ARABIC SECOND LANGUAGE LEARNERS' USE OF WORD ORDER

ORDER AND SUBJECT-VERB AGREEMENT FOR

ACTOR ROLE ASSIGNMENT

by

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ABSTRACT

Studies have shown that English speakers use first noun strategy in NVN word order to interpret these sentences as SVO, and that they use second noun strategy in VNN and NNV word order to interpret sentences as VOS and OSV, respectively (Harrington, 1987). In contrast, Taman (1993) found that Arabic native speakers rely primarily on gender agreement, followed by case marking and animacy to assign agency. This study investigates whether and/or how second language (L2) learners of Arabic use word order and subject-verb agreement to assign an actor role in simple sentences. It assesses the role of first language (L1) (English) in processing Arabic sentences, and how L2 processing develops with increasing exposure to the language. The purpose of this study is (1) to determine whether L2 learners of Arabic enrolled in their first year show L1 transfer and use word order to assign a subject role, and (2) if so, to what extent additional exposure to Arabic will decrease reliance of word order and increase reliance on verb agreement.

Language use patterns of three groups of L2 learners enrolled in first, second, and third year Arabic classes were examined. Participants read simple Arabic sentences and chose the subject of the sentence by button press (Bates et al., 1999, Experiment 3 & 4; Brandl, 2013; Kempe & MacWhinney, 1999). The dependent variable, frequency of choosing 1N, was calculated as a function of subject-verb variation for each group of students within the VNN and NVN word order. This study tentatively suggests that there might be an L1 transfer at the beginning stages of learning Arabic, and learners shift to

use the L2 cues in processing L2 sentences with more exposure to the language. It also

suggests some implications for L2 pedagogy. Whether it is because of L1 transfer or

universal strategies, the Beginner group did not utilize the verb agreement to assign actor

role regardless of the fact that they received explicit instructions about verb agreement in

Arabic.

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CHAPTER 1

INTRODUCTION

This chapter aims to briefly present the goals of the sentence processing field of

study, as well as the background and motivation for the current study. It also provides an

overview of Arabic language along with explanations of grammatical forms relevant to

this study.

1.1 Study overview and background

In the linguistic field of sentence processing, scholars seek to understand the ways

in which humans comprehend sentences; how they understand the meaning of the lexical

items of the sentence; and how they decide what the sentence as a whole means

(Wingfield & Titone, 1998, p. 228). The field tries to capture how the available

information—the syntactic, semantic, and/or context cues in the sentence—interacts to

help the reader/listener unfold the meaning of the sentence (Harrington, 2001, p. 91). In

this sense, sentence processing is interested in an individual's performance rather than

competence (Bialystok, 1990, p. 635).[1]

This study investigates how second language (L2) learners of Arabic use word

order and subject-verb agreement to assign an actor role in simple sentences. It aims to

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[1] The author is aware that the term *processing* recently has been used to describe parsing the stimuli in real-time (Harrington, 2001; Fender, 2001). As a result, current psycholinguistics research uses methods that can provide insights about what happens in real-time, such as self-paced reading/listening, etc. (Brandl, 2013). In this thesis, however, we use the term to describe the final outcome in assigning a syntactic structure; namely, the actor role in a sentence.

assess the role of the first language, L1 (English) in processing Arabic sentences, and how second language (L2) processing develops with increasing exposure to the language. One of the theoretical models in sentence processing that addresses these two questions is the *Competition Model* (CM, henceforth); this study employs CM principles, which take *cue validity* to be the basis upon which people comprehend sentences. Cue validity is measured mathematically using two constructs: *cue availability* and *cue reliability* (Bates & MacWhinney, 1987, 1989; MacWhinney, 1987, 1988, 1997, 2001, 2005; MacWhinney & Bates, 1989; MacWhinney, Bates, & Kliegl 1984; McDonald, 1986).

The purpose of this study is to determine (1) whether second language (L2) learners of Arabic enrolled in their first year at the University of Utah show first language (L1) (English) transfer and use word order to assign a subject role, and (2) if so, to what extent does more exposure to Arabic result in a decreased use of word order and increased reliance on verb agreement (a cue native speakers of Arabic rely on to complete the task). To answer these questions, the author examined the language use patterns of three groups of non-native Arabic speakers (NNS) enrolled in first, second, and third year Arabic classes.

A number of studies have been conducted to examine how L2 learners use syntactic or semantic cues to process sentences and assign subject-object roles (Brandl, 2013; McDonald, 1987b; Su, 1998; among others). The results from some of these studies show that there is an L1 transfer in sentence processing strategies, which is referred to as *syntactic accent* in the CM framework (MacWhinney, 2001, p. 84). The studies also illustrate that L2 learners move gradually from using cues that are more valid in their L1 to cues that are valid in the L2 (Su, 1998). Transfer within different language

components has been documented in different studies; for example, Flege & Eeftig

(1987) report phonological transfer in adult and 9-10 year-old Spanish speakers. Gass

(1980) and White (1985) conducted studies that observed syntactic transfer. Studies on

English native speakers (NS), within the CM framework, found that English speakers use

word order as a cue to assign an agent role in simple sentences (Bates & MacWhinney,

1981, 1982; McDonald, 1986, 1987a). These studies show that English speakers use first

noun strategy in NVN word order, and interpret the sentence as SVO. However, they use

second noun strategy in VNN and NNV word order and interpret the sentences as VOS

and OSV, respectively (Harrington, 1987; Kilborn, 1989).[2] In an Arabic study that

examined what cues Arabic NS rely on to assign agency, Taman (1993) manipulated

gender agreement (defined as agreement between the verb and the subject), case marking,

and animacy in a fixed VNN word order and found that, Arabic NS rely primarily on

gender agreement, followed by case marking and animacy. In contrast, in a study that

manipulated the aforementioned cues in VNN word order, Abu Radwan (2002) found

that native Arabic speakers rely more on case marking than gender agreement. However,

the difference between the two cues was very small and suggests that NS of Arabic may

rely on both cues equally. Moreover, the case marking cue is not relevant to the current

study because participants in first year did not encounter the case marking system in

Arabic; the textbook used in Arabic classes at the time of the experiment introduces

Arabic case marking starting in the second year. Finally, it should be mentioned that Abu

Radwan's (2002) study mainly investigated how English speakers-Arabic learners use

animacy, subject-verb agreement, and case marking in processing VNN Arabic sentences

which is more relevant to this study, and it will be discussed in detail in the next chapter.

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[2] For simplicity, the following abbreviations are used: Subject (S); Object (O); Noun (N); and Verb (V).

Nevertheless, it is notable that neither Taman nor Abu Radwan addressed word order as a cue in L1 or L2, a cue this study examined.

<div align="center">1.2 Arabic overview</div>

Arabic currently has just over 250 million speakers (Holes, 2004, p. 1) who generally use two registers: An informal register, which NS of Arabic encounter and learn as their mother tongue. It varies across and with the Arab countries, and is not always mutually intelligible across the Arab countries. The formal register, Modern Standard Arabic (MSA), dominates the media, political speeches, and more importantly, the education system in the Arabic countries. It is mutually intelligible across the Arab world.[3] Most universities in the USA teach only MSA in Arabic classes.

Arabic has two types of sentences: (1) nominal sentences (example 1.1), and (2) verbal sentences (example 1.2) (Mohammad, 2000).[4] The distinction is rather simple: verbal sentences start with a verb, while nominal sentences start with a noun and do not necessarily include a verb.

> (1.1) *al-rajul-u Tawilun.*
> the man tall-mas
> 'The man is tall.'
> (1.2) *yusaa3d al-walad al-bent*
> helps-mas-sing the boy the girl
> 'The boy helps the girl.'

Mohammad (2000) argues that all possible combinations of two nouns (subject, object) and a verb are possible in Arabic: SVO, OVS, VSO, VOS, SOV, and OSV. The variations of word order are possible for topicalization and pragmatic purposes such as contrastive emphasis on the object (Holes, 2004, p. 251). The primary constraint on word

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[3] Refer to Holes, 2004 for an extensive overview of Arabic language.
[4] The following abbreviations will be used for the sake of simplicity; sing=singular, pl=plural, mas=masculine, fem=feminine.

order is that sentences not start with indefinite nouns. The only other constraint on word

order is ambiguity in agency; in any word order, there will be a cue that refers to the

correct interpretation of the sentence, that is, there will be a cue that marks one of the

nouns as an agent (Mohammad, 2000, p. 2-3). Arabic employs case marking, pragmatic

(animacy), and/or subject-verb agreement to resolve ambiguity. To illustrate, in example

1.3, the subject-verb agreement marks to *al-walad* as the subject of the sentence.

However, in example 1.4, the case marking (the normative case) marks to *al-waladu* as

the subject of the sentence.

> (1.3) al-walad yusaa3d al-bent.
> the boy helps-mas the girl
> 'The boy helps the girl.'
> (1.4) al-waladu yusaa3d al-rajula
> the boy-nom helps-mas the man-acc
> 'The boy helps the man.'

How subject-verb agreement manifests depends on word order, the verb in VS

constructs only agrees with the subject in gender and it is always singular (example 1.5),

but in the SV order, the verb agrees with the subject in number and gender (example 1.6)

(Mohammad, 2000, p. 6). In NVN or VNN orders, if case marking is suppressed, and

both nouns have the same gender (i.e., if the subject-verb agreement is not available as a

cue to resolve ambiguity) only then is word order used as the last resort to interpret the

sentences.[5] In these cases, only the SVO and VSO interpretations are allowed,

respectively.

> (1.5) *yusaa3d al-awlaad al-rajul*
> helps-mas-sing the boys the man
> 'The boys help the man.'
> (1.6) *al-awlaad yusaa3duun al-rajul*
> the boys helps-mas- pl the man

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[5] The Arabic case marking system uses short vowels to mark singular nouns. However, the short vowels are rarely written in texts.

'The boys help the man.'

As mentioned above, word order in Arabic is free. However, the NVN interpretation provided by the Arabic textbook (Brustad , Al-Batal & Al-Tonsi, 2011) used at the time of the experiment matches the English interpretation: SVO is valid in both languages, while OVS is also valid—albeit rare—in Arabic. The interpretation of VNN word order is different between the two languages, although: English always interprets VNN as VOS (Bates & MacWhinney, 1981, 1982; McDonald, 1987a), while Arabic allows for both VSO (most common) and VOS.[6]

The cross-linguistic differences in word order between Arabic and English are interesting in that they may cause L2 learners of Arabic at first to employ L1 strategies in assigning actor-role in sentences. Then, with more exposure to the language, learners might shift toward a different set of cues—those employed by native Arabic speakers. Scholars have studied sentence processing patterns in L2 learners and suggested that non-native like processing mirrors incomplete acquisition (Juffs & Harrington, 1995). Although scholars have investigated sentence processing in many languages, researchers have focused on languages that fall inside the Indo-European category (Tucker et al., 2015). However, Tucker et al. (2015) suggest that sentence processing research "would benefit from the largest possible cross-linguistic coverage since it is conceivable that there is a cross-linguistic variation" (p. 4). To increase cross-linguistic coverage in sentence processing studies, we investigated the relationship between word order and verb-subject agreement in Modern Standard Arabic, (Arabic, henceforth), a language that is morphologically rich in its verb agreement system and has a free word order. Finally,

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[6] An example of VNN sentences that NS of English interpreted as VOS *is are licking the pens the cat* (Bates & MacWhinney, 1981, p. 201). It should be noted that CM used ungrammatical sentences in their stimuli.

studying how participants process this structure might help to shed light on how students

acquire the subject-verb agreement structure in Arabic.

CHAPTER 2

LITERATURE REVIEW

This chapter first provides a brief summary of sentence processing models and then introduces the Competition Model (MacWhinney & Bates, 1989), its principles, and its general findings in both L1 and L2 studies. The chapter continues with a discussion of research on Arabic language within the framework of the Competition Model and concludes by explaining the significance of the current study.

2.1 Sentence processing models

Sentence processing models can be distinguished based on the following questions: (1) Is there a specific parser for syntax or not?; (2) Do other sources of knowledge interact, that is, is processing an interactive or modular process?; and (3) Is processing a serial or parallel process (Harrington, 2001, p. 92; Fender, 2001, p. 326)? In addition, Harrington (2001) distinguishes processing models with respect to their views on how knowledge is represented (p. 100).[7] According to Harrington (2001), the three most influential approaches in sentence processing, are the *principle-based approach,* the *referential (discourse-based) approach,* and the *constraint-based approach* (p. 103)*.*

The principle-based approach assumes that there are two stages of processing. In the first stage, a syntactic processor is responsible for parsing the incoming lexical items;

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[7] Extensive review of sentence processing is beyond the scope of this study; however, for a comprehensive review of sentence processing and word integration, see Fender, 2001; Harrington, 2001.

in the second stage, other sources of information like semantic or pragmatic processors become available. Based on this model, sentence processing is a serial process. The main criticism of this approach and its models, such as the Garden Path Model (Frazier & Fodor, 1978), has come from sentence processing research that has shown that semantic and contextual information is as important as the syntactic structure in sentence processing. This extra semantic and contextual information allows the parser not to make a complete commitment to one interpretation and increases the parser's efficiency (Boland, Tanenhaus, & Garnsey, 1990; Tanenhaus & Trueswell, 1995). The referential approach, in turn, places an emphasis on context; however, it shares the principle-based approach's view that processing is a modular process. A lot of support for the model has come from research that demonstrates how context can bias the ways in which a sentence is interpreted (Harrington, 2001, p. 116).

The constraint-based approach describes sentence processing as an interactive process in which all available sources of information are processed together during sentence comprehension (Tanenhaus & Trueswell, 1995, p. 221-32; Wingfield & Titone, 1998, p. 253). Sentence processing in this approach is seen as a parallel process, in which the syntactic processor is not privileged over other processors. The approach adapts connectionist views and principles in which sentence processing involves activating several connections in the network based on the incoming data (Ellis, 2002). This approach is also called experience-based, and it directly accounts for the transfer of L1 elements in the acquisition of an L2 (Rah aus Aurich, 2009, p. 17). The Competition Model is one example of constraints-approach principles, and predicts that when learners start learning a new language, they process sentences using cues from their L1

(McDonald, 1987b; MacWhinney, 1997, 2001, 2002). As learners progress, they show a change toward cues used in the L2 (MacWhinney, 2005). The next sections will discuss the theoretical background of the model to lay the foundation of this study. However, for a comprehensive and extensive view on the CM, including its lexical, functionalist, and connectionist commitments; see (Bates and MacWhinney 1981, 1982, 1989; MacWhinney, 1987, 1988, 1989).

2.2 Theoretical background of CM

MacWhinney and Bates (1989) proposed the Competition Model, in which language processing is cue-driven (p. 26). The Competition Model views language learning from a functionalist and connectionist perspective (Bates & MacWhinney, 1981, 1982, 1987, 1989; MacWhinney, 1997, 2001, 2005). Its functionalist commitment rests on its claim that "the surface conventions [forms] of natural languages are created, governed, constrained, acquired, and used in the service of communicative functions" (Bates & MacWhinney, 1981, p. 192). These forms are used to express meanings and intentions (functions) and to communicate ideas. Following a minimalist approach, in which a minimal number of assumptions are made, Bates & MacWhinney (1989) specify only two levels of linguistic structure to lexical items. The first unit of these is the *functional level*, where all the meanings and intentions are represented (e.g., actor, agent, etc.); the second is the *formal level*, and includes the expressive surface devices available in the language (e.g., case marking, word order, etc.). CM uses the term *cue* to express any information that could be used to represent the relation between form and function. In sentence comprehension, cues are forms, but in sentence production cues are functions (MacWhinney, 2005). The next section goes into further detail regarding the basic

principles of the CM model that are related to this study.

2.3 Basic principles of CM

2.3.1 Two level mapping

In CM, lexical items are understood as structures with two levels: (1) an internal

level, called the functional level, which includes the semantic properties and the concept

behind the lexical item, and (2) an external, formal level containing the phonological and

orthographical information (Bates & MacWhinney, 1989, MacWhinney, 1992).[8] Lexical

items connect to one another by means of relations. For example, the lexical item *hit*

needs two arguments: the action and the doer, and action and the object (MacWhinney,

1987, p. 264). On the surface, different languages have developed different ways to

express functions; for instance, the preverbal form in English is highly correlated with the

actor/doer function. Both inter and intralevel mapping between forms and functions is

direct, but never one-to-one. For example, the preverbal position is a form that might

refer to a topic or an agent (Bates & MacWhinney, 1981, p. 197).

2.3.2 Competition

Competition is the most important principle with respect to sentence processing in

CM. Languages express complex semantic concepts with a finite number of forms such

as word order, stress, verb agreement, and case marking (Bates & MacWhinney, 1982, p.

190). Sentence processing, through the lens of CM, is seen as a dynamic process of

mapping between forms and functions. Because a limited number of forms exist,

functions compete for control over them. Following the same line of reasoning, when a

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[8] The model also assumes that hidden units exist and mediate between the two layers. This assumption is based on the connectionist perspective the model adapts, and it is necessary to account for nonlinear interactions between the input and the output. (Bates & MacWhinney, 1989, p. 39).

function "wins" the competition, it strengthens the relation between the form and itself while connections between that form and other functions weaken. This dynamic process of competing is what gives the model its name. Learning first and second languages is viewed as tuning these connections in the L1 and/or the L2 based on the input received (MacWhinney, 1997).

2.3.3 Cue strength

As discussed above, the connections between forms and functions are weighted by means of the process of competition. For instance, when the agency function competes with patient function, and wins control over the preverbal position form, the connection between the agent-preverbal position is considered to be stronger by means of weight than the connection between patient-preverbal position. The model assumes that children start with connection weights that are close to zero; that *cue strength* is a subjective measure of one's knowledge about form-function relations which could be measured empirically in the lab; and that cue strength varies across languages. For example, preverbal position is a strong cue that expresses agency in English, but not in Arabic nor in a number of other languages, including Spanish (MacWhinney, 1997). Cue validity, the topic of the following section, in turn determines cue strength in a particular context.

2.3.4 Cue validity

Cue validity is an objective measure of cue strength, and it can be calculated mathematically as the product of cue availability and cue reliability (McDonald, 1986, MacWhinney, 2005). Cue availability measures the frequency of cue-input in a particular linguistic context; for instance, subject-verb agreement in Italian is highly available.

According to MacWhinney (2002), cue reliability is a probability function of P(X|Y), where X is a function and Y is a cue, meaning that an interpretation of X should be chosen based on the presence of the cue Y (p. 34). To put it simply, a cue (e.g., preverbal position) is highly reliable for a function (e.g., agency) when it leads to that function whenever it is available. Measuring cue validity by means of text counts from different written or spoken discourses is a difficult task; however, MacWhinney (1991) created the Child Language Data Exchange System (CHILDES) to support research in CM.

Further empirical data from CM research has led to an understanding of two different kinds of cue validity: *overall validity* and *conflict validity* (McDonald, 1986, 1987a; Kail, 1989). Overall validity is general validity, which functions in all kinds of sentences, while conflict validity only comes into play when a sentence has cues that point to competing meanings/functions. This distinction helps to account for differences in children and adult data in Dutch, discussed in section 2.4.2 (McDonald, 1987a). It bears mentioning that in many languages, overall validity and conflict validity are similar (Year, 2003). Also, cues high in conflict validity are high in cue reliability. Thus, this distinction led to modifications of the CM predictions in which cue availability (which determines overall validity) accounts for the data that come from children, while cue reliability (which determines conflict validity) accounts for adults' data.

2.3.5 Cue cost

The notion of *cue cost* was also added to CM after its initial development; it refers to the demands on cognition when processing a cue (MacWhinney, Pléh, & Bates, 1985; Kail, 1989). Either of two avenues might lead to a high cognitive cost of the cue to be processed: (1) *assignability*; the cue is said to be highly assignable if its interpretation

coded across words, while cue is low in assignability if it is coded within one lexical item (Kail, 1989, p. 97), or (2) *detectability*; which measures how salient the cue is. Thus, if the cue is highly valid but places a high load on humans' working memory or perceptual system, children and L2 learners will rely upon it less. To illustrate, MacWhinney, Pléh, & Bates (1985) found that even though case inflection is the most valid cue in Hungarian, results from cue strength studies showed that children tend to use animacy because case marking is, in some cases, difficult to perceive (e.g., the accusative marker *-t* appears at the end of a consonant cluster); see Chapter 2, section 2.4.2.

2.4 First language studies

Before reviewing research on second language learners under the CM framework, it will be beneficial to review some studies relating to first language. L1 studies initially laid the foundation for the development of CM, before scholars extended the model to account for L2 data (Mayer, 2008).

Linguists have applied the CM framework to a number of languages, including Arabic (Taman, 1993), Chinese (Li, Bates, & MacWhinney, 1993), Dutch and English (McDonald, 1986, 1987a), French (McDonald & Heilenman, 1991), German (MacWhinney, Bates, & Kliegl, 1984), Hungarian (MacWhinney, Pléh, & Bates, 1985; MacWhinney & Pléh, 1988, 1997), Italian and Serbo-Croatian (Devescovi et al., 1998), and Russian (Kempe & MacWhinney, 1999), among others. Most of these studies aimed to evaluate how cue strength, measured subjectively by the speakers' knowledge of form-function mapping in their language, mirrors cue validity as objectively measured, based on cue availability and cue reliability. Additionally, some of these studies sought to understand how cue cost affects processing and acquisition in children, and how cues

could interact with each other in cases of competition or convergence (Year, 2003).

2.4.1 Methodology of L1 studies

Studies in CM have most frequently made use of subject-identification tasks. However, other techniques such as object-identification tasks, acting the sentences out using toys, picture choice tasks have also been used. In subject identification task studies, participants are typically asked to determine which of two nouns in a simple sentence the actor/doer of the action is. A few studies, however, have also looked into complex structures such as relative clauses (Bates et al., 1999, MacWhinney & Pléh; 1988, McDonald, 1987a). In these studies, scholars constructed experimental sentences using two nouns and one transitive verb. They manipulated cues such as verb agreement, word order, animacy, case marking, and stress as independent variables. To illustrate, Table 2.1 sketches the standard way in which researchers might manipulate word order, subject-verb agreement, and animacy.

The manipulation of the cues inevitably yields some grammatical and some ungrammatical sentences depending on the language; in English, the sentence, *the boy the girl hit*, is ungrammatical unless it is followed by another clause.[9] In experiments, cues are sometimes presented in a competing or converging order. For instance, in the ungrammatical sentence *the horses licks the cow*, word order and verb agreement compete; word order suggests that the agent of this sentence is *the horses*, while the verb agreement points toward *the cow*. However, in the sentence *the horses lick the cow*, word

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[9] The use of ungrammatical sentences has been considered problematic (Mclaughlin & Harrington, 1989), a matter to which we will return when discussing methodological issues of CM.

Table 2.1 Manipulation of word order, subject-verb agreement, and animacy cues

Word order	Subject-verb agreement	Animacy
NVN: Noun-Verb-Noun	NN: Both nouns agree (ambiguous)	AA: Both nouns animate.
VNN: Verb-Noun-Noun	1N: First noun only agrees	AI: 1N animate, 2N inanimate.
NNV: Noun-Noun-Verb	2N: Second noun only agrees	IA: 1N inanimate, 2N animate.

order and verb agreement converge, and both refer to *the horses* as the subject of the sentence. In the CM framework, word order wins in sentences where word order and verb agreement compete if participants choose *the horses* as the subject in spite of non-agreement with the verb. Thus, word order, according to the CM, is considered to be a stronger cue than verb agreement in English.

Most CM studies have only calculated the average rate by which participants choose the first noun as the subject of the sentence in different conditions (different cues, cues in competition or convergence, etc.). As mentioned earlier, such studies assess how cue reliability and cue availability (i.e., cue validity) influence cue strength (Kempe & MacWhinney, 1999). CM predicts that the cue validity hierarchy will match the cue strength hierarchy. Some studies investigated how cues in convergence or competition affect participants' reaction time to test the model's prediction that cue strength will be a facilitative factor and will reduce reaction time (Bates, McNew, MacWhinney, Devescovi, & Smith, 1982; Li, Bates, & MacWhinney, 1993). Other studies adopt the CM paradigm to compare learning approaches, such as rule-based and associative approaches (Kempe & MacWhinney, 1998).

2.4.2 General findings

As mentioned above, the main purpose of CM L1 research is to confirm the

model's predictions about cue validity, and most L1 studies have indeed supported such

predictions. Bates and MacWhinney (1989) provide a summary of cue hierarchies for cue

order across languages. Some of these results, including Taman's (1993), only for adults,

are presented in Table 2.2.

The results of these studies show not only that languages differ in the order of

relative cue strength, but also in the degree of reliance on various cues. Bates et al. (1999)

show that in NVN word order, when animacy and agreement have been neutralized in

complex sentences (i.e., when the animacy and/or agreement would point to both or

neither noun as the agent of the sentence), English native speakers choose the SVO

interpretation 86% of the time, while Italian speakers choose it only 75% of the time,

even though the two languages are considered to be SVO languages (Bates, McNew,

MacWhinney, Devescovi, & Smith, 1982). The most important contribution from L1

studies relates to the notions of conflict validity and cue cost, both of which were

developed to account for differences in data between children and adults. In examining

data from a cross-linguistic study of English and Dutch native speakers, McDonald

(1986, 1987a) could not explain the data that she found from adult speakers by using

overall validity alone. Adult speakers of Dutch were expected to rely on noun animacy,

the most valid cue in Dutch. Nevertheless, Dutch speakers relied more on case inflection.

Case inflection is a highly reliable cue, but as it is not highly available, it tends to be used

only in conflict sentences; it is high in conflict validity. Therefore, McDonald (1986)

hypothesized that conflict validity, rather than overall validity, controls processing in

Table 2.2 Order of cue strength in several languages in adult L1 speakers (adapted from Bates & MacWhinney, 1989, p. 44-5)

Language	Cue Order	Representative study
Arabic	verb agreement> case marking> animacy	Taman (1993)
Chinese	Animacy> SVO	Li, Bates, & MacWhinney (1993)
Dutch	Case inflection> SVO> animacy	McDonald (1986)
English	word order (SVO)> VOS, OSV> animacy, agreement> stress, topic	McDonald (1987a)
French	SV agreement> clitic agreement> animacy> SVO> Stress	MacDonald & Heilenman (1991)
German	Case marking> agreement> animacy> word order	MacWhinney, Bates, & Kliegl (1984)
Italian	SV agreement> clitic agreement> animacy> SVO> Stress, topic	Devescovi et al. (1998)

adults, and further experiments came to the same conclusions (see Kail, 1989, Experiment 1). Cue cost has also been added to the model to explain child development data. For example, Kail (1989, Experiment 2) found that children are better at dealing with local cues (attached to one lexical item) than global cues (agreement between different lexical items such as verb-subject agreement in gender and/or number). Now, I will turn to discuss the methodology and findings of L2 studies.

Many L2 studies have used the same subject-identification technique as L1 studies. Participants responded to agent-identification tasks, and analysts calculated the rate by which they chose the first noun as the agent or actor in the sentence. The main prediction CM makes is that L2 learners will use high-validity cues from their L1 as they begin to learn L2. Later, as they learn more about the L2, learners begin to use cues that

are valid in the new language (MacWhinney, 2005). In the following section, I will discuss studies that tested the predictions, and their contradictory findings.

<u>2.5 L2 findings</u>

A number of L2 studies within the CM framework confirm the transfer predictions the model anticipates. For example, McDonald (1987b) conducted one of the first CM studies on L2 processing with English-Dutch and Dutch-English L2 learners at different proficiency levels, and English and Dutch native speakers as control groups. She constructed the stimuli following the CM procedure and manipulated word order, subject-verb agreement, case marking, and animacy. As is the case for many other studies, the stimuli in her experiment included grammatical and ungrammatical sentences. She predicted that English-Dutch learners would rely on word order at low proficiency levels to comprehend sentences. Similarly, she predicted that Dutch-English learners would rely on case marking to complete the task. The results show that English speakers' reliance on word order declines while reliance on case inflections, the cue that Dutch NS rely on most, increases as students become more proficient in Dutch. Similarly, Dutch speakers in advanced English classes rely more on word order than those who were in beginner classes.

Su (1998) reports on two pilot studies on 24 English speakers-Chinese learners (CFL) and 36 Chinese speakers-English learners (EFL), as well as control groups of 12 English and 12 Chinese native speakers. Both groups of language learners were divided into three levels: beginner, intermediate, and advanced. The purpose of Su's study was to investigate whether L2 learners use L1 cues in the early stages of learning their L2 and if they move toward L2 cues as their proficiency increases. Su constructed sentences using

two nouns and one transitive verb in which all possible orders were explored: VNN, NVN, and NNV. Animacy was manipulated between the two nouns as the following: (1) Both are animate (AA); (2) animate-inanimate (AI); (3) inanimate-animate (IA) for both studies, and (4) inanimate-inanimate (II) only for the Chinese speakers-English learners groups. Animacy and word order cues were manipulated to construct the experimental sentences. Chinese EFL participants were asked to choose one of the two nouns as the subject of the sentence as quickly as possible. However, English-speaking CFL participants had to pick between two pictures that better represented the sentence they heard. It should be noted that Su conducted the study with the Chinese EFL learners first before running the study with the English-speaking CFL participants. The researcher had a concern with respect to the linguistic terminology used in the first pilot study as she asked the participants to choose the subject of the sentence. In her second pilot study, trying to control for any bias that might have been caused because of the terminology used in the task, she used a picture selection task. However, the CFL participants in the second pilot study behaved similarly to the English controls in the first pilot study, and the researcher concluded that there was no difference in the results obtained from the two different techniques (Su, 1998, p. 59).

The researcher then calculated the percentage of participants who chose the first noun (1N). While results from the control groups confirmed the same patterns found in previous studies on English and Chinese (see Table 2.2), results from the language learner groups indicated that English speakers' reliance on word order—a highly valid cue for native English speakers—declines as they become more proficient in Chinese, and they begin to rely more on animacy, the cue that Chinese NS rely on most. Similarly,

Chinese speakers in advanced English classes rely more on word order than those who

were in beginner classes (Su, 1998).

On the other hand, some scholars who conducted studies to test the CM

hypotheses did not find L1 influence when participants encountered L2 sentences. For

example, CM studies on Italian native speakers confirmed that subject-verb agreement is

the strongest cue in that language (Bates et al., 1984). Based on these findings, Gass

(1987) predicted that Italian speakers-English learners would use their L1 cue to interpret

English sentences. However, she found that this group of learners relied on animacy, but

she did not find evidence of L1 transfer. It should be noted that Gass (1987) also studied

English speakers-Italian learners, and found that this group also uses animacy in

interpreting Italian sentences. However, this cross-linguistic study showed that Italian

learners do in fact demonstrate a developmental shift toward word order as a cue. Based

on these results, Gass (1987) suggested that semantic cues might be universal cues in

processing L2, but further studies of L2 learners have not supported such claims (Kilborn

& Cooreman, 1987). Su (1998) in turn attempts to explain Gass's findings by suggesting

that L2 learners in these cases adapted semantic strategies as a last resort as the most

valid cue in their L1 (agreement) was neutralized; the morphology on the verb could not

be used as a cue to agency (p. 19). Another study that did not find L1 transfer at beginner

levels will be discussed in the next section.[10] However, before proceeding to the next

section, it is worth mentioning that other scholars proposed that L2 learners use universal

semantic strategies to process L2 sentences. For example, VanPatten (2007) claims that

comprehension is effortful and cognitively costly at the beginning phases of learning a

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[10] See Brandl (2013) for an extensive review on studies that account for L1 transfer as well as studies that
do not.

language. Thus, L2 learners resort to using local processing strategies such as assigning the first noun in the utterance as the subject of the sentence. However, VanPatten's *first noun principle* (FNP) was tested mainly with English NS learning different languages. As mentioned earlier, English NS have a first noun bias, which makes it hard to determine whether NS of English were transferring their L1 knowledge or using VanPatten's FNP (Brandl, 2013, p. 26).

2.6 Previous Arabic-language studies

As mentioned in Chapter 1, and to the best of this author's knowledge, only two Arabic-language studies have been conducted under the CM framework: (1) Taman (1993), who only studied how NS use case marking, subject-verb agreement, and animacy to assign an actor to a sentence; and (2) Abu Radwan (2002), who examined how two groups of English speakers-Arabic learners, a beginner and an intermediate group, used subject-verb gender agreement, animacy, and case marking cues to assign a subject-role in Arabic sentences. In addition to these two groups he used 9 Arabic NS as a control group. By manipulating these cues, Abu Radwan constructed 54 sentences using two nouns and one transitive verb.[11] Participants were asked to circle the subject of the sentence. The percentage of participants identifying the first noun (1N) as the subject was calculated. While Abu Radwan's (2002) main purpose was to study NNS, the study itself is important also as it is only the second study to use Arabic NS within CM research. The results from the NS revealed that they relied mostly on case marking, secondarily on verb-agreement, and lastly on animacy. The results of the NS group do not align with

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[11] Abu Radwan (2002) used a 3*4*3 design which yields 36 sentences. However, the total number of stimuli used was 54 sentences. This suggests that he used unequal number of sentences per condition. Moreover, he mentioned that he only used the same two nouns and verb creating all the stimuli (p. 195). Thus, it is not clear how he constructed 54 sentences.

Taman (1993), who conducted his study only on NS and found that the strongest cue for NS of Arabic is verb agreement, not case marking. As mentioned in the chapter before, the conflict is noteworthy, but irrelevant to this current study for two reasons: First, the statistical differences between the case marking and verb agreement are small in both studies (Abu Radwan, 2002, p. 206), and second, case marking is not introduced to first year students, and is therefore not a factor in this study. Nevertheless, both studies on NS show that they rely on verb agreement as a strong cue to assign an agency role in simple sentences.

Now, we turn to Abu Radwan's (2002) NNS results. Interestingly, Abu Radwan found that learners in their first semester of learning Arabic also relied predominantly on case marking, followed by verb-agreement and animacy, and did not transfer L1 behavior. The same pattern was observed in the intermediate group. Abu Radwan's findings do not show that beginner L2 learners used cues that are more valid in their L1, but rather that they used L2 cues. Abu Radwan (2002) attributes the lack of transfer from L1 to the effect of explicit instruction (p. 204). Abu Radwan used a fixed word order (VNN) and manipulated the case marking on both nouns; within this manipulation there were two conditions in which the two nouns were either accusative or nominative. In VNN Arabic sentences, only the subject is marked with the nominative marker, and only the object is marked with the accusative marker. Thus, having two nouns marked as accusative or nominative constitutes an ungrammatical sentence; however, Abu Radwan (2002) mentions that he did not use ungrammatical sentences (p. 195). Neither did he provide the list of stimuli used in his study nor an explanation of how he did not use ungrammatical sentences. Moreover, neither of the two studies investigated the role of

word order, but instead employed only VNN word order. On a final note, unlike other

CM studies, both studies used only 2-3 nouns and one transitive verb to conduct their

stimuli without any distractor sentences, which, in addition to the limitations mentioned

above, restrict the generalizability and the predictive power of these studies.

<div align="center">2.7 Methodological issues and limitations of CM</div>

The primary limitations of empirical research conducted under the CM framework

relate to: (1) the use of ungrammatical sentences, and (2) the use of simple sentences.

McLaughlin and Harrington (1989) argued that participants can be expected to find

difficulties processing ungrammatical sentences, and that participants might apply other

problem-solving strategies instead of using the sentence-processing strategies being

investigated (p. 125). Thus, ungrammatical sentences might introduce unwanted elements

into the analysis.[12] Second, the majority of studies conducted under the framework of CM

used simple sentences, although some studies explored more complex structures such as

relative clauses (Bates et al., 1999; MacWhinney & Pléh, 1988). Since languages of

course employ complex structures, studying only simple sentences limits the predictive

power of the CM model (Harrington, 2001, p. 113). Moreover, Gregg (2001, p. 164) and

Harrington (2001, p. 115) criticized the constraint-based approach itself, pointing out that

the approach lacks a theory of grammar that explains the constraints between different

sources of knowledge. Finally, Fender (2001, p. 325) states that new studies in the

sentence processing field have found that sentence processing is an incremental process,

meaning that each incoming lexical item provides some information that updates the

comprehension process; individuals never wait until they hear the whole utterance to

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[12] Refer to MacWhinney, Pléh, & Bates (1985) for the justification of using ungrammatical sentences.

interpret its meaning. In this sense, the CM studies fail to show how real-time process manifested. However, it should be reiterated that processing in this study is defined as assigning an agency role in simple sentences. Furthermore, this study responds to some of the methodological issues and limitations described above, and also provides justifications for using simple sentences.

2.8 The current study

The current study is motivated by (1) the lack of Arabic studies that investigate the role of L1 in L2 processing; (2) the lack of consensus about the role of L1; and (3) methodological limitations of prior studies.

This study seeks to answer the following questions:

- To what extent do L2 learners of Arabic enrolled in their first year show L1 (English) transfer by using word order to assign a subject role to Arabic sentences?
- Does more exposure to Arabic, measured by the enrollment year, result in declining use of word order and increased reliance on verb agreement—a cue that native speakers of Arabic rely on to complete the task—and to what extent?

Based on the literature reviewed, the Beginner group is expected not to utilize the verb agreement cue and to rely on L1 processing cues to assign agency. In addition, L2 learners' processing mechanism is predicted to shift toward native-like processing as they progress from beginning to more advanced levels. This current study tries to account for one of the limitations mentioned in previous Arabic studies, and to further clarify the role of L1 transfer in L2 processing: All of the sentences used in this study were grammatical;

following CM non-Arabic studies, more than two nouns and one transitive verb were used; and finally, the word order cue was manipulated to study its effect on agency assignment.

Scholars have identified simple sentences as a problem for the model (Year, 2003), as this practice fails to account for the complex structures found in natural languages. However, when including low and intermediate level L2 learners, the research within the CM claims to provide an insight into how those learners "utilize general cognitive and semantic/conceptual processing strategies to make meaning of the L2/ESL language" (Fender, 2001, p. 358). One goal of this study was to investigate the role of L1 transfer, which is why it includes beginning students of Arabic in their first year of study. However, including these learners also limited the study; for example, syntactic structures were limited to those structures covered in the textbook in the first year, which are quite simple. In addition, student vocabulary, based on the textbook participants are using, is limited. It is for these reasons that the author chose to limit the tasks to simple sentences with two nouns and one verb instead of, for example, using relative clauses. Finally, the stimuli in this study were presented in the visual mode to the participants, to control for stress since some previous research showed that it could affect how participants process sentences (Su, 1998). Kilborn (1989), in a study on the effect of stimuli modality, detected no difference between visual and audio stimuli when presented to German-English bilinguals. The next chapter discusses the details of design of the current study.

CHAPTER 3

METHODOLOGY

This chapter explains the experimental design of this study, including the participants, the stimuli, the materials used, the procedures followed in the study, the scoring, and the statistical analysis chosen for the data.

3.1 Participants

NNS participants in the study were students enrolled in a second semester (1020) Arabic course (Beginner, B), second semester (2020) Arabic course, (Intermediate, I), or second semester (3020) Arabic course, (Advanced, A). Two participants were excluded from the final analysis. One participant in the Intermediate group was excluded because of previous knowledge of the experiment. The Beginner group participant, enrolled as a noncredit student, was excluded because she had reported an inability to read. Her score for the vocabulary test confirmed the participant as an outlier. It should be mentioned that two sections existed for the first and second year Arabic classes. None of these sections had the same instructor. Moreover, the experimenter, at the time of the study, taught one section of the second-year class. However, the experimenter informed neither his colleagues nor his students about the purposes and goals of his research. Table 3.1 shows the number of participants (N), mean age, and age range of for each of the three groups.

CM predicts that L2 learners will use cues that are most valid in their L1. While all the participants identified English as their first language in the background

Table 3.1. Participant N, Mean Age, and Age Range

Group	N	Mean Age	Age Range
Beginner, B	22	22.4	19-33
Intermediate, I	18	24.9	19-56
Advanced, A	6	24.2	20-32

questionnaire, six of them started learning English after they had immigrated to the US at a young age. These six participants, along with the native English-speaking participants who reported that Arabic was not their only second language, exemplify the reality of second language classroom studies: It is impossible to control learner variables completely.[13] Table 3.2 shows age and L1 and L2 exposure of the six participants with immigrant background.[14]

At the time of the study, Arabic classes at the University of Utah used *Al-Kitaab fii Tacallum al-cArabiyya, Part 1 & 2* (Brustad, Al-Batal, & Al-Tonsi, 2011) as the primary textbook for first year and second year classes. Third year Arabic used various authentic resources from the media and Arabic literature instead of a textbook.[15] Students are exposed to nominal and verbal sentences early on, but do not learn these two types of sentences explicitly until Chapter 4 (Brustad, Al-Batal, & Al-Tonsi, 2011, p. 84-86). Nominal sentences begin with a noun and need not include a verb. *Al-Kitaab* also introduces nominal sentences that include a verb as SV(O) sentences. Verbal sentences,

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[13] For further discussion about learner-factors that affect second language acquisition, refer to Lightbown & Spada (2006).
[14] Excluding the six participants' data from the analysis did not have a significant effect on the final results. Thus, their data were included in the final analysis.
[15] Personal communication between the researcher and the third year Arabic instructor.

Table 3.2 Six Participants' Mean Age, L1 exposure, and L2 (English)

Group	N	Mean Age	L1 Exposure	Age starting English
Beginner, B	3	22	Somali, Persian, Urdu.	6, preschool, 13.
Intermediate, I	2	21	Somali, Spanish	4, 6
Advanced, A	1	20	Urdu	Preschool

in contrast, start with a verb. The book introduces the alternate word order used in

Arabic, VNN, interpreted as VSO. It is important to state that *Al-Kitaab,* like other L2

books, has conjugation charts and explains deductively that the verb should agree with its

subject in gender and number. Lastly, the SV(O) and VS(O) interpretations for NVN and

VNN word orders are very common in the Arabic language even for NS. (See Chapter 1,

section 1.2 for examples of the different grammatical structures explained above).

3.2 Materials

3.2.1 Stimuli

In total, 48 Arabic experimental sentences with VNN and NVN word order,

respectively, were constructed using 48 sets of "two nouns and one verb." The sets were

randomly generated using Excel's (Microsoft, 2010) random function; none of the sets

were identical. Example 3.1 illustrates a set.

Ex 3.1 (*Habiib,* 'lover $_{mas}$',

YataThkkar, 'remember$_{mas}$',

?X, 'brother').

The sets were constructed using 12 masculine nouns and their feminine

counterparts and 12 transitive verbs (see Appendix A). Ten of the nouns were feminized

using the Arabic feminine morpheme /a/, for example (*UstaaTh*, 'teacher $_{mas}$'→

UstaaTha, 'teacher $_{fem}$'). However, two of these nouns had irregular feminine

counterparts, that is, the feminine counterpart was not formed by adding the Arabic

feminine morpheme /a/, but it was indicated by using a different word. These nouns are:

(*walad*, 'boy'→ *ben*t, 'girl'), (*?x*, 'brother'→ *?xt*, 'sister'). Then, each of these 48

sentences, 24 sentences for each word order, were varied with respect to the subject-verb

agreement as follows: only the first noun (1N) agrees with the verb; only the second noun

(2N) agrees with the verb; both nouns agree with the verb (Amb).[16] This yielded a total of

144 experimental sentences. All sentences were semantically reversible, that is, either

noun could perform the action. More importantly, the semantic plausibility was balanced

in all sentences by making sure that either noun could equally be the subject of the

sentence. Previous research shows, for example, that children and non-native speakers are

likely to choose *mother* as the subject in the sentence *the baby feeds the mother* because

in the real world this is the only plausible interpretation (Bates et al., 1984, p. 342).

Studies that align with the CM framework usually employ anywhere from one to four

sentences per condition, and a large number of participants (e.g., Bates, McNew,

MacWhinney, Devescovi, & Smith, 1982; Gass, 1987; Taman, 1993). As will be

discussed later, this study, while it included almost all the Arabic L2 learners at the

University of Utah, was still limited by the small number of participants, especially those

in the third year (6 participants). Thus, to increase the power of the statistical analysis,

there were 8 sentences per condition. Twenty-four filler sentences were constructed using

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[16] For the sake of simplicity, the following abbreviations are used in this thesis; (1) to refer to the word order conditions used in this study: NVN, and VNN; (2) to refer to the subject-verb agreement conditions: 1N agrees, 2N agrees, and Amb; finally, for a specific condition yielded from the combination of the two variables: word order and subject-verb agreement: NVN_1N, NVN_2N, NVN_Amb, VNN_1N, VNN_2N, and VNN_Amb.

12 nouns, intransitive verbs, and prepositions. There were lexical items used in the fillers that had not been used in the experimental sentences. (See Appendix A for the complete set of the lexical items used to construct the experimental and filler sentences).[17] Adding the fillers had a twofold purpose: (1) To distract the participants from the pattern of the experimental sentences; and (2) to indicate if some participants were not invested in the task or if they did not comprehend the sentences. All lexical items were chosen from the first year textbook to help ensure that participants were familiar with them.

A total of 168 sentences (144 experimental and 24 filler sentences) were used for the study; 84 of the 168 sentences exhibit VNN order. Three lists were created from the 144 experimental sentences. In each list, one of the variation conditions of each "two nouns and one transitive verb" set appeared. In NVN, for instance, one variation of the three subject-verb agreement options (1N, 2N, Amb) appeared in each group. Selecting one variation of the agreement conditions was done to minimize the possible effect of seeing the same lexical items more than once, and to force the participants to read each sentence. Choosing one condition of the three agreement options in each group yielded 48 experimental sentence blocks. The same 24 filler sentences were added to each block, which created a 72 sentence block (which resulted in 168 different sentences and a total of 216 sentences). Table 3.3 shows a sample of each condition of the sentences used, as well as the fillers.

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[17] The following lexical items were only used in filler sentences: all the verbs (contrary to the verbs used in the experimental sentences, all filler verbs were intransitive), the prepositions, and three nouns—*yutah*, 'Utah,' *Jami3a*, 'University,' *assaf*, 'the class.'

Table 3.3 Stimuli examples

Word order	Example	Subject-Verb variation

VNN	(1) yadrub alwalad albent
	    Hits-masculine the boy the girl.
	    The boy hits the girl.
		1N only agrees with the verb.

	(2) tadrub alwalad albent
	    Hits-feminine the boy the girl.
	    The girl hits the boy.
		2N only agrees with the verb.

	(3) yudarres alwalad altalib
	    Teaches-masculine the boy the student-masculine.
	    The boy teaches the student.
		Ambiguous; both nouns agree with the verb.

	(4) yadrus alwalad ma3 albent
	    studies-masculine the boy with the girl.
	    The boy studies with the girl.
		Filler

NVN	(5) albent tudarres alwalad
	    The girl teaches-feminine the boy.
	    The girl teaches the boy.
		1N only agrees with the verb.

	(6) alwalad tudarres albent
	    The boy teaches-feminine the girl.
	    The boy teaches the girl.
		2N only agrees with the verb.

	(7) Altaleba tadrub albent
	    The student-feminine hits-feminine the girl
	    The student hits the girl.
		Ambiguous; both nouns agree with the verb.

	(8) Albent tadrus ma3 alwalad
	    the girl studies-feminine with the boy.
	    The girl studies with the boy.
		Filler

3.2.1.1 Characteristics of the noun phrases

Each experimental sentence consisted of two noun phrases (NP1, NP2) and one transitive verb; there were two orders: NP1-V-NP2 and V-NP1-NP2 to resemble the NVN and VNN manipulation used in the study. Each noun phrase consisted of the following components: (1) a singular noun that always referred to a human being, (2) either (a) the Arabic definite article "al, the", or (b) the possessive pronoun "ii, my." Adding either (a) or (b) maintained the grammaticality of the sentences by making the noun definite; Arabic sentences do not start with an indefinite noun (Mohammad, 2000). Both the definite article and the possessive pronoun "ii, my" were used because, for some lexical items (e.g., girl) in Arabic, it is more appropriate and sometime necessary, in order to maintain the meaning of the lexical item, to use the definite article rather than a possessive pronoun. If the possessive pronoun were to be added for *girl*, the meaning would change from 'girl' to 'daughter.' This raised the following issue: When the possessive pronoun was added to a feminine noun, the feminine marker was no longer the last morpheme in the noun phrase and it became less salient than if the definite article was added. See example 3.2 for an illustration.

Ex 3.2 (a): *Habiiba*, 'lover$_{fem}$' → *Habiibatii*, 'my lover$_{fem}$.'

(b): *UstaaTha*, 'teacher$_{fem}$' →*Al-UstaaTha*, 'The teacher$_{fem}$.'

The definite article was used only with four masculine nouns and their feminine counterparts (doctor, teacher, student, and boy.) An analysis was run to make sure that participants' performance did not differ in sentences that had a more salient feminine marker—that is, sentences with the definite article—than those that had a less salient feminine marker—that is, sentences with the possessive pronoun. The results did not

show any significant difference.

Each filler sentence consisted of the following elements: noun phrase (NP), prepositional phrase (PP), and one intransitive verb. Nominal sentences had the following orders: (PP –NP–V), and (NP–V –PP). Verbal sentences had the following orders: (PP – V–NP), and (V–NP –PP). It should be noted that sentences that started with the PP, while grammatical, are less common if the noun in the NP is definite, and are used for pragmatic reasons. However, they were constructed and used in this study in order not to have a first noun bias; the subject of these sentences was always the second noun, not the noun in the PP.

3.2.1.2 Verb morphology

Arabic has a rich morphology. As explained in Chapter 1, in a VS cluster, verbs agree with the subject in person, gender, and number. However, in SV structure, verbs agree with the subject in person and gender, but its number is always singular. In this study, both SV and VS structures were used; thus, to control for this issue, both nouns were singular. The verb in experimental, filler, and practice sentences was in the simple present tense. This was because participants in the first year, at the time of the experiment, were newly introduced to the past tense morphemes. Finally, the verb was always conjugated to a third person.

3.2.2 Other material

Besides the stimuli, the following materials were used in this study: consent form, background questionnaire, vocabulary training delivered by DMDX (Forster & Forster,

2003), and a vocabulary quiz.[18] The consent form informed the participants that they will participate in an Arabic study that aimed to gain a better understanding of second language learners' knowledge. No specific information about the purposes of the study was provided in the consent form, but it mentioned that the Arabic program might benefit from their participation. The background questionnaire gathered information about the participants' native language, their history studying Arabic, any visual impairments, and information about what they think the study is about (see Appendix B).

The vocabulary training session was carried out using the DMDX software (Forster & Forster, 2003). It aimed to familiarize the participants with the vocabulary used in the experiment. Each lexical item used in the experiment appeared in Arabic accompanied with its English meaning on the middle of the screen (see Figure 3.1). It should be noted that nouns appeared in masculine form only, except for irregular nouns which appeared in feminine and masculine forms. Finally, a vocabulary test was administered in which students were asked to write the English meaning of the Arabic words after they had finished the experiment.

3.3 Procedure

To avoid self-selection, all the students from each Arabic class came to a lab during their regular class time accompanied by their instructor.[19] They were randomly assigned a computer to use to achieve an equal number of students per experimental block. After the instructor had left, the experimenter asked for volunteers to participate in

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[18] DMDX is software created and maintained by Ken Forster and Jonathan Forster at the University of Arizona (Forster and Forster, 2003), and has been used in many language processing studies that require a binary decision, such as this one.

[19] Brown (1988) points out that researcher should control for self-selection, as students who volunteer to participate might have special motivations. He provided extensive lists for variables that might confound the results of a research project. However, as explained earlier, factors that might affect L2 acquisitions such as type of instructions, motivation, etc. are outside of the scope of this study.

friend   صديق

Figure 3.1 Example from the vocabulary training session.

a study. Students, who agreed to participate, completed and signed the consent form.

After the participants had received instructions, they completed the experiment at their

own pace. The experiment started with a vocabulary training session to familiarize the

participants with the lexical items used in the experiment. The purpose of the vocabulary

training session was to moderate and reduce the possibility that any incorrect answers

were due to the lack of knowledge of the lexical items. Each lexical item remained on

the screen for ten seconds or until the participant pressed the SECOND key.[20]

After that, participants performed a practice set of six sentences to familiarize

themselves with the experiment. Then, they proceeded to the actual experiment and

completed the task of choosing the noun that they thought was the subject in a simple

sentence with two nouns. Before the experiment started, written instructions notified the

participants to push FIRST (right shift) if the subject of a sentence which they read was

the first noun, and SECOND (left shift) if the subject of a sentence which they read was

the second noun; see Appendix C for the complete instructions the participants

encountered during the experiment. DMDX presented the sentences in random order, and

each sentence appeared for a maximum of nine seconds, or until the participants made a

response. A pilot study, run on a beginner NNS who did not participate in this study,

showed that the nine seconds were sufficient for the participant to read the sentence and

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[20] The right shift key was labeled with FIRST while the second shift key was labeled with SECOND for all
the computers used in the experiment.

to make a response.[21] Participants were instructed to ignore the sentence if it disappeared before they responded, and move on to the following one. A "+" sign appeared before each sentence in order to notify the participants that a stimulus was about to appear. At the end of the experiment, the participants completed a paper-and-pencil vocabulary quiz to make sure they knew the meaning of the lexical items that appeared on the test, and then filled out the background questionnaire. Each participant completed the experiment within 30 minutes.

<div align="center">3.4 Scoring and data analysis</div>

The dependent variable-frequency of choosing 1N- was calculated as a function of subject-verb variation for each group of students within the VNN and NVN word order. A score of 1 was awarded when the participant chose the first noun as the subject of the sentence, and a 0 score was given when the participant chose the second noun. To further explain, a score of 80% means that the participant chose the first noun 80% of the time, while they chose the second noun 20% of the time.

Missing data, for example, when the sentence timed out before the participant answered, were eliminated. This affected 8.37% of the results. The missing data constituted 8.52% of the beginner, 7.29% of the intermediate, and 11.11% of the advanced groups' responses. Then, the mean of choosing the first noun per condition was calculated for each group. First, the data for each group of L2 learners were submitted to an analysis of variance (ANOVA) with subject-verb agreement (1N, 2N, Amb), and word

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[21] In the reviewed literature, researchers allocated between three to ten seconds for each experimental sentence (MacWhinney & Pleh, 1988; Li, Bates, & MacWhinney, 1993). None of the researchers provided a rationale for the exact time provided. Thus, it was necessary to ensure that the allocated time is sufficient for participants to read the sentence, and for that reason, a pilot study was conducted before running the experiment on the participants.

order (NVN, VNN) as within-subject variables. Then, the data were submitted to

ANOVA with group of learners (Beginner, B; Intermediate, I; Advanced, A) as a

between-subject variable, and with subject-verb agreement (1N, 2N, Amb) and word

order (NVN, VNN) as within-subject variables. Paired sample t-tests were used to

evaluate the differences between the six conditions within each group, as well as across

the groups. The Beginner group's results, from ANOVA and paired sample t-tests, were

used to answer the first research question, while the results from the Intermediate and

Advanced groups along with the Beginner group's results were used to answer the second

research question. Following (MacWhinney, Bates, & Kliegl, 1984), the main effect for

word order and subject-verb agreement as well as their effect sizes (η^2_p) were calculated.

The interaction between word order and subject-agreement was also examined as it

illustrates the dominance of each cue (Brandl, 2008, p. 88)

CHAPTER 4

RESULTS

4.1 Introduction

This chapter presents the results of this study beginning with the average of the first noun choice and standard deviation (SD), then proceeds to the ANOVA with subject-verb agreement (1N, 2N, Amb) and word order (NVN, VNN) as within-subject variables for each group individually. The interaction of word order and verb agreement will be presented along with paired sample t-tests to evaluate each group's performance on the two independent variables. Then, it presents the ANOVA with group of learners (Beginner, B; Intermediate, I; Advanced, A) as a between-subject variable, and with subject-verb agreement (1N, 2N, Amb) and word order (NVN, VNN) as within-subject variables; this ANOVA will be referred to as complete ANOVA to differentiate it from the former mentioned ANOVA. Alpha level is set at 0.05 unless otherwise stated. As a reminder, this study posed two research questions:

- To what extent do L2 learners of Arabic enrolled in their first year show L1 (English) transfer by using word order to assign a subject role to Arabic sentences?

- Does more exposure to Arabic, measured by the enrollment year, result in declining use of word order and increased reliance on verb agreement and if so, to what extent?

4.2 Average of 1N choice

Figure 4.1 shows that there was a tendency for all groups to select the first noun; however, there was variation among the groups across the verb-subject and word order conditions. This variation is illustrated in Table 4.1, which shows the average for the first noun choice for each L2 NNS group across the six conditions: NVN_1N, NVN_2N, NVN_Amb, VNN_1N, VNN_2N, and VNN_Amb. As predicted, the data shows that regardless of the agreement condition, the Beginner group participants selected the 1N with an average of 0.917 in the canonical word order NVN, while they chose the 1N with an average of 0.527 in the noncanonical word order VNN across all the agreement conditions. These results are compatible with the research on native English speakers with respect to the robust first noun strategy reported, that is, choosing the first noun as agent in the NVN word order. On the other hand, the results of this study do not replicate the second noun strategy found in the noncanonical word order VNN: That in the VNN order, English speakers overwhelmingly prefer the VOS interpretation (Bates et al., 1999; Bates, McNew, MacWhinney, Devescovi, & Smith, 1982; Brandl, 2013; MacWhinney, Bates, & Kliegl, 1984; Su, 2001; among others). In contrast to previous findings, participants in this study did not show a preference for the VOS interpretation in the VNN condition. For the Intermediate and Advanced groups, participants' performance was not dependent on the word order, but it was on the verb agreement condition. However, the two groups' responses were less native-like in the 2N agrees condition in both word order conditions. Table 4.1 illustrates that both groups selected the first noun as agent more in 1N agrees and Amb conditions in both word orders.

The percentages of first noun choice dropped in the 2N agrees condition for NVN
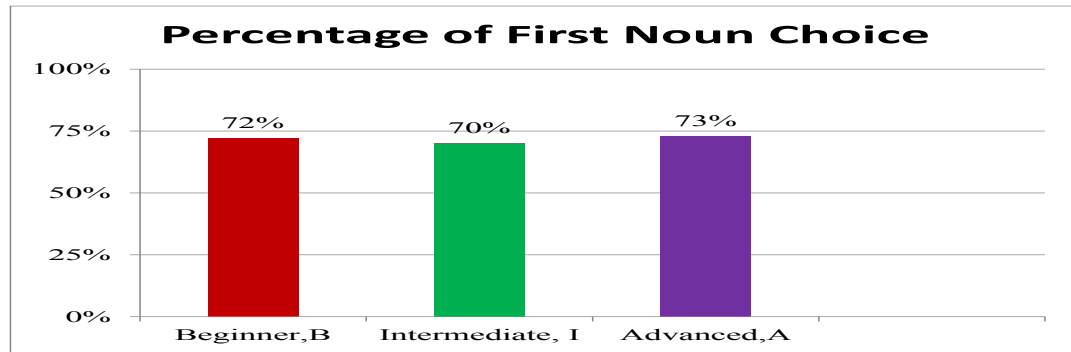
Percentage of First Noun Choice

Figure 4.1: Average percentages of the three L2 groups 1N choice in all of the experimental sentences

Table 4.1 Average and SD for B, I, and A groups' First Noun choice.
Note: NVN= noun verb noun, VNN= verb noun noun, 1N= verb agrees with the first noun, 2N= verb agrees with the second noun, Amb= verb agrees with both nouns.

Average and standard deviation for first noun choice							
Group		NVN_1N	NVN_2N	NVN_Amb	VNN_1N	VNN_2N	VNN_Amb
Beginner, B, n= 22	Mean	0.94	0.92	0.89	0.54	0.51	0.53
	SD	0.09	0.17	0.17	0.33	0.33	0.33
Intermediat, I, n= 18	Mean	0.96	0.45	0.97	0.79	0.32	0.70
	SD	0.08	0.35	0.08	0.31	0.22	0.30
Advanced, A, n=6	Mean	0.90	0.56	0.81	0.77	0.56	0.81
	SD	0.12	0.41	0.20	0.23	0.32	0.23

and VNN orders.[22] It is worth mentioning that the L2 groups' responses were more consistent (small SD in comparison with other conditions) in the NVN word order compared with the VNN word order. However, the responses were less consistent in the 2N agrees condition for the Intermediate group, and no difference was observed for the Advanced group.

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[22] Data from three native speakers was collected to confirm the researcher's assumption about how NS of Arabic interpret the sentences in the Amb condition. The Intermediate and Advanced groups' results resembled the native speakers' data; however, the native data showed: (a) less variation, measured by the standard deviation, (b) a higher average in choosing the 1N for the 1N agrees, and Amb agree conditions, and (c) a lower average in choosing the 1N for the 2N condition.

4.3 ANOVA results

To evaluate the differences in the responses presented above, the results of an ANOVA performed on the data are presented in Table 4.2 for the three L2 groups individually. Table 4.3 illustrates the complete ANOVA, which is necessary to show the interactions among the groups (B, I, A).The results of the ANOVA are first presented for the Word Order (WO) condition, and then for the Verb Agreement (AG) condition across the groups. After that, the interactions among WO and AG are presented for each group. Finally, the interaction between WO, AG, and group (G) is presented as they shed light on how the three groups differed in using word order and verb agreement to assign agency.

Table 4.2 ANOVA for B, I, and A group First Noun choice

ANOVA for the each NNS group *First Noun Choice*

Group	Source	df	Mean Square	F	Sig. (p)	Partial Eta Squared (effect size)	Observed Power[a]
Beginner, B	Verb Agreement (AG)	2	0.09	0.53	0.59	0.00	0.14
	Word Order (WO)	1	40.14	249.59	0.00	0.21	1.00
	AG * WO	2	0.12	0.75	0.47	0.00	0.18
	Error	960	0.16				
Intermediate, I	Verb Agreement (AG)	2	19.64	128.68	0.00	0.24	1.00
	Word Order (WO)	1	7.17	46.98	0.00	0.06	1.00
	AG * WO	2	0.42	2.76	0.06	0.01	0.55
	Error	795	0.15				
Advanced, A	Verb Agreement (AG)	2	2.41	13.44	0.00	0.10	1.00
	Word Order (WO)	1	0.14	0.76	0.38	0.00	0.14
	AG * WO	2	0.10	0.57	0.57	0.00	0.14
	Error	250	0.18				

a. Computed using alpha = .05

Table 4.3 Complete ANOVA for B, I, and A group First Noun choice

Source	df	Mean Square	F	Sig. (p)	Partial Eta Squared (effect size)	Observed Power[a]
Verb Agreement (AG)	2	10.958	68.554	.000	.064	1.000
Word Order (WO)	1	16.675	104.320	.000	.049	1.000
Group (G)	2	.216	1.352	.259	.001	.293
AG * WO	2	.069	.432	.649	.000	.121
AG * G	4	5.075	31.748	.000	.060	1.000
WO * G	2	4.534	28.365	.000	.028	1.000
AG * WO * G	4	.306	1.914	.105	.004	.582
Error	2005	.160				

a. Computed using alpha = .05

4.3.1 Word order condition

There was a main effect for word order on the Beginner and Intermediate groups but not the Advanced group. In the Beginner group, participants chose the first noun 91.7% of the time in the NVN word order and only 52.7% of the time in the VNN word order. Again, these results align with CM studies on English native speakers for the NVN order only. The word order accounted for 21% of the variance in the Beginner group data. The Intermediate group selected the first noun 79.33% of the time in the NVN word order and 60.33% of the time in the VNN word order. Unlike the Beginner group, word order accounted for only 6% of the variance in the data. Finally, the Advanced group selected the first noun 75.67% of the time in the NVN word order, and 71.33% of the time in the VNN word order. Word order did not account for any variance in the Advanced group's responses.

The complete ANOVA revealed a significant interaction between word order and group: $F(2,2005) = 28.365$, $p < 0.05$, $\eta^2_p = 0.028$ (see Figure 4.2). Figure 4.2 shows that the Beginner group selected the first noun in the NVN word order more than the Intermediate and Advanced groups; and they selected the first noun less than the other group in the VNN condition. The percentage of choosing the 1N differed by groups across the word order conditions.

4.3.2 Verb agreement condition

The ANOVA showed a significant effect for the verb agreement variable in Intermediate and Advanced groups but not in the Beginner group. The verb agreement effect was not significant in the Beginner group; it did not account for any variance in the group's responses. As Table 4.1 shows, participants in this group assigned agency to the
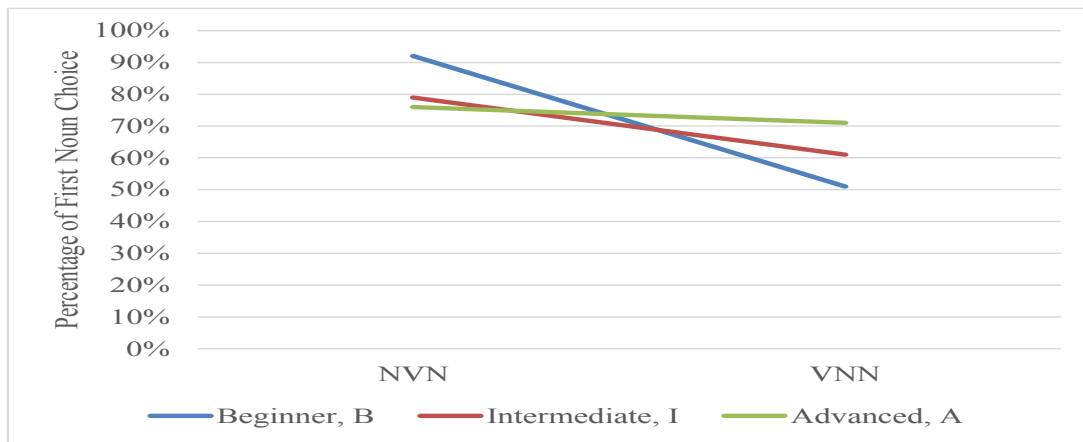
Figure 4.2 Group and word order interaction for the three L2 groups 1N choice

first noun with almost similar percentages across all the verb agreement conditions, with 74.00% of the time when the 1N agrees, 71.50% when the 2N agrees, and 71.00% for the Amb condition.[23]

On the other hand, the verb agreement variable accounted for 24% of variance in the Intermediate group's responses. Although relatively small, the effect of the verb agreement on the noun choice was higher for this group than the effect of word order, which accounted for 6% of the variance. The agency decision of the Intermediate group was clearly influenced by the verb agreement condition. In the 1N agrees condition, participants selected the first noun 87.50% of the time, in comparison with 38.50% of the time in the 2N agrees condition. However, they chose the first noun 83.50% of the time in the Amb condition. The results for the Advanced group largely followed the Intermediate group's pattern; however, there were some differences. The verb agreement in the Advanced group only accounted for 10% of the variance of this group's data. (Recall that the word order did not account for any variance in this group). Participants

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[23] While the paired sample t-tests (Table 4.5) did not reveal any significance difference between the verb agreement conditions in the Beginner group, the observed power was low (OP = 0.14,Table 4.2). Thus, the lack of significance is likely due the small sample size.

chose the first noun for 83.50%, 81.00% of the time for 1N agrees, and the Amb

conditions, respectively. Nevertheless, they chose the first noun 56.00% of the time in the

2N agrees condition. As expected, the interaction between group and verb agreement was

significant: $F(4,2005) = 31.748$, $p < 0.05$, $\eta^2_p = 0.060$ (see Table 4.3), and it is illustrated

in Figure 4.3.

Based on the results, and as predicted, the two cues used in this experiment, verb-

agreement and word order may be ranked as follows for each learner group:

Beginner: WO>AG.

Intermediate: AG>WO.

Advanced: AG>WO.

Next, the results of how the two cues interacted and how that interaction affects the

participants' performance are examined. The results of the interactions between word

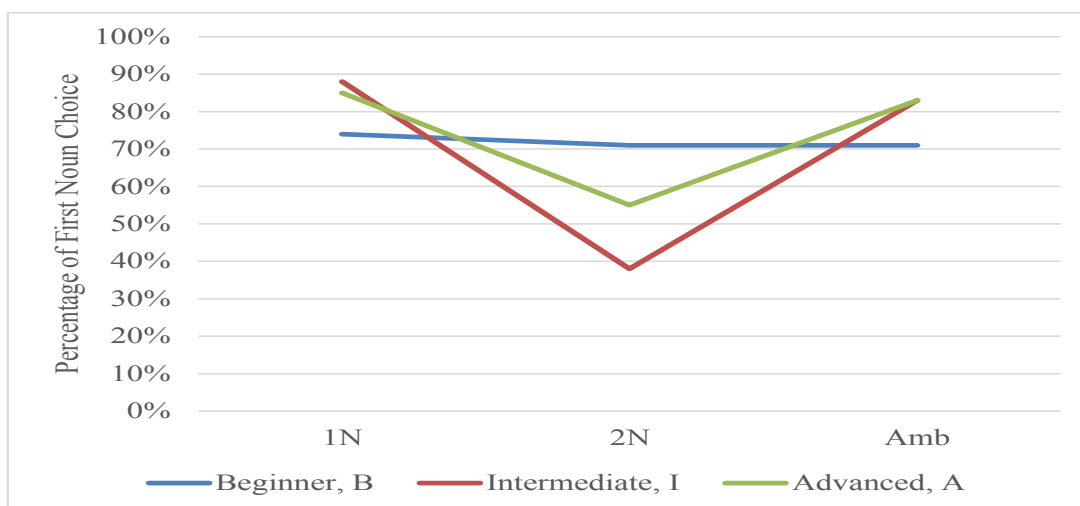order and verb agreement are presented for each group.

Figure 4.3 Group and verb agreement interaction for the three L2 groups 1N choice

4.4 Interactions of word order and verb agreement

4.4.1 Beginner group

The interaction between word order and verb agreement was not significant, $F(2,960) = 0.75$, $p < 0.47$, $\eta^2_p = 0$. Figure 4.4 demonstrates that within the same word order, the participants were consistent in selecting the first noun as agent. Participants chose the first noun as the agent 91.7% of the time in the NVN condition, regardless of agreement, while they selected the 1N with an average of 52.7% in the VNN condition, again disregarding verb agreement, the results from the VNN shows a slight tendency to choose first noun more than the second noun. Paired sample t-tests between: (1) word order conditions, and (2) agreement conditions confirmed these results, as shown in Table 4.4 and Table 4.5.

Table 4.4 shows that the Beginner group participants selected the first noun significantly more in the NVN condition compared with the VNN condition, regardless of verb agreement. At the same time, Table 4.5 indicates that within the same word order condition, participants picked the first noun, to an approximately equal extent in the three verb agreement conditions. There was no significant difference between the three verb agreement conditions within the same word order.

4.4.2 Intermediate group

The interaction among word order and verb agreement was not significant for the Intermediate group, where $F(2,795) = 2.79$, $p < 0.06$; however, it approached significance. This is illustrated in Figure 4.5; participants chose the first noun in the NVN when the verb agreed with the first noun or the ambiguous conditions more often than when the
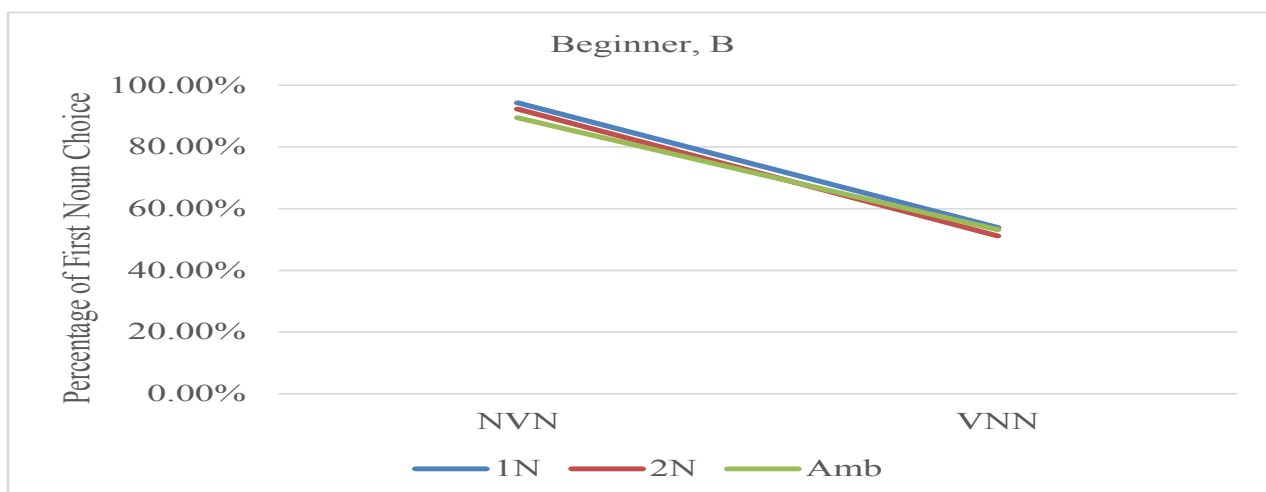
Figure 4.4 WO and AG interaction for B group 1N choice

Table 4.4 Comparisions between word order conditions for the B group

Beginner			
Verb agreement	Percentage of first noun choice	Mean difference	ηp2
1N	NVN > VNN	0.40352***	0.0714
2N	NVN > VNN	0.41082***	0.082
Ambiguous	NVN > VNN	0.36255***	0.0807

* p < .05, ** p < .01, *** p < .001

Table 4.5 Comparisons between agreement conditions for the B group

Beginner			
Word order	Percentage of first word noun choice	Mean difference	ηp2
NVN	1N ≈ 2N	0.0204	0.0381
NVN	1N ≈ Ambiguous	0.048	0.0329
NVN	2N ≈ Ambiguous	0.0276	0.0203
VNN	1N ≈ 2N	0.02771	0.0569
VNN	1N ≈ Ambiguous	0.00703	0.0437
VNN	2N ≈ Ambiguous	-0.02067	0.041

Figure 4.5 WO and verb AG interaction for I group 1N choice

verb agreed with the second noun. The same pattern applies to the VNN order; however, their performance in the VNN order was less native-like than their performance in the NVN word order, except for the 2N agrees condition.
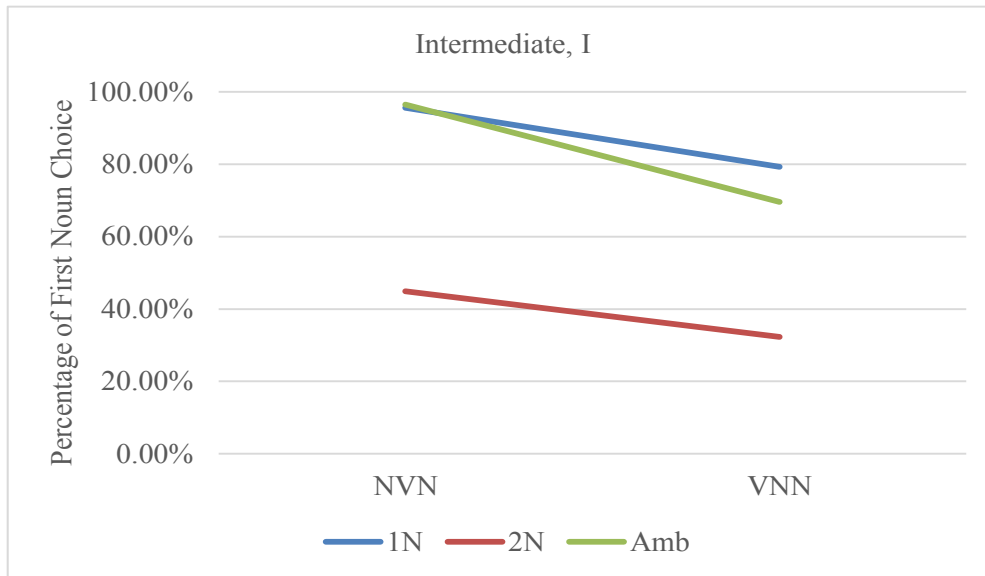
Paired sample t-tests between the word order conditions, illustrated in Table 4.6, show that the participants chose the first noun significantly more often in the NVN condition for the 1N and Amb verb agreement conditions as compared with the VNN condition. Nevertheless, their performance in the NVN and the VNN word order conditions tested in this study was not significantly different in the 2N agrees condition.

Paired sample t-tests between the verb agreement conditions, illustrated in Table 4.7, show that the participants chose the first noun significantly more often in the 1N and Amb conditions in comparison with the 2N condition for both word orders. On the other hand, there was no significant difference between the 1N agrees and the Amb conditions in either of the word order conditions.

Table 4.6 Comparisons between word order conditions for the I group

Intermediate			
Verb agreement	Percentage of first noun choice	Mean difference	$\eta p2$
1N	NVN > VNN	0.16369*	0.0712
2N	NVN ≈ VNN	0.12606	0.0743
Ambiguous	NVN > VNN	0.26918**	0.0701

* p < .05, ** p < .01, *** p < .001

Table 4.7 Comparisons between agreement conditions for the I group

Intermediate			
Word order	Percentage of first word noun choice	Mean difference	$\eta p2$
NVN	1N > 2N	0.50774***	0.0928
NVN	1N ≈ Ambiguous	-0.00893	0.0168
NVN	2N < Ambiguous	-0.51667***	0.0843
VNN	1N > 2N	0.47011***	0.1044
VNN	1N ≈ Ambiguous	0.09656	0.0599
VNN	2N < Ambiguous	-0.37354**	0.0897
* p < .05, ** p < .01, *** p < .001			

4.4.3 Advanced Group

Similar to the Beginner group, there was no significant interaction among word order and verb agreement for this group of participants: $F(2,250) = 0.57$, $p < 0.57$. However, Figure 4.6 resembles the Intermediate group performance (see Figure 4.5). The lack of significance is likely due to the small number of participants ($n = 6$) in this group; the low observed power (OP) of this interaction (OP = 0.14) indicates that the sample size was inadequate (see Table 4.2).[24]

Table 4.8, and Table 4.9 show the paired sample t-tests between the word order conditions, and between the verb agreement conditions, respectively. As stated earlier,

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[24] Conventionally, 0.80 is the minimum level of power researchers strive for to detect statistical significance.
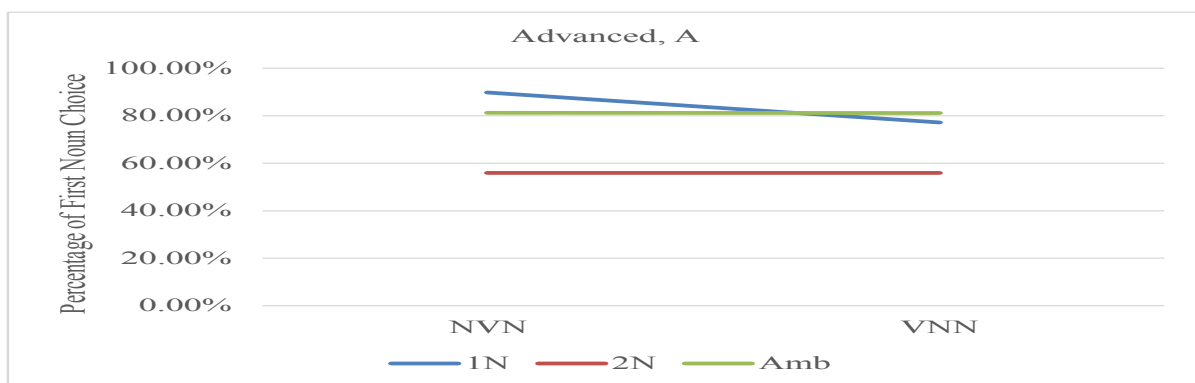
Figure 4.6 WO and AG interaction for A group 1N choice

Table 4.8 Comparisons between word order conditions for the A group

Advanced*			
Verb agreement	**Percentage of first noun choice**	**Mean difference**	**ηp2**
1N	NVN ≈ VNN	0.12619	0.089
2N	NVN = VNN	0	0.1435
Ambiguous	NVN ≈ VNN	0.0006	0.0868
*N = 6; thus, this analysis lacked sufficient statistical power to detect any significant differences.			

Table 4.9 Comparisons between agreement conditions for the A group

Advanced*			
Word order	**Percentage of first word noun choice**	**Mean difference**	**ηp2**
NVN	1N ≈ 2N	0.33869	0.1826
NVN	1N ≈ Ambiguous	0.08571	0.0621
NVN	2N ≈ Ambiguous	-0.25298	0.1634
VNN	1N ≈ 2N	0.2125	0.1834
VNN	1N ≈ Ambiguous	-0.03988	0.1406
VNN	2N ≈ Ambiguous	-0.25238	0.113
*N = 6; thus, this analysis lacked sufficient statistical power to detect any significant differences.			

the small number of participants is likely the reason why the analysis did not reveal any

significant difference between: (1) the word order conditions, which could indicate that

participants chose the first noun equally in both word order, regardless of the verb

agreement choice; or (2) the verb agreement conditions, which might suggest that

participants selected the first noun equally in the three verb agreement conditions,

regardless of the word order. Nevertheless, the average of first noun choice presented in

Table 4.1 and in Figure 4.6, and as mentioned earlier, show that the participants did choose the first noun more often in the 1N agrees and the Amb conditions, as compared with the 2N agrees condition.

<div align="center">4.5 Interactions of Word Order, Verb Agreement, and Group</div>

There was no significant interaction between word order, verb agreement, and group, where $F(4,2005) = 1.914$, $p < 0.105$. Nevertheless, the result approached significance. See Figure 4.7.

Table 4.10 summarizes the paired sample t-tests for the three groups. For the NVN word order condition, there were no significant differences between the three groups of learners in the 1N agrees condition. However, for the 2N agrees condition, the Beginner group chose the first noun significantly more often than either the Intermediate or the Advanced groups, there was no significant difference between the Intermediate and Advanced groups' responses. For the ambiguous verb agreement condition, the Beginner group's performance did not differ from the other groups' performances. Interestingly, there was a significant difference between the performances of the Intermediate and the Advanced group. For the VNN word order, only two significant differences existed in the performances of the three groups in all of the verb agreement conditions: (1) the Intermediate group chose the first noun significantly more often than the Beginner group in the 1N agrees condition, and (2) the Intermediate group selected the first noun significantly less often than the Beginner group in the 2N agrees condition. In these two cases, the Intermediate group's performance was, as expected, more native-like than the Beginner group.
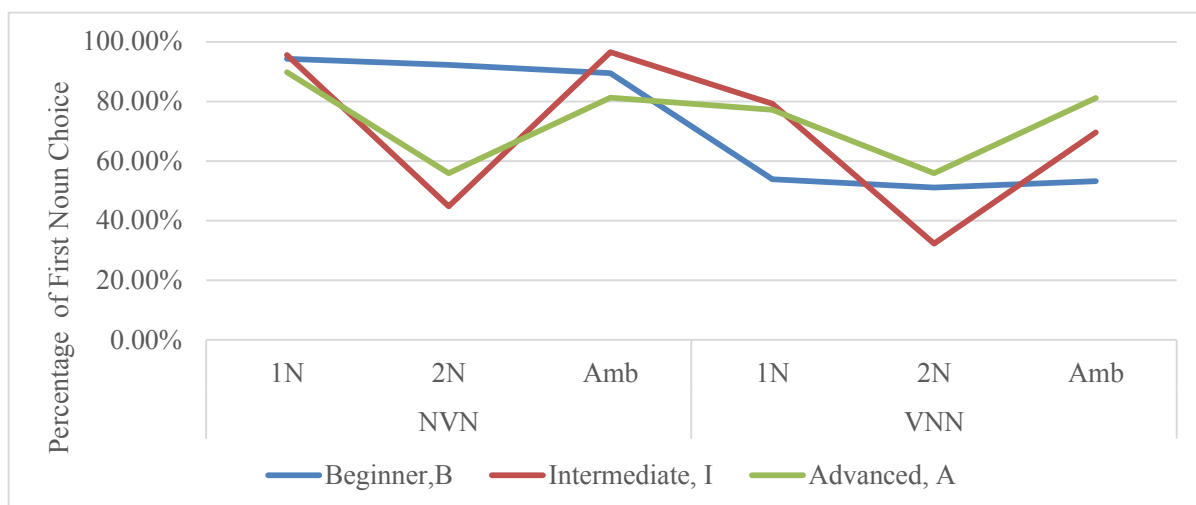
Figure 4.7 WO, AG, and G interaction of 1N choice

Table 4.10 Paired sample t-tests for B, I, and A groups

Word Order	Verb Agreement	Percentage of first noun choice	F	η_p^2
NVN	1N	Beginner ≈ Intermediate	0.226	0.005
		Beginner ≈ Advanced	1.156	0.026
		Intermediate ≈ Advanced	1.881	0.042
	2N	Beginner > Intermediate	27.014***	0.386
		Beginner > Advanced	7.545**	0.149
		Intermediate ≈ Advanced	0.673	0.015
	AMB	Beginner ≈ Intermediate	2.374	0.052
		Beginner ≈ Advanced	1.538	0.035
		Intermediate > Advanced	5.064*	0.03
VNN	1N	Intermediate > Beginner	6.579*	0.133
		Beginner ≈ Advanced	2.644	0.058
		Intermediate ≈ Advanced	0.02	0
	2N	Beginner > Intermediate	4.12*	0.087
		Beginner ≈ Advanced	0.127	0.003
		Intermediate ≈ Advanced	2.945	0.064
	AMB	Beginner ≈ Intermediate	2.756	0.06
		Beginner ≈ Advanced	3.822	0.082
		Intermediate ≈ Advanced	0.625	0.014

* p < .05, ** p < .01, *** p < .001

CHAPTER 5

DISCUSSION

This chapter will discuss the main findings of the study as they pertain to the
research questions that motivated this study. It will then present the study's limitations
and conclude with suggestions for future research directions.

Building on the CM model for L1 acquisition, L2 processing studies predicted
that L2 learners would initially transfer their L1 knowledge and would process L2
sentences by means of the most valid cue in their L1. Then, as their proficiency increased
they would shift to using the cues that are valid in that L2. L2 research findings are
contradictory: some findings report L1 transfer of what the CM referred to as *syntactic
accent* and a shift toward L2 cues as proficiency increases (MacDonald, 1987b); other
studies propose that L2 learners use universal cues such as animacy over syntactic cues
because these cues are cognitively less demanding and costly (Gass, 1987). To this end,
this study aimed to test the CM predictions and investigate: (1) if beginning Arabic
learners will transfer their L1 (English) processing cues and use word order to interpret
Arabic sentences; and (2) if more exposure to Arabic leads LL2 to abandon L1 cues and
use verb agreement to assign agency. The hypothesis was that the Beginner group would
not utilize the verb agreement cue and would rely on L1 processing cues to assign
agency. Moreover, it was predicted that L2 learners' processing mechanism would tend
to shift toward native-like processing as they progress from beginning levels of learning

to more advanced levels. The hypothesis for the first research question was partially confirmed: The Beginner group's results revealed that participants did not use the verb agreement cue and used word order to complete the task. Nevertheless, participants' performance on the VNN word order neither confirmed nor refuted L1 processing which was observed in the NVN word order condition. In fact, other alternatives, for example, universal FNP, can explain the data from the both word order conditions. Thus, a firm answer to this question cannot be provided based on the results from this study. There is a need for longitudinal study, and until more research is conducted the lack of evidence for the second noun strategy does not necessarily suggest that there is [no] L1 transfer.

Similarly, the hypothesis for the second research question was partially supported: there is tentative evidence that the performance of the three groups moved toward a native-like behavior as their exposure to the language increased. However, there were some cases in which the Intermediate group's responses were more native-like than the Advanced group's responses. The next section discusses the main findings in further detail.

5.1 Addressing the research questions

Research question 1 reads, "To what extent do L2 learners of Arabic enrolled in their first year show L1 (English) transfer by using word order to assign a subject role to Arabic sentences?"

The Beginner group showed high reliance on word order to assign agency. Word order accounted for 21% of variance in the group's responses, while verb agreement did not account for any variance (Table 4.2). No significant interaction between the word order and verb agreement was found in the beginner group: $F_{(2,960)} = 0.75$, $p < 0.47$,

$\eta^2_p = 0$. To explain, within the same word order, participants' percentage of first noun choice was not affected by the verb agreement condition; they were consistent in choosing the first noun as agent in the NVN sentences, and performing at chance in the VNN sentences across all the verb agreement conditions (Figure 4.4). The reliance on word order rather than verb agreement was confirmed by the paired samples t-tests which show: (1) that the Beginner group chose the first noun significantly more often in the NVN order than the VNN order (Table 4.4); and, (2) that no significant difference existed across the verb agreement conditions (Table 4.5). This group's reliance on word order was clearly manifested in the NVN_2N condition. In the NVN_2N condition, the Beginner group selected the first noun 92.00% of the time (Table 4.1). The native-like choice would be choosing the second noun as the subject of the sentence, which would lead to a low first noun choice percentage. Choosing the first noun for this condition with such a relatively small variation (SD = 0.17, Table 4.1) clearly demonstrates that the participants in this group did not pay attention to the verb agreement cue in these sentences.

The Beginner group's data illustrate a contrast in participants' behavior between the NVN order and the VNN order. The results from the NVN sentences align with research on English native speakers, which shows that they interpret the NVN sentences as SVO sentences (Bates & MacWhinney, 1981, 1982; McDonald, 1987a), and suggest that this group used their L1 to process the sentences. However, the pattern observed in the VNN sentences neither confirmed nor refuted L1 processing. To illustrate, according to CM studies, English native speakers apply a second noun strategy to the noncanonical orders, VNN and NNV. This means that the Beginner group was expected to interpret the

VNN sentences as VOS sentences, which would translate to a low first noun choice in all the VNN sentences regardless of the verb agreement condition. However, participants in the Beginner group performed at chance across all verb agreement with a small tendency to choose the first noun as an agent (Table 4.1). One possible explanation for the contrasts in the participants' behavior on the word order conditions relates to the fact that English is rigidly a NVN language with SVO interpretation except in passive sentences (MacWhinney, Bates, & Kliegl, 1984). On the other hand, Arabic has free word order, (refer to Chapter 1 for restrictions on word order in Arabic) with NVN and VNN word orders more common than the NNV.

The difference between the two languages is not only in the different word order, but also in the interpretations allowed within these word orders. In the NVN word order, Arabic allows SVO, which aligns with the most common interpretation in English; although, it is rare, Arabic, unlike English, also allows OVS sentences. The interpretations of VNN word order highlight the differences between the two languages; in Arabic the most common interpretation is the VSO sentences, but the rare VOS interpretation is also allowed, while in English VNN is always interpreted as VOS (MacWhinney, Bates, & Kliegl, 1984; McDonald, 1987a). Thus, the similarity between interpretations of the NVN word order across the two languages might have caused the L2 learners to not pay attention to verb agreement and to assume that the NVN Arabic sentences are always SVO sentences. MacWhinney (2001) refers to this sort of transfer as *positive transfer* (p. 80). Recall that the textbook used in first and second year explicitly introduces the NVN sentences as only SVO sentences for the sake of simplicity. On the other hand, the difference in interpreting VNN sentences between the two languages, as

well as the explicit instruction received from the textbook and their instructors about the order of Arabic verbal sentences, might have helped the L2 learners to suppress their L1 interpretation (VOS) to some degree. This assumption aligns with MacWhinney's (1997) claim that [beginner] L2 learners start learning their L2 by transferring everything that could be transferred from their L1 (p. 119). This is to say that the participants in this group might have started with VOS interpretation based on second noun bias found in NS of English; however, they moved to the VSO interpretation because of the explicit grammar instruction they received. MacWhinney (2005) claims that when learners detect errors caused by L1 transfer, they might be able to suppress this incorrect transfer (p. 57). High variability in the VNN order in comparison with the NVN was observed (Table 4.1), which might suggest that some learners detected that the direct transfer to the VNN yields misunderstanding, and that they needed to adjust their hypotheses about the VNN order in Arabic.

Now, the question raised here becomes, "Do these findings support the L1 transfer?" As discussed above, the results from the NVN order support the L1 transfer, while the VNN findings did not align with prior research findings. Some scholars proposed that L2 learners resort to universal strategies in interpreting L2 sentences, for example, first noun principle (FNP) (VanPatten, 2007). This principle states that "learners tend to process the first noun or pronoun they encounter in a sentence as the subject" (p. 122). The data from the NVN aligns with VanPatten's FNP. Moreover, the FNP explain the results from the VNN sentences; as with the L1 transfer explanation, we can argue that the participants start with the VSO order, and after spending almost two semesters learning the target language, their interlanguage is reorganizing to integrate the

verb agreement cue. That being said, it is not clear why they would shift from using the

FNP in interpreting VNN sentences and start to choose the second noun (Figure 4.2) as

an agent if the textbook explicitly interprets the VNN word order as VSO. Thus, it is

more plausible to assume that they started with their L1 assumption that VNN word order

is a VOS sentence; then later, with the explicit instruction they received, they shifted

toward a VSO interpretation.

Whether or not L1 transfer was involved cannot be conclusively determined from

the current data. The data did demonstrate, however, that the Beginner group did not use

the verb agreement cue, but rather word order to interpret Arabic sentences. The findings

from this group show the limitations of a cross-sectional study. A longitudinal study that

examines the same Arabic learners' performance at different stages, including earlier in

the first year, is needed.

Research question 2 asked, "Does more exposure to Arabic, measured by the

enrollment year, result in declining use of word order and increased reliance on verb

agreement, and to what extent?"

The Intermediate group showed a different pattern as compared to the Beginner

group; as expected, they relied on verb agreement rather than the word order to assign

agency. Verb agreement accounted for 24% of variance in the Intermediate group's

responses in comparison to 6% variance caused by the word order. However, there was

no significant interaction between subject-verb agreement and word order conditions, but

it approached significant, with $F\,(2,795) = 2.76$, $p < 0.06$, $\eta^2_{p} = 0.01$. Moreover, the

observed power (0.55; Table 4.2) suggests that with a bigger sample size, the results

might have been amplified. Examining the six different conditions, we see that in each

word order the participants picked the first noun more often in the 1N agrees and the

Amb verb agreement conditions in comparison with the 2N agrees verb agreement

condition (Figure 4.5). That being said, their performance on the NVN word order was

more consistent (small SD) and native-like than their behavior on the VNN order, except

for the 2N agrees condition (Table 4.1). This is an interesting finding that we return to

after examining the Advanced group's behavior.

For the Advanced group, no significant differences were detected for the

different interactions. Recall, that the small sample size prevented the analysis from

having statistical power. However, verb agreement accounted for 10% of the variance in

the data collected and it was, like the Intermediate group, but unlike the Beginner group,

significant: $F(2,250) = 13.44$, $p < 0.05$, $\eta^2_p = 0.10$. Word order was not significant and

did not account for any variance in the Advanced group's responses. Similar to the

Beginner group, the interaction between the word order and subject-verb agreement

conditions was not significant: $F(2,250) = 0.57$, $p < 0.57$. Nevertheless, the pattern of

interaction between the word order and verb agreement of the Advanced group is similar

to the Intermediate group, although not significant (Figure 4.6; Table 4.2). The

participants in the Intermediate and Advanced groups selected the first noun, regardless

of the word order, more in the 1N agrees and the Amb verb agreement conditions in

comparison to the 2N agrees verb agreement condition (Table 4.1; Table 4.7). The lack of

significance in the interactions between word order and verb agreement is likely to be due

not to the participants in the Advanced group performing the same across the verb

agreement condition, but, as stated before, to the small sample size.

As mentioned earlier, the results showed high variability in the Intermediate

group's behavior in the VNN sentences in comparison with the NVN sentences, except for the 2N agrees condition. This high variability in the participants' performance in the VNN order was similar to the beginner group behavior, which, as explained before, tentatively suggests an L1 effect. The findings from these two aforementioned groups suggest that L2 Arabic learners might more readily process NVN order with its variation in Arabic than VNN order. Interestingly, the Intermediate group's performance on the NVN_2N condition as compared to their performance on the VNN_1N condition showed the opposite pattern; the participant performance was more native-like on the VNN_2N variation with a smaller SD in comparison with the NVN_2N variation. This behavior might also suggest an L1 transfer effect. To explain, native English speakers apply a first noun strategy in the NVN word order which leads them to interpret the sentence as a SVO sentence. The SVO interpretation is the opposite interpretation for the NVN_2N sentences in Arabic. However, English speakers employ a second noun strategy for a noncanonical word order, such as VNN order; this leads them to prefer the VOS interpretation over the VSO which agrees with the Arabic interpretation of the VNN_2N sentences. On the one hand, since the NVN_2N native-like interpretation goes against their L1 first noun strategy, they might have faced some difficulties processing this variation in a native-like way (by utilizing the verb agreement cue). On the other hand, the VNN_2N native-like behavior mirrors their second noun strategy in noncanonical word order, and thus what seems like acquiring native-like strategies might only be the effect of L1 transfer. It should be reiterated that due to the lack of significant difference between the NVN_2N and the VNN_2N conditions measured by paired sample t-test (Table 4.6), there is a need for a longitudinal study in order to shed light on learners'

behavior at different periods of time, which will help us in understand these behaviors. Finally, the Advanced group did not show any significant difference (due to group size) between the participants' performances in the two word order conditions. Nevertheless, the difference in the mean of first noun choice between NVN order and VNN order was only seen in the 1N verb agreement condition (Table 4.1). This pattern is similar to the one found in the intermediate group, and as suggested above might be due to an L1 effect.

Interestingly, the Intermediate and even the Beginner groups outperformed the Advanced group in the NVN_1N and the NVN_Amb conditions. Moreover, the Intermediate group outperformed the Advanced group in the NVN_2N and VNN_2N conditions (Table 4.1). The Beginner group performed better because they applied either the FNP or because they were heavily transferring their L1 processing strategies and not because they attended to the subject-verb agreement cue, as discussed earlier. However, the Intermediate group did utilize the verb agreement cue, and the question remains as to why the Intermediate group behaved in a more native-like way than the Advanced group.

There are several explanations as to why this might be the case. However, before presenting these explanations, we should emphasize that paired sample t-tests show that there were no significant differences between the Intermediate group and the Advanced group except in the NVN_Amb condition. The Intermediate group selected the first noun more frequently than the Advanced group in the NVN_Amb condition, but this could be merely because of the small sample size of the Advanced group. The difference that does exist could be due to the fact that the Intermediate group had explicit instruction about verb agreement from the textbook and their instructors, while the Advanced group did not

receive any explicit instructions about the same grammatical structure. Moreover, participants in the Advanced group used authentic materials from different sources which possibly introduced them to more variations of subject-verb agreement forms such as feminine plural and dual agreement to which participants in the Intermediate group were not exposed. This could have caused the participants from the Advanced group to re-organize their knowledge of subject-verb agreement forms.

Finally, the participants' proficiency levels might not be aligned with the year of enrollment. The second language teaching and research center (L2TRec) at the University of Utah administered a proficiency test for Arabic students. However, the results were not available for all students, and we cannot depend on these results to compare the three groups.[25] Nevertheless, the Intermediate group performed on average between 0+ and 1 on the listening and reading test, while all the Advanced participants scored at 0+. At the same time, Intermediate group participants scored at the 0+/1 level in the speaking test while all Advanced participants scored at the 1 level. While we cannot rely on these results because not all participants who took part in this study were part of the L2TReC test, the results of the reading and listening test are representative of the participants' interpretative skills, and the results show that the Intermediate [sub]group outperformed the Advanced group. The L2TReC test results are beyond the scope of this study; however, the differences in instruction between the two groups might be the reason behind these interesting findings. It is clear that further research with a larger group of participants, as well as a proficiency exam to control for the level of the participants, is needed in order to reach sound conclusions.

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[25] The results follow the format of the Defense Language Proficiency Test (DLPT).

5.2 Limitations

Several limitations have already been discussed above. The sample size, especially in the advanced group ($n = 6$), was small, and this caused the statistical analysis to lack the power to yield a significant difference. Also, as we discussed, the results of the VNN order from the Beginner group raised the need to conduct a longitudinal study in order to answer the first research regarding L1 transfer. Moreover, the classification of the participants in the three groups was merely based on the year of enrollment in the Arabic program; the results from the L2TReC's proficiency test show the shortcomings of this method and the need to examine the participants' proficiency level using a standardized test. The CM research showed that cue availability is used in children to comprehend sentences before they move to use cue reliability (McDonald, 1987a). Also, as mentioned before, the textbook used in class introduces VSO and VSO as the only Arabic word orders; recall that VOS and OVS are rare and used for pragmatic reasons. With this in mind, we expect that the cue availability of the subject-verb agreement provided in the book was not accurate. Thus, the results of this study might have been affected by the fact that students were not exposed to all possible word orders in Arabic. As a solution to this problem, future research could run the experiment on two groups of learners in which one of the groups is only introduced to the SVO and VSO orders, while the other group is introduced to all possible variations. Finally, the task itself does not resemble a real life situation; the sentences used in this study are not only simple sentences but also limit the verb-agreement cue to a singular-third person subject agreement, which limits the generalizability of this study.

<u>5.3 Suggestions for further studies</u>

As mentioned before, there is a need for a longitudinal study to show the progress of the same group of learners over time. In that way, we can assess with certainty the L1 effect in processing L2 sentences. Furthermore, research with learners whose L1's differ might be beneficial to tease apart universal processing accounts from the CM, Spanish is a rich morphological language, and based on CM we would expect L1 Spanish speakers to behave differently from English L1 learners processing Arabic. If correct, this would provide support for L1 transfer accounts. However, if Spanish L1 and English L1 behave similarly, this would align with the universal processing accounts such as VanPatten (2007).

Future research may also use more complicated structures and investigate more grammatical forms within the subject-verb agreement structure; this would increase the generalizability of the study. Lastly, this subsequent research may also to adapt different techniques used in psycholinguistics' studies, such as self -pace reading or listening, eye tracking, and so forth. These techniques are said to provide real-time measurements that the agent identification task adapted in this study cannot provide.

To conclude, this study tentatively suggests that there might be an L1 transfer at the beginning stages of learning Arabic, and learners shift to use the L2 cues in processing L2 sentences with more exposure to the language. It also suggests some implications for L2 pedagogy. Whether it is because of L1 transfer or universal strategies, the Beginner group did not utilize verb agreement to assign agency even though they had received explicit instructions about verb agreement in Arabic. Finally, the study helped to fill the gap in Arabic research in the second language acquisition literature.

APPENDIX A

LEXICAL ITEMS

Lexical items used in the experimental sentences

A. VERBS

Transliteration	Meaning	Arabic
Darab	to hit	ضرب
Hawar	to discuss	حاور
aHab	to love	أحب
Darrasa	to teach	درّس
Tazauaj	to marry	تزوج
sa?l	to ask	سأل
Arad	to want	أراد
3arf	to know	عرف
sam3	to hear	سمع
sa3ad	to help	ساعد
Shakara	to thank	شكر
taThkar	to remember	تذكر

B. NOUNS

Transliteration	Meaning	Arabic
UstaaTh(a)	Teacher	أستاذ(ة)
doktuur(a)	Doctor	دكتور(ة)
xaal(a)	uncle (maternal)	خال(ة)
Walad	Boy	ولد
Bent	Girl	بنت
jaar(a)	neighbor	جار(ة)
waald(a)	Father	والد(ة)
?xw	Brother	أخو
?xt	Sister	أخت
taalb(a)	Student	طالب(ة)
Sadiiq	friend	صديق(ة)
zawj(a)	husband/wife	زوج(ة)
Habiib	Lover	حبيب(ة)
SaaHb	Friend	صاحب(ة)

C. Lexical items used to construct the fillers

Transliteration	Meaning	Arabic
UstaaTh(a)	Teacher	أستاذ(ة)
doktuur(a)	Doctor	دكتور(ة)
xaal(a)	uncle (maternal)	خال(ة)
Walad	Boy	ولد
Bent	Girl	بنت
jaar(a)	neighbor	جار(ة)
waald(a)	Father	والد(ة)
?x	Brother	أخ
?xt	Sister	أخت
taalb(a)	Student	طالب(ة)
Sadiiq	friend	صديق(ة)
Habiib	Lover	حبيب(ة)
SaaHb	Friend	صاحب(ة)
Jami3aa	University	جامعة
Yutah	Utah	يوتا
Saff	Class	صف
Darasa	Study	درس
Thahaba	Go	ذهب
Sakana	Live	سكن
rakaDa	Run	ركض
Raqasa	Dance	رقص
?akala	Eat	أكل
Xaraja	go out	خرج
Shariba	Drink	شرب
Kataba	Write	كتب
ma3	With	مع
Fii	In	في
?laa	To	إلى

D. Experimental and filler sentences

Sentences are constructed as explained in Chapter 3, section 3.3 using the lexical items above.

APPENDIX B

BACKGROUND QUESTIONNAIRE AND VOCABULARY TEST

A. Background questionnaire

Name and Age

Native language

Language spoken at Home

When did you start learning English?

Other second languages with the level of proficiency, please be specific

Have you studied Arabic outside the U? Where? How long?

Have you lived in an Arabic speaking country? How Long? Did you use Arabic to communicate?

What do you think this study was about? Be specific.

Do you have any visual impairment?

B. Vocabulary test

Please write the meaning of the following words in English

	أستاذ		ضرب
	دكتور		حاور
	خال		أحبّ
	ولد		درّس
	بنت		تزوج
	جار		سأل
	والد		أراد
	أخو		عرف
	أخت		سمع
	طالب		ساعد
	صديق		شكر
	زوج		تذكر
	حبيب		صاحب

APPENDIX C

CONSENT FORM AND TASK INSTRUCTIONS

A. Consent form

The purpose of this research study is to investigate three nonnative Arabic speaker (NNS) groups of beginning, intermediate and advanced proficiency levels. Participants are asked to identify the subject of a sentence, which they read orally. We are doing this study *to improve classroom instruction.*

What you should know about a research study:
- Someone will explain this research study to you.
- You volunteer to be in a research study.
- Whether you take part is up to you.
- You can choose not to take part in the research study.
- You can agree to take part now and later change your mind.
- Whatever you decide, it will not be held against you.
- Feel free to ask all the questions you want before and after you decide.
- By signing this consent form, you are not waiving any of the legal rights that you otherwise would have as a participant in a research study.

You will complete this study on a computer using a program DMDX. You will read to a sentence, then you will need to hit [Z] if you believe that the first noun in the sentence is the agent, or [M] if you believe that the second noun is the subject of the sentence. You might feel bored or frustrated during the 40 minutes time of the study.

If you have any questions, complaints, or if you feel you have been harmed by this research please contact Jamil Al Thawahrih, Languages and literature by calling 4074979908 or sending an email to jamil.thawahrih@utah.edu

Contact the Institutional Review Board (IRB) if you have questions regarding your rights as a research participant. Also, contact the IRB if you have questions, complaints or concerns which you do not feel you can discuss with the investigator. The University of Utah IRB may be reached by phone at (801) 581-3655 or by e-mail at irb@hsc.utah.edu.

It should take *about 40 minutes* to complete the study. Participation in this study is voluntary. You can choose not to take part. You can choose not to finish the study at any time without penalty or loss of benefits.

By returning this questionnaire, you are giving your consent to participate.

I highly appreciate your cooperation and willingness to help me conducting this research.

B. The instructions the participants encountered during the task

In the following section, you will first review some Arabic vocabulary.
Next, you will complete a task involving sentences featuring this vocabulary.
PRESS THE SPACE BAR TO CONTINUE

VOCABULARY REVIEW
In the following section, Arabic words will appear on the screen with
their English translations. These are basic vocabulary items that
should be familiar to you from your Arabic studies. Your task is
to review the vocabulary items on the screen in preparation
for reading sentences in which these items will appear. Once you have
finished reviewing each item, you may press the SECOND key to
continue; otherwise the program will automatically continue to the
next item after a few seconds.
PRESS THE SPACE BAR TO BEGIN THE REVIEW

In the following section, a sentence will appear on the screen.
Your task is to read the sentence and decide whether
the grammatical subject of the sentence is
the first or the second noun in the sentence. If the first noun of the sentence is the subject
of the sentence
press the FIRST key. If the second noun of the sentence is the subject of the sentence
press the SECOND key.
PRESS THE SPACE BAR TO CONTINUE
There will be a short pause after each sentence. Please respond
as quickly as possible."
the program will automatically advance to the next sentence after a few seconds.
If this happens, simply skip the sentence you missed and focus
on the next one.",
PRESS THE SPACE BAR TO CONTINUE

PRACTICE SENTENCES
Remember, your task is to read each sentence and decide
which noun is the subject of the sentence. If the first
noun is the subject, press the FIRST key. If the second noun
is the subject, press the SECOND key.
You will now complete a short practice test before proceeding to the
actual experiment.
PRESS THE SPACE BAR TO CONTINUE

THE EXPERIMENT
You have now completed the practice test and will proceed to
the actual experiment. Remember, if the subject of the
sentence is the first noun, press the FIRST key. If the subject
of the sentence is the second noun, press the SECOND key.
Please notify the experimenter before continuing if you have any questions.
PRESS THE SPACE BAR TO BEGIN THE EXPERIMENT

NICE WORK!!!
You have completed the experiment. Please raise your hand to notify the experimenter that you are finished.

APPENDIX D

TRANSLITERATION SYMBOLS

Transliteration Symbols[26]

Transliteration	Letters	IPA symbols
aa	ا (long vowel)	/aː/
a	fatHa (short vowel)	/a/
uu	و (long vowel)	/uː/
u	Damma (short vowel)	/u/
ii	ي (long vowel)	/iː/
i	kasra (short vowel)	/i/
ء	? (Hamza)	/ʔ/
b	ب	/b/
t	ت	/t/
th	ث	/θ/
j	ج	/dʒ/
H	ح	/ħ/
x	خ	/x/
d	د	/d̪/
Th	ذ	/ð/
r	ر	/r/
z	ز	/z/
s	س	/s/
sh	ش	/ʃ/
S	ص	/sˤ/
D	ض	/d̪ˤ/
T	ط	/t̪ˤ/
TH	ظ	/ ðˤ/
3	ع	/ʕ/
gh	غ	/ɣ/
f	ف	/f/
q	ق	/q/
k	ك	/k/
m	م	/m/
n	ن	/n/
h	ه	/h/
w	و (consonant)	/w/
y	ي (consonant)	/y/

Any doubled consonant signifies the geminate of the same.

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[26] This table is adapted from Husseinali (2006, p. 189-90).

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