that the participants were processing the sentences incrementally (Crain and Fodor, 1985; Frazier, 1987; Gibson and Warren, 2004; Traxler and Pickering, 1996; Stowe, 1986). Therefore, the findings of the Filled-gap Experiment support Hypothesis 1.

With respect to the subject-gap regions, the results showed that the participants had spent longer reading times in the wh-condition than the if-condition at the subject critical region in the Filled-gap Experiment; however, the interaction of Experiment\*Condition at this region was not significant. As argued by Stowe (1986), the short distance between the filler and the subject, which immediately follows the filler, might help the parser to recover easily from the misanalysis of a subject filled-gap because it may expect to find an object gap ahead.

### **5.5.2 The Relative Clause Island Experiment**

As in Canales' (2012) study, the Relative Clause Island Experiment is considered a complement to the Filled-gap Experiment. In the Filled-gap Experiment, the wh-extraction takes place from positions licensed by the grammar; whereas the wh-extraction from a relative clause island is prohibited. Although the findings of the Filled-gap Experiment do not directly support a shallow processing account, they are still at least compatible with it, in that participants might try to assign an interpretation to a moved element as soon as possible, i.e., at the first (in linear terms) thematic role assigner. What the

Filled-gap Experiment did not tell us whether this operation is driven and constrained by grammatical principles and applied over fully specified syntactic structures. Therefore, there was a need for the Relative Clause Island Experiment to investigate the type of information the participants were using in their processing of English wh-sentences in the Filled-gap Experiment.

Although the relative clause islands included a semantic gap licenser (a verb, such as *bothered* in (136b), wh-extraction out of these islands is ungrammatical. Thus, if the participants use abstract syntactic rules such as island constraints in their real-time processing, they would not attempt to posit gaps within these islands. Following grammatical accounts of islands (e.g. Philips, 2006, as detailed in the previous section and in Chapter 4, Section 4.2.1), a lack of significant differences in reading times at the ungrammatical gap position within the relative clause island in the wh-extraction condition relative to the same position in the if-condition would be considered evidence that the participants avoid positing gaps in unlicensed positions and that they used abstract syntactic rules in their real-time processing of wh-sentences. The results obtained from the Relative Clause Island Experiment allowed testing of Hypothesis 2:

*The Jordanian Arabic and Mandarin speakers of English will demonstrate sensitivity to wh-island constraints during processing, and will not posit a gap within an island when processing filler-gap dependencies.*

The results of the Relative Clause Island Experiment did not reveal any significant differences between the two conditions in region 9 (*a. The director questioned if the singer that bothered **Peter** last season criticized the pianist after the concert.*) (*b. The director questioned who the singer that bothered **Peter** last season criticized after the concert*). This indicates that neither L2 group attempted to posit a gap within a relative clause island in the wh-sentences, which supports Hypothesis 2.<sup>11</sup>

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<sup>11</sup> As mentioned earlier, according to a processing limitation account, this result could alternatively be ascribed to processing overload (processing account, Kluender, 1998; 2004; Kluender and Kutas, 1993; Hofmeister et al., 2013). However, the present study follows grammatical accounts to islands which predict that island effects arise as a

Turning to the subject filled-gap effect, which would be grammatical in the Filled-gap Experiment and the Relative Clause Island Experiment, the present study found that the participants had spent significantly longer reading times in the wh-condition than the if-condition at the subject critical region in the Relative Clause Island Experiment. The reading times were also longer in the wh-condition in the Filled-gap Experiment, but the difference did not reach significance ( $p = 0.055$ ). Recall that there is no grammatical reason to treat subject filled-gap positions differently between the Filled-gap and Relative Clause Island Experiments, because the sentences are structurally the same at that point. However, the types of DP differ between the two experiments, and this could play a role. Specifically, the subject filled-gap position in the Filled-gap Experiment contains a proper name (*Katy will*), whereas in the Relative Clause Island Experiment it contains a definite DP (*the singer*). Previous work on retrieval interference suggests that the subject filled-gap effect could be stronger in the presence of full definite DPs than with proper names. For example, Aldwayan et al. (2010) found a subject filled-gap in their NP island experiment where the subject gap contained full definite DPs containing an adjective (*the boring comment*), but not in their filled-gap experiment where the subject gap contained a proper name (*Barbara will*). Thus, the effect of the structure of the noun phrase on the size of the subject filled-gap effect seems an interesting open question.

### **5.5.3 The L1 transfer hypothesis**

Canales (2012) recommended that future studies investigate real-time processing of wh-dependencies in languages that are typologically different from Spanish and English to verify if the L1 plays a role in processing this structure. This highlights a contribution of the results of the current study to previously published research because the present study compares L2 processing of filler-gap in English wh-sentences by two groups of L2 learners

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result of structure-building constraints (e.g., Phillips, 2013). As pointed out in 4.4.4 in relation to Omaki & Schulz (2011), either account entails that the learners build the structure, but in the grammatical accounts the island effect is a result of a grammatical constraint whereas in the processing account it is the result of processing overload.

whose L1s are typologically different. The third Hypothesis of the present study (presented in Section 5.3.5) makes the following prediction:

*The Jordanian Arabic group may demonstrate a more robust filled-gap effect during filler-gap dependency processing than the Mandarin speakers of English, due to L1 influence.*

The results showed that the two groups did not exhibit distinct L2 processing in either self-paced reading experiment, against Hypothesis 3. Prediction 3 (134) (*there will be an interaction of L1 with Condition at the object filled-gap or the subject filled-gap positions, whereby reading times are longer in the wh-condition than the if-condition only in the Jordanian Arabic group*) was not confirmed.

These results, whereby the Jordanian Arabic and Mandarin groups appeared to show the same processing despite the typological differences in the structure of wh-dependencies in their L1s, provide support for De Vincenzi's (1991) re-interpretation of the Active Filler Strategy which states: avoid postulating unnecessary chain members, but do not delay postulating necessary chain members, regardless of whether the dependency is Filler-Gap or Gap-Filler. Thus, the present study contributes to previous research by providing experimental support from L2 data for this theoretical formulation about dependency processing. This result appears to support the Shallow Structure Hypothesis's claim about L1 transfer: that, as L2 processing relies less on syntactic structure, by definition transfer of L1 syntactic structure will not affect L2 processing. However, according to the Shallow Structure Hypothesis, the reason for the claim is that: because syntactic structure will be less used in L2 processing, transfer from L1 structure will not affect processing. However, the results in the present study suggest that syntactic structure is used during processing but despite that there was no L1 transfer. Thus, the absence of L1 influence is accounted for by the universality of the De Vincenzi formulation of dependency processing, and not by shallower processing.

#### 5.5.4 Implications

It was predicted that if second language speakers generate detailed syntactic structures incrementally and obey syntactic constraints when navigating these structures for the purpose of building long-distance syntactic relations, they would posit a gap in grammatically licensed positions (the Filled-gap Experiment) and they would not do so in an unlicensed position (the Relative Clause Island Experiment). If, on the other hand, L2 learners avoid processing detailed syntactic structures but rely on heuristics for thematic role assignment of *wh*-phrases, they would attempt to link *wh*-phrases to the closest thematic role assigner, regardless of whether this violates syntactic constraints.

The results of the present study suggest that the L2 participants whose L1s lack *wh*-movement were able to use the Active Filler Strategy. The study also found that L2 processing can be modulated by proficiency. More proficient learners showed more native-like real-time processing. Moreover, there was no evidence that the L2 participants process *wh*-sentences that include relative clause islands differently from native speakers. Following grammatical accounts of islands, this could suggest that the participants avoid positing gaps in unlicensed positions and that they used abstract syntactic rules in their real-time processing of *wh*-sentences in the same way as native processing (McElree & Griffith, 1998; Phillips, 2006; Stowe, 1986; Traxler & Pickering, 1996; Wagers & Phillips, 2009). The finding that L2 speakers respect island constraints during processing indicates some level of fine-grained hierarchical structure building during L2 parsing.

While the nature of islands is an ongoing debate, with syntactic, semantic and processing based accounts, the present results strongly support a deep processing account. As explained earlier, according to formal grammatical accounts of islands, gap-filling inside islands is prohibited due to utilization of syntactic knowledge (e.g., Phillips, 2006; Stowe, 1986; Traxler & Pickering, 1996). Processing-based accounts, on the other hand, assume that the complex structure of islands leads to processing overload that increases difficulty in resolving filler-gap dependencies (e.g., Hofmeister & Sag, 2010; Kluender & Kutas, 1993). However, as noted by Omaki and Schulz (2011), the processing-based account of islands argues that island sensitivity indicates that



the parser is capable of building some level of abstract structural representation of relative clause island which prohibits filler-gap dependency completion inside a relative clause island. Thus, whether a syntactic account or a processing-based account of island effects is adopted does not significantly change the nature of the arguments against the Shallow Structure Hypothesis, as identification of an island would also require a deep and detailed representation also within a processing-based approach to islands. Cunnings (2017, p.666) stated that “island sensitivity in the L1 and L2 indicates similar levels of structural complexity during parsing”. Kim (2014) argued that sensitivity to island constraints in online sentence processing involves deep syntactic processing. All in all, it seems reasonable to hypothesize that also under these approaches one would expect a shallow processor to try and assign thematic roles in an ‘opportunistic’ fashion, i.e., ignoring islands when attempting to make use of the first available thematic role assigner. Further, adopting a semantic account of islands (see Szabolcsi, 2006) does not eliminate the challenge to shallow processing posed by these data. Appealing to a semantic account of islands to explain the lack of Active Filler effects within islands, in fact, would still require sophisticated structural representations to be built in order to feed into the semantic computation. Finally, it must be acknowledged that even though the L2 speakers’ object filled-gap reading time patterns were the same as those of native English speakers in previous studies by Stowe and Canales, this does not rule out different abstract representations underlying the L2 speakers’ behaviour. Indeed, the comprehension questions in the present study did not test understanding of the embedded questions in the test sentences, so it is not impossible that the L2 speakers may not have had the same interpretation of the sentences as native English speakers. However, if the L2 participants avoid processing detailed syntactic structures but rely on semantic knowledge for thematic role assignment of *wh*-phrases, they would attempt to link *wh*-phrases to the closest thematic role assigner, regardless of whether this violates syntactic constraints. As a result, they would show reading time contrast between the *wh*-condition and the *if*-condition at the object position in the Relative Clause Island Experiment, which was not found in the present study. Alternatively, if participants have not understood the embedded questions at all, their reading times would presumably not show any pattern

that could be related to object filled-gaps. Instead, however, there the data show a clear pattern that maps on to where potential gap sites are licensed. Further research that incorporates a test of understanding of embedded wh-questions could shed further light on this issue. Nonetheless, given the evidence to hand, whereby the L2 speakers' behaviour in the current study is the same in terms of reading time patterns at the critical regions as that of L2 speakers in previous studies and of native English speakers, it seems reasonable to conclude that the most parsimonious account is that the L2 speakers' processing relies on the same syntactic representations as native English speakers' processing.

The findings of this study corroborate the L2 findings by Canales (L1-Spanish L2-English) and Aldwayan et al. (L1-Najdi Arabic L2-English). Together, this set of data provides strong evidence that L2 processing exploits the same syntactic knowledge (e.g., wh-constraints) as L1 processing even when the learners' L1s are not subject to wh-movement constraints. However, the present study goes beyond Aldwayan et al. and Canales' studies by incorporating proficiency as a continuous predictor into the reading time analyses. This yielded the finding that while non-native speakers can achieve native-like processing behaviour (demonstrating a filled gap-effect that is structure sensitive), this behaviour seems to be modulated by proficiency, with more proficient learners showing stronger filled-gap effects. In terms of the Shallow Structure Hypothesis, it could be that the weaker filled-gap effects at lower proficiency could indicate underuse of syntactic structure at that stage of L2 development. Further research focusing on the lowest proficiency level included in the present study could shed further light on this issue.

Another interesting contribution of this study is related to the effect of proficiency, which is something that previous studies might do not bring out. It is interesting to note from all the interaction plots presented in Section 5.4.4.1 that in both groups, there was a tendency towards slower reading times as proficiency increases. The longer reading times suggest that the higher proficiency participants were taking longer to process due to reanalysing the filled gaps. This result could be said to tie in with Hopp's (2010) finding that

sensitivity to grammatical structure (morphosyntax in Hopp's case) decreases with increased time pressure (in both native speakers and L2 speakers). It could be argued that the higher proficiency participants may have generally been giving themselves more time to read which means more time to process, which means more chance of processing the filler-gap dependency.

Regarding the subject filled-gap effect, the results showed the participants in the current study are different from Canales's L2 participants, who did not show a subject filled-gap effect. Speculatively, contributing reasons for this could be that the L1s of the participants in the current study are non-wh-movement languages and have different scripts to the L2; whereas the L1 in Canales' study (i.e., Spanish) is a wh-movement and has similar scripts to English. The results also indicated that the structure of the noun phrase in the subject filled-gap position may play a role in the size of the subject filled-gap effect because a stronger effect was found in the presence of full definite DPs than with shorter proper names.

In sum, there is no evidence in the results of the current study that non-natives process wh-dependencies differently from native speakers. This constitutes a challenge for the Shallow Structure Hypothesis, which claims that L2 learners may not make efficient use of grammatical information during real-time processing (Clahsen and Felser, 2006, 2018). Instead, the results add support to previous studies which have demonstrated that L2 speakers of English posit gaps actively in grammatical positions and avoid doing so in unlicensed positions (e.g., Kim et al., 2015; Omaki & Schulz, 2011). The results show that this behaviour increased as proficiency increased, with more proficient learners showing stronger filled-gap effects than less proficient learners.

## **5.6 Conclusion**

The present study examined how Jordanian Arabic L2 learners of English and Mandarin L2 learners of English process English wh-sentences in real time. Three main questions were addressed in this study. First, the study explored whether the gap-positing procedures of Jordanian Arabic and Mandarin L2 learners of English are similar to native speakers of English and whether

participants' behaviour is affected by proficiency. Second, the study investigated whether the two groups have access to syntactic knowledge during their real-time processing. Finally, the study examined whether the Jordanian Arabic group would show a more robust filled-gap effect during filler-gap dependency processing than the Mandarin speakers of English, due to L1 influence. The results of the current study show that the L2 participants whose L1s lack *wh*-movement are able to use the Active Filler Strategy and apply syntactic constraints regardless of the order of the filler gap in their L1. This is the case even though similar constructions of English embedded *wh*-questions in Mandarin would lack a *wh*-dependency. The study also concludes that L2 processing can be modulated by proficiency. More proficient learners show more native-like real-time processing. Finally, there was no evidence in the results of the present study that non-natives process *wh*-dependencies differently from native speakers.

Further studies are recommended to investigate the interplay of storage and retrieval mechanisms in filler-gap dependency formation (e.g., is there evidence that both categorical features (DP vs. PP) and semantic features (e.g., animacy) are kept active while processing of filler gap dependencies (cf. Chow & Zhou, 2018; Wagers & Phillips, 2014)? If so, do we see the same effects in a local configuration and non-local configuration (i.e., across (multiple) sentence boundaries?)). A study or set of experiments on L2 along these lines would be a very welcome follow-up to the real-time studies presented in this chapter.

## Chapter 6

# An investigation of the acquisition of definiteness in L2 English relative clauses by L1 Jordanian Arabic speakers

### 6.1 Introduction

This chapter reports on an experimental investigation of whether the [+definiteness] feature of the relative clause complementizer in Jordanian Arabic (discussed in Chapter 2, Section 2.3.1) can affect the L2 acquisition of English definite and indefinite relative clauses. The chapter is organized as follows: Section 6.2 defines the notion of definiteness and provides an overview of previous research on the second language acquisition of definiteness in English. Section 6.3 discusses the differences between English and Jordanian Arabic relative markers in terms of the definiteness feature. The motivation for conducting this study comes out of these differences. Section 6.4 describes the experimental design of an acceptability judgement task to investigate crosslinguistic influence of definiteness in Jordanian Arabic relative clauses on L2 English. Section 6.5 reports the results of the acceptability judgement task. Section 6.6 provides a discussion of the results.

### 6.2 L2 acquisition of definiteness in English

Definiteness is an element of interpretation that exists in all languages. It mainly refers to the identifiability of referents in discourse. Every nominal context can either be definite or indefinite (Trenkic, 2008). Ionin et al. (2004, p.5) provided the informal definition of definiteness in (137).

#### 137. Definiteness

If a Determiner Phrase (DP) of the form [D NP] is [+definite], then the speaker and hearer presuppose the existence of a unique individual in the set denoted by the NP.

By extension, if a DP is [–definite] (i.e., indefinite) then the existence of a unique individual corresponding to the NP is not necessarily presupposed.

The definiteness status of referents in most languages can be inferred pragmatically (Trenkic, 2007). However, many languages have overt grammatical markers of definiteness such as articles or affixes. English is among the languages that use an article system to mark the definiteness of nominal expressions. The article system in English includes the definite article *the* (138a), the indefinite article *a(n)* (138b), and the zero  $\emptyset$  article (138c) (Ekiert, 2007:8).

138. a. **The** lion escaped from the zoo.  
b. **A** lion escaped from the zoo.  
c.  $\emptyset$  Lions escaped from the zoo.

Spada and Tomita (2010, p.267) argue that the rules regarding the article use are too abstract for learners to infer from the input, and that explicit instruction on article use is often not effective. Further, they argued that the definiteness system in English poses problems even for advanced L2 learners. Ekiert (2007, p.1) described the definiteness system in English as “a complex set of abstract distinctions which are, to some extent, arbitrarily mapped onto surface forms”. For example, it could seem arbitrary that *the* can be used for both singular (138a) and plural nouns (139), but *a(n)* is restricted to singular (138b vs. 138c).

139. The lions that escaped from the zoo were chased yesterday.

Many studies have been conducted to investigate the L2 acquisition of English definiteness and the article system. Some of these have found evidence of L1 transfer. For example, Jarvis (2002) investigated the degree to which Finnish and Swedish L2 speakers of English mark discourse newness with articles in their written narratives. The results showed that both groups were sensitive to newness. However, the participants' L1 was found to affect the degree to which each group marked new and not-new NP referents. Finnish L2 speakers of English, whose L1 lacks an article system, showed a lower tendency to mark newness with articles than Swedish participants, who already have an article system in their L1. This suggests that the definiteness system in the L1 may affect the configuration of the article system in the learners' L2.

Specifically, the similarity between Swedish and English may have facilitated article use in English. Along the same lines, Crosthwaite (2014) used a narrative picture sequence production task to investigate the article use by L1 speakers of Mandarin and Korean and by Korean and Mandarin L2 English learners. The study found that at lower proficiency levels, the Mandarin group was more accurate in supplying *a/an* in indefinite contexts than the Korean group, who tended to omit articles. The study also found that in the L1 Mandarin data, Mandarin speakers tended to use the indefinite article *yi* in the same contexts in which Mandarin L2 speakers of English supplied *a/an*. Crosthwaite argued that Mandarin speakers' earlier acquisition is a possible consequence of positive transfer from their L1.

Further evidence of L1 transfer in the L2 acquisition of articles comes from Ekiert's (2007) longitudinal study of elicited data of an adult Polish L2 learner of English. Ekiert (2007) investigated whether the differences in the grammar of indefiniteness in L1 and L2 can result in detectable and systematic differences in interlanguage. She found that the participant underused English articles. Ekiert ascribed this to L1 transfer because the Polish system has no articles or article-like morphemes.

The definiteness system in the English language is not straightforward for L2 learners whether their L1 has an article system (García Mayo, 2009) or not (Hawkins et al., 2006; Ionin et al., 2008; Lopez, 2019; Snape, 2009).<sup>12</sup> For example, in her investigation of L1 Spanish speakers of English, whose L1 exhibits an article system, García Mayo (2009) showed that low-intermediate level L1-Spanish L2 learners of English were less accurate at supplying *a* in indefinite contexts than *the* in definite contexts in a forced-choice elicitation task. However, the overall accuracy for both determiners in García Mayo's (2009) study was high, which may suggest that learners whose L1 already has an article system that encodes definiteness can transfer this to English even at intermediate level of proficiency. Snape (2009) examined the acquisition of

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<sup>12</sup> The content of this paragraph and the next two paragraphs draws on an overview in Lopez, An and Marsden (forthcoming).

English articles by intermediate-level Chinese L2 speakers of English using two tasks: a written forced-choice elicitation task and an oral elicited picture description task. The study found out that in the forced-choice elicitation task, L2 learners tended to select *the* as a specific marker and *a* as a non-specific marker. However, they were able to distinguish between the definite and indefinite articles. On the other hand, the results of the oral description task showed that the participants were more accurate with English definite articles than indefinite articles. This suggests that the type of task used could affect participants' behaviour. Snape argued that the full acquisition of English definiteness system may not be straightforward for Mandarin L2 learners of English, which could be attributed to the lack of an article system in their L1.<sup>13</sup> In short, a number of L2 English studies that have investigated the acquisition of the English system of definiteness have found that this system is challenging for L2 learners, and that having similar article use in the L1 may facilitate acquisition.

However, other studies show an absence of L1 transfer effects in the L2 acquisition of English articles. For example, Ionin et al. (2004) examined the effect of the semantic features of definiteness and specificity in L2 English article choice by intermediate and advanced L2 learners from article-less languages (L1-Russian and L1-Korean speakers of English). Definiteness is a semantic feature that refers to the shared knowledge of both the speaker and the hearer about a unique discourse referent, while specificity is a semantic feature related to the knowledge state of the speaker only. The article system in English only marks definiteness, not specificity. Thus, specific [+specific] and non-specific [-specific] DPs can be used with definite (*the*) or indefinite (*a*) articles, as illustrated in the test items from Ionin et al. (2004, pp. 64-68).

140. a. [+specific, +definite]: target *the*

I would like to meet the author of that book some day – I saw an interview with her on TV, and I really liked her!

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<sup>13</sup> Although Mandarin seems to have an indefinite article, it has no systematic use of a definite article (Li and Thompson, 1981).



- b. [-specific, +definite]: target *the*

I would like to meet the author of that painting – unfortunately, I have no idea who it is, since the painting is not signed!

- c. [+specific, -definite]: target *a*

I am here for a week. I am visiting a friend from college – his name is Sam Brown, and he lives in Cambridge now.

- d. [-specific, -definite]: target *a*

He is staying with a friend – but he didn't tell me who that is.

Ionin et al. (2004) provided the participants with short dialogues that included sentences such as those in (140a-d). The articles in these sentences were replaced by blanks and the participants were asked to fill the blank with the appropriate article: *the*, *a(n)*, or *X* for zero article. The result showed that Russian and Korean L2 learners of English overused the definite article in specific contexts, and the indefinite article in nonspecific contexts. In other words, they tended to select *the* as a specific marker and *a* as a non-specific marker. The findings revealed that definiteness and specificity can result in some difficulties for L2 learners of English whose L1s lack an article system. Ionin et al. argued that since English articles are set to definiteness while specificity is signalled by context, at the initial stage of L2 article acquisition, L2 learners “fluctuate” between definiteness and specificity until the input guides them to the right setting (The Fluctuation Hypothesis, Ionin et al., 2004, p.17).

Lopez, An and Marsden (forthcoming) investigated whether article choice in L1 Mandarin affects article choice in L2 English. L1-Mandarin high-proficiency L2 learners of English completed a forced-choice elicitation task. Despite the fact that, unlike English, Mandarin does not have a grammaticalized definiteness feature, the results showed that the participants were very accurate in their use of obligatory definite and indefinite articles. Moreover, the results did not find evidence that the absence of a grammaticalized definiteness feature in Mandarin influences the participants' L2 English. However, Lopez et al. pointed out that lower proficiency learners may show an L1 transfer effect.

A number of studies have investigated the use of English articles by L1-Arabic speakers. For example, Bataineh (2005) explored the errors made by Jordanian Arabic L2 learners of English in their use of English articles. Similar to Modern Standard Arabic, the definiteness system in Jordanian Arabic has a definite article *il* (141a), but no indefinite article. Instead, indefiniteness is marked by the absence of the definite article (141b).

141. a. *ħbiet il- kitab illi qara2-tuh mbarah*  
 I-liked **the- book** that I-read yesterday.  
 I liked the book I read yesterday.
- b. *bħib aqra? Ø ktab kul youm.*  
 I-like read **a book** every day.  
 I like to read a book every day.

As illustrated by (141a), the definite article *il-* in (*il- kitab*) corresponds to the English definite article *the* in the DP (*the book*). On the other hand, unlike English, in Jordanian Arabic, there is no equivalent for the English indefinite article *kitab* 'a *book*' in (141b). Bare noun phrases (count/mass and singular/plural nouns) in Arabic are interpreted as indefinite (Schulz, 2004).

The participants in Bataineh (2005)'s study were 209 L1-Jordanian Arabic L2-learners of English. The participants were provided with a number of topics and they were asked to write about one of these topics (e.g., my favourite author/story/poet; why do you study English?). The researcher analysed the compositions written by the participants and identified any errors in the use of the English indefinite articles. Most relevant to the current discussion, one error category involved omission of the indefinite article, as illustrated in (142) (Bataineh, 2005, p.11).

142. English is international language. [Should be *an international language*]

According to Bataineh (2005), the omission of the indefinite article can be attributed to L1 transfer since, as outlined above, the participants' L1 does not have a distinct marker for indefiniteness the way English does. In the same vein, Crompton (2011) examined the acquisition of English definiteness by

advanced L1-Arabic L2-English learners. A large corpus of argumentative essays written by first- and second-year Arab students was analysed. Twenty percent of the students were Emirati, the others were from different Arab nationalities resident in the Emirates. Crompton found that the most common error in the students' writings was the misuse of the definite article for generic non-count reference (143 & 144) (Crompton, 2011, p.21). In both examples, *the* should be omitted.

143. Some of us consider the money as the force which controls our lives, while others...

144. King Fahd University graduates are knowledgeable and ready to join the real life from the first day in their business.

Crompton suggested that this error may be due to L1 transfer, as the use of the definite article in Arabic in such cases is obligatory. Since Bataineh (2005) and Crompton (2011) are production studies, the data are only informative about what is grammatical in the learners' grammar, and not what is ungrammatical. Using an experimental design with an acceptability judgement task on the other hand, can yield insights into what is allowed/disallowed (Schütze & Sprouse, 2014).

In sum, there is considerable evidence which suggests that the L2 acquisition of the definiteness system in English may present some difficulties for L2 learners whose L1 differs from English in relation to the definiteness system. On the other hand, there are also some cases where L2 learners were able to show success in the acquisition of the article system that is not found in their L1 (e.g., Lopez et al. (forthcoming); among others).

It can be concluded that the extent to which definiteness effects in the L1 transfer to the L2 is not clear yet. In this context, the definiteness effect in Jordanian Arabic relative clauses (outlined in Chapter 2, Section 2.3.1) presents a potentially new avenue for research into L1 transfer of definiteness.

The next section provides more details on how the definiteness of the head of a relative clause affects the use of the covert vs. overt relative marker in the participants' L1, namely, Jordanian Arabic.

### 6.3 Motivation of the study

As illustrated in Chapter 2 (Section 2.3.1), while an overt English relative marker can be a relative pronoun, (e.g., *who*) or a relative complementizer (i.e., *that*), a relative marker in Jordanian Arabic is a relative complementizer (i.e., *illi*). As discussed earlier in the same section, the interaction with definiteness is one of the ways in which Jordanian Arabic relativization differs from English. In English, the use of an overt versus covert relative marker is based on the grammatical function of the head in the relative clause. The overt form is obligatory in the subject position (145a) and optional elsewhere (145b) (Notice the position of asterisks and brackets):

145. a. The judges sentenced the suspect (who/ \*Ø)\_\_\_vandalized the shop.  
 b. I saw the suspect (who/ Ø) the judge sentenced \_\_\_\_\_to five years in prison.

In Jordanian Arabic, on the other hand, the use of the relative complementizer is entirely based on the definiteness of the head noun. The relative complementizer should be overt after definite nouns, as was represented in (5) repeated here as (146). In contrast, indefinite head nouns (147) cannot be followed by the overt relative complementizer.

146. a. halli-t            is-suʔa:l            [illi]    kan    bil-li-mtifa:n]  
           answered-I    the-question    that    was    in-the-exam  
           'I answered the question that was in the exam.'

- b. \*halli-t            is-suʔa:l            kan    bil-li-mtifa:n]  
           answered-I the-question was    in-the-exam

147. a. halli-t            suʔa:l            kan    bil-li-mtifa:n]  
           answered-I question was    in-the-exam  
           'I answered a question in the exam.'

- b. \*halli-t      suʔa:l      [illi      kan      bil-li-mtifa:n]  
 answered-I      question      that      was      in-the-exam

As exemplified in (146), the use of the relative marker *illi* with definite head nouns is obligatory, as illustrated by the ungrammaticality of (146b). By contrast, indefinite head nouns cannot be followed by *illi* (147). This explains the ungrammaticality of (147b) where the relative marker, *illi*, follows an indefinite head noun (*suʔa:l* ‘question’). As discussed in Chapter 2 (Section 2.3.1), Al-Momani (2010) argues that definite head nouns trigger the use of the relative complementizer *illi*, thus, the appearance of *illi* is the phonological reflex of the [+def] feature. By contrast, in English, relative markers can follow definite (148a) and indefinite head nouns (148b), which suggests that they are not specified for definiteness.

148. a. I answered the question **that** was in the exam.  
 b. I answered a question **that** was in the exam.

The present study exploits the difference between Jordanian Arabic and English relative complementizers to investigate possible L1 transfer in relation to definiteness using an acceptability judgement task. The question that this experiment attempts to answer is:

149. Will the relationship in the participants’ L1 between definiteness and the use of a null or overt relative complementizer transfer to the L2 English?

The theoretical L2 acquisition framework within which the current study will address this question is the Feature Reassembly Hypothesis (Lardiere, 2008, 2009). According to the Feature Reassembly Hypothesis, initially, L2 learners will transfer the feature values from their L1 to the L2. Subsequently, the transferred feature sets may be restructured if evidence in the L2 input motivates such restricting. Based on this account, Jordanian Arabic L2 learners will transfer the [+def] feature of their L1 relative complementizer *illi* to their initial abstract representations of the English relative complementizer *that*. However, evidence in the input may motivate removal of this feature.

Specifically, encountering English indefinite relative clauses which include an overt relative complementizer in the input may provide an opportunity for learners to come to know that the English relative complementizer is not specified for definiteness. The availability of the evidence for reassembly means that, it seems reasonable to assume that lower proficiency learners are less likely to have encountered enough relevant evidence to motivate this specific reassembly than higher proficiency learners. Therefore, *that* in lower proficiency learners may bear a [+def] feature whereas in higher proficiency learners *that* may have the target underspecification for definiteness. The following hypotheses are tested by means of an acceptability judgement task:

150. **Definiteness Hypothesis 1:** Lower proficiency Jordanian Arabic speakers of English will treat the English overt relative complementizer *that* as incompatible with definite relative clauses, and the null complementizer as incompatible with indefinite relative clauses, due to transfer of the [+def] feature from the Jordanian Arabic relative complementizer *illi*.

151. **Definiteness Hypothesis 2:** Higher proficiency Jordanian Arabic speakers of English will allow target-like distribution of English overt and null relative complementizers with both definite and indefinite relative clauses, due to reassembly of the L1-based feature set following evidence in the input.

The next section details the experimental method.

## 6.4 The acceptability judgement task

### 6.4.1 Participants

Two groups of participants completed the acceptability judgement task: a control group of 31 native speakers of British English and a group of 39 Jordanian Arabic L2 learners of English.<sup>14</sup> The Jordanian L2 learners of English were undergraduate students at The Hashemite University in Jordan. They

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<sup>14</sup> None of these participants had participated in the Self-paced Reading Task reported in the previous chapter.

were all native Jordanian Arabic who ranged in age between 19-33 years old (19 females and 20 males). All participants had studied English as a foreign language for at least ten years.

In addition to the acceptability judgement task, the Jordanian Arabic participants were asked to complete the Oxford Quick Placement Test (2001) to provide a measure of their language proficiency. The participants' scores in the Oxford Quick Placement Test (OQPT) along with their profiles can be seen in Table 17. In order to give details about the participants' proficiency level, the participants are classified into three proficiency groups in Table 17: lower intermediate (B1), upper intermediate (B2) and advanced (C1).<sup>15</sup> However, proficiency score was used as a continuous predictor in the analysis.

**Table 17.** Characteristics of the Jordanian Arabic participants of the Acceptability Judgement Task.

Proficiency Group	Age Range			OQPT Score		
	Mean	SD	Range	Mean	SD	Range
Lower-inter (n=20)	23.45	4.82	19-33	33.55	2.35	30-38
Upper-inter (n=14)	22.00	3.08	19-30	44.57	1.74	42-47
Advanced (n=5)	23.77	3.08	20-27	49.6	1.94	48-53

#### 6.4.2 Acceptability judgement task design and predictions

The current study employed an acceptability judgement task which comprised relative clause items to test the main research question and the hypotheses stated in (150–151), above. The operationalisation of “definiteness” in the judgement task is through the definite and indefinite articles (*the* and *a*). Therefore, items to check the participants' general knowledge of definiteness in English articles were incorporated into the task, in addition to the relative clause items. These separate components of the task are detailed in the following.

<sup>15</sup> As explained in the preceding chapter (Section 5.3.5), the results of the two parts of the Oxford Quick Placement Test are out of 60 and can be mapped onto levels of the Common European Framework.

#### 6.4.2.1 The relative clause items

Thirty-two critical sentences were developed especially for the current experiment to investigate whether Jordanian Arabic speakers of English treat the English relative complementizer as if it has a [+def] feature, rendering the overt relative complementizer incompatible with indefinite head nouns and the null form incompatible with definite head nouns.

The linguistic variables in the acceptability judgement task are definiteness with two levels (definite, indefinite) and complementizer type (overt, null) and these two variables are crossed with each other to yield four conditions. Each sentence has four conditions: a definite relative clause with an overt relative complementizer (152a); a definite relative clause with a null relative complementizer (152b); an indefinite relative clause with an overt relative complementizer (152c); and an indefinite relative clause with a null relative complementizer (152d).

152. a. Sarah read *the book that* her father bought.  
b. Sarah read *the book*  $\emptyset$  her father bought.  
c. Sarah read *a book that* her father bought.  
d. Sarah read *a book*  $\emptyset$  her father bought.

All four conditions in (152) are grammatical in English. However, the grammaticality of Jordanian Arabic equivalents of these sentences varies by condition. The definite relative clause condition in (152a) contains a definite head NP (*the book*) that is followed by an overt relative complementizer (*that*), which is similar to grammatical relative clauses in Jordanian Arabic. Condition (152b) is considered ungrammatical in Jordanian Arabic because the relative complementizer cannot be null after a definite head. The indefinite relative clause condition in (152c) is also ungrammatical in Jordanian Arabic, whereas (152d) is grammatical because as illustrated earlier, the use of the overt relative complementizer is not allowed when the head of the relative clause is indefinite (*a book*). In sum, Jordanian Arabic sentences that are analogous to conditions (b & c) are ungrammatical.



All the test sentences used direct object relative clauses because, as discussed earlier, the use of the overt English relative complementizer is optional in object relatives, unlike subject relatives where the use of the overt relative complementizer is obligatory. This allows the investigation of the participants' degree of acceptance of the overt vs. null use of the relative complementizer after definite/indefinite heads. Some factors that can affect general processability of the sentences were taken into consideration to avoid processing difficulties caused by reasons not relating to the phenomenon under investigation. For example, indirect object relatives were not included to avoid a possible processing difficulty effect because previous research found that indirect object relatives are less accessible than direct object relatives (Keenan and Comrie, 1977). Moreover, proper names (16 different female and 16 different male names) were used as subjects of the main clause in all target sentences. Further, all the relative clause head nouns were inanimate because object relatives are most likely to have inanimate heads (e.g., Fox and Thompson, 1990). Previous research showed that object relatives are easier to process when the head noun is inanimate (e.g., Traxler, Morris, & Seely, 2002; Traxler, Williams, Blozis, & Morris, 2005). In order to keep the frequency of occurrence constant through the task, each verb in the matrix clause was used twice and each verb in the relative clause was also used twice. Verbs of perception were avoided because these verbs sometimes induce unexpected effects.

#### **6.4.2.2 The article check items**

Because the present study investigates the definiteness feature reassembly in the relative clause context, it is necessary to incorporate a measure of the participants' basic knowledge of the English definite system. In order to do this, the study adapted an acceptability judgement task (AJT) used by Ionin and Montrul (2010). In Ionin and Montrul's study, this AJT was used to test the basic familiarity of L1-Spanish and L1-Korean L2 learners of English with English articles. Ionin and Montrul (2010) found that the native English control group performed at ceiling on this task, whereas accuracy was gradient among the L2 learners. Therefore, the test is appropriate for checking the basic familiarity of English articles.

Ionin and Montrul’s task included nine categories; 5 of which test the articles’ use with singular nouns and 4 test their use with plural nouns. However, because the target relative clause items employed in the current study include only singular nouns, Ionin and Montrul’s plural categories were excluded. Some of Ionin and Montrul’s original test items include two proper names. These items were changed in the present study so that each item would have one proper name only, like the relative clause items. The five test categories that were used are illustrated in Table 18.

**Table 18.** The five test categories in the article check Acceptability Judgement Task

<b>Category</b>	<b>Example</b>
Singular, second-mention, the	Mary had a cat. The cat was black and white.
*Singular, second-mention, a	Robin owned a dog. A dog had a blue collar.
Singular, first-mention, a	Smith opened his office door. A student came in.
*Singular, second-mention, bare	Louis had a kitten. Kitten was very cute.
*Singular, first-mention, bare	Tom heard a noise. Cow was standing outside.

Each category in Ionin and Montrul’s test included 4 sentences. In the present study, four more sentences were added to each category. Thus, the article check items employed in the present study included 40 sentences (16 grammatical and 24 ungrammatical sentences). These items serve a dual purpose: to provide a measure of knowledge of article use and to distract attention from the key property of interest (the relative clauses). In the analysis of these items, a criterion of 75% (6/8) accurate on each of the five article categories was used as an indicator of robust knowledge of the basic use of definite and indefinite articles with singular nouns.

#### **6.4.2.3 Fillers**

Twenty-four ungrammatical filler sentences were used in order to balance the acceptable and unacceptable sentences within the whole test. The fillers were either biclausal sentences (153a) like the relative clause items or consisted of two sentences (153b) like the article check items. The ungrammaticality of the fillers is related either to the consecutive use of simple

past (e.g., *stopped rained* in (153a) or to wrong word order (such as *attended she* in (153b)).

153. a. \*George played outside when it stopped rained.

b. \*Margaret heard this news. Then attended she the meeting.

Based on the researcher's knowledge and professional experience of English language learning by Jordanian Arabic speakers, these ungrammaticalities should be identifiable even by lower proficiency Jordanian Arabic speakers of English.

#### **6.4.2.4 Putting the whole Acceptability Judgement Task together**

As mentioned before, the article check items and the fillers serve as distractors from the property under investigation, i.e. relative clauses. The ratio of distractors to the target sentences is 2:1. There is a debate in the literature on the ideal ratio of target to distractor stimuli for an experiment in the second language acquisition field (Jegerski, 2013). Jegerski reports that there is some evidence that an absolute minimum proportion of distractors should be 50% (Havik, Roberts, Van Hout, Schreuder & Haverkort, 2009). This study followed common practice and used a higher proportion than 50%.

In order to control for difficulty in understanding, all the test sentences have been designed with simple and frequently used vocabulary. The Oxford Learner's Dictionaries tool was used to check that the used vocabulary is categorised as at most low-intermediate level (B1), which is the third level of English in the Common European Framework of Reference for Languages (CEFR; Council of Europe, 2001)<sup>16</sup>. For systematicity, all the verbs used in the whole task were in the simple past tense. This resulted in changing the tense of some of Ionin and Montrul's original test sentences.

As mentioned above, 32 relative clause items were developed for the present study, each of which had four conditions. Four Latin Square presentation lists were created for the relative clause items, so that every

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<sup>16</sup> The URL for the Oxford Learner's Dictionaries tool is:  
<https://www.oxfordlearnersdictionaries.com/wordlists/oxford3000-5000>.

participant would read one instance of each critical sentence, and no participant would read two versions of the same sentence. Each participant had to judge 8 sentences of each of the four conditions. Each relative clause list (32 items) was combined with all the article check items (40 items) and all the fillers (24 items). Thus, each participant needed to rate 96 sentences: 48 grammatical sentences and 48 ungrammatical ones. The relative clause items, the article check items and the fillers were presented in random order. Table 19 summarises the whole task.

**Table 19.** A summary of the relative clause conditions, the article check conditions, and fillers.

<b>Condition</b>	<b>Tokens per condition</b>
<i>The RC items</i>	
Definite/ overt	8
Definite/ null	8
Indefinite/ overt	8
Indefinite/ null	8
<i>The article check items</i>	
Singular, second mention, the	8
*Singular, second-mention, a	8
Singular, first-mention, a	8
*Singular, second-mention, bare	8
*Singular, first-mention, bare	8
<i>Fillers</i>	
* Consecutive use of simple past	12
* Incorrect word order	12

Note. Shading indicates that the tokens are ungrammatical.

#### **6.4.2.5 Acceptability judgement task procedure**

The whole task was designed and conducted using the online Qualtrics Software ([www.qualtrics.com](http://www.qualtrics.com)), which is a survey software that only needs a

minimum of computer skills use by the participants. The task started with a page of instructions which informed the participants that they would be presented with a series of written sentences, and that they should evaluate how acceptable each sentence sound, indicating their response using a 7-point Likert scale where “1” means completely unacceptable and “7” means perfectly acceptable. The practice stimuli prepared the participants to give judgements to a one-sentence stimulus (154a) and to a two-sentence stimulus (154b), to ensure that they were trained to give judgements to the relative clause items and the article check items, respectively. The participants were asked to read each item and then judge whether the underlined part is an acceptable sentence of English.

154 a. The Pacific Ocean is much larger the Atlantic Ocean.

b. The gardeners are planting trees. It is a cherry tree.

In the instructions, it was made clear that the participant needs to read the whole sentence before judging the underlined part. For example, for practice sentence (154b), it was stated that the underlined sentence is odd because it refers to one tree, but the context (in the preceding sentence) refers to many trees. Thus, the participants were made aware that they need to judge the underlined part in light of the non-underlined part.

The response time for each item in the acceptability judgement task was limited, because time pressure is argued to lead to a more reliable indication of participants' implicit knowledge (e.g., Ellis, 2005; Ionin and Zyzik, 2014; Spinner and Gass, 2019). Loewen (2009) reported that the adequate timing for sentence presentation in judgement tasks is not determined yet. Loewen found that the time range used in previous research is 3-10 seconds. Spinner and Gass (2019) showed that the time range of other studies was longer than that. For instance, Huang (2014) used 15-second time limits. However, Spinner and Gass (2019) pointed out that the timing decision should be based on the length and complexity of sentences, and they recommended piloting a judgement task with a number of participants to make appropriate decisions about time limits. Thus, in the present study, the task was piloted first by 4 native speakers of

English and 12 Jordanian Arabic speakers with a 6 second timing for each sentence presentation because it is half-way between the 3-10s range that was reported by Loewen (2009). This timing was found to be too short for a number of lower-proficiency level participants, who would normally need longer to process sentences. Thus, the timing was changed into 10 seconds for each sentence presentation. Based on another task piloting with 15 L2 learners, this timing was found appropriate for participants from different proficiency groups. However, if a participant read and judged a sentence in less than 10 seconds, s/he could press *next* to go to the next sentence, so there was no need to wait for the full 10 seconds.

#### **6.4.2.6 Hypotheses and predictions**

Two hypotheses were presented above, in Sections 6.3, and these are repeated, for convenience in (155) and (156) below.

155. **Definiteness Hypothesis 1:** Lower proficiency Jordanian Arabic speakers of English will treat the English overt relative complementizer as incompatible with definite relative clauses, and the null complementizer as incompatible with indefinite relative clauses, due to transfer of the [+def] feature from the Jordanian Arabic relative complementizer *illi*.

156. **Definiteness Hypothesis 2:** Higher proficiency Jordanian Arabic speakers of English will allow target-like distribution of English overt and null relative complementizers with both definite and indefinite relative clauses, due to reassembly of the L1-based feature set following evidence in the input.

Taken together, Definiteness Hypotheses 1 and 2 suggest that L2 behaviour will be non-target like and lead to the following predictions, taking into account the participant variable (i.e., native English vs. L1-Jordan Arabic speakers of English) and the two linguistic variables (definiteness and complementizer type):

157. **Definiteness Prediction 1:** There will be an interaction of L1, definiteness and relative complementizer type, whereby the L2 group's acceptability ratings for the English definite relative clauses with null relative complementizers and for indefinite relative clauses with overt relative complementizers will be significantly lower than those of the L1 group's ratings for the same conditions.
158. **Definiteness Prediction 2:** Within the L2 group, there will be an interaction of definiteness, relative complementizer type (overt/null) and proficiency, whereby ratings for the conditions that include definite relative clauses with null complementizers and indefinite relative clauses with overt relative complementizers get higher (i.e., more target-like) as proficiency increases.

### **6.4.3 General procedure**

Ethical approval for the data collection was obtained from the Ethics Committee in the Department of Language and Linguistic Science at the University of York. The Jordanian Arabic participants were invited to voluntarily participate in the study by a professor at the Hashemite University, on behalf of the researcher. He provided the students with the information sheet and informed them that the findings would be used for research purposes only and that their individual responses would remain anonymous. Those who agreed to be involved in the task completed an online consent form first, followed by a language background questionnaire, the Acceptability Judgment Task, and finally the Oxford Quick Placement Test through a link that they received via email. Jordanian participants received 5 marks in their course work in compensation for participating in the task. Native speakers of English, on the other hand, were invited to participate in the study by a word of mouth. Most of them were either students at the University of York or teachers at some primary schools in York. Native speakers of English were asked to read an online information sheet about the study and to sign up for participation if they wished to do so. The information sheet and the consent form were presented electronically at the beginning of the online task, and the participants were notified that clicking through these forms to the experiment constituted informed

consent. The Acceptability Judgement task took approximately 20 minutes for the L1 group and 25-30 minutes for the L2 group to complete.

#### **6.4.4 Data preprocessing and analysis**

First, the average judgment ratings were calculated for the article check items for each participant. As mentioned before (Section 6.4.2.2), the participants needed to score 75% (6/8) accurate on each of the five article check categories. This score was taken as indication that they have acquired the basic knowledge of articles required to judge the definite and indefinite relative clause items. Two native English speakers did not meet this criterion in one category each; however, they were not excluded from the analysis because they scored 75% accuracy across all the categories. For the Jordanian Arabic participants, this criterion resulted in excluding three participants (i.e., 7% of the data). Thus, the statistical analysis of the results in this study was conducted based on the data of 36 Jordanian Arabic L2 speakers of English and 29 native English speakers. For the remaining L2 participants, proficiency score in the Oxford Quick Placement Test was used as a continuous predictor in the analyses of the relative clause sentences.

Ordinal regression mixed models were used for statistical analysis of the responses to relative clause conditions, (Christensen, 2019), in R (the R statistical environment, R Core Team 2019). *P*-values were computed with the *clmm* function from the *ordinal* package. Following standard practice in linguistic research, *p*-values of  $<.05$  are considered to indicate a statistically significant effect.

### **6.5 Results**

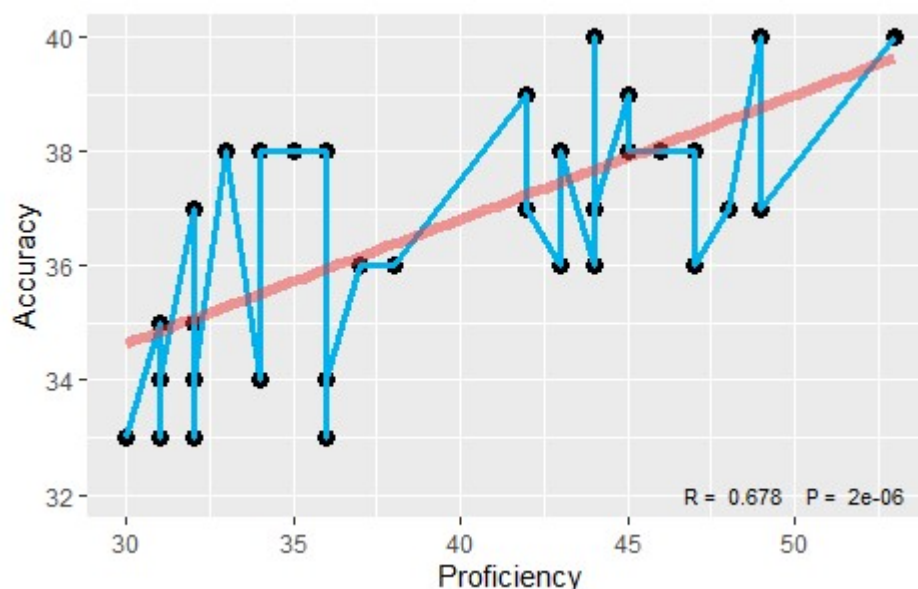
The descriptive results for the article check categories for the Jordanian Arabic group and the native English group in the acceptability judgement task are summarized in Table 20. Figure 18 presents the distribution of the article-check scores by proficiency scores.



**Table 20.** Mean ratings and SD for the article check categories by the Jordanian Arabic group (n = 36) and the native English group (n = 31)

L1	2 <sup>nd</sup> -mention, <i>the</i>	2 <sup>nd</sup> -mention, <i>a</i>	1 <sup>st</sup> -mention, <i>a</i>	2 <sup>nd</sup> -mention, <i>bare</i>	1 <sup>st</sup> -mention, <i>bare</i>
NE	6.42 (0.97)	2.19 (1.45)	6.12 (1.30)	1.68 (0.97)	1.63 (0.97)
JA	6.17 (1.18)	2.25 (1.26)	5.88 (1.48)	1.84 (1.06)	1.79 (0.97)

As stated in Section 6.4.2.2, each individual participant whose data are included in Table 20 met the criterion of at least 75% accuracy on each article check category. The results of the five article check categories in Table 20 show that the Jordanian Arabic group's ratings in each category are similar to the native English group's ratings. This suggests that the Jordanian Arabic participants have acquired the basic knowledge of articles required to judge the definite and indefinite relative clause items. Figure 18 shows the distribution of the L2 group's article-check scores by their Oxford Quick Placement Test scores.



**Figure 18.** The distribution of the article-check scores by the OQPT scores.

As can be seen in Figure 18, in general, more proficient participants show higher accuracy on article-check questions than less proficient participants.

There was moderate positive correlation between the article-check score and the proficiency score ( $r = 0.678, p < 0.001$ ).

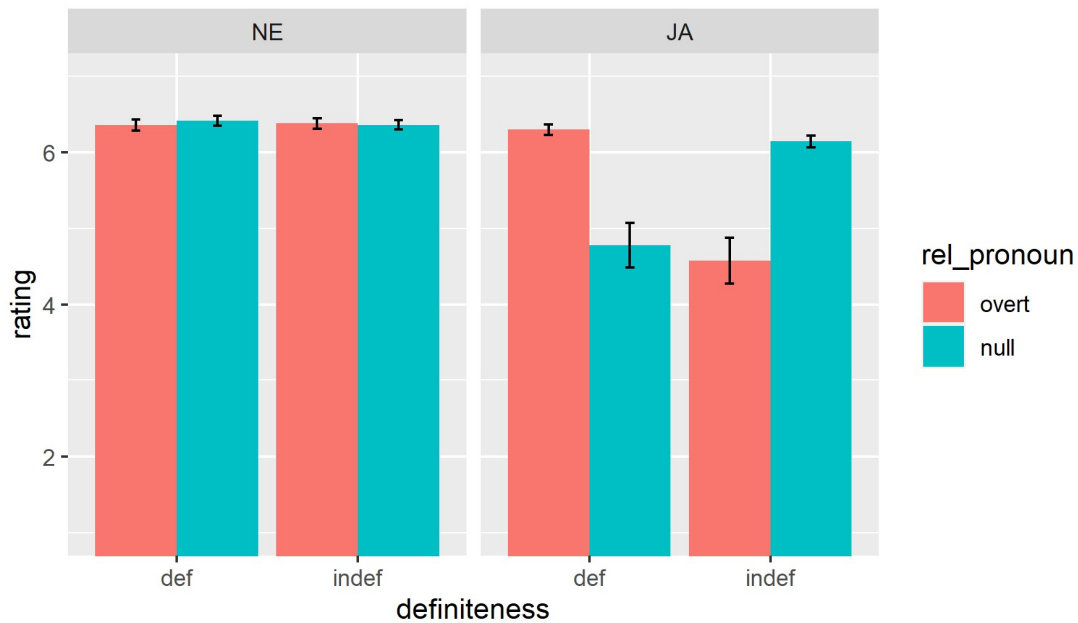
As mentioned before (in Section 6.4.2.3), 26 ungrammatical fillers were used as distractors in the acceptability judgement task. The mean rating for the Jordanian Arabic participants for these items was 1.96 (SD: 1.26), whereas the mean rating for the control group mean was 1.89 (SD: 1.04). These low mean ratings suggest that both groups considered the fillers to be ungrammatical and were paying attention to the task.

With respect to the relative clause items analysis, the descriptive results for each condition for the native English group and the Jordanian Arabic group are summarized in Table 21.

**Table 21.** Acceptability ratings of the four relative clause conditions by L1 (the rating scale was from 1-7)

L1	Def/that		Def/null		Indef/that		Indef/null	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
NE	6.38	0.82	6.43	0.69	6.38	0.81	6.38	0.82
JA	6.30	0.92	4.78	2.03	4.58	2.11	6.14	1.28

To facilitate visualisation, the mean acceptability ratings are also presented in Figure 19.



**Figure 19.** Mean acceptability ratings for the four conditions by the native English group and the Jordanian Arabic group. The error bars represent standard errors.

Figure 19 shows that the native English group had uniformly high mean acceptability ratings in all four conditions. It also shows that the Jordanian Arabic group had high mean acceptability ratings in the definite condition with overt relative complementizers and in the indefinite condition with null relative complementizers, and that they had strikingly lower mean ratings in the other two conditions.

The first ordinal regression model was run on the raw ratings of all the participants as the dependent variable and L1 (native English and Jordanian Arabic), definiteness (definite vs. indefinite) and relative complementizer type (overt vs. null) as predictors. The model included random intercepts for both subjects and items. In addition, the model included random slopes for the interaction of definiteness with relative complementizer by subject, and random slopes of the interaction of definiteness, relative complementizer, and L1 by item. The predictors were sum-coded: definiteness (definite = -1, indefinite = 1), relative complementizer type (overt = -1, null = 1); language (native English = -1, Jordanian Arabic = 1). The results of the ordinal regression model are presented in Table 22.

**Table 22.** Ordinal regression mixed-effects model estimates of ratings in the acceptability judgement task as a function of definiteness, relative complementizer, and L1.

<b>Coefficient names</b>	<b>Estimate</b>	<b>SE</b>	<b>z-value</b>	<b>P</b>
Definiteness: indefinite	0.076	0.049	1.532	.126
Relative comp: null	-0.035	0.058	-0.600	.549
L1: Jordanian Arabic	0.722	0.161	4.474	<.001
Definiteness*Relative comp	0.524	0.131	4.002	<.001
Definiteness*L1	-0.052	0.052	-0.992	.321
Relative comp*L1	0.038	0.058	0.654	.513
Definiteness*Relative comp*L1	-0.634	0.120	-4.883	<.001

Note. Shading highlights estimates with a significant  $p$ -values  $\leq 0.05$ .

Note. `clmm(as.factor(rating) ~ definiteness*relative_complementizer*language + (1+definiteness*relative_complementizer|subject) + (1 + definiteness * relative_complementizer*language|item))`

The results of the ordinal regression model in Table 22 show a main effect of L1, a significant two-way interaction of definiteness and relative complementizer type (overt vs. null), and a significant three-way interaction of L1, relative complementizer type (overt vs. null), and definiteness. A follow-up nested model was run in order to investigate this significant three-way interaction further. The model nested relative complementizer type within definiteness within L1 as fixed effects, and participants and items as random effects. The model included random slopes and intercepts of the nested relative complementizer within definiteness by subject, and random slopes and intercepts of the nested relative complementizer within definiteness within L1 by item. The results of the nested model are presented in Table 23.

**Table 23.** Nested ordinal regression mixed-effects model estimates for the relative complementizer type within definiteness within L1.

Coefficient names	Estimate	SE	z-value	P
L1: Jordanian Arabic	0.722	0.151	4.78	<.001
NE*Definiteness	0.024	0.070	0.34	.735
Jordanian Arabic*Definiteness	0.127	0.073	1.74	.082
NE*Definite*Relative comp	-0.108	0.211	-0.51	.609
JA*Definite*Relative comp	1.085	0.179	6.07	<.001
NE*Indefinite*Relative comp	0.114	0.200	0.57	.568
JA*Indefinite*Relative comp	-1.230	0.178	-6.91	<.001

Note. Shading highlights estimates with a significant  $p$ -values  $\leq 0.05$ .

Note. `clmm(as.factor(rating) ~ language/definiteness/relative_complementizer + ( 1 + definiteness /relative_complementizer|subject) + ( 1 + language / definiteness / relative_complementizer|item)`

The follow-up analysis indicates that the three-way interaction in the omnibus model was due to the fact that definiteness and relative complementizer type played a strong role for Jordanian Arabic speakers ( $p < 0.001$ ), but not for native English speakers ( $p \geq .568$ ). According to the mean ratings presented in Table 21, this is due to the Jordanian Arabic participants having significantly higher mean ratings for the definite condition with an overt relative complementizer and for the indefinite condition with a null complementizer than those for the definite condition with a null relative complementizer and for the indefinite condition with an overt complementizer, respectively.

A second ordinal regression model was run on the Jordanian Arabic speakers' data to assess the role of proficiency. The model included random slopes for the interaction of definiteness with relative complementizer by subject, and random slopes for the interaction of definiteness, relative complementizer, and proficiency by item. The model also included random

intercepts by subject and by item. The predictors were sum-coded: definiteness (definite = -1, indefinite = 1); relative complementizer type (overt = -1, null = 1), and proficiency scores were centred around the means (following Cunnings, 2012). Table 24 presents the results of the ordinal regression model.

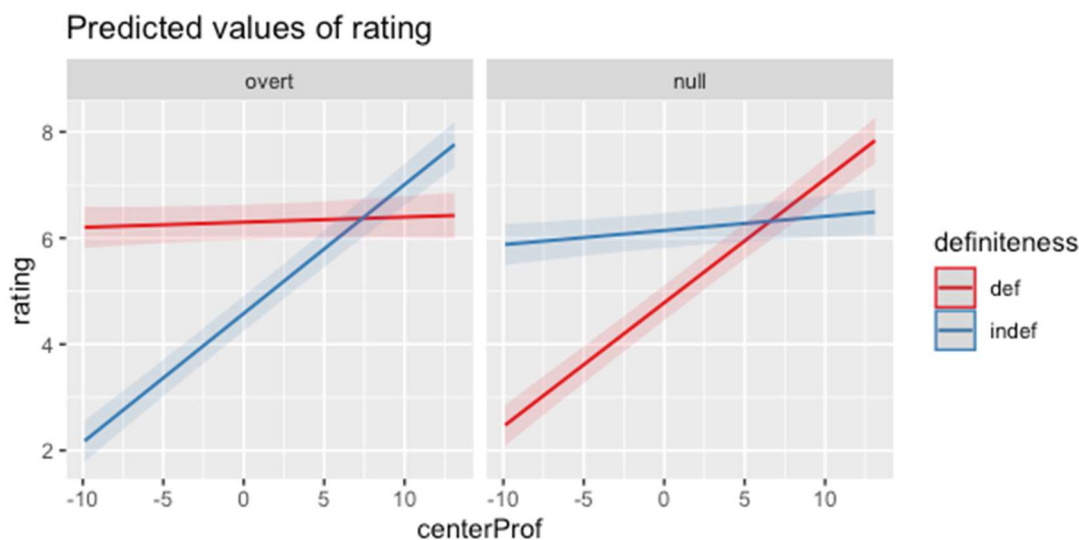
**Table 24.** Fixed effect coefficients for ordinal mixed regression model fit for Jordanian Arabic speakers' ratings as a function of definiteness, relative complementizer and proficiency.

Coefficient names	Estimate	SE	z-value	P
Definiteness	-2.470	0.284	-8.71	<.001
Relative comp	-2.060	0.275	-7.48	<.001
Proficiency	0.020	0.022	0.94	.350
Definite*Relative comp	4.445	0.444	10.01	<.001
Definite*Proficiency	0.332	0.040	8.30	<.001
Relative comp*Prof	0.343	0.039	8.73	<.001
Definite*Relative comp*Prof	-0.662	0.066	-10.10	<.001

Note. Shading highlights estimates with a significant  $p$ -values  $\leq 0.05$ .

Note. `clmm(factorRating ~ definiteness*relative_complementizer*centerProf+(1+definiteness *relative_complementizer|subject) + (1 + definiteness * relative _ complementizer*centerProf|item)`

Table 24 shows that almost all the main effects and interactions were significant. Of most interest is the significant three-way interaction of Definiteness\*Relative complementizer type\*Proficiency. This indicates that the interaction of definiteness and relative complementizer depended on the proficiency of the participants. The visualisation of exactly how these three predictors are interacting is given in the plots of model estimates represented in Figure 20.



**Figure 20.** Plots of model estimates for the interaction of definiteness, relative complementizer type, and proficiency.

The plots in Figure 20 clearly show that lower proficiency participants provided notably lower acceptability rates for the English definite relative clauses with null relative complementizers and for the indefinite relative clauses with overt relative complementizers than definite relative clauses with overt relative complementizers and indefinite relative clauses with null relative complementizers, respectively. The implications of this outcome and those of the results of the present study will be discussed in the next section.

## 6.6 Discussion

The current study investigated whether the [+def] feature of the relative complementizer in Jordanian Arabic can affect the L2 acquisition of English definite and indefinite relative clauses with overt or null relative complementizers using an acceptability judgement task. The experiment tests predictions that were presented above (in Section 6.4.2.6) and repeated below as (159) and (160).

159. **Definiteness Prediction 1:** There will be an interaction of L1, definiteness and relative complementizer type, whereby the L2 group’s acceptability ratings for the English definite relative clauses with null relative complementizers and for indefinite relative clauses

with overt relative complementizers will be significantly lower than those of the L1 group's ratings for the same conditions.

160. **Definiteness Prediction 2:** Within the L2 group, there will be an interaction of definiteness, relative complementizer type (overt/null) and proficiency, whereby ratings for the conditions that include definite relative clauses with null complementizers and indefinite relative clauses with overt relative complementizers get higher (i.e., more target-like) as proficiency increases.

This section discusses what the results mean in the context of these predictions and in relation to the Feature Reassembly Hypothesis (Lardiere, 2008, 2009). Then it discusses certain limitations of the study and further research ideas to develop the current findings.

The main observation of the results of the acceptability judgement task is that the combination of definiteness (definite vs. indefinite) and relative complementizer type (overt vs. null) played a strong role for Jordanian Arabic L2 learners of English, but not for English native speakers. The native English speakers did not differentiate among the four experimental conditions, with high acceptance ratings for all of them. However, in the L2 group, the mean ratings for the definite condition with the overt relative complementizer and for the indefinite condition with the null complementizer were significantly higher than those for the definite condition with the null relative complementizer and for the indefinite condition with the overt complementizer, respectively. The results of the three-way interaction of L1\*Definiteness\*Relative complementizer type and its follow-up nested models confirm Definiteness Prediction 1 (159). Moreover, the findings of the three-way interaction of Definiteness\*Relative Complementizer type\*Proficiency and its follow-up nested models revealed that the interaction of definiteness and the relative complementizer type depended on the L2 English proficiency of the participant, in that this behaviour increases as proficiency decreases. Therefore, the results confirm Definiteness Prediction 2 (160).



Recall that under the Feature Reassembly account, initially, L2 learners will transfer the feature values from their L1 to the L2. Based on the L2 input, L2 learners are expected to determine the appropriate specification of the features on the L2 morpholexical item, and reassemble the feature set. Thus, the acquisition task of L2 features consists of reconfiguring features from the way they are bundled in the L1 to configurations appropriate for the L2. The findings of the present study suggest that the feature set of the English relative complementizer *that* in the interlanguage of L2 speakers who have lower proficiency of English seemed to include the [+def] feature. Specifically, this conclusion is motivated by the significant three-way interaction of definiteness, relative complementizer type, and proficiency that increased as proficiency decreased. This shows that lower proficiency learners had lower acceptability ratings for null English relative complementizers after definite head nouns and overt English relative complementizers after indefinite head nouns, compared to their acceptability ratings for the other two conditions that correspond to grammatical structures in their L1. This three-way interaction also shows that the feature set of the relative complementizer in the L2 learners' interlanguage who have higher proficiency of English does not appear to include the [+def] feature, as suggested by the acceptance of the null use of English relative complementizer after definite head nouns and the overt use of English relative complementizer after indefinite head nouns, which appears to increase as proficiency increases. In sum, the experimental hypotheses that were based on the Feature Reassembly Hypothesis (155 & 156) were supported by the results of the present study as it was found that L1-based feature sets may be in use by lower proficiency adult L2 learners, and that higher proficiency adult L2 learners had acquired a feature set in the L2 that does not match its closest equivalent in the L1 (*illi* in this case).

In line with previous studies that found evidence of L1 transfer in the L2 acquisition of definiteness in English (Crosthwaite, 2014; García Mayo, 2009; Jarvis, 2002; Snape, 2009), the present study also found evidence compatible with an L1 transfer account in the lower proficiency L2 speakers, with the L1 transfer effect becoming attenuated in the higher proficiency L2 speakers. However, one limitation of this study is that it did not include another L1 group.

An alternative explanation of the lower proficiency L2 speakers' differential behaviour on the definite-null and indefinite-overt conditions compared with the other conditions could be that they exhibited a general L2 development pattern that any L2 English learners might demonstrate, regardless of L1. Thus, future study is recommended, to investigate L2 participants whose L1 does not have a definiteness effect in order to check whether the lower proficiency participants' behaviour is indeed related to L1 transfer. For an L1 group with no definiteness specification on its relative complementizer, no two-way interaction of definiteness with the relative complementizer type or three-way interaction of definiteness, the relative complementizer type, and proficiency is expected, similar to the L1-English group's responses/ results. Also, a replication of the present study with relative pronouns (i.e., *which*, or *who* if the experiment was modified to include animate head nouns) instead of relative complementizers is recommended in order to see whether similar findings apply to relative pronouns as well as relative complementizers. It could be possible that similar findings to the present study would apply in this case because there are no relative pronouns in the participants' L1, so the participants might treat all the English relative markers in the same way. Initially, they may transfer the feature set of *illi* to their initial abstract representations of the English relative pronouns, but evidence in the input may motivate removal of this feature set.

A further interesting question for future research is what would happen when English speakers, whose L1 relative markers are not specified for definiteness, acquire a language like Arabic, where the relative complementizer bears a [+def] feature. English L2 learners of Arabic need to acquire the [+def] feature on the relative marker instead of deleting it. This task could be more difficult than in the L1-Jordanian Arabic –L2-English case because evidence of the ungrammaticality of *illi* in indefinite relative clauses and the ungrammaticality of deleting *illi* in definite relative clauses would not occur in the input unless this topic is taught in Arabic language classes (an informal check with an L2 Arabic teacher suggests that this topic is not typically covered). This means that the input would not provide a motivation for adding [+def] to *illi*. Thus, the L2 acquisition of the Arabic relative complementizer by English speakers may be more difficult. The proficiency effect revealed in the

present study showed that more proficient Jordanian Arabic L2 learners of English can acquire the target definiteness and no longer show L1 transfer. But in the opposite direction (L1-English L2-Arabic), acquisition may occur later or maybe not at all if there is no evidence to motivate restricting the feature set of *illi* to [+def].

## **6.7 Conclusion**

This chapter has reported on an experimental investigation of whether Jordanian Arabic adult L2 learners of English will transfer the [+def] feature of the relative complementizer in their L1 to the English relative complementizer. The participants completed an acceptability judgement task. The proficiency test scores revealed that the participants' English general English proficiency ranged from B1 to C2, and these scores were used as a continuous predictor in the analysis of their behaviour in the acceptability judgement task. In addition, a group of English native speakers completed the task as controls. Two predictions were tested: (i) that L2 behaviour would be non-target like due to significantly lower ratings for definite relative clauses with a null complementizer and indefinite relative clauses with an overt relative complementizer due to L1 transfer; and (ii) that this behaviour was expected to increase as proficiency decreases.

The results for the control group showed no significant differences in the means of the acceptability ratings between the definite and indefinite relatives with overt and null relative complementizers. However, the results of the L2 group showed significant higher acceptability ratings of the definite relatives with overt complementizers and indefinite relatives with null relative complementizers than the definite relatives with null relative complementizers and indefinite relatives with overt relative complementizers, respectively. The results also revealed that the interaction of definiteness and relative complementizer type increases as proficiency decreases, which suggests that the feature set of the lower proficiency participants resulted in a non-target relationship between definiteness and overt vs. null relative complementizers to a greater extent than in higher proficiency participants. This suggests that the [+def] feature on the L1 Jordanian Arabic relative complementizer

influenced the lower-proficiency participants' L2 English. On the other hand, the results of the higher proficiency level participants suggest that the initial L1-based grammar had already been reassembled. In sum, the findings are compatible with the Feature Reassembly Hypothesis in that evidence of L1 transfer was found in the lower proficiency participants' data; whereas the higher proficiency L2 learners' data showed evidence that they had acquired a structure that would be incompatible with their L1 features. This suggests that the [+def] feature has been deleted from their L1-based feature set for the English relative complementizer *that*. These L2 participants appeared to know that the use of the relative complementizer in English is not constrained by definiteness, unlike the lower proficiency learners. Thus, the study concludes that among Jordanian Arabic L2 speakers of English who have mastered the definiteness contrast in English, it is lower proficiency speakers who showed evidence of L1 transfer regarding the relationship in the participants' L1 between definiteness and the use of a null or overt relative complementizer to the L2 English. Finally, concrete suggestions for follow-on research steps have been made, including research with a different L1 group that could further test the L1 transfer account of the current findings for L1-Jordanian Arabic speakers of English.

## **Chapter 7**

### **Concluding discussion, limitations, and recommendations for further research**

#### **7.1 Introduction**

This chapter begins with a brief reiteration of the key results of the two investigations in the present thesis, namely, the examination of the L2 processing of filler-gap dependency by L2 learners of English and the investigation of L1 transfer in relation to definiteness. It then proceeds to discuss the results of the two investigations in relation to the theories that the present thesis tested (the Shallow Structure Hypothesis and the Feature Reassembly Hypothesis). The chapter then discusses the findings of this thesis in relation to L1 transfer. It then expands its focus to discuss the limitations of the thesis and suggestions for further research.

#### **7.2 Processing and acquisition**

Two main studies were employed in this thesis: a study of filler-gap dependency processing and a study of L1 transfer in the acquisition of definiteness. The first study included two self-paced reading experiments (the Filled-gap Experiment and the Relative Clause Island Experiment) that investigated L2 real-time processing of English filler-gap dependencies by two groups at an intermediate level (Jordanian Arabic and Mandarin L2 learners of English). Specifically, this investigation addressed three main questions. First, the study explored whether the gap-positing procedures of Jordanian Arabic and Mandarin L2 learners of English are similar to those of native speakers of English. Second, the study investigated whether the two L1 groups have access to syntactic knowledge during their real-time processing. Finally, it examined whether the L1 Mandarin group would show evidence of a less robust filled-gap effect than the Jordanian Arabic group due to a difference in the embedded wh-question structure: Jordanian Arabic is similar to English at the surface level because there is a dependency filler-gap in English, filler-resumptive pronoun in Jordanian Arabic (a filler-gap dependency in English; a filler-resumptive

pronoun dependency in Jordanian Arabic); however, in Mandarin there is no dependency.

The results of the Filled-gap Experiment showed that both groups make use of the Active Filler Strategy which is taken as evidence that they were processing sentences incrementally. The results of this experiment are in line with previous studies on L2 real-time processing of filler-gap dependencies which reported such incremental processing for L2 learners whose L1s have the same filler-gap order as English (L1-Najdi Arabic: Aldwayan et al., 2010; L1-Spanish: Omaki & Schulz, 2011; Canales, 2012). However, the current study adds evidence that even L2 learners whose L1 is head-final and (when relevant) has gap-filler order (Mandarin) are able to use the Active Filler Strategy in their real-time sentence processing in the same way as native speakers of English. This result aligns with De Vincenzi's (1991) re-formulation of the Active Filler Strategy (the Minimal Chain Principle: *avoid postulating unnecessary chain members, but do not delay postulating necessary chain members*). Under this interpretation, active gap processing should not differ from active filler processing. The present study contributes to previous research by providing experimental support from L2 data for this theoretical formulation about dependency processing.

The findings of the Relative Clause Island Experiment showed that L2 learners did not attempt to posit a gap in the relative clause islands. This could suggest that they respect island constraints during processing. Traditionally, as discussed in Chapter 3, island constraints are grammatical constraints that have been used as a test case to investigate UG accessibility in L2 acquisition (e.g., Aldosari, 2015; Hawkins & Chan, 1997; Johnson & Newport, 1991; Li, 1998; White & Juffs, 1998). Kim (2014) argued that sensitivity to island constraints in online sentence processing involves deep syntactic processing. Following grammatical accounts of islands (e.g., Philips, 2006), the finding that L2 speakers respect island constraints during L2 parsing "even when their L1s lack wh-movement and island constraints" suggests that the L2 parsing is governed by syntactic knowledge. In sum, there was no evidence that the L2

participants process wh-sentences that include relative clause islands differently from native speakers.<sup>17</sup>

The self-paced reading task also makes another small advance beyond previous related L2 studies (Aldwayan, et al. 2010, Canales, 2012) by including proficiency as a predictor. The findings revealed that higher proficiency participants showed stronger filled-gap effects. Second, there was a tendency towards slower reading times at the critical gap segment as proficiency increased. Thus, the higher proficiency participants were taking more time to read and thus more time to process.

Overall, the findings of the self-paced reading task employed in the present thesis are not in line with the Shallow Structure Hypothesis, which claims that unlike native speakers who use detailed syntactic information as well as lexical information in real-time sentence processing, L2 learners rely less heavily on morpho-syntactic knowledge than on lexical semantics knowledge during real-time processing (Clahsen and Felser, 2006). The results of the current study challenge this prediction, because they suggest that the participants' real-time processing of filler-gap dependencies is governed by abstract syntax knowledge, in that they appeared to posit a wh-gap only in grammaticality licensed positions despite the fact that their L1s are not subject to syntactic constraints that govern wh-movement. Instead, the results corroborate previous studies which found that L2 speakers of English showed full syntactic processing (e.g., Kim et al., 2015; Omaki & Schulz, 2011).

As illustrated in Chapter 5 (Section 5.6), a notable difference between the results of the present L2 processing study and previously published research is that the present study investigated the role of L1 influence, by comparing L2 processing of filler-gap dependencies in English wh-sentences by two groups of L2 learners whose L1s are typologically different. Whereas embedded wh-

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<sup>17</sup> An alternative way of interpreting this result would be that the participants did not posit gaps within the structure due to the processing burden incurred by the complex structure of the relative clause islands (following a processing-based account of islands, e.g., Kluender, 1998; 2004). However, following this account still entails that the L2 learners were capable of building some level of abstract structural representation of relative clause islands which, due to its complexity, prohibited filler-gap dependency completion inside a relative clause island.

question in English and Jordanian Arabic involve a wh-dependency, equivalents of English embedded wh-questions in Mandarin are not filler-gap structures or gap-filler structures (as illustrated previously, in 107). Consequently, it was predicted that the Jordanian Arabic speakers of English may demonstrate a more robust filled-gap effect during filler-gap dependency processing than the Mandarin speakers of English, due to this L1 influence. However, despite the typological differences between Jordanian Arabic and Mandarin, no evidence which suggests that the L1 impacted the participants' behaviour in the two experiments was found. In other words, the two groups did not exhibit distinct L2 processing in either self-paced reading experiment. In sum, there was no evidence of L1 influence in the results of either self-paced reading experiment. The issue of L1 transfer in L2 processing is briefly discussed further, in the following section.

Taken together, the set of findings from the self-paced reading study suggest that L2 processing of wh-sentences may not be fundamentally different from native processing. As illustrated earlier, the Shallow Structure Hypothesis assumes that L2 real-time processing relies less on grammatical and more on nongrammatical information sources in comparison to L1 real-time processing. However, the present study showed evidence that L2 processing is guided by the structure-driven mechanism just as in L1 processing (e.g., Omaki and Schulz 2011; Stowe, 1986); however, it also showed that L2 real-time processing can be affected by processing-related factors such as proficiency.

The second investigation in the present thesis examined L1 transfer in relation to definiteness by Jordanian Arabic L2 learners of English. As detailed in Chapter 6 (Section 6.3), the Jordanian Arabic relative complementizer *illi* has a [+def] feature. This means it can only be used after definite head nouns. When a head noun is indefinite, the relative complementizer is null. English relative markers, on the other hand, are not specified for definiteness, so they can follow definite and indefinite head nouns.

This investigation tested predictions based on the Feature Reassembly Hypothesis (Lardiere, 2008, 2009). According to the Feature Reassembly



Hypothesis, Jordanian Arabic L2 learners will transfer the [+def] feature of their L1 relative complementizer *illi* to their initial abstract representations of the English relative complementizer *that*. However, evidence in the input may motivate removal of this feature. Based on this account, it was predicted that L1-based feature sets may be in use by Jordanian Arabic adult L2 learners of English at lower proficiency level due to transfer at the initial state and to reassembly not yet having taken place. On the other hand, Jordanian Arabic L2 learners of English at higher proficiency levels may have achieved feature reassembly by deleting the [+def] feature. The results of the English control group confirmed that, as expected, they accepted all four conditions and that there were no significant differences in the means of the acceptability ratings between the definite and indefinite relatives with overt and covert relative complementizers. By contrast, the results of the L2 group showed significant lower acceptability ratings of the definite relatives with null complementizers and indefinite relatives with overt relative complementizers than the definite relatives with overt relative complementizers and indefinite relatives with null relative complementizers, respectively. The results also revealed that the interaction of definiteness and relative complementizer type depended on the proficiency of the participant in that the lower proficiency learners had lower acceptability ratings for null English relative complementizers after definite head nouns and overt English relative complementizers after indefinite head nouns, compared to their acceptability ratings for the other two conditions that correspond to grammatical structures in their L1. Based on these results, it could be argued that it was the feature set of the lower proficiency participants that led to a non-target relationship between definiteness and overt vs. null relative complementizers more than higher proficiency participants. These findings are compatible with the Feature Reassembly Hypothesis in that there was evidence of L1 transfer in the lower proficiency participants' responses; while the higher proficiency L2 learners' data showed evidence that they had acquired a structure that would be incompatible with their L1 features.

In general, the results of both the self-paced reading task and the acceptability judgement task are largely consistent with the full-syntactic accounts of L2 acquisition that propose full access to and use of syntactic

representations (e.g., Hopp, 2010). The studies' findings suggest that L2 learners did, in fact, have access to abstract syntactic knowledge, and that it is possible for adult L2 learners to acquire syntactic properties that do not exist in their L1. To conclude, the results of both studies reported in this thesis suggest that L2 learners whose L1s lack syntactic properties that are required in the L2 are able to acquire these properties in their L2. In terms of L2 processing, the findings of the self-paced reading task provide evidence of use of syntactic information during real-time processing; however, this evidence is less robust in less proficient learners. In terms of L2 acquisition, the findings of the investigation of L1 transfer in relation to definiteness are compatible with the Feature Reassembly Hypothesis in that evidence of L1 transfer was found in the lower proficiency participants' data; whereas the higher proficiency L2 learners' data showed evidence that they had acquired a structure that would be incompatible with their L1 features.

### **7.3 L1 transfer**

This section briefly discusses the findings about L1 transfer across the two tasks reported in this thesis (i.e., the Self-paced Reading Experiment and the Acceptability Judgement Task) in relation to previous research.

The findings of the Self-paced Reading Task showed no L1 transfer effect in filler-gap dependency processing. As explained earlier (in Chapter 5, Section 5.5.3), this result matches the Shallow Structure Hypothesis's prediction about L1, but its prediction of no L1 transfer is based on the assumption that L2 processing utilises shallower, less detailed syntactic structures than L1 processing. This would rule out transfer from L1 structure in processing because syntactic structure will be less used in L2 processing. However, evidence of sensitivity to wh-island constraints in both groups, in addition to the filler-gap effect in both groups, suggests that the L2 speakers' processing is based on detailed syntactic structure. Thus, the current study's absence of an L1 effect in L2 processing does not necessarily support the Shallow Structure Hypothesis. Instead, as mentioned above, the results appear to provide evidence from L2 data for the Minimal Chain Principle, which predicts that the postulation of the other member of a chain should not be delayed, regardless

of whether the dependency is Filler-Gap or Gap-Filler. In short, the absence of evidence of L1 influence in the filler-gap processing study suggests use of detailed, target syntactic structure during processing, and application of a universal filler-gap processing principle.

While evidence of L1 transfer in sentence processing is mixed and requires further investigation (Cunnings, 2017), there is a lot of evidence generally of L1 transfer in L2 grammar acquisition (White, 2003). The results of the second study in the thesis, the Acceptability Judgement Task, which investigated L1 transfer in relation to definiteness showed an apparent L1 transfer effect in the data of lower proficiency participants. This raises the question of why some studies of definiteness did not find L1 transfer effects (e.g., Ionin et al's, 2004). As illustrated in Chapter 6, Ionin et al. (2004) examined the effect of the semantic features of definiteness and specificity in L2 English article choice by L2 learners from article-less languages (L1-Russian and L1-Korean speakers of English). Their study found that Russian and Korean L2 learners of English overused the definite article in specific contexts, and the indefinite article in nonspecific contexts. The results showed that the L2 learners from both L1 groups tended to select *the* as a specific marker and *a* as a non-specific marker. The similar patterns of performance between L1-Russian speakers and L1 Korean speakers provided evidence that the association of *the* with the feature [+specific] is not attributable to L1 transfer. One reason for the absence of L1 transfer in Ionin et al's study could be that, in their study and others that followed their design, illustrated in Chapter 6, the definiteness effects are dependent on discourse. However, the definiteness phenomenon investigated in the current thesis is purely morphosyntactic: the relative complementizer in Jordanian Arabic has to agree with the definiteness of the head noun. This could suggest that it could be easier to measure L1 transfer of syntactic effects than discourse effects; or it could be that transfer effects may be more evident in local morphosyntactic phenomena than in discourse-driven syntax-semantics phenomena. However, a notable exception to this argument is Crosthwaite's (2014) study where positive transfer from Mandarin was found in an experiment where target-like production of determiners depended on discourse. However, the participants in Crosthwaite's

(2014) study were at lower proficiency level, which might play a role in the L1 transfer as argued by the Feature Reassembly Hypothesis. In sum, it seems that the effect of L1 transfer of definiteness remains an interesting open question.

#### **7.4 Limitations and recommendations for future research**

There are some limitations of the methodology of the Self-paced Reading Task and the Acceptability Judgement Task that should be taken into account when designing further studies. The first limitation concerns the Self-paced Reading Task. Although Jordanian Arabic L2 learners of English and Mandarin L2 learners of English were at intermediate proficiency level, they differ in terms of exposure to natural L2 input. While the Mandarin speakers had been in the UK for two years minimum, the Jordanian Arabic speakers had never lived in an English-speaking country. In order to tease apart the effect of naturalistic input, both groups should be matched for type of L2 exposure. A future study where none of the learners have ever lived in an English-speaking country is recommended, to see if the naturalistic input could have had an effect on the Mandarin speakers' processing of English dependencies.

One limitation of the investigation of L1 transfer in relation to definiteness is that it did not include a comparison L1 group. Thus, it is recommended that future studies investigate L2 participants whose L1 does not have a definiteness effect in relation to relative complementizers in order to check whether the lower proficiency participants' behaviour is indeed related to L1 transfer or whether it is indicative of a general L2 English acquisition pattern that would arise regardless of L1. Moreover, it could be informative in relation to questions about the role of L1 transfer in L2 processing to investigate if the [+def] feature of Jordanian Arabic relative complementizer can affect the real-time processing of English definite and indefinite relative clauses with overt or covert relative markers. In this case, Jordanian Arabic L2 speakers of English may show slowdowns at perceived ungrammaticality (the overt use of the English relative complementizer after indefinite heads and the null use of it after definite heads). This behaviour is expected to increase as proficiency decreases. Native English controls, on the other hand, are not expected to

demonstrate any slowdown related to the combination of definiteness and the relative complementizer type.

A useful avenue for further research that arises as a result of the investigation of L1 transfer in relation to definiteness is the investigation of the L2 acquisition of English relative pronouns (e.g., *which*, *who*) in relation to definiteness. It could be possible that similar findings to the present study would apply in this case because in the participants' L1 (Jordanian Arabic) there are no relative pronouns, so the participants may treat all the English relative markers in the same way. Namely, they may initially transfer the feature set of *illi* to their initial abstract representations of the English relative pronouns, and evidence in the input may motivate removal of this feature set.

Finally, as recommended in Chapter 6, it would be useful to investigate what would happen when English speakers, whose L1's relative markers are not specified for definiteness, acquire a language like Arabic, where the relative complementizer bears a [+def] feature. This would involve the acquisition of the [+def] feature on the relative complementizer instead of the need to delete that feature. As argued in Chapter 6, there may not be any direct evidence in the input to motivate the relevant reassembly in this direction, so investigation of the acquisition of the [+def] feature on the Arabic relative complementizer could be informative about acquisition when the target L2 property is underdetermined by evidence in the input.

## **7.5 Conclusion**

Two studies were conducted in the present thesis to further the understanding of the characteristics of L2 processing and acquisition of L2 properties that are not present in the participants' L1. Both studies aimed to help to examine the transfer of L1 properties related to wh-movement and definiteness on the L2 grammar. The key contribution of the thesis is two-fold: to provide a replication of a previous study on the real-time processing of L2 filler-gap dependency, with two different L1 groups. This replication is a response to calls for more replication studies in L2 research generally (e.g., Porte, 2012, 2013) and in L2 processing research specifically (Klein, 1999). Klein pointed out that replications support the validity and reliability of previous

research and explore the effect of similarities and differences in parsing strategies cross linguistically. Clahsen and Felser (2018, p.704) stated that “We hope that the number of linguistically and psycholinguistically informed L2 processing studies will continue to rise, so that we can obtain a more comprehensive and nuanced picture of L1/L2 processing differences and similarities that will inform theory building or theory refinement”. Further, Canales (2012) identified replication with different L1 groups as a key follow-on step from his study. The first study reported in this thesis replicated Canales’ (2012) study with different populations, to compare L2 processing of filler-gap dependencies in English *wh*-sentences by two groups of L2 learners whose L1s lack *wh*-movement (i.e., Jordanian Arabic and Mandarin speakers of English). Its importance lies in its focus on new data from Arabic speakers, a less commonly investigated language in the field of second language processing and acquisition; its comparison of two contrasting L1 groups; and its incorporation of proficiency into the analysis. This study aimed to see whether L2 participants whose L1s lack *wh*-movement process *wh*-sentences incrementally, and whether they make use of syntactic knowledge in their real-time processing. The study also investigated whether proficiency played any role in the participants’ real-time processing of *wh*-dependencies. The results of this study showed that the L2 participants are able to process filler-gap dependencies incrementally in real-time, and that this behaviour increases as proficiency increases. Moreover, there was no evidence that the L2 participants process *wh*-sentences that include relative clause islands differently from native speakers. Following grammatical accounts of islands, this suggests that the participants made use of abstract syntactic rules in their real-time processing of *wh*-sentences in the same way as native processing and avoided positing gaps in unlicensed positions (McElree & Griffith, 1998; Phillips, 2006; Stowe, 1986; Traxler & Pickering, 1996; Wagers & Phillips, 2009).

The second contribution of this thesis is to investigate a potential transfer effect in a new context, namely, relative clauses. The definiteness effect in Jordanian Arabic relative clauses offers a new perspective for research into L1 transfer of definiteness. This investigation aimed to provide experimental evidence relevant to the Feature Reassembly Hypothesis by means of

investigation of a cross-linguistic phenomenon not previously investigated in L2 acquisition research. Specifically, this study was conducted to examine whether the relationship in the participants' L1 between definiteness and the use of a null or overt relative complementizer would transfer to the L2 English. The findings showed evidence of L1 transfer in the lower proficiency participants' data; while the higher proficiency L2 learners' data provided evidence that they had acquired a structure that would be incompatible with their L1 features. Thus, the results of this study are compatible with the Feature Reassembly Hypothesis (Lardiere, 2008, 2009) which argues that learners can acquire L2 features that would be incompatible with their L1 features.

To conclude, this thesis has provided further evidence that L2 sentence processing may not be different from L1 processing, at least in the context of processing wh-dependencies. In addition, the thesis showed that L2 learners can acquire a feature set related to definiteness that is not initiated in their L1. The thesis has also raised further questions for future research regarding the investigation of L2 processing of English relative pronouns and the L2 acquisition of the Arabic relative complementizer by English speakers.

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# Appendices

## Appendix 1. Stimuli sentences for the Filled-gap Experiment

1. a. My brother asked if Barbara will photograph Ali beside Mom at the graduation.  
b. My brother asked who Barbara will photograph Ali beside at the graduation.
  
2. a. My niece guessed if Kelly will photograph Kim with Edward at the parade.  
b. My niece guessed who Kelly will photograph Kim with at the parade.
  
3. a. My sister knew if Roger will place Pat with Jason at the lunch table.  
b. My sister knew who Roger will place Pat with at the lunch table.
  
4. a. My nephew revealed if Alex will put Ted near Nancy at the gathering.  
b. My nephew revealed who Alex will put Ted near at the gathering.
  
5. a. My friend wondered if Julie will recommend Amy to Sarah before the deadline.  
b. My friend wondered who Julie will recommend Amy to before the deadline.
  
6. a. My mother asked if John will find Rob beside Dad at the restaurant.  
b. My mother asked who John will find Rob beside at the restaurant.
  
7. a. My aunt guessed if Patrick will film Sue with Kelly at the banquet.  
b. My aunt guessed who Patrick will film Sue with at the banquet.

8.
  - a. My grandmother knew if Adam will find Jen with Rachel at the mall.
  - b. My grandmother knew who Adam will find Jen with at the mall.
  
9.
  - a. My classmate revealed if Jack will meet Moe with Sarah before the dance.
  - b. My classmate revealed who Jack will meet Moe with before the dance.
  
10.
  - a. My cousin wondered if David will put Liz near Jack at the wedding.
  - b. My cousin wondered who David will put Liz near at the wedding.
  
11.
  - a. The manager asked if Ethan will meet Sam with Jeff outside the office.
  - b. The manager asked who Ethan will meet Sam with outside the office.
  
12.
  - a. The student guessed if Ryan will introduce Jim to Heather after the break.
  - b. The student guessed who Ryan will introduce Jim to after the break.
  
13.
  - a. The teachers knew if Michael will discover Ron with Jerry during the game.
  - b. The teachers knew who Michael will discover Ron with during the game.
  
14.
  - a. The secretary revealed if Shawn will introduce Lou to Jared after the speech.
  - b. The secretary revealed who Shawn will introduce Lou to after the speech.
  
15.
  - a. The instructor wondered if Chris will film Tom with Susan at the reception.
  - b. The instructor wondered who Chris will film Tom with at the reception.
  
16.
  - a. The boy asked if Matt will place Ben with Susie at the party.
  - b. The boy asked who Matt will place Ben with at the party.



17. a. The babysitter guessed if Christopher will discover Dan with Lindsey in the closet.
  - b. The babysitter guessed who Christopher will discover Dan with in the closet.
  
18. a. The manager knew if Katie will recommend Joe to Patricia after the assembly.
  - b. The manager knew who Katie will recommend Joe to after the assembly.
  
19. a. The girl revealed if Melissa will seat Ann by Susan at the dinner.
  - b. The girl revealed who Melissa will seat Ann by at the dinner.
  
20. a. The teacher wondered if Harry will seat Bob by Rachel in the classroom.
  - b. The teacher wondered who Harry will seat Bob by in the classroom.

## **Appendix 2. Stimuli sentences for the Relative Clause Island Experiment**

1. a. My father asked if the actress that married Tyler last summer kissed the director during the rehearsal.  
b. My father asked who the actress that married Tyler last summer kissed during the rehearsal.
2. a. My manager investigated if the assistant that fired Kylie last June seduced the supervisor before the party.  
b. My manager investigated who the assistant that fired Kylie last June seduced before the party.
3. a. My brother questioned if the journalist that followed Henry last Saturday provoked the guard at the store.  
b. My brother questioned who the journalist that followed Henry last Saturday provoked at the store.
4. a. My teacher wondered if the principal that suspended Jacob last spring disappointed the parents with the news.  
b. My teacher wondered who the principal that suspended Jacob last spring disappointed with the news.
5. a. My brother asked if the woman that defended Dylan last Tuesday slapped the thief on the face.  
b. My brother asked who the woman that defended Dylan last Tuesday slapped on the face.
6. a. The psychologist investigated if the boy that hit Timmy last Thursday offended the teacher after the incident.  
b. The psychologist investigated who the boy that hit Timmy last Thursday offended after the incident.

7.
  - a. My uncle questioned if the man that visited Ellie last night irritated the neighbours with the noise.
  - b. My uncle questioned who the man that visited Ellie last night irritated with the noise.
  
8.
  - a. My wife wondered if the hunter that located Jenny last Sunday contacted the police from the camp.
  - b. My wife wondered who the hunter that located Jenny last Sunday contacted from the camp.
  
9.
  - a. My daughter asked if the clown that scared Eddie last Wednesday delighted the nanny with the balloon.
  - b. My daughter asked who the clown that scared Eddie last Wednesday delighted with the
  
10.
  - a. The prosecutor investigated if the accountant that fooled Maria last December defrauded the investors over the internet.
  - b. The prosecutor investigated who the accountant that fooled Maria last December defrauded over the internet.
  
11.
  - a. The senator questioned if the traitor that exposed Diana last month betrayed the president after the scandal.
  - b. The senator questioned who the traitor that exposed Diana last month betrayed after the scandal.
  
12.
  - a. My nephew wondered if the banker that dated Molly last year shocked the auditor with the report.
  - b. My nephew wondered who the banker that dated Molly last year shocked with the report.
  
13.
  - a. The politician asked if the reporter that challenged Carol last Monday annoyed the moderator at the debate.
  - b. The politician asked who the reporter that challenged Carol last Monday annoyed at the debate.

14. a. The Sheriff investigated if the boxer that defeated Peter last March paid the referee for the championship.  
b. The Sheriff investigated who the boxer that defeated Peter last March paid for the championship.
15. a. The reporter questioned if the politician that impressed Peggy last February insulted the senator at the conference.  
b. The reporter questioned who the politician that impressed Peggy last February insulted at the conference.
16. a. The agent wondered if the producer that consulted Lucas last Friday hired the musician after the audition.  
b. The agent wondered who the producer that consulted Lucas last Friday hired after the audition.
17. a. The chief asked if the officer that interviewed James last week angered the lawyer during the trial.  
b. The chief asked who the officer that interviewed James last week angered during the trial.
18. a. The doctor investigated if the nurse that vaccinated Aaron last April harmed the child at the hospital.  
b. The doctor investigated who the nurse that vaccinated Aaron last April harmed at the hospital.
19. a. The director questioned if the singer that bothered Becky last season criticized the pianist after the concert.  
b. The director questioned who the singer that bothered Becky last season criticized after the concert.
20. a. The agent wondered if the spy that shot Megan last evening kidnapped the ambassador from the hotel.  
b. The agent wondered who the spy that shot Megan last evening kidnapped from the hotel.

### **Appendix 3. Fillers for the two self-paced reading experiments**

1. My roommate asked who will join us with Chris after our vacation.
2. My brother guessed who will accompany us with Mom to the office.
3. My father inquired who will find us with Vicki at the mall.
4. My boss questioned who will report me to Martha after the convention.
5. My dad wondered who will situate me by Simon at the dinner.
6. My friend asked who Karen will situate beside Bill at the party.
7. The musician inquired who Matt will record with Kevin at the station.
8. The teacher revealed who Beth will join with Paul at the cafeteria.
9. The artist wondered who Mary will paint with Sally at the gallery.
10. The girl guessed who Jessica will situate beside John at the table.
11. My uncle forgot if Calvin will cook us a big dinner on Saturday.
12. My sister wondered if Laura will give me the secret recipe after school.
13. My son asked if John will send us a big package on Monday.
14. My mother inquired if Matt will bake me some chocolate cookies on Friday.
15. My brother questioned if Jim will make me a delicious lunch for tomorrow.
16. My cousin forgot what Bill will cook us next week at the celebration.
17. My mom predicted what Jill will tell me next Monday after the wedding.
18. The students guessed what Judy will ask us next week on the test.
19. My dad questioned what Mary will show me this evening at the party.
20. The manager discussed what Hilary will teach us next Friday at the conference.
21. My aunt forgot who will cook us a big turkey on Thanksgiving Day.
22. My sister revealed who will bring me an expensive present on Saturday night.
23. My father asked who will buy me a new costume for the party.
24. My mother wondered who will deliver me a large vase of fresh flowers.
25. The teacher guessed who will bake us an apple pie for the picnic.
26. It was Calvin that revealed if John would dance at the party.
27. It was Tom that asked if Nancy would play in the game.

28. It was John that wondered if Judy would eat at the restaurant.
29. It was Mary that inquired if Matt would run in the marathon.
30. It was Karen that predicted if Todd would sleep at the opera.
31. It was Dennis that said who Bill would see before the big concert.
32. It was Lisa that inquired who Richard would join at the fancy reception.
33. It was Bryan that wondered who Joseph would interrupt at the press conference.
34. It was Christopher that predicted who Frank would bring to the wedding party.
35. It was Donald that asked who Linda would surprise during the family vacation.
36. My brother asked whether Holly would cry during the sad French movie.
37. The girl wondered whether Charles would sleep during the boring class lecture.
38. My sister inquired whether Thomas would return after the long winter break.
39. The manager questioned whether Betty would go to the annual office picnic.
40. The students knew whether George would play for the best football team.
41. The young boy said that Janet and Calvin sang very loudly at the wild party last night.
42. The new student revealed that Saad and Emad studied every day at the public library this week.
43. My gym teacher stated that Calvin and Julie practiced the routine at the old stadium last weekend.
44. The project manager claimed that Tom and Chris left several boxes in the new office yesterday morning.
45. My oldest daughter thought that Nancy and Kathy spent several hours at the big mall last Monday.
46. The scared girl revealed that Sara and Holly bullied many children on the school bus yesterday afternoon.
47. My new neighbour said that Laura and Bill washed the windows of the old house last night.
48. The old librarian claimed that Mike and John stole many books from the library shelf last Saturday.

49. My new coach announced that Betty and George ran several miles on the stadium track yesterday morning.
50. The new chef knew that Sara and Julie cooked various dishes in the busy kitchen yesterday afternoon.
51. The teacher said that his students liked the film about the school system in Paris.
52. The principal thought that his staff loved the summary of the new policy on testing.
53. My daughter revealed that her friends hated the lecture on the political situation in Canada.
54. The teachers stated that their students enjoyed the show about the wild animals in Africa.
55. My friend mentioned that his boss loaned the copy of the computer program to Sally.
56. The manager announced that her staff rejected the revision of the office manual on harassment.
57. My professor said that his son wrote the article about the new theory in physics.
58. My friend thought that his dad liked the story about the native Americans in Oklahoma.
59. The teacher mentioned that her class enjoyed the book about the haunted houses in Massachusetts.
60. My brother stated that his wife liked the movie about the fishing towns in Maine.
61. The news reporter said that the American tourists really liked to dance all night long.
62. My younger brother claimed that the French students really wanted to get much higher grades.
63. The head nurse claimed that the eye doctor truly wanted to perform the risky surgery.
64. The new professor thought that the ambitious athletes really needed to study more after class.
65. My previous landlord revealed that the building owners desperately wanted to increase the monthly rents.
66. The worried parents stated that the angry teachers urgently needed to end the noisy protest.

67. The police officer thought that the young drivers really needed to obey the traffic rules.
68. My local newspaper stated that the insurance companies really needed to lower the monthly rates.
69. My annoyed grandmother complained that the new cashier really hated to help the elderly costumers.
70. The school principal found that the annoying students really needed to receive more strict discipline.
71. Adam and Sara repeatedly asked what their students hated about the chemistry teacher from the prestigious university.
72. Kathy and Sandra always wondered what their friends liked about the red car in the parking lot.
73. Helen and Kevin clearly knew what the principal disliked about the expensive repairs to the new school.
74. Donna and Jason finally discovered what the teachers said about the boring lecture at the education conference.
75. Laura and Paul finally revealed what their parents liked about the famous school in their small town.
76. Jessie and Mark never revealed what their boss mentioned about the employee cafeteria in their office building.
77. Joseph and Thomas easily guessed what the group disliked about the English professor from the famous college.
78. Edward and Daniel specifically asked what the archaeologist wrote about the old temple in the big city.
79. Linda and Christopher constantly wondered what the engineers loved about the electric engines in the new cars.
80. Joan and Matt often questioned what their professor claimed about the new theory in the science book.



## **Appendix 4. Information sheet for the self-paced reading tasks**

### **INFORMATION SHEET**

*You are invited to take part in a research study. Before you decide whether to participate it is important for you to understand why the research is being done and what it will involve. Please take the time to read the following information carefully. If there is anything you do not understand, or if you want more information, please ask the researcher.*

#### **Title of study:**

#### **Processing English Sentences by Non-native Speakers of English**

#### **Researcher:**

Alaa Al-Maani, a PhD student in the Department of Language and Linguistic Science, University of York.

#### **What is the research about?**

The study compares the processing of English sentences by two groups: Jordanian learners of English and Mandarin learners of English.

#### **Who is carrying out the research?**

Alaa Al-Maani at the Department of Language and Linguistic Science, University of York.

#### **Who can participate?**

You can participate in this research if you are a native speaker of Jordanian Arabic or Mandarin who speaks English as a second/foreign language.

#### **What does the study involve?**

The study includes four sections that you complete on a computer:

1. A consent form (5 minutes).
2. A language background questionnaire (takes about 4 minutes).

3. A test that requires you to read sentences word by word, pressing a button to reveal each word (40 minutes).
4. An English task using multiple choice questions (takes around 20 minutes).

### **Do I have to take part?**

If you decide to take part in the study, you will be asked to sign an electronic consent form. After deciding to take part in the study, you will still be free to withdraw at any time during the data collection session. If you withdraw from the study, we will destroy your data and will not use it in any way. However, once the data collection is complete, you will not be able to withdraw from the experiment.

### **What are the possible risks of taking part?**

There are no foreseeable risks to taking part.

### **Are there any benefits to participating?**

This research is entirely based on the participation of individuals; thus, your participation will make a very valuable contribution. The benefits are that you may feel gratification at providing valuable information in your academic community that could lead to new insights that help future language learners. You will also experience taking part in an academic research project. Finally, you will be offered a thank you-payment of 8 UK pounds after completing the required tasks.

### **What will happen to the data I provide?**

The data you provide will be stored securely in the University of York, Department of Language and Linguistic Science and will be used alongside the data of other participants to compare the online processing of English sentences by Jordanian learners of English with Mandarin learners of English.

### **What about confidentiality?**

Your identity will be kept strictly confidential. You will not need to enter your name during the data collection.

### **Will I know the results?**

Individual results will not be provided.

*This study has been reviewed and approved by the Departmental Ethics Committee of the Department of Language and Linguistic Science at the University of York. If you have any questions regarding this, you can contact the chair of the L&LS Ethics Committee, Márton Sós-kuthy, (email: [marton.soskuthy@york.ac.uk](mailto:marton.soskuthy@york.ac.uk); Tel: (01904) 324171).*

If you have further questions regarding this study, please feel free to contact:  
Alaa Al-Maani  
Department of Language and Linguistic Science  
University of York, Heslington, York, YO10 5DD  
**tel:** +447476731376; **email:** [aiam503@york.a.uk](mailto:aiam503@york.a.uk)

## Appendix 5. Consent form for the self-paced reading tasks

### Processing of English Sentences by Non-native Speakers of English

Researcher: Alaa Al-Maani, University of York

This form is for you to state whether or not you agree to take part in the study. Please read and answer every question. If there is anything you do not understand, or if you want more information, please ask the researcher.

Have you read and understood the information sheet about the study? Yes  No

Have you had an opportunity to ask questions about the study and have these been answered satisfactorily? Yes  No

Do you understand that the information you provide will be held in confidence by the research team, and your name or identifying information about you will not be mentioned in any publication? Yes  No

Do you understand that you may withdraw from the study at any time before the end of the data collection session without giving any reason, and that in such a case all your data will be destroyed? Yes  No

Do you understand that the information you provide may be kept after the duration of the current project, to be used in future research on language? Yes  No

Do you agree to take part in the study? Yes  No

## Appendix 6. Background questionnaire

1. How old are you? .....
2. Gender: Male / Female/ Prefer not to say
3. What is (are) your native language(s)? (By native language, I mean the language you grew up speaking at home. You may have more than one native language. ....
4. What other language(s) can you speak? .....
5. How long have you been learning English? .....
6. How many years (or months) have you lived in a country where English is a dominant language? .....

## **Appendix 7. Relative clause items for the acceptability judgement task**

1.
  - a. Sarah read the book her father bought.
  - b. Sarah read the book that her father bought.
  - c. Sarah read a book her father bought.
  - d. Sarah read a book that her father bought.
  
2.
  - a. John ate the sandwich his son made.
  - b. John ate the sandwich that his son made.
  - c. John ate a sandwich his son made.
  - d. John ate a sandwich that his son made.
  
3.
  - a. Mary closed the door that her colleague repaired.
  - b. Mary closed a door that her colleague repaired.
  - c. Mary closed the door her colleague repaired.
  - d. Mary closed a door her colleague repaired.
  
4.
  - a. Tom received the letter his friend wrote.
  - b. Tom received the letter that his friend wrote.
  - c. Tom received a letter his friend wrote.
  - d. Tom received a letter that his friend wrote.
  
5.
  - a. Susan bought the house her cousin built.
  - b. Susan bought the house that her cousin built.
  - c. Susan bought a house her cousin built.
  - d. Susan bought a house that her cousin built.
  
6.
  - a. Jack used the camera his aunt bought.
  - b. Jack used the camera that his aunt bought.
  - c. Jack used a camera his aunt bought.
  - d. Jack used a camera that his aunt bought.
  
7.
  - a. Victoria visited the village her friend recommended.
  - b. Victoria visited the village that her friend recommended.

- c. Victoria visited a village her friend recommended.
  - d. Victoria visited a village that her friend recommended.
8. a. Mark bought the computer his mum recommended.  
b. Mark bought the computer that his mum recommended.  
c. Mark bought a computer his mum recommended.  
d. Mark bought a computer that his mum recommended.
9. a. Sally kissed the cat her brother hit.  
b. Sally kissed the cat that her brother hit.  
c. Sally kissed a cat her brother hit.  
d. Sally kissed a cat that her brother hit.
10. a. Edward broke the van his brother rented.  
b. Edward broke the van that his brother rented.  
c. Edward broke a van that his brother rented.  
d. Edward broke a van that his brother rented.
11. a. Emily found the bag her sister lost.  
b. Emily found the bag that her sister lost.  
c. Emily found a bag her sister lost.  
d. Emily found a bag that her sister lost.
12. a. Adam read the poem his mother wrote.  
b. Adam read the poem that his mother wrote.  
c. Adam read a poem his mother wrote.  
d. Adam read a poem that his mother wrote.
13. a. Anna watched the cartoon DVD her aunt brought.  
b. Anna watched the cartoon DVD that her aunt brought.  
c. Anna watched a cartoon DVD her aunt brought.  
d. Anna watched a cartoon DVD that her aunt brought.

14. a. Bill ate the meal his mother made.  
b. Bill ate the meal that his mother made.  
c. Bill ate a meal his mother made.  
d. Bill ate a meal that his mother made.
15. a. Katie used the laptop her husband repaired.  
b. Katie used the laptop that her husband repaired.  
c. Katie used a laptop her husband repaired.  
d. Katie used a laptop that her husband repaired.
16. a. Jack fixed the gate his neighbour broke.  
b. Jack fixed the gate that his neighbour broke.  
c. Jack fixed a gate his neighbour broke.  
d. Jack fixed a gate that his neighbour broke.
17. a. Elizabeth fixed the chair her nephew broke.  
b. Elizabeth fixed the chair that her nephew broke.  
c. Elizabeth fixed a chair her nephew broke.  
d. Elizabeth fixed a chair that her nephew broke.
18. a. Peter closed the window his grandmother opened.  
b. Peter closed the window that his grandmother opened.  
c. Peter closed a window his grandmother opened.  
d. Peter closed a window that his grandmother opened.
19. a. Sofia kissed the dog her grandmother brought.  
b. Sofia kissed the dog that her grandmother brought.  
c. Sofia kissed a dog her grandmother brought.  
d. Sofia kissed a dog that her grandmother brought.
20. a. Ibrahim photographed the house his cousin designed.  
b. Ibrahim photographed the house that his cousin designed.  
c. Ibrahim photographed a house his cousin designed.



- d. Ibrahim photographed a house that his cousin designed.
21. a. Diana brought the dress her mum washed.  
b. Diana brought the dress that her mum washed.  
c. Diana brought a dress her mum washed.  
d. Diana brought a dress that her mum washed.
22. a. Oliver broke the cup his father washed.  
b. Oliver broke the cup that his father washed.  
c. Oliver broke a cup his father washed.  
d. Oliver broke a cup that his father washed.
23. a. Lucy decorated the flat her husband rented.  
b. Lucy decorated the flat that her husband rented.  
c. Lucy decorated a flat her husband rented.  
d. Lucy decorated a flat that her husband rented.
24. a. David sold the house his son designed.  
b. David sold the house that his son designed.  
c. David sold a house his son designed.  
d. David sold a house that his son designed.
25. a. Kath found the magazine her daughter lost.  
b. Kath found the magazine that her daughter lost.  
c. Kath found a magazine her daughter lost.  
d. Kath found a magazine that her daughter lost.
26. a. Ali received the report his colleague presented.  
b. Ali received the report that his colleague presented.  
c. Ali received a report his colleague presented.  
d. Ali received a report that his colleague presented.
27. a. Lisa decorated the house her uncle built.  
b. Lisa decorated the house that her uncle built.

- c. Lisa decorated a house her uncle built.
  - d. Lisa decorated a house that her uncle built.
28. a. George brought the toy his daughter wanted.
- b. George brought the toy that his daughter wanted.
  - c. George brought a toy his daughter wanted.
  - d. George brought a toy that his daughter wanted.
29. a. Caroline photographed the dog her nephew hit.
- b. Caroline photographed the dog that her nephew hit.
  - c. Caroline photographed a dog her nephew hit.
  - d. Caroline photographed a dog that her nephew hit.
30. a. William watched the show his sister presented.
- b. William watched the show that his sister presented.
  - c. William watched a show his sister presented.
  - d. William watched a show that his sister presented.
31. a. Isabelle visited the shop her uncle opened.
- b. Isabelle visited the shop that her uncle opened.
  - c. Isabelle visited a shop her uncle opened.
  - d. Isabelle visited a shop that her uncle opened.
32. a. Joseph sold the car his neighbour wanted.
- b. Joseph sold the car that his neighbour wanted.
  - c. Joseph sold a car his neighbour wanted.
  - d. Joseph sold a car that his neighbour wanted.

## **Appendix 8. The article check items for the acceptability judgement task**

### **Test category 1: Second-mention, the**

1. Mary had a cat. The cat was black and white.
2. Jason saw a butterfly. The butterfly was pretty.
3. Leah got a newspaper. She read the newspaper.
4. Hugo watched a film. He liked the film.
5. John answered a question. The question was hard.
6. Samantha played a game. She enjoyed the game.
7. Jennifer heard a story. The story was long.
8. Tommy drove a car. The car was very expensive.

### **Test category 2: \*Second-mention, a**

9. \*Robin owned a dog. A dog had a blue collar.
10. \*Judy found a ring. A ring was beautiful.
11. \*Christopher rode a bike. Then he parked a bike.
12. \*Angelica saw a penguin. She photographed a penguin.
13. \*James met a teacher. A teacher was smart.
14. \*Caroline noticed a thief. A thief was arrested.
15. \*Robert tried a new drink. He liked a drink.
16. \*Carol lived in a village. A village was near a city.

### **Test category 3: First-mention, a**

17. Smith opened his office door. A student came in.
18. Sue looked out the window. A lion was in her garden.
19. Alice saw a little boy. He was eating an apple.
20. Nora visited her grandfather. He was reading a magazine.
21. Laura opened a window. A bird was singing outside.
22. Nicole called her father. He was drinking a cup of tea.
23. Julie had dinner. She cooked a turkey.
24. Arthur dug the soil. Then he planted a flower.

**Test category 4: \*Second-mention, bare**

- 25. \*Felicia drove a truck. Truck was very big.
- 26. \*Louis had a kitten. Kitten was very cute.
- 27. \*Gerald bought a sandwich. Then he ate sandwich.
- 28. \*Timothy visited a doctor. He talked to doctor.
- 29. \*Catherine carried a child. Child was crying.
- 30. \*Janet kicked a ball. Her friend caught ball.
- 31. \*Bill borrowed a pencil. He used pencil to draw.
- 32. \*Andrew invited a lady. Lady came from Italy.

**Test category 5: \*First-mention, bare**

- 33. \*Annabel opened the door. Boy was outside.
- 34. \*Tom heard a noise. Cow was standing outside.
- 35. \*Kendra couldn't sleep. So she read book.
- 36. \*Philip was happy. He got dog for his birthday!
- 37. \*Anne parked a big van. Van was green.
- 38. \*Steven drew a picture. Picture was beautiful.
- 39. \*Maria planted a flower. Flower was red.
- 40. \*Helen wore a jacket. Jacket was warm.

## **Appendix 9. Fillers for the acceptability judgement task**

### **Ungrammatical fillers that include incorrect word order**

1. \*The soldiers fought bravely when attacked they the enemies.
2. \*The actress became famous when lived she in England.
3. \*Paul cried last night because lost he his ball in the garden.
4. \*The producer chose the actress because was she talented.
5. \*Margaret heard this news after attended she the meeting.
6. \*The boy did his maths homework after arrived he home.
7. \*Betty got bored while was attending she a science lesson.
8. \*The chef burnt his finger while was cooking he the dinner.
9. \*Samantha passed her exams, and celebrated she with her family.
10. \*The boy played football, and found he a snake in the park.
11. \*Janet helped her mum at home then went she shopping.
12. \*Mr Hill asked the students a question then answered they correctly.

### **Ungrammatical fillers that include consecutive use of simple past**

13. \*Ben invited his friends to his wedding. They would like came.
14. \*My friend visited London. He would like visited Paris.
15. \*The baby was eating. His mum helped him held the spoon.
16. \*Gary met an old man. She helped him crossed the road.
17. \*Claudia loved languages. She decided took Spanish lessons.
18. \*Linda finished high school. She decided travelled to France.
19. \*Nancy felt nervous. She stopped smoked two weeks ago.
20. \*George played outside. He went home when it stopped rained.
21. \*The girl went to a new cafe. She enjoyed drank coffee there.
22. \*The baby was happy. She enjoyed had a bath last night.
23. \*The mum was annoyed. Her child kept shouted in the shop.
24. \*Justin was in the cinema. A man kept talked during the film.

## **Appendix 10. Information sheet for the acceptability judgement task for native English speakers**

### **INFORMATION SHEET**

*You are invited to take part in a research study. Before you decide whether to participate it is important for you to understand why the research is being done and what it will involve. Please take the time to read the following information carefully. If there is anything you do not understand, or if you want more information, please ask the researcher.*

#### **Title of study:**

**The Acceptability of English Sentences by native and non-native speakers of English**

#### **Researcher:**

Alaa Al-Maani, a PhD student in the Department of Language and Linguistic Science, University of York

#### **What is the research about?**

The study compares the acceptability of English sentences by two groups: Jordanian learners of English and English native speakers.

#### **Who is carrying out the research?**

Alaa Al-Maani at the Department of Language and Linguistic Science, University of York.

#### **Who can participate?**

You can participate in this research if you are a native speaker of English.

#### **What does the study involve?**

The study involves an online test that requires you to read sentences in English and indicate whether they are acceptable or unacceptable using a rating scale where "1" means completely unacceptable and "7" means perfectly acceptable. The test will take around 20-25 minutes to complete, including time for explaining the task. Full details of how to do the task will be provided, and participants do not need to feel under any pressure to perform "well" in the tasks. The researcher is interested in your authentic responses, with no judgement about or expectation of a particular level of performance.

#### **Do I have to take part?**

Your participation is voluntary. If you decide to take part in the study, you will be asked to sign an electronic consent form. After deciding to take part in the study, you will still be free to withdraw at any time during the data collection session. If you withdraw from the study, we will destroy your data and will not use it in any way. However, once the data collection is complete, you will not be able to withdraw from the experiment.

**What are the possible risks of taking part?**

There are no foreseeable risks to taking part.

**Are there any benefits to participating?**

This research is entirely based on the participation of individuals; thus, your participation will make a very valuable contribution. The benefits are that you may feel gratification at providing valuable information in your academic community that could lead to new insights that help future language learners. You will also experience taking part in an academic research project.

**What will happen to the data I provide?**

The data you provide will be stored securely in the University of York, Department of Language and Linguistic Science and will be used alongside the data of other participants to compare the acceptability of English sentences by native speakers of English with Jordanian learners of English.

**What about confidentiality?**

Your identity will be kept strictly confidential. In the online test you will not use your name.

**Will I know the results?**

Individual results will not be provided.

*This study has been reviewed and approved by the Departmental Ethics Committee of the Department of Language and Linguistic Science at the University of York. If you have any questions regarding this, you can contact the chair of the L&LS Ethics Committee, Eytan Zweig, (email: linguistics-ethics@york.ac.uk; Tel: (01904) 324171).*

If you have further questions regarding this study, please feel free to contact:

Alaa Al-Maani

Department of Language and Linguistic Science

University of York, Heslington, York, YO10 5DD

tel: +447476731376; email: aiam503@york.a.uk

## **Appendix 11. Information sheet for the acceptability judgement task (Jordanian Arabic participants)**

### **INFORMATION SHEET**

*You are invited to take part in a research study. Before you decide whether to participate it is important for you to understand why the research is being done and what it will involve. Please take the time to read the following information carefully. If there is anything you do not understand, or if you want more information, please ask the researcher.*

#### **Title of study:**

**The Acceptability of English Sentences by native and non-native speakers of English**

#### **Researcher:**

Alaa Al-Maani, a PhD student in the Department of Language and Linguistic Science, University of York

#### **What is the research about?**

The study compares the acceptability of English sentences by two groups: Jordanian learners of English and English native speakers.

#### **Who is carrying out the research?**

Alaa Al-Maani at the Department of Language and Linguistic Science, University of York. The following researcher will help in data collection: Dr. Bassil Mashaqba.

#### **Who can participate?**

You can participate in this research if you are a native speaker of Jordanian Arabic who has never lived in an English-speaking country for more than two months, and neither of your parents is an English native speaker.

#### **What does the study involve?**

The study involves an online test that requires you to read sentences in English and indicate whether they are acceptable or unacceptable using a rating scale



where “1” means completely unacceptable and “7” means perfectly acceptable. The test will take around 20-25 minutes to complete, including time for explaining the task. Full details of how to do the task will be provided, and participants do not need to feel under any pressure to perform “well” in the tasks. The researcher is interested in your authentic responses, with no judgement about or expectation of a particular level of performance.

In addition, participants need to sign an online consent form and to complete an online English proficiency task that will take around 20 minutes and an online language background questionnaire that takes about 5 minutes.

### **Do I have to take part?**

Your participation is voluntary. If you decide to take part in the study, the researcher will offer you an appointment for completing the online test in a computer lab. At the beginning of the test, you will be asked to sign an electronic consent form. After deciding to take part in the study, you will still be free to withdraw at any time during the data collection session. If you withdraw from the study, we will destroy your data and will not use it in any way.

### **What are the possible risks of taking part?**

There are no foreseeable risks to taking part.

### **Are there any benefits to participating?**

This research is entirely based on the participation of individuals; thus your participation will make a very valuable contribution. The benefits are that you may feel gratification at providing valuable information in your academic community that could lead to new insights that help future language learners. You will also experience taking part in an academic research project.

### **What will happen to the data I provide?**

The data you provide will be stored securely in the University of York, Department of Language and Linguistic Science and will be used alongside the data of other participants to compare the acceptability of English sentences by native speakers of English with Jordanian learners of English.

### **What about confidentiality?**

Your identity will be kept strictly confidential.

### **Will I know the results?**

Individual results will not be provided.

*This study has been reviewed and approved by the Departmental Ethics Committee of the Department of Language and Linguistic Science at the University of York. If you have any questions regarding this, you can contact the chair of the L&LS Ethics Committee, Márton Sós-kuthy, (email: [marton.soskuthy@york.ac.uk](mailto:marton.soskuthy@york.ac.uk); Tel: (01904) 324171).*

If you have further questions regarding this study, please feel free to contact:

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University of York, Heslington, York, YO10 5DD

**tel:** +447476731376; **email:** [aia503@york.a.uk](mailto:aia503@york.a.uk)

## Appendix 12. Consent form for the acceptability judgement task

### The Acceptability of English Sentences by Native and Non-native Speakers of English

PhD student: Alaa Al-Maani, University of York

This form is for you to state whether or not you agree to take part in the study. Please read and answer every question. If there is anything you do not understand, or if you want more information, please ask the researcher.

- Have you read and understood the information sheet about the study? Yes  No
- Have you had an opportunity to ask questions about the study and have these been answered satisfactorily? Yes  No
- Do you understand that the information you provide will be held in confidence by the research team, and your name or identifying information about you will not be mentioned in any publication? Yes  No
- Do you understand that you may withdraw from the study at any time before the end of the data collection session without giving any reason, and that in such a case all your data will be destroyed? Yes  No
- Do you understand that the information you provide may be kept after the duration of the current project, to be used in future research on language? Yes  No
- Do you agree to take part in the study? Yes  No