Grammatical Gender Processing in Standard Arabic as a First and a Second Language

by

Ali Alamry

Thesis submitted to the
University of Ottawa in partial fulfillment of
the requirements for the Ph.D. degree in
Linguistics

Thesis supervisor

Laura Sabourin

Department of Linguistics
Faculty of Arts
University of Ottawa

Abstract

The present dissertation investigates grammatical gender representation and processing in Modern Standard Arabic (MSA) as a first (L1) and a second (L2) language. It mainly examines whether L2 can process gender agreement in a native-like manner, and the extent to which L2 processing is influenced by the properties of the L2 speakers' L1. Additionally, it examines whether L2 gender agreement processing is influenced by noun animacy (animate and inanimate) and word order (verb-subject and subject-verb).

A series of experiments using both online and offline techniques were conducted to address these questions. In all of the experiments, gender agreement between verb and nouns was examined. The first series of experiments examined native speakers of MSA (n=49) using a self-paced reading task (SPR), an event-related potential (ERP) experiment, and a grammaticality judgment (GJ) task. Results of these experiments revealed that native speakers were sensitive to grammatical violations. Native speakers showed longer reaction times (RT) in the SPR task, and a P600 effect in the ERP, in responses to sentences with mismatched gender agreement as compared to sentences with matched gender agreement. They also performed at ceiling in the GJ task.

The second series of experiments examined L2 speakers of MSA (n=74) using an SPR task, and a GJ task. Both experiments included adult L2 speakers whom were divided into two subgroups, -Gender and +Gender, based on whether or not their L1s has a grammatical gender system. The results of both experiments revealed that both groups were sensitive to gender agreement violations. The L2 speakers showed longer RTs, in the SPR task, in responses to sentences with mismatched gender agreement as compared to sentences with matched gender agreement. No difference was found between the L2 groups in this task. The L2 speakers also performed well in the GJ task, as they were able to correctly identify the grammatical and ungrammatical sentences. Interestingly in this task, the -Gender group outperformed +Gender group, which could be due to proficiency in the L2 as the former group obtained a better score on the proficiency task, or it could be that +Gender group showed negative transfer from their L1s. Based on the results of these two experiments, this dissertation argues that late L2 speakers are not restricted to their L1 grammar, and thus, they are able to acquire gender agreement system of their L2 even if this feature is not instantiated in their L1.

The results provide converging evidence for the FTFA rather than FFFH model, as it appears that the -Gender group was able to reset their L1 gender parameter according to the L2 gender values. Although the L2 speakers were advanced, they showed slower RTs than the native speakers in the SPR task, and lower accuracy in the GJT. However, it is possible that they are still in the process of acquiring gender agreement of MSA and have not reached their final stage of acquisition. This is supported by the fact that some L2 speakers from both -Gender and +Gender groups performed as well as native speakers in both SPR and GJ tasks.

Regarding the effect of animacy, the L2 speakers had slower RT and lower accuracy on sentences with inanimate nouns than on those with animate ones, which is in line with previous L2 studies (Anton-Medez, 1999; Alarcón, 2009; Gelin, & Bugaiska, 2014). The native speakers, on the other hand, showed no effect of animacy in both SPR task and GJT. Further, no N400 effect was observed as a result of semantic gender agreement violations in the ERP experiment.

Finally, the results revealed a potential effect of word order. Both the native and L2 speakers showed longer RTs on VS word order than SV word order in the SPR task. Further the native speakers showed earlier and greater P600 effect on VS word order than SV word order in the ERP. This result suggests that processing gender agreement violation is more complex in the VS word order than in the SV word order due to the inherent asymmetry in the subject-verb agreement system in the two-word orders in MSA.

Acknowledgments

First and foremost, I must thank Allah, God the Almighty, as He is all and guides me through all.

I am also indebted to many others without whom this work could not have been possible. With the outmost respect and appreciation, I thank my supervisor, Professor Laura Sabourin, for inspiring and encouraging me, as well as for generously offering me her valuable time. Thank you, Laura, you were always available and were always understanding whether my problem was scientifically related or not.

I would like to thank my committee members. Dr. Kara Morgan-short, Dr. Juana Munoz-Liceras, Dr. Tania Zamuner, and Dr. Éric Mathieu. Thank you for your support, encouragement, and valuable comments and suggestions.

My most sincere gratitude extends to my family members, my parents and my brothers and sisters. Special thanks to my wife, *Muna Alamri*, and my lovely kids *Juana, Mayar, and Deema.* Thank you very much for your endless love, encouragement, and support. I love you.

I am also eternally grateful for the continuous support of my beloved uncle, Dr. Abdulrahman Alamri, who has imparted me with a wealth of invaluable guidance throughout my academic journey. I would also like to thank my friends and colleagues Dr. Salah Alqahtani and Emad Alansary. Thank you for your unconditional support throughout the completion of this project.

I am also grateful to all the L2 speakers and native speakers who generously gave their time and agreed to participate in this study. I also wish to recognize the Arabic Linguistic Institute at King Saud University in Riyadh, and those who welcomed me there, for their support, for the excellent facilities they made available to me, and for the overall opportunity to conduct my study there.

Last but not least, many thanks are owed to all the professors and colleagues in the Department of Linguistics at University of Ottawa, especially my colleagues at the ERPling lab (Dr. Santa Vīnerte, Michèle, Mahsa, Gabrielle, Leah, and Joy). Thank you very much for your inspiration and support.

Table of Contents

List of Table

List of Figures

Chapter 1

Introduction

This dissertation investigates grammatical gender processing in Modern Standard Arabic (MSA) as a first (L1) and a second language (L2). It focuses on how native speakers and second language adult learners process grammatical gender agreement, and explores whether the nature of the underlying processes involved in gender processing are similar for native and L2 speakers. The standard assumption in L1 acquisition is that L1 speakers of any given language ultimately display convergence on a target-like grammar for their L1 because early language acquisition. According to (Chomsky, 1995) this capacity that children have is due to an innate biological language system that guides their acquisition. This innate system is known as Universal Grammar (UG). However, in L2 acquisition, adult learners of an L2 often develop grammatical representations which diverge in some aspects from that of adult L1 speakers of the target language. Thus, a persistent question across the field of Second Language Acquisition (SLA) is whether L2 adult learners can attain an equivalent level of proficiency as that of native speakers of the target language, and whether UG is still accessible for them.

Over the last two decades, there have been many proposals arguing for or against the possibility of the ultimate attainment of native-like grammar by adult L2 learners. These positions can be categorized into two overarching camps of thought: the representational deficit account, and the full access account. Several proposals in the literature, such as the Fundamental Difference Hypothesis (Bley-Vroman, 1989, 1990), the Failed Functional Features Hypothesis

(Schwartz & Sprouse, 1996), Shallow Structure Hypothesis (Clahsen & Felser, 2006), and the Interpretability Hypothesis (Tsimpli & Dimitrakopoulou, 2007), are in favour of a representational deficit account. Despite some differences between these proposals, they all argue that post-puberty L2 learners are unable to incorporate parameterized functional features that are not present in their L1s. In contrast to this view, a full access account suggests that L2 learners are not restricted to their L1 grammar and can acquire the functional features of L2. Hypotheses that support this view include the Full Access/Full Transfer Hypothesis (Schwartz & Sprouse, 1996) and the Missing Surface Inflection Hypothesis (Prevost & White, 2000). Both claim that L2 learners have full access to UG and thus have the ability to reset parameters and acquire all the linguistic properties and features that are not instantiated in their L1. According to this view, L2 learners' failure to show a native-like performance could be due to different task demands (Prevost & White, 2000) or processing constraints (Hopp, 2010, White, Valenzuela, Kozlowska-MacGregor, & Leung, 2004).

Research on grammatical gender has informed the question whether or not late learners can attain native-like competence in L2. Grammatical gender is a parameterized feature that has been considered one of the most difficult structures that non-native learners need to acquire (Dewaele & Véronique, 2001; Sabourin, Stowe, & de Haan, 2006). Learning a grammatical gender system requires learners to acquire both gender assignment and gender agreement. That is, learners need to know how to assign nouns to genders and how to process this assignment within a syntactic structure. The complex nature of grammatical gender acquisition has generated debates concerning the ability of learners of an L2 that has grammatical gender to attain native-like grammar even if they do not have a grammatical gender system in their L1. In the current literature, numerous studies using different methodologies have investigated

grammatical gender in SLA, yet no consensus has been reached. For some researchers, grammatical gender and its features are functional categories that cannot be acquired in adulthood unless L2 learners have similar features in their L1 (Franceschina, 2001, 2005; Meulman, Stowe, Sprenger, Bresser, & Schmid, 2014; Sabourin et al., 2006). Other researchers, on the other hand, provide empirical evidence suggesting that L2 learners are not restricted to the grammar of their L1 and can acquire the grammatical features of a target L2 regardless of their age, as well as their L1 (Bond, Gabriele, Fiorentino & Banon, 2011; Foucart, 2008; Slabakova, 2000; White, Valenzuela, Kozlowska-MacGregor & Leung, 2004). Although these studies provide different explanations and support various findings, what they have in common is that they all agree that L1 transfer has a negative or positive effect on learning an L2 at least in the initial stages. The main difference between them is confined to the final outcome that L2 learners can expect to achieve.

A large portion of previous research in grammatical gender acquisition and processing, in L1 and L2, are confined to Indo-European languages such as French (e.g. Foucart & French-Mestre, 2011), Spanish (e.g., Barber & Carreiras, 2005; Franceschina, 2002), Italian (e.g., Molinaro, Vespignani & Job, 2008b), German (e.g, Gunter, Friederici & Schriefers, 2000), and Dutch (e.g., Hagoort, 2003; Sabourin, 2001). Further, in the case of L2 research, most studies include L2 speakers whose L1 is either a Romance or Germanic language. Hence, a large amount of results available in the literature are obtained from a limited subset of the languages of the world. On the other hand, little research has been done on many other languages, including MSA. MSA provides a good case to expand the empirical base as it has a rich inflectional morphology (gender, number, case) on both verbs and nouns.[1]

[1] The issue of Arabic diglossia and the interaction between MSA and Arabic varieties are discussed in Chapter 4.

To date, there is a notable void in research on MSA as a second language, not only in terms of quantity, but also in terms of range of topics and methods employed. A few studies have been conducted on L2 MSA morphosyntax though, still, little has been written about L2 MSA phonology, interlanguage development, and language learning skills (writing, reading, etc.). Moreover, only a few studies have addressed the issue of grammatical gender in MSA in regards to L2 (e.g., Alamry, 2014; Alhawary, 2009, 2019). These studies have discussed the acquisition of grammatical gender in MSA by comparing the performance of L2 learners from different L1 backgrounds to native speakers of Arabic. Although they have employed different methods and tested participants from various L1 backgrounds, they all found no difference between L2 speakers, regardless of the presence or absence of gender in participants' native language[2]. That being said, none of these studies used an online task; Alhawary's data was obtained from production tasks (e.g., picture naming task), and Alamry's data was obtained from a grammaticality judgment task. To the best of my knowledge, no previous studies have investigated grammatical gender in MSA as an L2 using an online method.

The aim of the present dissertation is to investigate the processing of grammatical gender agreement in MSA[3]. MSA is a language that has a two-gender system; nouns are either masculine or feminine. The surface morphological marking of gender is very complicated as it differs according to the case, number, person, and word orders. Nouns display agreement with verbs, adjectives, adverbs, and pronouns. In order to simplify and control the type of agreement, the present study examines a single structure of the gender agreement system: verb-subject gender agreement in both verb-subject (VS) and subject-verb (SV) word orders.

[2] Full details of these studies will be reviewed in Chapter 3.
[3] The main focus of this dissertation is to investigate grammatical gender agreement, but not gender assignment.

To summarize, this dissertation has four goals. First, it investigates whether L2 and L1 speakers of MSA process gender agreement in a similar manner through the use of three distinct methods. The first is an offline method known as grammaticality judgment task (henceforth, GJ). The second and third are online methods: self-paced reading (henceforth, SPR), and event-related potential (henceforth, ERP). All of these methods have been widely used to measure participants' conscious and unconscious response to language stimuli. It is worth mentioning here, however, that the ERP experiment only included native speakers due to the lack of L2 speakers of MSA who met the criteria in the city where the experiment was conducted (Ottawa). The second goal is to also investigate whether grammatical gender agreement processing in L2 is affected by L1. To examine this question, the study included two different groups of L2 speakers according to the presence (e.g. French and Urdu) or absence (e.g. Chinese and Indonesian) of a grammatical gender system in their L1s. The use of two L2 groups with different L1s helped determine if the presence or absence of a grammatical gender system in L1 facilitates or hinders the processing and acquisition of an L2 grammatical gender system. The third goal is to examine whether animacy (animate vs inanimate) and word order (VS vs. SV) has an impact on grammatical gender processing. The last goal is to test the validity of two competing hypotheses in the field of SLA: Failed Functional Feature Hypothesis (Hawkins & Chan, 1997), and Full Transfer/ Full Access Hypothesis (Schwartz & Sprouse, 1996).

This dissertation is organized as follows. Chapter 2 provides a short introduction to the linguistics of a gender system in general and to the grammatical gender system in MSA in particular. Chapter 3 reviews the theoretical background regarding SLA, and the different models and previous empirical research on grammatical gender research. Chapter 4 presents Experiment 1 (SPR) and Experiment 2 (ERP), which investigate grammatical gender

processing in native speakers. Chapter 5 presents Experiment 3 (GJT) and Experiment 4 (SPR), which investigate grammatical gender processing in L2 speakers. Chapter 6 offers a general discussion and conclusion.

Chapter 2

The linguistics of gender

The purpose of this chapter is, first, to provide a brief introduction to *gender* as a linguistics phenomenon. It addresses the definition of gender and briefly describe its agreement and assignment system. The second part deals with the grammatical gender system in MSA. It describes the gender assignment of individual words, and then the gender agreement between subject and verb. The description is not intended to be exhaustive, but rather focused on those features relevant to the data investigated.

2.1 Gender as agreement classes

Gender is a classification of nouns. Languages generally fall into two types in terms of gender classification: those that have natural gender and those that have grammatical gender. Natural gender is present in all languages, unlike grammatical gender which is present in some. Natural gender (semantic gender) is determined according to the semantics of the noun. It is distinguished based on the characteristics of individual nouns such as male/female, animate/inanimate, or human/nonhuman. In a natural gender language, like English, nouns that refer to humans are sometimes distinguished based on the gender of their referent such as *boy* and *actor*, which refer to males, and *girl* and *actress* which refer to females. However, modifiers and verbs that are used with these nouns do not manifest a distinctive form. Grammatical gender, on the other hand, is a classification system for nouns. Corbett (1991) provides a

working definition of grammatical gender, which differentiates it from natural gender:

> To understand what linguists mean by 'gender' a good starting point is Hockett's definition: 'Genders are classes of nouns reflected in the behavior of associated words' (1958: 231). A language may have two or more such classes or genders. The classification frequently corresponds to a real-word distinction of sex, at least in part, but often too it does not ('gender' derives etymologically from Latin genus, via Old French gender, and originally meant 'kind' or 'sort'). The word gender is not used for just a group of nouns but also for the whole category; thus we may say that a particular language has, say, three genders, masculine, feminine and neuter and that the language has the category of gender. (Corbett 1991, p.1)

Grammatical gender can be alternatively called 'lexical gender' or 'word gender' because it is a property of nouns themselves, not of the referent of these nouns, for example, the word *qalam*$_{\text{MAS}}$ (pen) in Arabic is a masculine noun while it does not denote a masculine referent. The gender property of a noun is reflected in the behaviour of syntactically related words. The word *qalam*$_{\text{MAS}}$ (pen), for instance, takes the singular masculine demonstrative pronoun *haða* (this), and the word *wardah*$_{\text{FEM}}$ (flower) takes the singular feminine demonstrative pronoun *haðihi* (this). This sort of behaviour is called 'agreement' or 'concord'. That is, the gender of a noun affects the form of other related words in the sentence; these related words differ among languages but they could be verbs, pronouns, adjectives, adverbs, determiners, and quantifiers, among others.

Grammatical gender is a syntactic phenomenon because the agreement process between two or more elements can only be defined by their syntactic categories (verb, article, adjective, etc.). It is also a morphological phenomenon because gender agreement is marked by inflectional representation. In some languages, such as Swahili, the gender system is an 'overt' system, in which the gender of a noun is reflected on the morphology of both the noun itself and on its agreement target. Other languages, such as German, have a 'covert' gender system,

in which the gender marker is present on the agreement target only, but not on the noun itself. A language can also have a gender system that is not fully overt nor fully covert. For instance, in Italian, nouns that end with *-o* or *-i* tend to be masculine, and nouns that end with *-a* or *-e* tend to be feminine, though there are numerous exceptions to this tendency.

2.2 The Gender System in MSA

Modern Standard Arabic is a language that has a rich grammatical gender system. It is comprised of two gender classes: masculine and feminine. This classification is not restricted to certain categories of nouns such as human or animate ones; it includes every noun in the language: human, non-human, animate, and inanimate. These nouns then display agreement with verbs, adjectives, adverbs, and pronouns. The focus here is on one construction, namely the verbal gender agreement. In MSA, a verb displays gender agreement with its subject on both subject-verb (SV) and verb-subject (VS) word orders. Before discussing gender agreement, the following section focuses on the gender assignments of individual words.

2.2.1 Gender Assignment

The gender categories of nouns are classified based on either biological/semantic gender, or grammatical gender. Semantic gender is the assignment of gender (masculine or feminine) to words based on the biological sex of a human or animal referent as in (1). Whereas, grammatical gender is an arbitrary assignment of gender (masculine or feminine) to words, as in (2). It is semantically arbitrary but most of the time the gender is assigned to a noun according to its morphological form.

(1) a. tˤabiib

"a male doctor"

b. tˤabiib**ah**

"a female doctor"

(2) a. baab

"door$_{MAS}$"

b. nafið**ah**

"window$_{FEM}$"

The examples (1a and 2a) illustrate masculine forms, which are morphologically unmarked. In example (1b) the word *tabi:b**ah*** 'a female doctor' is assigned a feminine gender determined by the biological sex of the doctor. While in (2b), the noun *nafið**ah*** 'window' is not biologically feminine, but marked as a feminine noun because it ends with *-ah*, which is a feminine suffix as indicated above.

The masculine is the default base form, and it does not manifest gender markers. The feminine form usually exhibits one of the following three gender suffixes:

1. [*-ah/ -at-un*] [4] as in *tuffaħ-**ah*** 'apple$_{FEM}$',
2. [*-a*ʔ] as in *saħr-**a*****ʔ*** 'desert$_{FEM}$',
3. [*-aa*] as in *bushr-**aa*** 'tidings$_{FEM}$'.

These three suffixes mark almost all feminine singular nouns (Saydawi, 1999). However, not every feminine word has a gender marker[5]. A small subclass of words is feminine but have no suffix (e.g. Zaynab 'a proper name', *nafs* 'self', *harb* 'war').

[4] There is no difference between *-ah* and *-at-un,* as they both indicate the gender marker *taa marbuuta*. *-ah* reflects the formal pausal pronunciation, (i.e. in case of a pause, a word like *sayyar-at* (car) would be pronounced *sayyar-ah*).

[5] Feminine nouns without a gender marker were not included in the stimuli of the present study.

2.2.2 Verbal Gender Agreement

In MSA, verbs are richly inflected and display agreement with the subject in person (1st, 2nd or 3rd), number (singular, dual or plural), and gender (masculine or feminine). This agreement differs according to the sentence word order, that is, whether it has a VS (verb subject) or SV (subject verb) order. In the case of VS order, the verb partially agrees with its subject in gender and person, but always takes the default singular form regardless of whether the status of its subject is singular, dual or plural [6] (see examples 3 and 4):

(3) a. *katab* ʔl-muʕallim
wrote$_{\text{Past.3.MAS.SG}}$ the-teacher $_{\text{MAS.SG}}$ [7]
'The teacher wrote'

b. *katab* ʔl-muʕallim-uun
wrote$_{\text{Past.3.MAS.SG}}$ the-teacher-$_{\text{MAS.PL}}$
'The teachers wrote'

(4) a. *katab-**at*** ʔl-muʕallim-ah
wrote$_{\text{Past.3.FEM.SG}}$ the-teacher $_{\text{FEM.SG}}$ [8]
'The teacher wrote'

b. *katab-**at*** ʔl-muʕallim-aat
wrote$_{\text{Past.3.FEM.SG}}$ the-teacher-$_{\text{FEM.PL}}$
'The teachers wrote'

The examples in (3) show that the verb *katab* 'wrote' has no gender marker because the subjects are in the masculine form. In comparison, in examples (4), it is inflected with the feminine

[6] In some Arabic dialects, the verb also agrees with its subject in number even in case of VS order; however, this does not raise concerns for the current study.
[7] The following abbreviations are used in the glosses: 3 = third person, MAS = masculine, FEM = plural, SG = singular, PL = plural, AN= animate, IN= inanimate
[8] The following abbreviations are used in the glosses: 3 = third person, MAS = masculine, FEM = plural, SG = singular, PL = plural, AN= animate, IN= inanimate

marker [***at***], which refers to feminine, third personal, and singular forms. Notably, the verb remains the same with the singular subject in (3a & 4a) and the plural subject in (3b & 4b).

In contrast, with SV order the verb exhibits full agreement with the subject in gender, person, as well as number, as demonstrated in (5):

(5) a. ʔl-muʕallim-ah *katab-**at***
the-teacher$_{\text{FEM.SG}}$ wrote$_{\text{Past.3.FEM.SG}}$
'The teacher wrote'

b. ʔl-muʕallim-aat *katab-na*
the-teacher-$_{\text{FEM.PL}}$ wrote-$_{\text{Past.3.FEM.PL}}$
'The teachers wrote'

In (5a) and (5b), the verb *katab* 'wrote' agrees in gender, number and person with its subject. When the subject is singular, as in (5a), the verb is inflected with the singular feminine marker [*at*], and when the subject is plural, as in (5b), the verb is inflected with the plural feminine marker [*na*]. So as mentioned above, verb-subject agreement in MSA is linked to the clause word orders. VS word order exhibits partial agreement (gender only), and SV exhibits full agreement. However, both word orders show full agreement if the subject is singular (Fassi Fehri, 1993; Benmamoun, 2000), as can be seen from examples (3a) and (4a) above. MSA word orders and the agreement patterns associated with them have been investigated in a number of studies (e.g., Aoun, Benmamoun & Choueire, 1994; Ouhalla, 1994; Soltan, 2001, 2007)

Verbs in MSA are inflected by means of prefixes and suffixes in order to agree with the subject in gender, number, and person. For gender agreement, verbs take the gender markers for masculine and feminine in the second and third person. The first person (I, we) is gender-neutral. In the past tense, the verb is inflected with a suffix that indicates all the agreement features, as shown in Table 2.1.

Table 2.1. Past verb agreement system

Person	Number	Gender	Affix	Example	Gloss
1	Singular	MAS/FEM	-tu	*ħadˤar-tu*	I attended
2	Singular	MAS	-ta	*ħadˤar-**ta***	You (m.) attended
2	Singular	FEM	-ti	*ħadˤar-**ti***	You (f.) attended
3	Singular	MAS	-Ø	*ħadˤar*	He attended
3	Singular	FEM	-at	*ħadˤar-**at***	She attended

In the present tense, the verb stem is inflected with a prefix and a suffix. The prefix gives gender and person information, while the suffix gives number and gender information, as shown in Table 2.2.

Table 2.2. Present verb agreement system

Person	Number	Gender	Affix	Example	Gloss
1	Singular	MAS/FEM	ʔa-	*ʔa-ħadˤuru*	I am attending
2	Singular	MAS	ta-	*ta-ħadˤaru*	You_{MAS} are attending
2	Singular	FEM	ta- -iin	*ta-ħadˤar-iina*[9]	You_{FEM} are attending
3	Singular	MAS	ya-	*ya-ħadˤuru*	He is attending
3	Singular	FEM	ta-	***ta**-ħadˤuru*	She is attending

To summarize, any verb in MAS has to agree with its subject in gender in both SV and VS word orders. The present study focuses on gender agreement between subject and verb in the third person singular construction, in the past tense, and in both word orders.

[9] In the case of second person, the prefix is the same for both masculine and feminine, but it is the suffix [iin] that indicates the feminine gender.

Chapter 3

Theoretical Background

This chapter is a literature review of the linguistic hypotheses and research related to this dissertation. It first addresses language acquisition in L1 and L2. Then, it discusses different hypotheses of gender acquisition in L2 with a special focus on two competing hypotheses. These two hypotheses make different predictions regarding L2 learners' processing of grammatical gender. Then, it reviews previous research on grammatical gender acquisition and processing in different languages and in MSA.

3.1 Gender Acquisition

Previous research in L1 gender acquisition has reported that children effortlessly acquire and master gender at an early age. Yet, acquiring gender as an adult has been proven to be difficult (Dewaele & Véronique, 2001; Sabourin et at., 2006). Researchers in psycholinguistics have investigated gender acquisition in both L1 and L2 in an attempt to characterize how SLA of gender is similar to, or different from, the L1 process, how soon children master gender, and what the developmental stages that make up gender acquisition in L1 are. The following sections review research on L1 and L2 gender acquisition from this vast literature.

3.1.1 Gender Acquisition in L1

The complex nature of acquiring gender system stems from the fact that it involves an interaction between semantics, morphology, and syntax. Children have to learn not only the gender for each noun, but also the morphology and its distribution across words, as well as the underlying syntactic relations. Despite this complexity, results from various languages show that children as young as 3 years old have an implicit knowledge of grammatical gender (Belacchi & Cubelli, 2012; Gagliardi & Lidz, 2014). Omar (1973) found that grammatical gender in Arabic is acquired around the age of three, and that errors in gender agreement are very rare by the age of four. Some studies, however, reported that mastering some aspects of gender in German (Eichler, Jansen, & Müller, 2013) and Dutch (Cornips & Hulk, 2008) took children until the age of six. Notably, due to the fact that some gender systems are more complicated/opaque than others, mastering gender systems may take longer in one language than another. Eichler at al. (2013) declare that the German gender system is the most problematic for children to acquire, followed by the French gender system. Meanwhile, the Spanish and Italian gender systems are less problematic.

Researchers have put forward some factors that might influence the speed of gender acquisition: the complexity of gender assignment, the availability of cues, and the interaction with other features such as number and case (Audring, 2016). Gender assignment can be based on formal or semantic distinctions. Studies show that with increasing transparency of gender assignment and availability of cues, the faster acquisition occurs. For example, Perez-Pereira (1991) has found that native Spanish-speaking children attend to phonological cues (word endings) more than semantic cues (a male or female referent). Moreover, the frequency of an assignment rule plays a role. English-speaking children were slow in mastering the assignment

system, even though it is comparatively a clear system (Corbett, 1991; Mills, 1986). One possible reason is the small range of the agreement system, which is restricted to pronouns only, decreases the syntactic cues available to the child. Thus, richer and clearer agreement systems provide children with more opportunities to learn (Audring, 2014). Another aspect of gender system complexity in some languages is the interrelation between gender and number and case. Eichler et al. (2013) claim that the presence of a case system causes difficulty for children learning German, which might explain why German is more difficult than Romance languages.

Although children might be slower in acquiring the gender system in some languages due to one reason or another, they eventually master their gender system with little apparent effort or confusion. Chomsky (1995) argues that this capacity that children have to acquire their language through exposure and without formal instruction is due to an innate language system that enables them to interact with the language input in their environment, and guides their progress toward adult grammar. This innate system is known as Universal Grammar (UG). UG is an innate biological language system of abstract constraints that guides the acquisition of the L1 by restricting the class of possible natural human grammars. UG is comprised of invariant principles generally shared by all languages, as well as parameters that allow for variation across languages.

This UG system, however, is claimed to be time restricted, meaning that it must be stimulated within a certain period of time known as the Critical Period (CP). This CP is thought to end roughly around adolescence, after which time learning a new language through UG becomes unavailable or at least partially unavailable. Whether or not UG is available to late L2 learners is a controversial issue in the field of SLA research, a debate I return to in the next

section. That being said, learning a second language generally, and an L2 grammatical gender system particularly, has been proven to be problematic, and especially so for adult learners.

3.1.2 Gender Acquisition in L2

The acquisition of an L2's grammatical gender has been considered one of the most difficult structures for adult learners to master (Bartning, 2000; Dewaele & Véronique, 2001; Franceschina, 2005; Hawkins, 2001; Sabourin, 2003). Several studies revealed that while children L2 learners make errors similar to those of monolingual children, late L2 learners make other types of errors (Andersson, 1992, Dewaele & Veronique, 2001; Hawkins & Franceschina, 2004). To explain the apparent differences between gender acquisition in L1 and L2, researchers in SLA claim that it is attributed to the existence of a critical period for language learners (DeKeyser, 2000; Hyltenstam & Abrahamsson, 2003). That is, before the age of puberty, children are sensitive to language input and, as a result, they can acquire language easily and perfectly. This sensitivity diminishes with increasing age (Lenneberg, 1967). The age-related effect in SLA is linked to UG, raising the question of whether or not adult L2 learners have access to UG and whether this access, if it exists, is full or partial. As mentioned earlier, UG includes principles, that define human language, and parameters which allow for the variations that exist cross-linguistically. UG parameters are assumed to be binary, meaning that they have only two settings. The appropriate setting is determined by the input that the child/learners is exposed to. The parametric variations between grammar are linked to certain grammar categories, particularly, functional categories (Chomsky, 1995; Ouhalla, 2003). Functional categories include complementizer, inflection (agreement, tense), negation, determiner, numbers, and others. Further, the functional categories are comprised of certain formal features associated with them such as tense, number, person, gender, and case. If UG is

still accessible to L2 learners, then they are expected to be more apt at adopting the L2 grammatical categories available in their L1s. They are also expected to accommodate the input from L2 that is not available in their L1 by accessing UG. In other words, they can use their access to UG to reset parameters, and hence, reconstruct and reprogram their grammatical categories to accommodate any input from L2. Numerous studies have investigated the accessibility of UG to late L2 learners by examining the acquisition of different structures, including agreement, in various languages, yet the findings are inconclusive. Two conflicting views have emerged: the first view includes proposals arguing that there is a deficit in the grammatical representation of late L2 learners because they no longer have access to UG. The opposing view includes proposals claiming that L2 learners still have access to UG, and that non-native like performance is due to quantitative factors such as proficiency, task demands, and processing speed. A review of these two views is provided in the following sections.

3.1.2.1 A representational deficit view

Proposals that argue for a representation deficit view vary based on the degree of UG accessibility by adult L2 learners yielding to two stances: *(1) no access:* UG is no longer available to L2 learners; *or (2) partial access:* UG is partially available to L2 learners.

The first approach assumes that UG is no longer available to adult L2 learners, and is therefore not involved at any stage of L2 acquisition. Bley-Vroman (1989, 1990), in his Fundamental Difference Hypothesis, argues that there is an essential difference in the type of knowledge that late L2 learners possess compared to children L1 speakers. While children's L1 acquisition is directed by UG, L2 acquisition is guided by means of general problem-solving skills. Other differences also include the cognitive status of mature L2 learners, their previous

experience in their native language, the method of learning (as they often receive formal instructions and corrections in L2 acquisition), and individual differences in mastering L2. Clahsen and Muysken (1986) who argue for this position, further assume that neither L1 transfer nor resetting parameters of UG take place in SLA. In Clahsen and Muysken's (1989) study of word order in German, they compared children learners of German as an L1 and adult learners of German as an L2 whom L1s was either English, Italian, or Turkish. Results revealed that children were able to discover that German is an SOV language at early stages. The adult L2 learners, by contrast, erroneously assumed that German is an SVO language regardless of their L1s' background, even when they were Turkish participants who have similar word order in their L1. The authors conclude that neither access to UG nor L1 transfer occur in L2 learning, and that successful L2 attainment is attributed to successful general learning strategies and problem-solving skills. This conclusion was challenged by other L2 studies. Several studies that investigated SLA of OV languages like Dutch (e.g. Jansen, Lalleman & Muysken 1981) and German (e.g. Vainikka & Young-Scholten 1994, 1996) found an effect of L1 transfer. L2 learners with OV L1s such as Turkish and Korean start with OV order, and L2 learners with VO L1s such as Italian and Spanish start with VO order. Clahsen and Felser (2006) later proposed their Shallow Structure Hypothesis (SSH), in which they claim that the processing strategies that late L2 learners and native speakers employ are completely different. According to their hypothesis, while native speakers rely on syntax to integrate lexical-thematic, prosodic and contextual information, L2 learners mainly rely on lexical-semantic and pragmatic information, and hence engage in less detailed syntactic processing. In effect, L2 learners might process morphology and semantics similarly to native speakers, but not syntax. Other

proponents of the *no access* approach emphasize the role of L1 transfer whether partial (Eubank, Bischof, Huffstutler & West, 1997) or full (Schachter 1990).

Other proposals for a deficit representational view argue for partial access to UG. Advocates of this position declare that L2 learners are able to partially access UG, although they disagree about which parts are accessible and which are not. On this view, there are two stances. The first stance recognizes L2 learners' access to UG principles but denies the possibility of resetting parameters (Tsimpli & Roussou, 1991). According to their hypothesis, L1 grammar is the starting point of L2 acquisition. L2 learners can acquire the L2 grammar only via L1 parameter settings, but they cannot reset parameters. They assume that parameters are independent from UG principles. That is, parameters are a sub-module of the UG lexicon, particularly functional categories. These functional categories are subject to maturation, and hence, adult L2 learners cannot reset L2 parameters that are not instantiated in their L1 grammars. Tsimpli and Roussou investigated the acquisition of subject pronouns in English by intermediate and post-intermediate Greek learners of English. They tested participants on three properties, namely, null subject, VS order, and *that*-trace sequences, all of which are disallowed in English but allowed in Greek. Participants performed two tasks: a grammaticality judgment task, which required them to make corrections to ungrammatical sentences, and a Greek to English translation task. They found that all participants rejected VS order sentences, and also rejected null subject sentences that involve **referential** subjects in English. However, about 80% of the participants accepted ungrammatical sentences like (6a) where the **expletive** subject was absent. The other participants who rejected such construction, changed the sentence to (6b) producing a construction that is still ungrammatical in English but grammatical in Greek:

(6) a. Seems that Mary is happy

b. Mary seems that is happy

Tsimpli and Roussou claim that constructions like (6a & 6b) reveal that participants continue to accept null subject. Furthermore, 95% of the participants accepted ungrammatical English sentences with *that*-trace violation, and incorrectly failed to omit *that* in their translation of Greek sentence with *that*-constructions. Tsimpli and Roussou conclude that participants had not reset parameters. Participants appeared to be native-like in some of these properties but not others. This suggests that participants have analyzed the null subject construction in a way that produces English in the surface, but they have an underlying grammar that has Greek parametric values. This conclusion is reformulated by Tsimpli and Dimitrakopoulou (2007) proposing the Interpretability Hypothesis, which states that uninterpretable features of L2 are inaccessible to L2 learners unless these features are part of their L1 feature inventory.

The second stance is represented in the work of Hawkins and Chan (1997) who followed Tsimpli and Roussou's line of reasoning. Hawkins and Chan propose the Failed Functional Features Hypothesis (FFFH), according to which certain features of functional categories – instead of the categories themselves - such as *Complementiser, Agreement, and Determiner* are inaccessible to L2 adult learners unless they have these features instantiated in their L1. Hawkins and Chan illustrate their proposal by investigating the acquisition of *wh*-movement in English by L2 speakers of Chinese. The Chinese learners were not able to acquire English *wh*-movement fully due to the absence of the same structure in their mother tongue. They acquired the complementizer *that* but analyzed it as the [-wh] feature *ge* in Cantonese or *de* in Mandarin rather than the lexical realization of [+wh]. What appeared to be parameter resetting is in fact a reanalysis of L1 values; participants analyzed constructions of L2 English as constructions in

their L1 counterparts. According to Hawkins and Chan, L2 learners will first tend to map morphological forms from the L2 onto L1 feature specifications. Then, with more exposure to the L2 input, they will move progressively toward the target language. However, because L2 learners have no access to certain fixed functional features, they will establish grammar representations differing from those found in the target language and in their L1 grammar as well but were possible grammar constrained by the principles of UG.

3.1.2.2 A Full Access view

In contrast to the above approaches, several studies have proposed that UG governs L2 acquisition as it does L1 acquisition. That is, UG is fully available to adult L2 learners, meaning that the language faculty involved in L1 acquisition is involved in adult L2 acquisition in the same manner (Flynn, 1996). The involvement of UG in L1 acquisition was initially motivated due to the observation that native speakers end up with a highly complex grammar that goes beyond what is available in the linguistic input. In other words, the input is said to underdetermine the output, which suggests that universal principles (e.g., from UG) guide the acquisition of language (White, 1990). This logical problem of L1 acquisition has encouraged SLA researchers to argue that if L2 learners are also able to adopt highly complex grammar that goes beyond the input, and if this process cannot be reduced to simple general learning strategies or native language information, then UG could mediate L2 acquisition as well. It seems most unlikely that L2 input is the only source that builds L2 learners' grammar, and therefore, L2 input will underdetermine the L2 grammar as it happens in L1 acquisition (White 1985). Hence, it is suggested that the acquisition of L1 and L2 are contingent on UG, and that UG is the rationale behind the acquisition of complex linguistic knowledge in both situations.

Within this view, Schwartz and Sprouse (1994, 1996) propose the Full Transfer/ Full Access (FTFA) approach, which posits that "the initial state of the L2 acquisition is the final state of L1 acquisition (Full Transfer) and that failure to assign a representation to input data will force subsequent restructurings, drawing from options of UG (Full Access)" (Schwartz & Sprouse, 1996, p. 40). In other words, the L1's entire grammar, including all abstract properties, constitutes the initial state of L2. The authors claim that the grammar that L2 learners start with is gradually going to change. When L1 grammar fails to accommodate the L2 input, the learners call upon unused options of UG, including new parameter settings, functional features, and feature values. The UG apparatus is not the only factor that determines the course of L2 acquisition. Other factors such as initial state, input, and learnability factors also take a part. Although this hypothesis claims that there exists full access to UG, native-like grammar is not guaranteed; that is, L2 learners' final outcome grammar might differ from the native grammar of the target language. Regardless, it is still UG constrained since L2 learners start the L2 initial state grammar from their L1 grammar values, leading them to analyze the input differently and to construct grammar values that differ from those of native speakers. Schwartz and Sprouse (1996) argue that a learner might come up with parameter settings that are neither part of L1 nor L2, but still fall within the range sanctioned by UG. Numerous empirical studies have supported the FTFA hypothesis (e.g. Haznedar, 1997; Slabakova, 2000; Yuan, 1998). For example, Yuan (1998) explored the acquisition of the Chinese long-distance (LD) reflexive "*ziji*" by English and Japanese L2 learners at different levels of proficiency. Yuan's results showed participants treat *ziji* differently. On one hand, Japanese groups who have this similar property in their L1 (*zibun* in Japanese) performed as well as Chinese native speakers. On the other hand, English groups, who do not have this property in English, initially transferred local

antecedent (LOC) binding when acquiring the Chinese long-distance reflexive "*ziji"* (full transfer). However, at later stages of acquisition, they realized that Chinese ziji and English reflexives are morphologically different and were able to reset the parameter form LOC to LD setting (full access). Yuan argues that such results support the FTFA approach.

Another proposal that supports the full access account is the Missing Surface Inflection Hypothesis (Haznedar & Schwartz, 1997; Prévost & White, 2000). Similar to FTFA accounts, it argues that L2 learners can acquire an L2 to a native-like level through access to UG, and that the variability in L2 learners' acquisition is a result of a failure in mapping from abstract categories to surface morphology. Prévost and White (2000) examined verb optionality (finite, not-finite) in spontaneous data from two adult L2 learners of French (Arabic L1) and two adult L2 learners of German (one Spanish L1 and one Portuguese L1). In terms of finiteness, the finite verb forms can only occur in finite (raised) positions and not in non-finite positions (e.g., after a preposition or an auxiliary). Non-finite verb forms, however, can occur in both finite and non-finite contexts. The data revealed that for finite verb forms the L2 learners were highly accurate (i.e. used finite verbs in finite contexts). For non-finite verb forms, they were only highly accurate in non-finite contexts (i.e. used non-finite verbs in non-finite contexts), but not in finite contexts. That is, in cases where they were supposed to use non-finite verb forms in finite contexts, they used finite verb forms. Prévost and White suggest that the L2 learners were aware of agreement but failed to identify the correct surface forms and instead used the finite form as a default form. Their data also revealed that the L2 learners were highly accurate on verbal agreement in inflected verbs, and were highly accurate in using finite verbs with respect to a negator (i.e. before *pas* and *nicht*). The authors conclude that the L2 learners have acquired the L2 underlying abstract categories, and that failure to use the appropriate verb forms is not

arbitrary but rather systematic. The L2 learners tend to use a default form (finite form in this case) whenever they do not know how to supply the correct verb form. The authors point out that the L2 learners may have difficulty accessing the target morphological forms because of task demands. L2 learner might perform better on an untimed task (e.g. grammaticality judgment task) than on a time task or spontaneous production.[10]

In summary, the main sticking point between the representational deficit view and the full access view is late L2 learners' access to UG, and the potential for them to achieve a native-like level of competence. The former view claims that late learners cannot acquire parameterized functional features that are not present in their L1, and therefore cannot reach native-likeness. The latter argues the opposite, and claims that late learners can acquire new functional features by resetting parameters via UG, thus suggesting the possibility of native-like performance. Nevertheless, L1 transfer and access to UG remain to date dominant debates among late second language acquisition theorists and researchers.

3.1.2.3 Language Transfer

Language transfer is defined as "the influence resulting from similarities and differences between the target language and any other language that has been previously (and perhaps imperfectly) acquired" (Odlin, 1993, p.27). Two types of transfer occur: negative transfer, and positive transfer. Negative transfer is a result of differences between the two languages (i.e. interference), which makes learning the L2 difficult and lengthy. Lado (1975) explains:

[10] It is well established in psycholinguistics that different methods/tasks tap into implicit and explicit knowledges, and that participants' performance may differ according to the task performed. This issue is discussed further in the next section.

> "the student who comes in contact with a foreign language will find some features of it quite easy and others extremely difficult. Those elements that are similar to his native language will be simple for him, and those elements that are different will be difficult" (p.2)

Positive transfer, on the other hand, is a result of the similarities and matches between structures in the two languages, which consequently facilitate the acquisition of L2. Both partial access and full access proposals, mentioned above, agree that L1 grammar is the initial state of L2 acquisition.[11] The main difference between them is confined to the final outcome that L2 learners can expect to achieve.

3.2 Previous research on grammatical gender

A large number of studies have investigated grammatical gender and whether L2 learners can achieve native-like attainment. These studies vary in terms of languages being tested, methods being used, and their findings. Moreover, researchers have investigated this issue under different theoretical frameworks such as Universal Grammar (e.g. Franceschina, 2005; Hawkins, 1998; White et al, 2004), error analysis (e.g. Al-Ani, 1973; Finneman, 1992; Rogers, 1987), and Processability Theory (e.g. Alhawary, 2003; Nielsen, 1997). In this section, I will briefly address some of the methodologies that have been used in grammatical gender research. Then, I will present the most relevant research to the present study by first reviewing previous research on grammatical gender in native speakers in different languages, followed by an overview of the existing research on L2 speakers.

[11] There exist some studies that propose a full access/no transfer approach (e.g., Epstein et al., 1996; Platzack, 1996; among others). They claim that the L2 initial state is similar to the L1 initial state and that all properties of UG are still available in L2 acquisition (full access), and they reject the possibility that L1 grammar forms the initial state of L2.

3.2.1 Methodologies in grammatical gender research

Experiments on second language acquisition and processing have employed a variety of techniques to investigate both production and comprehension. In these experiments, researchers systematically manipulate one or more variables in order to test certain language structures. Production experiments use different techniques to elicit speech samples from participants. These techniques include, but are not limited to, interviews, videos or games, picture naming tasks, sentence completion tasks, and imitation tasks (Eisenbeiss, 2010). Likewise, comprehension experiments use different tools and techniques to collect data. Researchers use both offline and on-line experiments to address questions about children and adults' language comprehension in both L1 and L2. Typical examples of offline task are untimed grammaticality judgement tasks, sentence-picture matching tasks, cloze tests, and sentence combining tests. These tasks are used to measure participants' knowledge about certain language structures. And because offline tasks are untimed, participants can use their explicit knowledge and metalinguistic abilities to complete the task. Moreover, participants give their interpretation or response to a given task after they have heard or read the full sentence. This might cause bigger exertion on participants' working memory, as they have to process the sentence and keep it in their memory until they make a decision. Participants with a high working memory may outperform those with low working memory. In such situations, it is hard for researchers to reach a solid conclusion because the participants' successful performance in one task could be due to high working memory or good metalinguistic ability rather than an indication of native-like attainment. For this reason, researchers use online tasks or combine both on- and offline methods as in the case of the present dissertation. Online tasks not only measure participants'

implicit responses to language stimuli[12], but also their responses at the same time as they read or listen to a sentence. In some online measures (e.g., ERP) participants do not have the time to think about the sentence, so they cannot use their explicit knowledge about the language. Online tasks include eye-tracking, word monitoring, cross-modal priming, self-paced listening, self-paced reading (SPR), and event-related brain potentials (ERP). The last two techniques, SPR and ERP, were used to collect data for the present dissertation. Hence, in what follows, I briefly introduce each method.

3.2.1.1 Self-Paced Reading (SPR)

Self-paced reading is a task in which participants read sentences word-by-word or phrase-by-phrase by pressing a button. The time elapsed (reaction time or RT) for each button press is recorded, and thus, it indicates how fast participants process each word or phrase. Researchers often add a comprehension question after all or some of the sentences, or ask the participants to assess the sentences' grammaticality at the end of each sentence. This is to make sure that participants are reading for comprehension. The underlying assumption of this task is that a longer RT at a certain word or phrase (e.g. unexpected, unfit semantically, ungrammatical) reflects processing difficulties. Evidence of such incremental processing is highlighted by many studies in both L1 and L2 acquisition (Felser, Roberts, Gross & Marinis, 2003; Ferreira, Henderson, Anes, Weeks & McFarlane, 1996; Juffs, 1998; Just, Carpenter & Woolley, 1982).

[12] It is possible that in some online tasks, participants may use their explicit knowledge. For example, in an SPR task when the exposure duration for each word is not time-constrained by the researcher, participants can take as much time as they need to go from one word to the next. In such task, it is more likely to allow access to awareness and explicit knowledge (Ellis, 2005; Kim & Nam, 2016)
.

The SPR task employs different types of presentations: 1) cumulative presentation, 2) linear non-cumulative, and 3) center non-cumulative (Marinis, 2010). In a cumulative presentation, the text is displayed as a series of dashes on the computer screen, with each dash representing a letter of a word. When participants make the first button press the first word appears, replacing the dashes that correspond to that word. When they make the second button press the second word appears and the previous word remains. As they continue pressing, the next word appears until the end of the sentence. In this type of presentation, when participants reach the end of the sentence, they see the whole sentence on the screen so they can go back and read. The cumulative presentation is depicted in Figure 1 below.

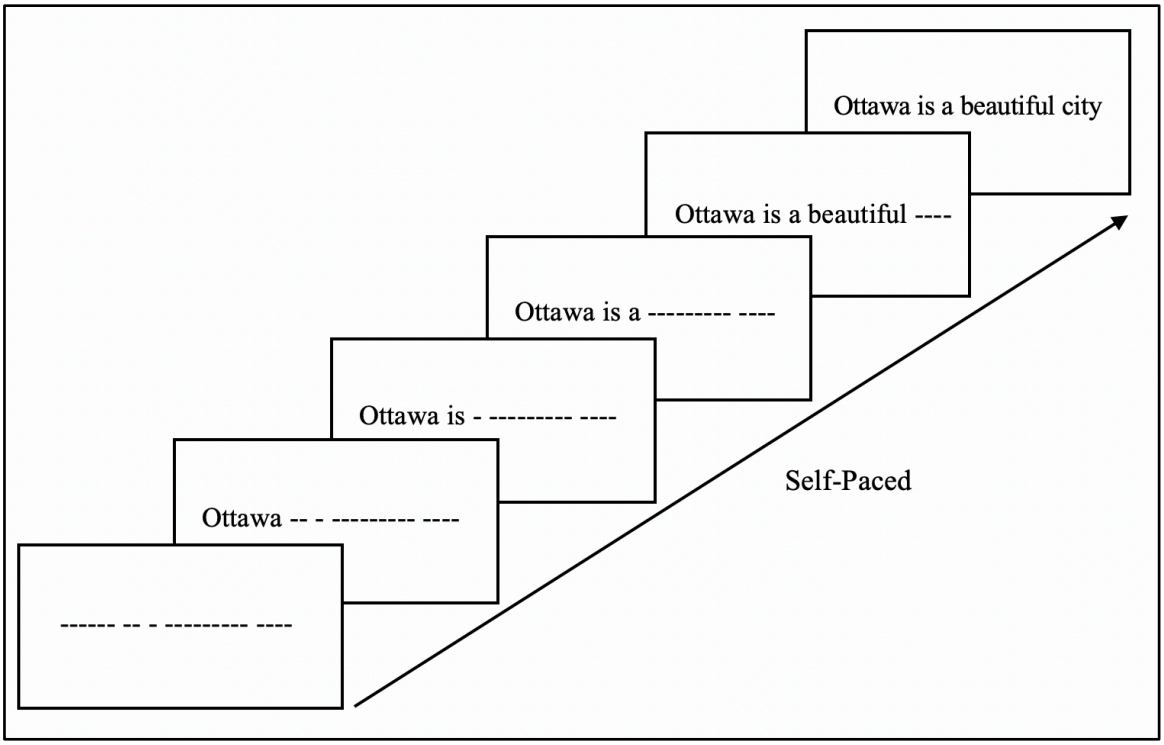


Figure 1. The cumulative presentation technique for SPR.

The linear non-cumulative presentation is similar to the cumulative one except that when a new word appears on the screen the previous words disappear. Participants cannot go back and read the previous words. This type of presentation is depicted in Figure 2 below.

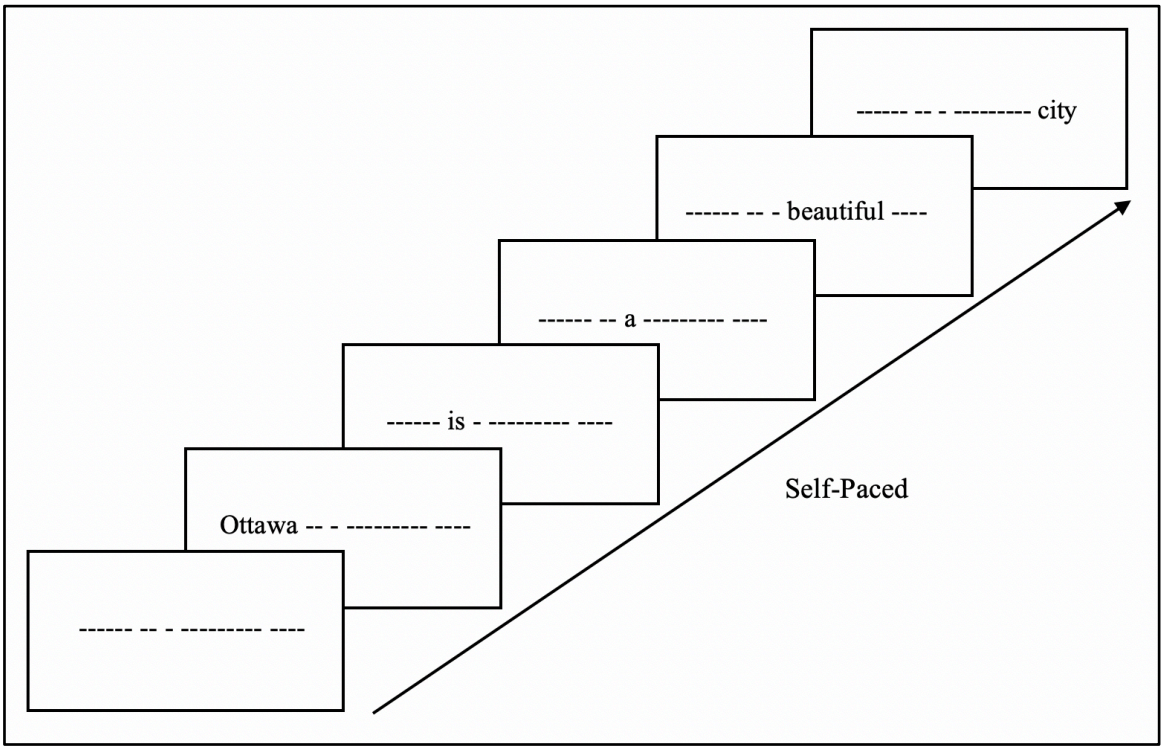


Figure 2. The linear non-cumulative presentation technique for SPR.

In the center non-cumulative presentation, the sentence appears in the center of the screen word by word one at a time. The first button press causes the first word to appear, then the second press replaces the first word by the second one until the end of the sentence. Participants cannot go back and reread the previous words. This type of presentation is depicted in Figure 3 below.

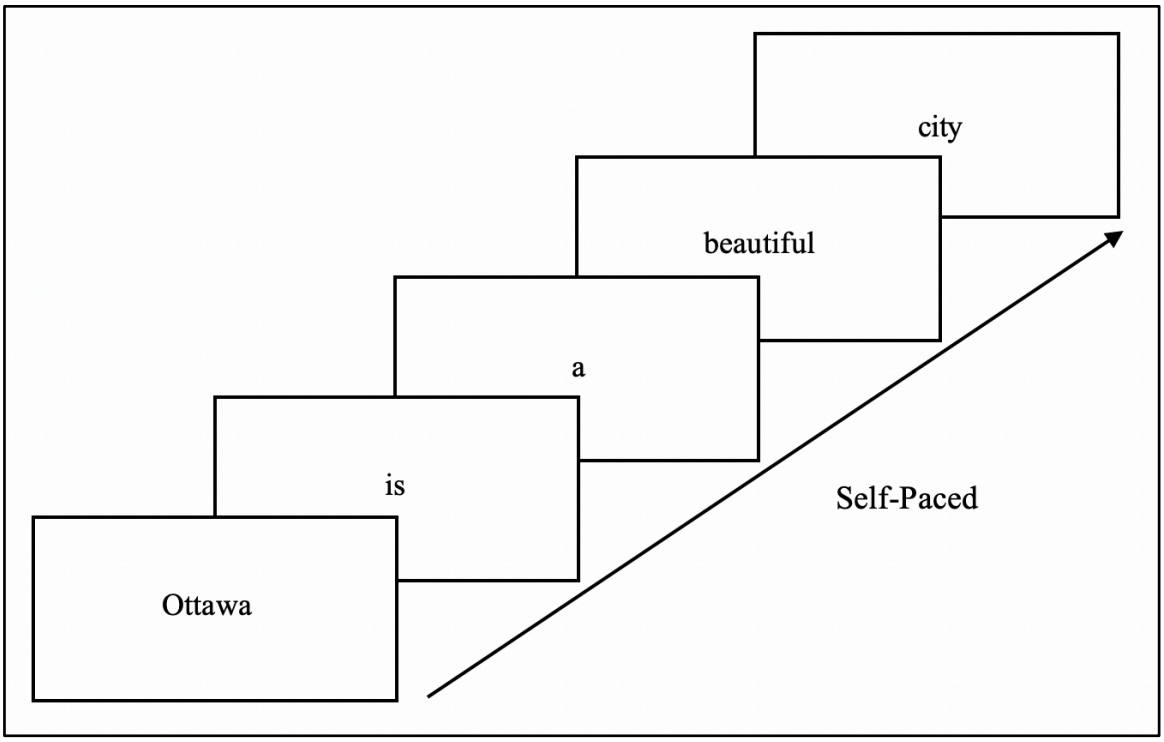


Figure 3. The center non-cumulative presentation technique for SPR.

Although in a SPR task participants control the exposure duration for each word, in some situations researchers limit the duration for each word to appear for certain period (e.g., maximum 5000 ms) in order to force the participant not to spend a long time on each word.

The SPR method has been widely used in the field of L1 to investigate several linguistic variables such as reading mechanisms (e.g., Aaronson & Scarborough, 1976), processing of ambiguous sentences (e.g., MacDonald, 1994; Trueswell & Kim, 1998), filler-gap dependencies (e.g., Crain & Fodor, 1985; Frazier & Clifton, 1989), and pronoun resolution (Stewart, Pickering & Sanford, 2000; Wolf, Gibson & Desmet, 2004). It was not until 1995 that researchers in SLA started to employ the SPR method.[13] Similar to L1 research, SLA researchers have employed the SPR method to investigate L2 speakers' processing of

[13] The first published SLA study that applied SPR task was conducted by Juffs and Harrington (1995).

ambiguities (Juffs, 1998; Juffs & Harrington, 1996), anomalies (Foote, 2011; Sagarra & Herschensohn, 2011), and distance dependencies (Jiang, 2004; Williams, Möbius & Kim, 2001). However, the initial motivation for using SPR in L2 research was to examine L2 speakers' online performance in comparison to their offline performance (Jegerski, 2014).

Further, the SPR method has been employed by numerous studies that investigated language processing in both L1 and L2 speakers, and whether L2 processing is fundamentally different form L1 processing (Hoover & Dwivedi 1998; Juffs, 2005; Marinis, Roberts, Felser & Clahsen, 2005; among many others).[14]

3.2.1.2 Event-Related Potentials (ERP)

The event-related potentials (ERPs) technique has been increasingly adopted by linguists to investigate automatic language processing in real time in an attempt to understand the neurocognitive bases of linguistics processes (Sabourin, Brien & Tremblay, 2013). Researchers have employed this technique to address several issues such as lexical processing, lexical acquisition, speech perception, semantic anomaly, and syntactic anomaly in L1 acquisition, SLA, and aphasia.[15]

The ERP technique is used to measure electrical brain activity that is time-locked to the onset of a particular stimuli (event). This event can be a sensory stimulation, a motor event, or a mental operation (Thigpen, Kappenman & Keil, 2017). In the case of a linguistic event, the stimuli could be written words or letters, spoken words, images, or sounds. The online EEG measures small voltage changes in response to these different types of events. These small

[14] For a detailed review of the SPR method, see Marinis (2010), Jegerski (2014), and Marsden et al (2018).
[15] For a detailed review of the ERP method, see Luck and Kappenman (2011), Sabourin, Brien & Tremblay (2013), and Kaan (2007).

voltage changes that are recorded are averaged over many similar trials in order to obtain a reliable brain activity called the ERP. The obtained ERP waveforms are composed of a series of positive and negative peaks (called ERP components). There exist some ERP components that have been found to be sensitive to different aspects of language processing (e.g., lexical processing, sentence processing), and thus, they provide information on when and how language processes take place. Some of these components are the mismatch negativity (MMN), the left anterior negativity (LAN), the P300, the N400, and the P600. These components are named on the basis of several characteristics such as their polarity (N for negative; P for positive) and their latency (e.g., N400 is a negative peak with a peak latency of 400ms). The ERP components are measured for a number of factors such as latency, amplitude, and topographical distribution.

The ERP components that are most relevant to the present dissertation are the N400, the LAN, and the P600. The N400 is a negative-going wave between 200-600 ms that typically peaks at approximately 400 ms after stimulus onset, and is reliably found to be sensitive to semantic violations. It is often largest in centroparietal areas with a right hemisphere bias (Kutas & Hillyard, 1980; Kutas, van Petten, & Kluender, 2006). All content words in a sentence elicit an N400 component as a result of semantic integration, however, its amplitude is found to be larger when a word is difficult to integrate given the preceding context (e.g., "*He spread the warm bread with socks"* Kutas & Hillyard, 1980). The N400 is not only modulated by the ease of integration. Other semantic factors can have an impact, such as context, word position in the sentence, word class, and semantic expectancy (Kutas & Hillyard, 1980; Van Petten, 1993). Further, it has been suggested that N400 may reflect difficulty in lexical access (for a full review see Kutas and Federmeier, 2011).

Kutas and Hillyard (1983) have observed that while semantic violations elicit an N400, syntactic violations elicited different ERP components. In their study, they found that morphosyntactic violations elicited a negativity around 300-400 ms at left-anterior scalp positions. This anterior negativity also known as the LAN has been suggested to reflect an early stage of morphosyntactic processing (Friederici, 2002). Other researchers suggest that it may index the use of working memory during the processing of verbal material (Coulson, King & Kutas, 1998; King & Kutas, 1995; Kluender & Kutas, 1993). However, this component has been found to be sensitive to various types of syntactic violations, including morphosyntactic agreement violations (Gunter, Stowe & Mulder, 1997, Gunter et al., 2000; Osterhout & Mobley, 1995), case-marking violation (Coulson et al., 1998), tense violation (Newman, Ullman, Pancheva, Waligura & Neville, 2007), and word category violation (Friederici, Hahne & Mecklinger, 1996; Hagoort, Wassenaar & Brown, 2003). Moreover, it is often followed by an increasing posterior positivity (P600), which is another component that is induced by syntactic constraint violations (see below). This might support the idea that it reflects syntactic processing.

The LAN component sometimes emerges in an earlier time window, at 100-200 ms after stimulus onset, and is then called ELAN. The ELAN emerges in response to word category or phrase structure violations (e.g., a passive participle instead of a noun following a determiner) (Friederici, Pfeifer & Hahne, 1993; Hahne & Friederici, 1999). Kaan (2007) states that the position of the affix that indicates a violation in agreement or word category may affect the timing of the LAN; that is, the earlier the affix is in a word, the earlier the LAN can be observed.

Note, however, that the existence of the LAN effect is debatable in the literature; numerous studies have not observed the LAN for agreement violation (e.g., Foucart & French-

Mester, 2012; Hagoort, Brown & Groothusen, 1993; Kaan & Swaab 2003; Osterhout & Mobley, 1995). It has been suggested that only overt morphological violation can elicit the LAN effect (Hagoort & Brown, 1999; Molinaro, Barber & Carreiras 2011a). However, this view was challenged by findings from Italian (Caffarra, Siyanova-Chanturia, Pesciarelli, Vespignani & Cacciari, 2015) and Spanish (Caffarra, Barber, Molinaro & Carreiras, 2017) languages, in which the LAN was observed in both opaque and transparent nouns. Other factors have been suggested to determine the presence of the LAN effect such as the referencing site of the EEG recording (Molinaro et al., 2011a), and the averaging procedures (Osterhout, McLaughlin, Kim & Inoue, 2004; Tanner & van Hell, 2014). In any case, the variability in LAN elicitation highlights the need for careful analysis of the components and the conditions under which it is elicited.

The last ERP component to be discussed here is the P600. The P600 (also sometime called the *syntactic positive shift, or* SPS, according to Osterhout and Holcomb (1992)) is a late positive deflection in the ERP waveform that typically peaks around 500 ms after the stimuli onset and persists for several hundred milliseconds (Swaab, Ledoux, Camblin & Boudewyn, 2012). It generally reaches its maximum in the posterior electrode sites. However, a more anterior P600 has been reported in the literature and linked to syntactic processing difficulty (Friederici, Hahne & Saddy, 2002; Kaan & Swaab, 2003). The P600 has been found to be sensitive to various types of syntactic violations;[16] that is, sentences that contained phrase-structure violation (Friederici et al., 1996; Neville, Nicol, Barss, Forster & Garrett, 1991), agreement violations including gender, number and case (Coulson et al., 1998; Friederici et al.,

[16] While both LAN and P600 are typically sensitive to syntactic violations, it has been argued in the literature that the earlier negativity (LAN) reflects more automatic mechanisms underlying syntactic processing, and the posterior positivity (P600) indexes more controlled mechanisms (Friederici, 2002; Batterink & Neville, 2013).

1996; Münte, Matzke & Johannes, 1997; Osterhout & Mobley, 1995), verb tense violation (Mehravari, Tanner, Wampler, Valentine, Osterhout, 2015; Osterhout & Nicol, 1999), word category violation (Ainsworth-Darnell, Shulman & Boland, 1998; Weber-Fox and Neville, 1996), and subjacency violation (McKinnon & Osterhout, 1996).

Furthermore, the P600 effect has also been reported to be sensitive to syntactic complexity. Sentences that are grammatically correct but syntactically difficult or less preferred can elicit a P600 as compared to sentences that are easier or more preferred (Gouvea, Phillips, Kazanina & Poeppel, 2010; Kaan & Swaab, 2003; Mecklinger, Schriefers, Steinhauer & Friederici, 1995; but see Swaab et al., 2012). An example of this is what is called "garden path" structures. A garden path sentence is a grammatically well-formed sentence that leads a parser to an interpretation that remains plausible until realizing at one point the need for another interpretation (e.g., *The patient met the doctor and the nurse with the white dress* ***showed*** *the chart during the meeting*; Gouvea et al., 2010, p.156).

There have been some proposals regarding the functional significance of the P600. Osterhout, Holcomb and Swinney (1994) and Gouvea et al. (2010) suggest the P600 emerges as a result of a syntactic reanalysis when an initial analysis is disconfirmed, as in the case of syntactically complex sentences or "garden path" sentences. Another proposal suggests that the P600 reflects syntactic repair as in the case of syntactic violation (e.g., Hagoort et al., 1993; Gunter et al., 2000). Gouvea et al. (2010) compared the P600 effects that were elicited in response to syntactic violations, garden path sentences, and long-distance *wh*-dependencies. They found that the P600 elicited by long-distance dependencies is different in terms of scalp distribution and amplitude from the other two conditions. They suggest that the P600 may vary due to diverse underlying syntactic processes. Friederici et al. (2002) propose a neurocognitive

model for sentence comprehension suggesting three parsing phases. The first phase (100-300 ms; the ELAN time window) is a structure building phase, in which the initial syntactic structure is formed. The second phase (300-500 ms; the N400 & LAN time window) is a thematic role assignment phase on the basis of semantic and syntactic information. The last phase is (500-1000 ms; the P600 time window) an interactive phase, in which all preceding types of information are integrated.

The P600 component has been robustly found to be sensitive to syntactic agreement violation in many languages including **Dutch** (Hagoort, 2003; Hagoort & Brown, 1999, 2000; Hagoort et al., 1993; Kaan & Swaab, 2003; Vos, Gunter, Herman, Kolk & Mulder, 2001), **English** (Coulson et al., 1998; Molinaro, Kim, Vespignani & Job, 2008a; Osterhout & Holcomb, 1992), **French** (Frenck-Mestre, Osterhout, McLaughlin & Foucart, 2008), **German** (Gunter et al., 2000; Hammer, Jansma, Lamers & Münte, 2008; Münte et al., 1997; Schmitt, Lamers & Münte, 2002; Rossi, Gugler, Hahne & Friederici, 2005), **Hebrew** (Deutsch & Bentin, 2001), **Hindi** (Nevins, Dillon, Malhotra & Phillips, 2007), **Italian** (Caffarra et al., 2015; De Vincenzi, Job, Di Matteo, Angrilli, Penolazzi, Ciccarelli & Vespignani, 2003; Molinaro et al., 2008b), **Spanish** (Alemán Bañón, Fiorentino & Gabriele, 2012; Barber & Carreiras, 2005; Mancini, Molinaro, Rizzi & Carreiras, 2011; Martín-Loeches, Nigbur, Casado, Hohlfeld & Sommer, 2006; O'Rourke & Van Petten, 2011), and **Basque** (Chow, Nevins & Carreiras, 2018; Díaz, Sebastián-Gallés, Erdocia, Mueller & Laka, 2011; Zawiszewski & Friederici, 2009).

3.2.2 L1 Processing of Gender Agreement

Previous ERP research in gender agreement processing shows that native speakers consistently showed a P600 effect that was at times preceded by a LAN effect in response to

agreement violations within sentential contexts. This P600 effect is often observed at approximately 500 ms after stimuli onset and lasts to 800-1000 ms. It has been consistently found in various languages (**Spanish**: Alemán Bañón et al., 2012; Barber & Carreiras, 2005; **German**: Gunter et al., 2000; **Hebrew**: Deutsch & Bentin, 2001; **Dutch**: Hagoort, 2003; Hagoort & Brown, 1999; **English**: Osterhout & Mobley, 1995; **Italian**: Caffarra et al., 2015; Molinaro et al., 2008b; **French**: Foucart & French-Mestre, 2011; **Brazilian Portuguese**: Resende, Mota & Manhães, 2015), and with various sentential constituents (e.g., **determiner-noun**: Foucart & French-Mestre, 2011; Resende et al., 2015; **noun-adjective**: Guajardo & Wicha, 2014; O'Rourke & Van Petten, 2011; **noun-verb**: Deutsch & Bentin, 2001). Moreover, researchers have investigated various factors that may interact with or affect the syntactic processing of gender agreement, including gender and number agreement interaction, long and close structural dependency, and semantic and syntactic processing interaction. What follows is a review of some these studies.

Hagoort and Brown (1999) investigated grammatical gender agreement between the definite article and the subject in Dutch. In their study, native speakers of Dutch read sentences, half of which had gender violations and half of which did not. Participants' brain waves were recorded. The results revealed that gender violations elicited a P600 but not a LAN. Hagoort and Brown argue that the absence of the LAN was due to the type of violation their stimuli included, suggesting that their stimuli included only agreement violations, while previous studies have shown (e.g., Friederici, 2002; Friederici et al., 1996) that the LAN is sensitive to word category violations. Hagoort (2003) found similar results in another ERP study of Dutch grammatical gender processing.

In another ERP study, Barber and Carreiras (2005) investigate the possible differences in processing of gender and number in Spanish. Two ERP experiments were conducted. The first examined the processing of agreement in word pairs in which gender and number agreement was manipulated. The word pairs were an article and a noun, and a noun and an adjective. Native speakers of Spanish were asked to read two lists of word pairs and to judge the grammatical agreement between them. The results showed an N400 for grammatical mismatching for each word pair. Furthermore, article-noun word pairs showed an additional LAN effect, possibly resulting from more syntactic processing. Moreover, a P3 effect was found for both gender and number agreement violations, however its latency was later for gender as compared to number, thus suggesting that the response-related decision occurs later for gender agreement violations.[17] The second experiment examined the effect of agreement violation in the same word pairs as in experiment 1, but inserted in sentences. Participants were asked to read sentences and to judge the extent to which a sentence was grammatically correct. The results showed a pattern of LAN-P600 effects. Similar to experiment 1, the size of the effect of gender agreement violation was greater than the number effect, which indicated a greater impact of gender violation on the later syntactic processes. The authors suggest that their results support the idea that repair processes after grammatical violation might require more steps in case of gender as opposed to number violation.

Similarly, Alemán Bañón et al. (2012) investigated the processing of number and gender agreement in Spanish by examining the impact of structural distance (number of intervening syntactic phrases) on this processing by comparing agreement violation within the same phrases

[17] The P3 (or P300) is an ERP component generated in the process of decision-making. It is known to reflect processes of evaluation or categorization. This component is elicited via an oddball paradigm using stimuli that contain a mixture of low-probability and high-probability items. In Barber and Carreiras' (2005) study, the P3 is attributed to categorization and reanalysis processes.

(DP) and across a verb phrase (VP). Linear distance (number of intervening words) was also controlled for. Using ERP, twenty-five native speakers of Spanish read sentences on a screen and judged them for grammaticality. Behavioural results showed a high score (above 97%) in the grammaticality judgment for every condition, which indicates that participants were able to detect number and gender violations. The ERP results revealed that, across the two levels of structural distance, participants showed a P600 effect for both number and gender violations. The effect was equally robust for number and gender in all time windows associated with the P600. There was no significant difference between number and gender violations in any of the time window for the P600, suggesting that both features are processed similarly at the brain level. An analysis carried out in the 250-400 ms time window revealed that the P600 was not preceded by a LAN effect. In addition, a 1000-1400 ms time window analysis indicated that there was a broadly distributed and sustained negativity for agreement violations, which might be interpreted as a memory effect. Regarding structural distance effect, the results showed more positive waveforms for within phrase rather than across phrase agreement in the violation condition. No interaction between agreement and structural distance was found. Several other studies on Spanish grammatical gender have revealed similar results where gender violations elicited P600 effects and, sometimes, LAN effects (Barber, Salillas, & Carreiras, 2004; Caffarra et al., 2015; Caffarra, Janssen & Barber, 2014; Guajardo & Wicha, 2014; Havas, Rodríguez-Fornells & Clahsen, 2012; Martín-Loeches et al., 2006; O'Rourke & Van Petten, 2011; Wicha, Moreno & Kutas, 2004).

On the semantic effect in gender processing, Gunter et al. (2000) investigate the effect of semantic expectancy on the processing of German grammatical gender, and vice versa. They examine the interaction of gender violation with semantic expectancy by conducting a 2x2

design in which gender (correct vs. incorrect) and semantic expectancy (high vs. low) were crossed. Thirty-two German speakers were presented with a total of 160 experimental sentences. Half of them were low cloze and the other half were high cloze. Moreover, half of the sentences had a gender violation between nouns and the immediately preceding articles. Participants were asked to read presented sentences word by word on a screen. The results show that gender violations elicited a LAN effect, cloze probability manipulations elicited a N400 effect, and the interaction between cloze probability (semantic) and gender violations (syntax) was reflected in a P600 effect. The P600 effect was reduced and delayed when semantic expectancy was low, which could have been due to difficulties at both a syntactic and semantic level. These results suggest that syntax and semantics are processed in parallel during a first phase, and the interaction between them are presented in a later phase.

Caffarra et al. (2015) examine another factor that may affect gender agreement processing. They examined whether gender regularity/irregularity affects the underlying processing of gender agreement between determiners and nouns in Italian. Stimuli included regular nouns and irregular nouns. In Italian, regular nouns typically end with *-o* for masculine (e.g., *cucchiaio* "spoon$_{MAS}$") and end with *-a* for feminine (e.g., *bibita* "drink$_{FEM}$"). Whereas irregular nouns reverse these endings, where *-o* is for feminine (e.g., *mano* "hand$_{F}$") and *-a* is for masculine (e.g., *diadema* "diadem$_{MAS}$"). Determiners either match or mismatch with these nouns in gender. Results showed that while gender violation in both types of noun (regular and irregular) elicited a P600 effect preceded with a LAN effect, regular nouns elicited an increased frontal negativity and a late posterior positivity (350-950 ms). This result suggests that agreement between regular nouns and their determiners (with reliable gender cues) were detected at an earlier stage of processing compared to irregular nouns.

Another ERP study, which is similar in some ways to the ERP study in the current dissertation, is conducted by Deutsch and Bentin (2001).[18] They examined the interrelation between syntactic and semantic processing of gender agreement in Hebrew. To do this, they had three experimental conditions: 1) gender agreement violation between subjects and verbs to test syntactic processing; 2) animacy of the subject to test semantic processing; and 3) morphological markedness to test the impact of markedness on agreement processing. In Hebrew, the verb must agree with the subject whether animate or inanimate in gender and number. Animate and inanimate nouns are inflected with the same suffixes, but the key difference is that for animate nouns these suffixes have semantic features as they correspond with the biological sex of their referents. While for inanimate nouns, they only reflect grammatical gender matching. To control for markedness, the experimental sentences included verbs in the masculine forms only, singular verbs being the unmarked forms, and plural verbs being the marked forms (see examples in table 3.1).[19] The authors argue that the difference between animate and inanimate nouns in terms of the semantic features might be reflected in the underlying processing and hence elicit different patterns in the ERP; that is, while the LAN and P600 are expected to emerge in response to all gender violations in both animate and inanimate conditions, the N400 is expected to emerge only in the animate condition. The results revealed that gender violations elicited an ELAN effect, an N400 effect, and a P600 effect. The ELAN did not interact with the animacy condition nor with the markedness condition. The P600 interacted with markedness (the P600 was only present for marked verbs) but not with animacy. The N400 interacted with animacy (the N400 was only present on the animate nouns) but not

[18] This paper includes another experiment that employed the eye-tracking technique to investigate the same questions. I only report on the ERP experiment here.

[19] Table 3.1 was taken from Deutsch and Bentin (2001) to maintain the original translation.

with markedness. The authors concluded that their results support the view that syntactic processing is affected by the semantic properties and the forms of a word, and that syntactic and semantic processing interact with each other.

Table 3.1: Example of experimental sentences used by Deutsch and Bentin (2001)

	Animate	Inanimate
Unmarked		
Congruent	"The woman saw that *the boy had fallen into the pond*." "H,ɔiʃa ra,ɔata ki *hayeled* (article "ha" + subject masc. sing. "the boy") napal (predicate masc. sing. "had fallen") letox habrexa."	"The woman saw that *the diamond had fallen into the pond*." "H,ɔiʃa ra,ɔata ki *hayahalom* (article "ha" + subject masc. sing. "the diamond") napal (predicate masc. sing. "had fallen") letox habrexa."
Incongruent	"The woman saw *that the girl had fallen into the pond*." "H,ɔiʃa ra,ɔata ki *hayalda* (article "ha" + subject fem. sing. "the girl") napal (predicate masc. sing. "had fallen") letox habrexa."	"The woman saw that *the necklace had fallen into the pond*." "H,ɔiʃa ra,ɔata ki *haʃarʃeret* (article "ha" + subject fem. sing. "the necklace") napal (predicate masc. sing. "had fallen") letox habrexa."
Marked		
Congruent	"I enjoyed seeing how *the actors were enchanting the tired audience*." "ɔani neheneti lir,ɔot keytzad *hasaxkanim* (article "ha" + subject masc. pl. "the actors") maksimim (predicate masc. pl. "enchanting") ,ɔet hakahal haʂayef."	"I enjoyed seeing how *the movies were enchanting the tired audience*." "ɔani neheneti lir,ɔot keitzad *hasratim* (article "ha" + subject masc. pl. "the movies") maksimim (predicate masc. pl. "enchanting"),ɔet hakahal haʂayef."
Incongruent	"I enjoyed seeing how *the actresses were enchanting the tired audience*." "ɔani neheneti lir,ɔot keytzad *hasaxkaniot* (article "ha" + subject fem. pl. "the actresses") maksimim (predicate masc. pl. "enchanting") ,ɔet hakahal haʂayef."	"I enjoyed seeing how *the pictures were enchanting the tired audience*." "ɔani neheneti lir,ɔot keytzad *hatmunot* (article "ha" + subject fem. pl. "the pictures") maksimim (predicate masc. pl. "enchanting") ,ɔet hakahal haʂayef".

However, the effect of noun animacy on gender agreement processing is not consistent across studies. Several other studies did not find the N400 effect in response to gender agreement violations with semantic gender nouns (Barber et al., 2004; Demestre, Meltzer, Garcia-Albea & Vigil, 1999; Osterhout & Mobley, 1995). Barber et al. (2004), for instance, examined noun-adjective gender agreement in Spanish. Native speakers of Spanish read sentences that included gender agreement violation. The nouns were manipulated for animacy;

half of them were animate and the other half were inanimate (see the example 7-10). As in the case of Hebrew, unlike the inanimate nouns, the animate nouns denote semantic features.

7) El faro es luminoso y alto. (Agreement – inanimate noun)
The$_{MAS}$ lighthouse$_{MAS}$ is bright$_{MAS}$ and high.

8) El faro es luminosa y alto . (Agreement – inanimate noun)
The$_{MAS}$ lighthouse$_{MAS}$c is bright$_{FEM}$ and high .

9) El abuelo estaba delgado y débil . (Disagreement – animate noun)
The$_{MAS}$ grandfather was slim$_{MAS}$ and weak .

10) El abuelo estaba delgada y débil . (Disagreement – animate noun)
The$_{MAS}$ grandfather was slim$_{FEM}$ and weak .

The results revealed that gender violations elicited a LAN effect followed by a P600 effect. However, the semantic information of gender (i.e., in case of animate nouns) did not elicit an N400, suggesting no influence of semantic gender on the syntactic agreement processing.

3.2.3 L2 Processing of Gender Agreement

Numerous studies have investigated grammatical gender in L2 speakers and whether L2 learners can achieve native-like attainment. Researchers have investigated this issue under different theoretical frameworks such as Universal Grammar (e.g. Franceschina, 2005; Hawkins, 1998; White et al, 2004), error analysis (e.g. Al-Ani, 1973; Finneman, 1992; Rogers, 1987), and Processability Theory (e.g. Alhawary, 2003; Nielsen, 1997). This dissertation investigates this issue under the UG framework by comparing two hypotheses; namely, the Failed Function Feature Hypothesis (FFFH) and the Full Transfer/Full Access (FTFA).

Therefore, in what follows, I will present previous studies that examined gender agreement in L2 speakers with relevance to UG.

3.2.3.1 Studies supporting FFFH

A number of studies, which have investigated SLA in different languages, have supported the proposal that adult L2 speakers cannot reach a native-like level and cannot acquire a structure in the L2 unless they have it in their L1. Franceschina (2002) investigated the acquisition of case, number, and gender agreement in Spanish by learners who were native speakers of English, French, German, Greek, Italian, and Portuguese. The participants were grouped based on the presence or absence of gender systems in their L1s. One group of participants included speakers of French, German, Greek, Italian, and Portuguese. The other group included only native speakers of English. Also, native speakers of Spanish served as a control group. Results showed significant differences between the three groups. All groups performed well with regard to number and structural case; however, there was a significant difference in performance when it came to gender. The "no gender" group performed significantly worse than the other two groups, whereas no significant differences were found between the L1 Spanish group and the "+Gender" group. The author concluded that L2 learners are incapable of acquiring abstract grammatical features that are not found in their L1.

In another study, Ellis, Conardie and Huddlestone (2012) examined the acquisition of grammatical gender in German by L2 adult learners. Participants' L1s were either Afrikaans, English, or Italian. Italian is a language that has a gender system but it differs from that of German, whereas Afrikaans and English lack gender systems. The findings indicated that the Italian group outperformed the Afrikaans and English groups, which provides evidence in favour of an L1 effect. Ellis et al. further concluded that their results support the deep transfer

position (transferring abstract grammatical categories) since the grammatical gender systems in Italian and German are not congruent.

Another group of researchers took this theory a further step and claimed that, not only the presence of an abstract grammatical feature in L1 determines the acquisition of L2, but also the similarity between the two systems in L1 and L2 impacts it. Sabourin (2001) investigated the effects of L1 on offline processing of Dutch grammatical gender by adult L2 learners. The learners were native speakers of German, a Romance language (either French, Italian, or Spanish), and English. German has a similar grammatical gender system to Dutch. Romance languages have a gender system but it differs from the one employed in Dutch. English has no grammatical gender system. Sabourin's findings showed a hierarchy of performances with significant differences between learners. The German group achieved the better score among the L2 learner groups, but still placed significantly lower than the native speakers. The Romance group not only performed significantly worse than the native speakers, but also worse than the German group. The English group had the worst results. Sabourin concluded that the presence of a grammatical gender system in L1, as well as the similarity between this system in L1 and L2, strongly influence the acquisition of the L2 grammatical gender system. These results were supported by another study conducted by Sabourin et al. (2006) who examined the role of transfer from different L1s in learning the Dutch grammatical gender system. Participants whose L1 was either German, English, or a Romance language were tested on both gender assignment and agreement. Sabourin et al. found that all learners were able to assign the correct gender to nouns. This suggests that transfer from L1 was not necessary for learners to acquire gender assignment since the English speakers, who have no gender system in their L1, were able to accomplish this task. However, transfer from L1 did prove to be important in facilitating

the acquisition of gender agreement, as the German and Romance groups scored much better than the English group, with the German group in the lead. These studies suggest that it is likely necessary, and conclusively better, for learners' L1 to share their target L2's gender features.

Besides the aforementioned studies which have employed offline methods, several ERP studies have also shown evidence in favour of the FFFH account. In an ERP experiment, Sabourin and Stowe (2008) examined the effect of L1 on the processing of grammatical gender in Dutch. Participants were adult second language learners of Dutch whose L1 is either German or a Romance language. There was also a group of Dutch native speakers. Two experiments were conducted to test two different grammatical constructions. The first experiment tested verbal domain dependency, which is a construction that is shared between all languages being tested. Forty sentences were created for this experiment, half of which were grammatical (correct past participle form and correct infinitive form) and the other half of which were ungrammatical (correct past participle form and incorrect infinitive form, or vice versa). The second experiment tested gender agreement within the nominal domain, which is a construction that is congruent to that of the German language but not to that of the Romance languages. Forty sentences were also created to test gender agreement between determiners and nouns. Participants were asked to perform a grammaticality judgment task during ERP measurement. After the ERP experiment, participants were asked to assign gender to all critical nouns used in the experiment. The result revealed that native Dutch speakers showed a P600 effect for both constructions. With regard to L2 learners, only German speakers were able to show the P600 effect in both constructions, similar to that of Dutch native speakers. Romance language speakers only showed the P600 effect in the verbal domain task, but failed to show such an effect in the gender agreement task. The results suggest that only when similar grammatical

construction is present in L1 and L2, L2 learners are likely able to process this construction in the L2 in a native-like manner. Even though speakers of Romance languages have a gender agreement system in their L1, they failed to meet an equivalent level of gender agreement processing to native speakers in Dutch.

In the same vein, Foucart and Frenck-Mestre (2011) found that highly proficient L2 learners are possibly able to show online sensitivity to grammatical gender only when there is a similarity of syntactic rules across L1 and L2. They examined whether German-speaking L2 learners of French process grammatical gender similarly to native speakers, and the extent to which similarities between L1 and L2 with respect to grammatical gender manipulate such processing. Participants event-related brain potentials (ERPs) were measured while they read sentences containing three types of violations of gender agreement within the DP between the determiner and the noun in the singular (experiment 1), the postposed adjective and the noun in the plural (experiment 2), and the preposed adjective and noun in the plural (experiment 3). The results showed that, in experiment 1, both L2 and native participants' brain activity revealed sensitivity of the gender violations which corresponds to a P600 effect, although L2 learners were less consistent than the native speakers. In experiments 2 and 3, unlike native speakers who showed P600 effect, L2 learners did not show any effect, which could be due to the difference between the L1 and L2 with regard to the target structures. The researchers concluded that high proficiency and similarities across L1 and L2 are essential factors that shape the participants' ability to process gender agreement similarly to native speakers.

Finally, Meulman et al. (2014) found that adult learners are unable to show native-like sensitivity even when their L1s possess a grammatical gender system. They examined the differences between native speakers and L2 learners in processing non-finite verb violation and

grammatical gender violation in Dutch. The study included native speakers of Dutch and Romance language native speakers who are highly proficient L2 learners of Dutch. They were tested on non-finite agreement and gender agreement. In addition, two versions of the stimuli were created, namely, a visual version in which participants read the sentences on the screen, and an auditory version in which participants listened to the sentences. Participants were asked to judge sentences for grammaticality. The results showed that native speakers show a biphasic N400-P600 pattern for non-finite verb violation and only a P600 for gender agreement violation. It also revealed that none of the L2 learners were able to show P600 effect within gender agreement violations, but they showed native-like N400 for non-finite verb violations in the auditory modality. The results also revealed that there was no effect of stimulus modalities (written vs. auditory), age of acquisition, length of residence, or proficiency. The researchers declare that, although participant's L1s possess grammatical gender systems, they were still not able to show native-like sensitivity to gender in L2, which could be attributed to the differences between L1 and L2 in the gender system and the complexity of the Dutch gender system.

To summarize this section, all the above-mentioned studies provide empirical results in favour of the FFFH. The core principle of this hypothesis is that late L2 learners cannot acquire parameterized functional features that are not already instantiated in their L1. In consequence, if L1 and L2 parameters differ, this hypothesis suggests that L2 learners will not be able to acquire new abstract features similarly to native speakers. Findings from these studies showed that a significant difference in, or a total absence of a gender agreement system in L2 learners' L1 leads to their failure in acquiring/processing gender agreement in their L2 in a native-like manner.

3.2.3.2 Studies supporting FTFA

In contrast, another body of research contradicts the above-mentioned results claiming that the presence of a grammatical gender system is not essential in order to process this system in L2 in a native-like manner. White et al. (2004) investigated how L2 learners who vary in their L1s acquire Spanish gender and number agreement. Participants were divided into three levels of proficiency: low, intermediate, and advanced. Based on production and comprehension tasks, White et al. found that number agreement was acquirable by all learners. Participants with lower proficiency showed more accuracy on number agreement than on gender agreement, and on masculine nouns more than feminine ones. The advanced and intermediate groups performed about as accurately as native speakers. Moreover, the findings indicated that there were significant effects of proficiency but not of L1 or of prior exposure to an L2 with a gender system. High proficient learners whose L1 was English were able to perform well in both offline tasks (production and comprehension), just like the French L1 and native speaker control groups.

Similarly, Bond et al. (2011) conducted an ERP study to examine number and gender agreement in Spanish by native speakers of English. Number features on verbs are similar between the two languages, but number features on adjectives and gender agreement are only present in Spanish. The findings indicated that the participants were able to develop native-like processing in terms of gender agreement, even though it is a feature that is not instantiated in their L1. Again, their conclusion supports the FTFA.

In another ERP study, Dowens, Vergara, Barber, and Carreiras (2010) examined processing number and gender in Spanish by Spanish native speakers and English-speaking learners with a high level of proficiency. Participants were asked to read Spanish sentences that

violate number and gender agreement with-phrase (article-noun) and across-phrase (noun-adjective) and then to decide whether or not a sentence is grammatically correct. Native and L2 participants showed a LAN and P600 effects for both gender and number in the within-phrase condition, and showed a P600 effect for both gender and number in the across-phrase. The L2 participants, however, showed different patterns in processing gender and number, as they showed stronger effects (earlier onset and increased amplitude) in the case of number processing than in gender processing. The authors attributed this to the presence of the number agreement system in English in contrast to gender agreement. Dowens, Guo, Guo, Barber & Carreiras (2011) replicated this experiment in Chinese proficient learners. They examined the effect of L1-L2 transfer, and L2 proficiency. Unlike Spanish, Chinese Mandarin is an isolating language that does not have a number and gender grammatical system. The results revealed that participants showed a late P600 effect in response to both gender and number agreement violations. The researchers concluded that features that are not instantiated in L1 can be fully acquired in the L2 at a higher stage of proficiency.

In a study similar to the one developed in the current dissertation, Sagarra and Herschensohn (2011) investigated the processing of gender and number agreement in Spanish monolingual and L2 learners employing online and offline techniques. Two main research questions were addressed: *1)* whether L2 learners whose L1 does not have gender can process Spanish grammatical gender at native-like level, and whether their L2 proficiency affect the acquisition process; and 2) whether they process animate and inanimate nouns differently. Participants were Spanish monolinguals, as well as beginner and intermediate native English speakers learning Spanish as L2. Participants performed a self-paced reading task (moving window task) and a grammaticality judgment task. Experimental sentences contained correct

and incorrect noun-adjective combinations. For the self-paced task, the results revealed that the mean RTs for all groups seem similar at the word before the adjective, whereas the mean RTs for intermediate and native Spanish speakers tend to be longer at the adjective and the word after the adjective in the disagreement condition. For the grammatical judgment task, intermediate learners, but not beginners, were more accurate with sentences that had gender agreement and disagreement. Additionally, both intermediate and native Spanish groups showed sensitivity to noun animacy. Both groups show longer RTs in processing animate rather than inanimate nouns, and show lower accuracy in sentences with animate rather than inanimate nouns. The authors argue that the intermediate group showed emergence of target-like processing, which highlights the role of proficiency and suggests that L2 learners with no gender system in their L1s can acquire gender and number agreement similarly to native speakers. The results also reveal that noun animacy affects the processing of both native and L2 learners. Although this study and other studies (e.g., Alarcón, 2009; Bruhn de Garavito & White, 2002) showed that inanimate nouns are easier to process that animate nouns, other studies showed the reverse (Alarcón, 2009; Fernández-García, 1999; Finnemann, 1992), or no difference (Antón-Méndez, Nicol, & Garrett, 2002; Barber et al., 2004). Alarcón (2009), for example, examined the effect of animacy on gender agreement in Spanish. Native and L2 speakers (with English L1) performed a computerized sentence completion task, in which participants' RT was measured. Participants first read a sentence that contained a masculine or a feminine subject, and then they had to choose the adjective that matches with it in gender. The results showed that participants were faster with animate nouns than with inanimate nouns.

A final note in this section is that the presence of grammatical gender system in the L1 might be a disadvantage in terms of acquiring another system in L2. Interference from L1 might

hamper and slow down the acquisition of L2. Foucart (2008) conducted ERP and eye-tracking experiments to examine grammatical gender processing in French. French L2 speakers (English L1 and German L1) were compared to French native speakers. The results showed English learners demonstrated native-like processing, despite the fact that they do not have a grammatical gender system in L1. While German learners, who do have a grammatical gender system in L1, failed to show any effect to gender agreement violations. The author referred this to the presence of a competing system in L1. German learners seemed to apply rules of the gender system of their L1 to their L2, which affects gender processing in the L2.

In summary, the above reviewed studies provide support for the FTFA hypothesis. The crucial assumption of this hypothesis is that L2 acquisition is constrained by UG, and therefore, late L2 learners can reset parameters regardless of their L1 properties. Under this view, learners' L1 constitutes the initial stages of L2 acquisition, so that negative transfer may take place especially when the parametric value of L2 differs from the one adopted by L1 grammar. This negative effect will disappear with more exposure to L2 and eventually learners will reset parameters according to the L2 values. Findings from the above-mentioned studies showed that it was possible for late L2 learners with or without gender systems in their L1s to acquire and process L2 gender agreement equivalently to native speakers.

It remains, though, that most of the studies that either support the FFFH or the FTFA hypothesis have examined the processing/acquisition of gender agreement in either Spanish, Dutch, French, or German, and in L2 speakers whose L1s are either a Romance or Germanic language. The current dissertation aims to fill this gap by examining the assumptions of these two hypotheses based on data obtained from a different subset of languages including the target language, which is MSA, and the participants' native languages.

3.2.4 Previous studies in Arabic grammatical gender

During the past two decades, there have been a number of studies conducted on grammatical gender acquisition and processing in Arabic as an L1 or an L2, although it is still negligible compared to research on other languages such as Spanish, Dutch, and French. A number of earlier studies in the field of SLA have investigated the acquisition of grammatical gender from a developmental perspective by examining Pienemann's (1998) Processability Theory (PT). PT states that learners restructure their L2 knowledge according to processing procedures, which occur in different stages in hierarchical order. In other words, the already processed structures that learners "developed at one stage are necessary prerequisites for the following stage" (Pienemann, 1998, p. 87). According to PT, learners can only produce what they have processed. Studies within the PT framework have yielded unexpected findings regarding the order in which L2 learners of Arabic acquire certain grammatical features such as definite articles or nouns, noun-adjective (N-A) agreement, and subject-verb (S-V) agreement. For example, while PT suggests that N-A agreement emerges in learners' interlanguage before S-V agreement, Nielsen (1997) found that both structures emerged at the same time in one participant's interlanguage, and none of these structures were present in another participant's. Likewise, Alhawary (1999, 2003) found that the majority of his participants acquired S-V agreement before N-A agreement, though participants received formal instruction on N-A agreement before they did on S-V agreement.

One of the earliest studies that examined agreement in Modern Standard Arabic (MSA) is by Mansouri (1995). This study tested whether the availability of discourse cues (discourse coherence, lexical cues) and semantic information (humanness, animacy and collectivity) assist the L2 learners on the production of subject-verb agreement morphology. The participants were

English-speaking learners, and all were at a high level of proficiency. Two written tasks (grammatical tasks and close test) were used in which learners were asked to fill in a blank with a verb in the appropriate forms in terms of person, number, and gender markers. Mansouri found that all these factors were significant in terms of helping the learners to identify the correct form of verbs. The participants were able to produce the correct form even in the absence of any semantic cues by extracting information from the general discourse context. Mansouri highlights the role of proficiency in mastering the L2 grammar.

Within the framework of UG and L1 transfer theories, there exist a number of studies that examined agreement in MSA. Alhawary (2005) investigated the acquisition of Arabic morphosyntactic structures including subject-verb agreement, noun-adjective agreement, and noun-adjective word order. The subjects were native English speakers and native French speakers divided into three groups based on the amount of formal instruction in Arabic they had received: first year, second year, and third year. Unlike French, English does not have a grammatical gender system. Data included semi-spontaneous production data on three picture tasks: picture description, picture differences, and picture sequencing. The results indicated that with subject-verb agreement there was no significant difference between the L1 French groups and the L1 English groups. However, there was a significant difference between them with noun-adjective agreement, and with gender categories (semantic gender vs. grammatical gender); the English participants faced more difficulty. The results also revealed that, overall, the L1 French speakers outperformed the L1 English speakers; however, some advanced L1 English participants obtained a 100% correct score. Alhawary concluded that these results support the FTFA hypothesis, which states that late learners can reach native-likeness in L2 regardless of L1s.

In a later study, Alhawary (2009) also conducted longitudinal and cross-sectional studies investigating the acquisition of nominal (noun-adjective) and verbal (subject-verb) gender agreement in Arabic. The data were also collected via production tasks from L2 learners with different L1s (English, French, and Japanese). Results from both studies showed that participants tended to use masculine gender more than feminine gender in the case of nominal gender agreement. In addition, English L1 and Japanese L1 participants performed significantly worse than French L1 speakers when adding the correct feminine gender marker to adjectives in order to agree with the corresponding feminine nouns. These studies also revealed that, unlike the French L1 participants, both English and Japanese speakers seemed to have more difficulty with nominal agreement than verbal agreement, as there was no significant difference between all three groups with respect to verbal agreement.

In a recent study, Alhawary (2019) examined the acquisition of different structures in MSA including nominal and verbal gender agreement. Using production tasks, he collected data from Russian and Chinese learners of Arabic who had different lengths of exposure to the target language. The results showed that no significant difference was found between the participants on both verbal and nominal gender agreement. The Russian participants had no advantage drawn from having a gender system in their L1.

Similarly, Alamry (2014) investigated the acquisition of subject-verb gender agreement in L2 learners of Arabic. The participants were divided into two groups based on whether or not their L1 has grammatical gender (e.g., Indonesian, Tagalog, French, Urdu). They were also grouped into intermediate or advanced groups based on their proficiency level. Three tasks were used in the study: a grammaticality judgment task, a sentence completion task, and a production task. The Arabic learners performed significantly worse than the native speaker on all tasks.

There was also a significant difference between the intermediate and advanced groups on all tasks. There was, however, no significant difference between participants who have grammatical gender in their L1s and those who do not on any of the tasks or in each of the proficiency levels. The advanced learners did not perform as well as the native speakers, however, the author argues that as the participants were still learning the language at the time of conducting the study, they probably have not yet reached their final state of acquisition.

It should be noted here that all the above-mentioned studies in MSA gender agreement have used either a production task or an offline comprehension task. No previous study has used an online task such as SPR or ERP to test this issue. The current dissertation is an attempt to fill the existing gap by using online methods, which will be explained in detail in the next section.

3.3 The current study

This dissertation investigates grammatical gender processing in MSA and focuses on subject-verb agreement. Specifically, it examines how native and late L2 learners of MSA process gender agreement, and whether the nature of the underlying processes is similar in the two populations. Theoretical linguistic models have proposed contrasting assumptions regarding the extent to which late L2 learners can acquire grammatical gender in their L2. A great deal of attention was given to the effect of the learners' L1 and how it can facilitate or hinder L2 acquisition. Therefore, this study is set up to examine the effect of L1 by including L2 learners with different L1 backgrounds, which vary with respect to the presence or absence of gender agreement. The study also controls for animacy effect by including animate and

inanimate nouns in the stimuli, which also appears to be a controversial issue in terms of whether or not it impacts gender agreement processing in both L1 and L2 settings.

A series of experiments were conducted to examine the processing of gender agreement in MSA. Experiments 1 and 2 tested native speakers' processing and used a self-paced reading task (SPR: Experiment 1), and an ERP paradigm (Experiment 2). Experiments 3 tested L1 and L2 speakers of MSA and used an offline grammaticality judgment task (GJT). Finally, Experiment 4 tested L2 speakers of MSA and used an online self-paced reading task (SPR).

The ERP experiment (Experiment 2) only tested native speakers due to a lack of advanced L2 learners in the city of Ottawa who meet the criteria of this study. As mentioned earlier, one objective of the current dissertation was to examine whether the presence or absence of a gender agreement system in L1 has an impact on L2 processing, which requires the inclusion of learners with a gender system in their L1s (+Gender group) and learners without a gender system in their L1s (-Gender group). In order to meet this objective, Experiments 3 and 4 took place in King Saudi University in Riyadh, Saudi Arabia, which lacked an ERP laboratory.

3.3.1 Research questions and predictions

As outlined above, in the current study I aim to examine gender agreement processing in MSA as a first and a second language. More specifically, I ask the following research questions and offer my predictions for each of them respectively:

RQ 1: How do native speakers process gender agreement?

According to previous studies in gender agreement processing in different languages (**For SPR task:** e.g., Alarcón; 2009; Dong, Wen, Zeng, & Ji, 2015; Sagarra & Herschensohn,

2011; **For ERP:** Barber & Carreiras, 2005; Deutsch & Bentin, 2001; Gunter et al., 2000; Molinaro et al., 2008b), MSA native speakers should show longer reaction time (in the SPR) and a P600 and possibly a LAN (in the ERP) in response to sentences with gender agreement violations as compared to sentences without agreement violations.

RQ 2: How do L2 speakers process and represent gender agreement? Will they show evidence of processing gender agreement in a native-like manner?

RQ 3: Will L2 speakers' L1 influence their representation and processing of gender agreement in MSA? Will the results support the FTFA or FFFH?

As mentioned earlier, the current dissertation investigates MSA L2 speakers' gender agreement processing within two UG hypotheses, which are the FFFH (Hawkins & Chan, 1997) and the FTFA (Schwartz & Sprouse, 1994). The former claims that certain features of functional categories, including gender agreement, are inaccessible to L2 adult learners unless they have these features instantiated in their L1. The latter proposed that attaining native-like in the L2 is not limited by learners' L1 or their age. The FTFA suggests that those L2 learners with grammatical gender systems in their L1 will likely be better than those without a grammatical gender system in their L1, however, L2 learners with no gender system will be able to overcome this difficulty and will eventually achieve knowledge of the L2 gender system similar to those of L2 learners with a gender system in their L1. In contrast, the FFFH predicts that the L1 will determine the acquisition of the L2 gender system, and thus show significant differences at all stages of development. Accordingly, L2 learners with gender systems in their L1s will always outperform learners with no gender system, even at the final stage of acquisition.

With respect to the current dissertation's research questions, the FFFH and FTFA make the

following predictions:

a) The FFFH predicts that only the +Gender group will perform similarly to the native speakers.

b) The FTFA predicts that both L2 learner groups (the +Gender group and the –Gender group) will perform similarly to the native speakers.

c) The FFFH predicts that the +Gender group will outperform the –Gender group.

d) FTFA predicts that the –Gender group will perform similarly to the +Gender group.

RQ 4: Do nouns' animacy affect gender agreement processing in native and L2 speakers?

The effect of animacy on gender agreement processing is not clear in the literature. It has not been previously investigated in MSA. Further, previous studies in different languages have revealed inconsistent results even within the same language (e.g., Spanish). Therefore, if this effect exists, in the SPR experiment, participants should show differences in RT between animate nouns and inanimate nouns. In the ERP experiment, participants should show an N400 in response to gender violations in sentences with animate nouns (semantic gender) as compared to inanimate noun (grammatical gender).

RQ 5: Do sentence word orders affect gender agreement processing in native and L2 speakers?

The effect of word order on gender agreement processing in MSA has not yet been studied. Since the gender agreement system is obligatory in the two-word orders (discussed in chapter 2), participants may show no effect of word order. However, in case of L2 speakers there might be an effect of their L1 in preferring one-word order over the other.

RQ 6: Do nouns' gender (masculine, feminine) affect gender agreement processing in native and L2 speakers?[20]

Previous research in MSA (Alamry, 2014; Alhawary, 2011), found that, unlike native speakers who showed no effect of gender type, L2 speakers were more accurate producing/accepting sentences with masculine than with feminine nouns. Accordingly, it is predicted that native speakers, in the present study, will process masculine and feminine noun in a similar manner. L2 speakers, on the other hand, may show preference for the masculine form over the feminine form due to the fact that masculine in MSA is considered to be the default form, and it is morphologically unmarked for gender.

[20] The effect of gender type is not the main interest of the present study; however, our stimuli was controlled for gender (masculine vs. feminine) to check for a possible effect of markedness/ default form on gender agreement processing.

Chapter 4

Gender agreement processing by native speakers

Introduction

As mentioned from the beginning, this dissertation explores gender agreement processing in MSA. However, one important issue to consider when testing MSA is how linguistically comparable Arabic varieties are to standard Arabic. One distinctive feature of the Arabic language is *diglossia,* which refers to the co-existence of two genetically related varieties of the same language in a particular speech society (Ferguson, 1959). In most Arabic-speaking communities, there exist the standard literary variety (or MSA), and the colloquial variety (spoken Arabic varieties). Typically, the standard form is used in official settings, education, media, and writing, while the colloquial one is used on a daily basis for everyday conversational purposes. Unlike colloquial variations of Arabic, which are specific to local communities, standard Arabic is universally understood by all Arabic speakers (Eisele, 2002; Tayash & Ayouby, 1992). The extent to which an Arabic spoken variety can be understood by other communities is based on the degree of linguistic distance between this variety and standard Arabic. Thus, considering the situation of Arabic as a diglossic language is essential when studying Arabic mainly because it is hard to find a native speaker of Arabic who sustains continuous production of MSA in everyday interactions. In order to minimize the effect of diglossia, and to make sure that the experiments performed call upon the knowledge of interest

in this dissertation, some steps were taken. First, I restricted the participation in Experiments 1 and 2 to one Arabic-speaking community. The Saudi community was chosen as it is one of the varieties that is linguistically close to MSA, with minimal differences phonologically, syntactically and lexically. Gender agreement, which is the concern here, is preserved in Saudi Arabic in both SV and VS word orders. Second, I included only Saudi participants who had completed their primary and higher education in Saudi Arabia, where MSA is the medium of instruction, media, and official interactions. Third, the stimuli in the experiments included high frequency words only, although this measure is not as important for native speakers as it is for the L2 participants (discussed in Chapter 5).

The following sections report Experiment 1 (SPR) and Experiment 2 (ERP) for native speakers. In both experiments, grammatical gender processing was explored. Participants were not the same across the two experiments. However, the stimuli lists were the same.

4.1 Experiment 1: Self-Paced Reading (SPR)

As mentioned in Chapter 3, in an SPR task, participants' reaction times (RTs) are recorded while reading a sentence, and the basic assumption is that longer RTs at certain positions in the sentence indicate processing difficulties. Previous research that had investigated sentence processing using SPR (gender agreement: Sagarra & Herschensohn, 2011; number agreement: Foote, 2011; tense/aspect agreement: Roberts, 2009; case marking: Jegerski, 2012) has showed that sentences with grammatical violations induced longer RTs at the point of violation, presumably as a result of difficulty incorporating a word that does not grammatically match the existing context. The current experiment uses the SPR task and aims to answer the following specific research questions:

RQ 1) Will participants show sensitivity to gender agreement violations and hence show longer RT on the target word resulting in the ungrammatical sentences as compared to the grammatical ones?

RQ 2) Will participants show any evidence of nouns with a semantic gender (animates) being easier to process, and thus will there be differences in RTs between sentences with animate nouns and sentences with inanimate nouns?

RQ 3) Will participants show evidence of a specific word order being the default in MSA or of a specific word order being considered more complex for them? Relatedly, will there be differences in RTs as a result of word order alternations (VS word order versus SV word order)?

RQ 4) Will participants show any evidence of one gender being considered unmarked/ or as a default and thus will there be differences in RTs between sentences with masculine nouns and sentences with feminine nouns?

4.1.1 Participants

Fifteen native speakers of MSA took part in this experiment (9 males, 7 females). Their ages ranged between 20 and 35 (mean= 26.9). Participants were recruited at King Saud University in Riyadh, Saudi Arabia. All participants speak Saudi Arabic, and have completed their primary and higher educations in Saudi Arabia. Most of them were monolingual, but they have learned English as a second language. All participants needed to complete all tests, and to score above 70% in the grammaticality judgment questions of the SPR task. All participants were compensated with SR 60 (CAD $20).

4.1.2 Material

Stimuli were created to test four conditions: grammaticality (grammatical vs. ungrammatical), animacy (animate vs. inanimate), gender (masculine vs. feminine), and word order (VS vs. SV). A total of 280 sentences (160 experimental and 120 fillers) were formed and split into two lists. Each list had 140 sentences, consisting of 80 experimental sentences and 60 fillers. The same experimental sentences from these two lists were manipulated for word order and gender match to create another two lists. Thus, four stimuli lists were created: lists 1 and 2 included sentences with VS word order, and lists 3 and 4 included sentences with SV word order. Lists 1 and 3, and list 2 and 4 have the same sentences but, in addition to the verb-subject order alternation, gender agreement was manipulated; that is, gender matched sentences in the VS lists were manipulated to be gender mismatched in the SV lists and vice versa. Participants performed two lists (one VS and one SV) and they were either lists 1 and 4, or lists 2 and 3 in order to avoid seeing a sentence twice. Complete lists of stimuli are provided in Appendix A.

All experimental sentences were in the past tense, and started with a prepositional phrase or an adverbial noun phrase. Half of the 80 experimental sentences were grammatical, and the other half were ungrammatical. The grammatical ones were divided into four categories: 10 sentences with animate-masculine subjects, 10 sentences with animate-feminine subjects, 10 sentences with inanimate-masculine subjects, and 10 sentences with animate-feminine subjects. The following are representative examples from the VS stimuli list:

(11) Masculine animate subject:

bikulli	maʃaqah	**ʒarra**	**ʔl-ħisˁanu**	ʔl-ʕarabah
with	hardship	$\text{pull}_{\text{past.3.MAS}}$	$\text{the-horse}_{\text{MAS.SG.AN}}$	the cart

'With difficulty, the horse pulled the cart'

(12) Feminine animate subject:

qabla	ʔams	**nasiy-at**	**Fatimatu**	kitaba	ʔan-naħowi
before	yesterday	forget$_{\text{past-3.FEM}}$	Fatimah$_{\text{FEM.SG.AN}}$	book	the-grammar

'The day before yesterday, Fatimah forgot her grammar book'

(13) Masculine inanimate subject:

fi	ʔl-ʕutˤlati	ʔl-madiyah	**qaddama**	**ʔl-matˤʕamu**	xusˤumatin	kabiirah
in	holiday	the last	offer$_{\text{past-3.MAS}}$	the-restaurant$_{\text{MAS.SG.IN}}$	discounts	great

'Last holiday, the restaurant offered great discounts'

(14) Feminine inanimate subject:

ʕinda	ʔl-ðˤahirah	**ħaʒab-at**	**ʔas-saħabatu**	noor	ʔaʃ-ʃams
at	noon	block$_{\text{past-3.FEM}}$	the-cloud $_{\text{FEM.SG.IN}}$	light	the-sun

'At noon, the cloud blocked the sunlight'

Here are examples from the SV stimuli list:

(15) Masculine animate subject:

qabla	sanatain	**Mohammad**	**taxarraja**	fi	ʔl-jamiʕah
before	two years	Mohammad$_{\text{MAS.SG.AN}}$	graduate$_{\text{past.3.MAS}}$	in	the university

'Two years ago, Mohammad graduated from the university'

(16) Feminine animate subject:

bikulli	wodˤoħ	**ʔl-muʕallimatu**	**ʃaraħ-at**	ʔad-dars
with all	clarity	the teacher$_{\text{FEM.SG.AN}}$	explain$_{\text{past-3.FEM}}$	the-subject

'With all clarity, the teacher explained the subject'

(17) Masculine inanimate subject:

qabla	ʃahar	**ʔl-ʕamalu**	**ʔintahaa**	fi	maħatˤat	ʔalqitˤar
before	month	the-work$_{\text{MAS.SG.IN}}$	finish$_{\text{past-3.MAS}}$	in	station	the train

'Last month, the work was done in the train station'

(18) Feminine inanimate subject:

bisabab ʔl-ʕawasˁif **ʔatˁ-tˁaʔiratu** **ʔaqlaʕ-at** fi waqt mutaʔaxxir
because the storm the-airplane$_{\text{FEM.SG.IN}}$ depart$_{\text{past-3.FEM}}$ in time late

'Because of the storm, the airplane departed late'

The ungrammatical sentences were designed to exhibit disagreement in gender between the verb and the subject. The ungrammatical sentences also included 10 sentences with animate-masculine subjects, 10 sentences with animate-feminine subjects, 10 sentences with inanimate-masculine subjects, and 10 sentences with inanimate-feminine subjects. The following are examples of ungrammatical sentences from the VS list (19 and 20) and the SV list (21 and 22).

(19) Masculine animate subject:

*biħirafiyatin baliɣah **sˁanaʕ-at** **ʔan-naʒʒaru** ʔbwaaban ʒamiilah
proficiently very **make**$_{\text{past-3.FEM}}$ **the carpenter**$_{\text{MAS.SG.AN}}$ doors beautiful

'Proficiently, the carpenter made beautiful doors'

(20) Feminine animate subject:

* bimaharatin kabirah **tasallaqa** **ʔl-qitˁatu** ʔʃ-ʃaʒarata
skilfully great climb $_{\text{past.3.MAS}}$ the-cat$_{\text{FEM.SG.AN}}$ the tree

'Skilfully, the cat climbed the tree'

(21) Masculine inanimate subject:

*bidon sabiq ʔinðar **ʔl-qaribu** **taʕatˁal-at** wasatˁa ʔan-nahr
without warning the-boat $_{\text{MAS.SG.IN}}$ stop$_{\text{past-3.FEM}}$ middle the-river

'Suddenly, the boat stopped in the middle of the river'

(22) Feminine inanimate subject:

* bisabab ʔas-surʕah **ʔas-sayyartu** **ʔisˁtˁadam** bir-rasˁiif
because of speeding the-car$_{\text{FEM.SG.IN}}$ collide$_{\text{past.3.MAS}}$ with the sidewalk

'Because of speeding, the car collided with the sidewalk'

The 120 fillers were designed to draw the participants' attention away from the structure being investigated. Half of these fillers was grammatical (see example 23 below), and the other half was not (see example 24 below). Since the incorrect part of the ungrammatical experimental sentences was always at the beginning of the sentences, the ungrammatical fillers were designed to show the incorrect part in a different position in the sentences.

(23) Grammatical sentence:

ʔal-qiraʔatu	tumattiʕu	ʔan-nafsa	wa	tuɣaððy	ʔal-ʕaql
reading	entertain	the soul	and	nourish	the mind

'Reading entertains the soul and nourishes the mind'

(24) Ungrammatical sentence:

* yatakawanu	baitu	ʒarinaa	min	ʔarbaʕati	ɣurfah
consist	house	neighbour our	of	four	$room_{SG}$

'Our neighbour's house consists of four rooms'

To ensure that participants, and especially L2 speakers (tested in Experiments 3 and 4), knew all of the vocabulary items used in the tasks, all words used were kept at a very basic level, and participants were instructed to ask any questions they had before or during the task.

4.1.3 Procedures

The data for this experiment was collected at King Saud University in Riyadh, Saudi Arabia over three days. Participants were tested individually or in small groups. Participants had to complete the tests in one session in a computer lab, which lasted approximately for one hour. Before starting the experiment, participants signed a consent form. After that, participants were asked to perform a self-paced reading (SPR) task. This task consisted of two lists (a VS list and an SV list). These two lists were broken up by a 10 to 15 minute break in which participants filled out a short background questionnaire that asked for biographical data such as

age, country of birth, country of primary and higher education, and information about other languages in their background. Participants had to complete either lists 1 and 4, or list 2 and 3. The lists were counterbalanced in two aspects. First, half of the participants completed lists 1 and 4, and half of them completed lists 2 and 3. Second, half of them started with a VS list (1 or 2), and half of them started with an SV list (3 or 4).

For the SPR task procedure, participants were seated in front of computers on which the experimental software (E-Prime software: Schneider, Eschman, & Zuccolotto, 2002) had been loaded. They started the task by reading instructions that were given on the screen, and then they completed eight practice trials prior to beginning the experimental trials. The task was a centre non-cumulative presentation, in which the sentence appears on the centre of the screen word by word one at a time. Each trial began with a fixation cross "+" symbol at the centre of the screen to prompt participants to direct their gaze at the location of where the words of the stimulus would appear. Each time participants pressed the space bar a single word appeared on the centre of the screen until the end of the sentence. At the end of each trial, question marks "???" appeared, which prompted participants to decide whether the sentence they just read is grammatically correct or incorrect by pressing one of two keyboard keys, either "L" for correct, or "A" for incorrect. An example of a trial is shown on Figure 4 below.

The grammaticality judgment test was added to the SPR task for various reasons. This was done to ensure that participants were cognitively engaged in the task and not just pressing buttons without paying attention to the stimuli. In addition, it provided complementary data regarding participants' accuracy rate to compare it with their RTs. Finally, it helped determine the eligibility of participants, as those who scored less than 70% were excluded.

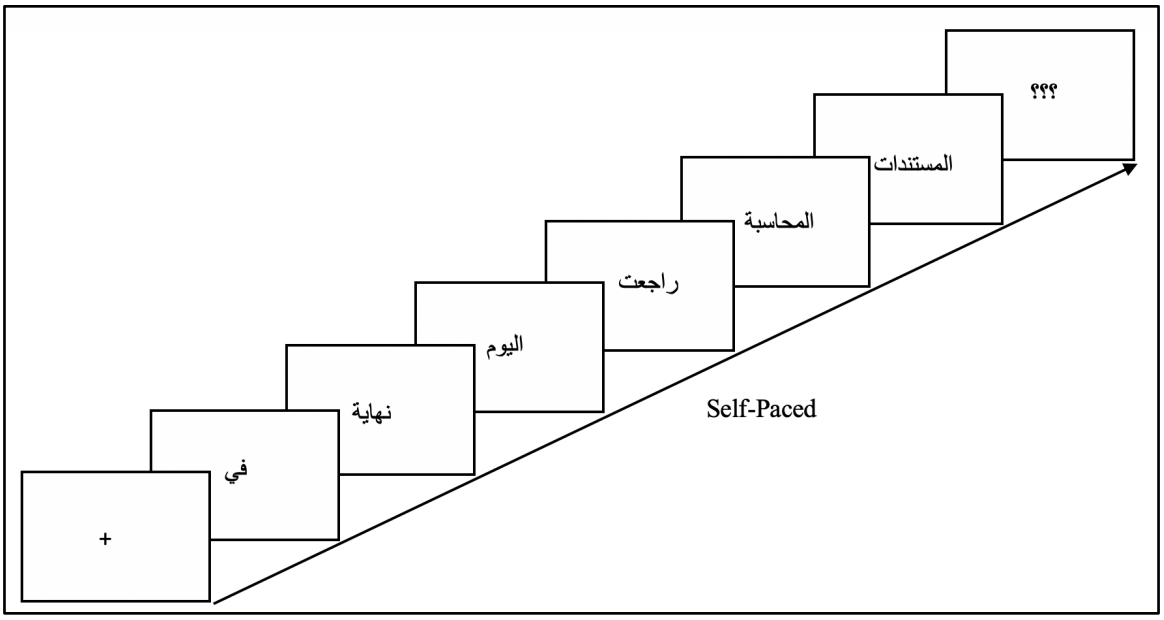


Figure 4. Example of a trial in the SPR task. It is translated as "At the end of the day, the accountant reviewed the documents".

4.1.4 Results

4.1.4.1 The grammaticality judgment task

All native participants scored above 90% accuracy on the grammaticality judgment task in both the VS list and SV list (Mean: 98.5% and 97.6% respectively). Their scores in the VS list ranged between 96.25% and 100%, while in the SV they ranged between 93.75% and 100. Thus, all 15 participants were included in the analysis.

4.1.4.2 The SPR task

A repeated measures analysis of variance (ANOVA) was conducted on the effect of four independent variables (grammaticality, gender, animacy, and word position) on participants' RTs. This was done separately for each word order. The first three variables included two levels as follows: grammaticality included grammatical and ungrammatical, gender included

masculine and feminine, and animacy included animate and inanimate. The fourth variable, word position, included three levels: position 1, position 2, and position 3.

During the SPR task, reaction times (RT) for all words in the sentences were recorded. However, only RTs for the critical word (CW), the word preceding it (CW-1), and the word following it (CW+1) were included in the analyses (see examples 25 and 26 for illustration). The critical word here means the word that rendered the sentences to be ungrammatical in the ungrammatical sentences. Before conducting the analysis, RTs that were 2.5 standard deviations (SD) above each participant's mean were considered outliers and removed from the analysis. Incorrect responses were also removed from the analysis. No data were removed in the current experiment as a result of these procedures.

(25) Verb-Subject word order

a. qabla ʔams **nasiy-at** **Fatimatu** **kitaba** ʔan-naħowi
(CW-1) (CW) (CW+1)
before yesterday forget$_{\text{past-3.FEM}}$ Fatimah$_{\text{FEM.SG.AN}}$ book the-grammar
'The day before yesterday, Fatimah forgot her grammar book'

b. * qabla ʔams **nasiy** **Fatimatu** **kitaba** ʔan-naħowi
(CW-1) (CW) (CW+1)
Before yesterday forget$_{\text{past-3.MAS}}$ Fatimah$_{\text{FEM.SG.AN}}$ book the-grammar
'The day before yesterday, Fatimah forgot her grammar book'

(26) Subject-Verb word order

a. bikulli wodˁoħ **ʔl-muʕallimatu** **ʃaraħ-at** **ʔad-dars**
(CW-1) (CW) (CW+1)
with all clarity the teacher$_{\text{FEM.SG.AN}}$ explain$_{\text{past-3.FEM}}$ the-subject
'With all clarity, the teacher explained the subject'

b. *bikulli wodˁoħ **ʔl-muʕallimatu** **ʃaraħ** **ʔad-dars**
(CW-1) (CW) (CW+1)
with all clarity the teacher$_{\text{FEM.SG.AN}}$ explain$_{\text{past-3.MAS}}$ the-subject
'With all clarity, the teacher explained the subject'

The following sections report on the results for each list separately. General significance is assumed at the value $p \leq 0.05$, and a trend toward significance is assumed at the value $p < 0.10$. Greenhouse-Geisser correction of *p*-values was reported for repeated measure with more than one degree of freedom.

4.1.4.2.1 SPR task analysis: the VS word order

A significant main effect of grammaticality (F (1, 14) = 34.983, $p < 0.001$) was found. Participants were slower reading ungrammatical sentences (M = 610.24) compared to grammatical sentences (542.80).

No main effect of gender was found (F (1, 14) =1. 41, p = 0.304). Participants had approximately similar RTs on sentences with masculine nouns (M = 570.53) and on sentences with feminine nouns (M = 582.50). Similarly, no main effect of animacy was found (F (1, 14) = 1.053, p = 0.322). Participants had approximately similar RTs on sentences with animate nouns (M = 573.42) and on sentences with inanimate nouns (M = 579.62).

Further, the results revealed a significant main effect of word position (F (2, 28) = 16.347, $p < 0.001$). Participants were significantly slower at the CW compared to the preceding or following words (see table 4.1).

Table 4.1. Mean RTs according to word positions

	Word Position	Mean (SD)
Native speakers	CW-1	559.25 (29.36)
	CW	**659.10** (46.13)
	CW+1	532.84 (27.190)

A significant interaction was found between grammaticality and word position (F (2, 28) = 14.186, p = 0.001). Follow-up analysis revealed that grammaticality had a significant main effect only at the CW position (F (2, 28) = 9.723, p = 0.003). Participants were slower at CW in the ungrammatical sentences compared to the preceding or following words (see figure 5). This suggests that no spill-over effect was found in the Native Speaker data for the grammatical gender violations.[21] No other significant interactions were found.

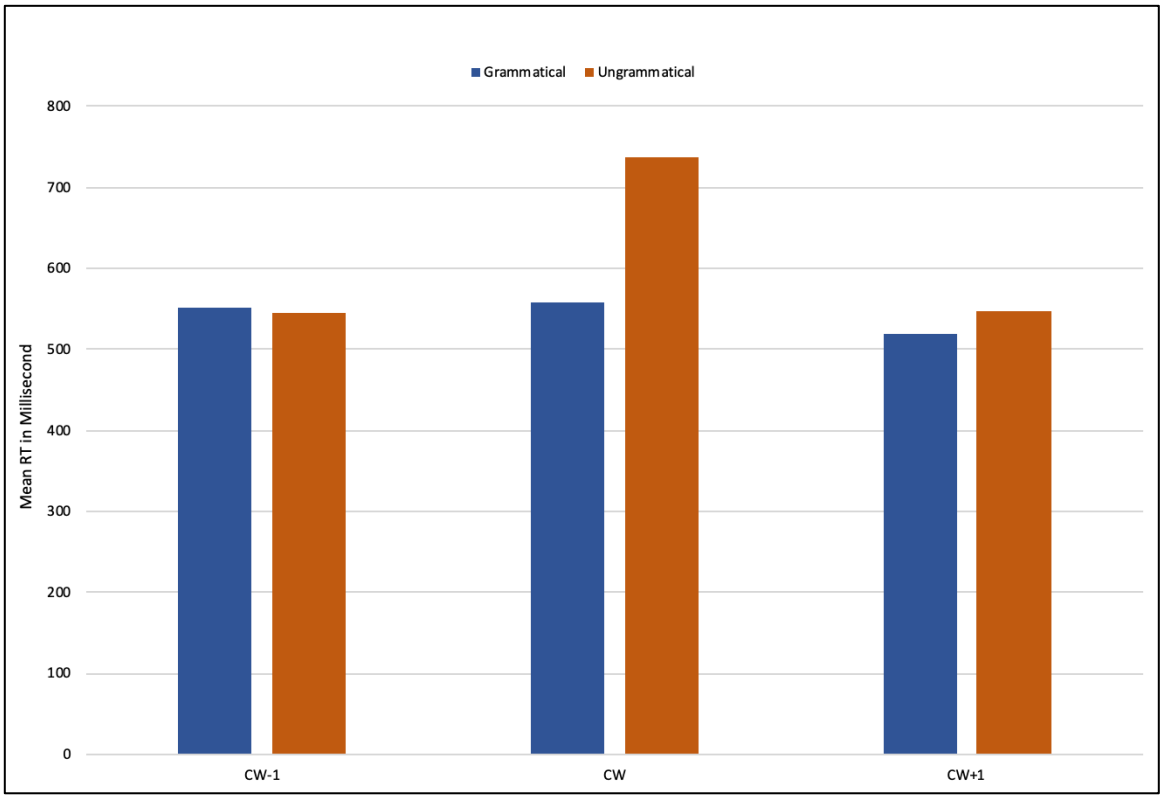


Figure 5. Mean RTs by grammaticality and word positions in VS word order

[21] Spill-over effect refers to a case when a reader faces cognitive processing difficulties while processing a word even after the eye has left the word (Murray, 2000; Rayner, 1998).

4.1.4.2.2 SPR task analysis: the SV word order

A significant main effect of grammaticality (F (1, 14) = 44.917, $p < 0.001$) was also found in the SV word order. Participants were slower reading ungrammatical sentences (M = 585.87) compared to grammatical sentences (522.01). No main effect of gender was found (F (1, 14) = 0.536, p = 0.476). Participants had approximately similar RTs on sentences with masculine nouns (M = 557.97) and on sentences with feminine nouns (M = 549.92). Similarly, no main effect of animacy was found (F (1, 14) = 0.020, p = 0.888). Participants had approximately similar RTs on sentences with animate nouns (M = 554.32) and on sentences with inanimate nouns (M = 553.56). The results also revealed a significant main effect of word positions (F (2, 28) = 33.006, $p < 0.001$). Participants were significantly slower at the critical word compared to the preceding or following words.

Table 4.2. Mean reaction times according to word positions

	Variable	Mean (SD)
Native speakers	CW-1	533.17 (20.75)
	CW	**619.18** (32.65)
	CW+1	509.49 (21.45)

A significant interaction was found between grammaticality and word position (F (2, 28) = 25.293, $p < 0.001$). Follow-up analysis revealed that grammaticality had a significant main effect at CW (F (1, 14) = 69.624, $p < 0.001$), and at CW+1 (F (1, 14) = 8.391, p = 0.012). Participants were slower at CW and at CW+1 in the ungrammatical sentences (see Figure 6). This suggests that spill-over effects are found in this word order. No other significant interactions were found.

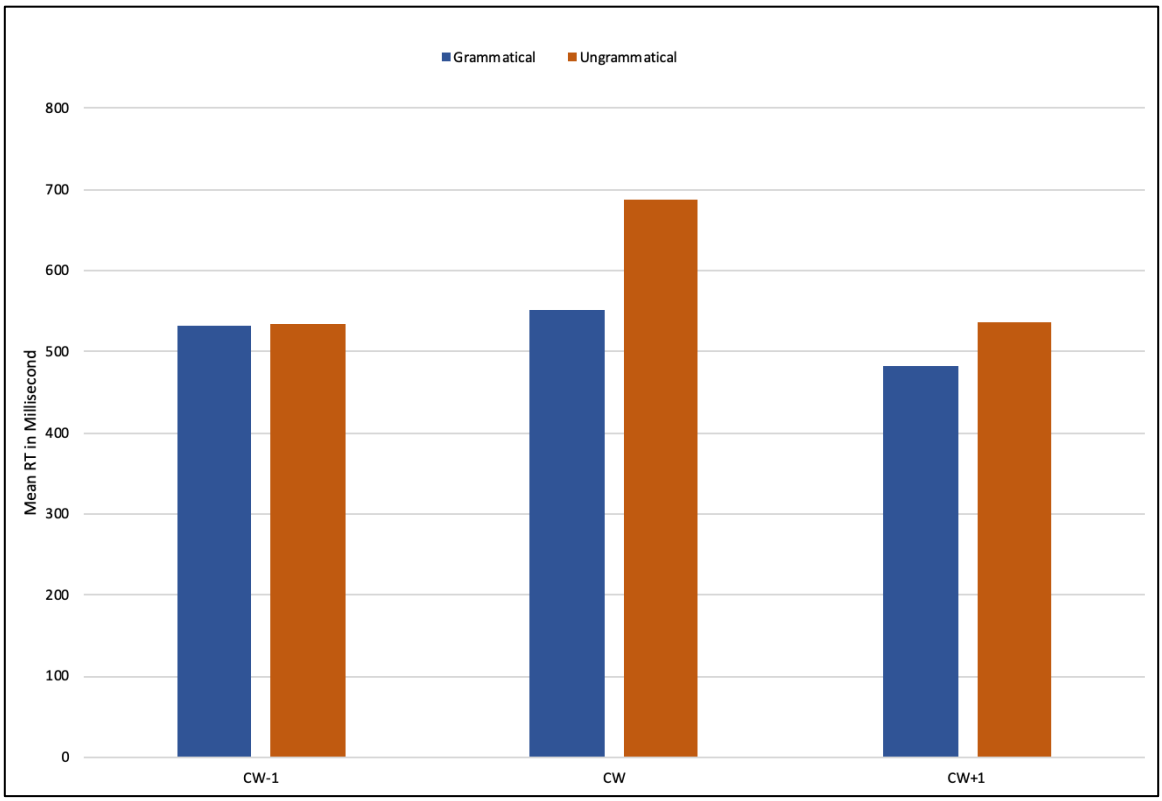


Figure 6. Mean RTs by grammaticality and word positions in SV word order

4.1.5 Discussion

This study was conducted to investigate how native speakers of MSA process grammatical gender. Fifteen participants performed an SPR task, in which they read sentences while their reading times were recorded. The task was controlled for grammaticality, gender, animacy, and word order. As expected, the results showed that participants were sensitive to grammatical gender violations. This was confirmed by their longer RTs on sentences that contained a grammatical gender violation compared to sentences that did not. This finding is consistent with previous research that found differences in RTs between grammatical and ungrammatical sentences, in which the ungrammatical sentences caused processing difficulty that resulted in longer reaction times (Foote, 2011; Jegerski, 2012; Jiang, 2004; Jiang, 2007;

Juffs, 1998a; Juffs & Harrington, 1996; Roberts, 2009; Sagarra & Herschensohn, 2011; Williams et al., 2001).

The results further revealed that there was no effect of gender. In both word orders, native speakers showed relatively similar RTs for masculine nouns and feminine nouns (see Table 4.3). This finding suggests that native speakers have no preference of one gender over the other, which is in line with previous findings reporting no effect of gender among L1 speakers (Alamry, 2014; Alarcón, 2009; Alhawary, 2009).

Table 4.3. Mean RTs by word order and gender

Variable		Mean RT		Difference
		VS	SV	
Gender	Masculine	570.53 ms	557.57 ms	11.97 ms
	Feminine	582.50 ms	549.92 ms	7.65 ms

* RTs for CW-1, CW, and CW+1 are collapsed all together.

With regard to noun animacy, the results showed no difference in RTs when nouns were animate (e.g., *tˁabiibah* 'doctor $_{\text{feminine}}$') or inanimate (e.g., *tˁawilah* 'table $_{\text{feminine}}$'). Although the effect of animacy in sentence processing is inconclusive, several studies have reported no difference in agreement processing related to animate and inanimate nouns (Antón-Méndez, Nicol, & Garrett, 2002; Barber, Salillas, & Carreiras, 2004).

Finally, the results from sentences of both VS and SV word orders showed that participants were sensitive to grammatical gender violations. In both cases, RTs were longer for the ungrammatical sentences than the grammatical ones. Moreover, the results for the experimental conditions (gender, animacy, and word position) were similar. While no effect of gender and animacy were found, the effect of word positions was noticeable with longer RTs

at critical words. That being said, by comparing mean RTs in the two constructions, small differences in RTs were found between the VS word order and the SV word order (see Table 4.4).

Table 4.4. Mean RTs comparison between VS and SV word orders

Variable		Mean RT		Difference
		VS	SV	
Grammaticality	Grammatical	542.80	522.01	20.79
	Ungrammatical	610.65	585.87	24.78

* RTs for CW-1, CW, and CW+1 are collapsed all together.

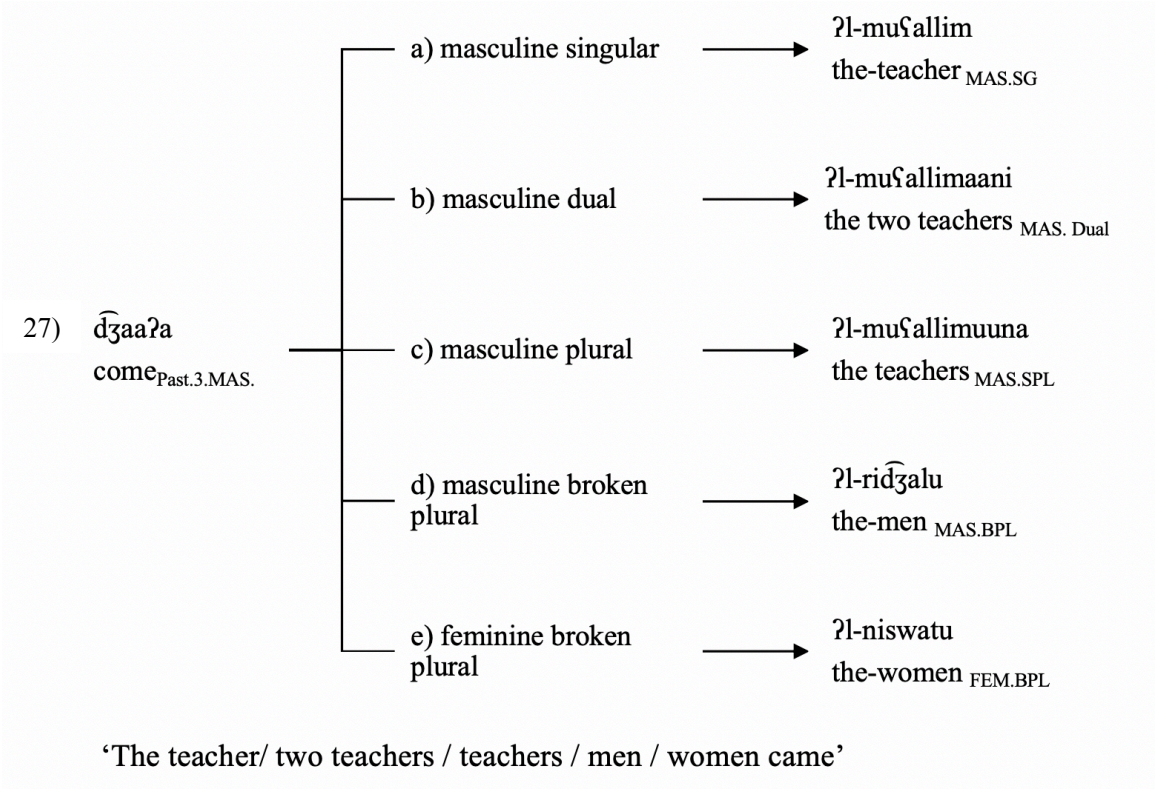
Overall, RTs were slightly longer in the VS word order than in the SV word order in both the grammatical and ungrammatical sentences. However, the difference in RTs between the two constructions reached its maximum at the critical word in the ungrammatical sentences (see Table 4.5).

Table 4.5. Mean RTs by grammaticality at the critical word position for VS and SV word orders

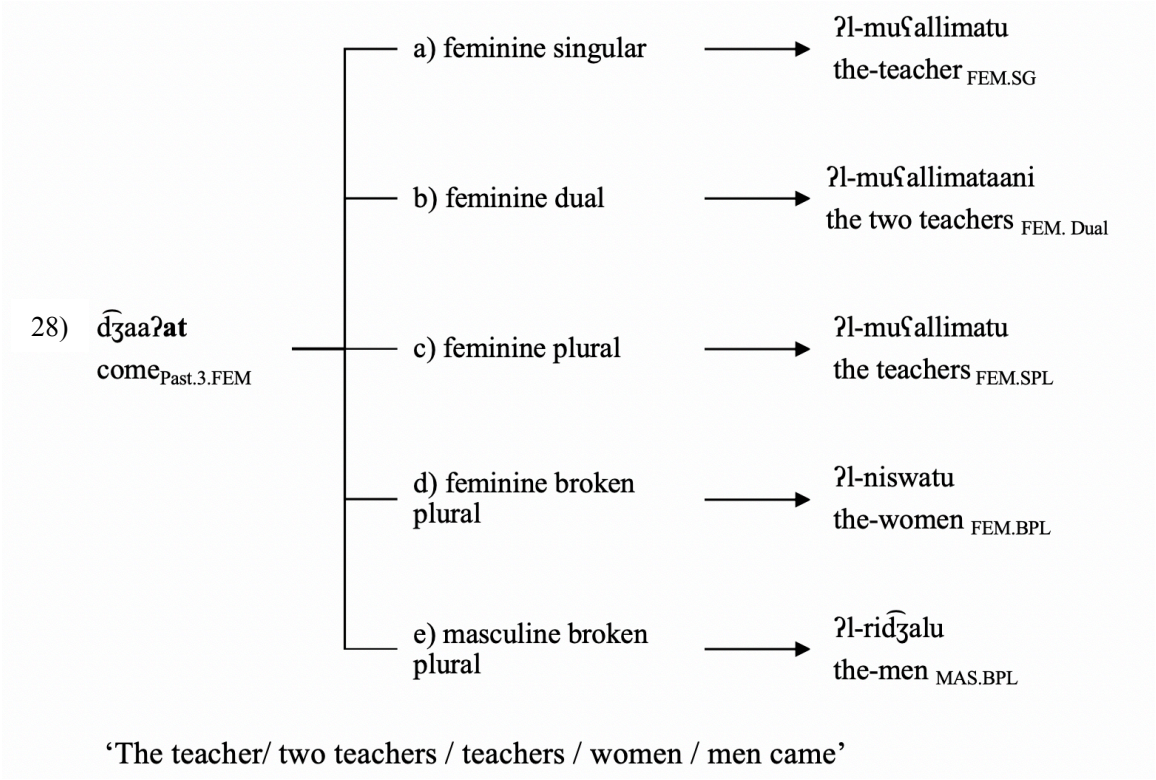
Variable		Mean RT		Difference
		VS	SV	
Grammatical	CW	557.33	550.99	6.34
Ungrammatical	CW	737.60	687.36	50.24

RTs from Table 4.5 show that participants took longer to process gender violation in the VS word order than in the SV word order. Although the critical word in the VS order is the subject and, in the SV order, it is the verb, the difference in RT is not due to the word category itself. This can be proven by the similarity in RTs between CW-1 in VS (which is the verb, *M*= 546.05 ms) and CW-1 in SV (which is the subject, *M*= 534.14 ms). A potential explanation for the

difference between the two constructions is that the gender violation is more complex to repair in the VS word order than in the SV word order. That is, as mentioned in Chapter 2, the agreement system in MSA differs according to the presence of a VS or SV sentence word order. In the case of the VS order, the verb partially agrees with its subject in gender and person. As a result, the agreement system allows for the subject to be either singular, dual or plural. Consider examples 27 and 28, which show possible subjects that can follow a masculine (or non-marked) verb in 27, and a feminine verb (marked with a feminine marker) in 28.



'The teacher/ two teachers / teachers / men / women came'



'The teacher/ two teachers / teachers / women / men came'

Examples 27a,b,c and 28a,b,c show that the verbs in these sentences agree with the subjects in gender but not in number; the verbs remain the same with the singular subject (27a and 28a), the dual subject (27b and 28b), and the plural subject (27c and 28c). Further, examples 27 and 28 show a fourth possibility, which is the case of broken plural. In the VS construction, if the subject is broken plural, the verb can optionally agree or not agree in gender. In examples 27d and 28e, both sentences have the same subject *ʔl-ridʒalu* 'men', but in 28e the verb has the gender suffix ***-at,*** while the verb in 27d does not.[22]

In contrast, in the SV order the verb exhibits full agreement with the subject in gender, person, and number, as demonstrated in (29) for a masculine subject and in (30) for a feminine subject.

[22] Sentences 27d and 28e convey different meanings. In 27d, what is conveyed is that men came one by one, while in 28e, the sentence means that they came in a group. The same differences apply to 27e and 28d, respectively.

(29) a. masculine singular	⟶	ʔl-muʕallimu the-teacher$_{MAS.SG}$	d͡ʒaaʔa come$_{Past.3.MAS.SG}$
b. masculine dual	⟶	ʔl-muʕallimaani the two teachers $_{MAS.\ Dual}$	d͡ʒaaʔa**a** come$_{Past.3.MAS.Dual}$
c. masculine plural	⟶	ʔl-muʕallimuuna the- teachers $_{MAS.SPL}$	d͡ʒaaʔ**uu** come$_{Past.3.MAS.PL}$
d. masculine broken plural	⟶	ʔl-rid͡ʒalun the-men $_{MAS.BPL}$	d͡ʒiʔ**uu** come$_{Past.3.MAS.PL}$

'The teacher / two teachers / teachers /men came'

(30) a. Feminine singular	⟶	ʔl-muʕallimatu the-teacher$_{FEM.SG}$	d͡ʒaaʔ**at** come$_{Past.3.FEM.SG}$
b. Feminine dual	⟶	ʔl-muʕallimataani the two teachers $_{FEM.\ Dual}$	d͡ʒaaʔa**taa** come$_{Past.3.FEM.Dual}$
c. Feminine plural	⟶	ʔl-muʕallimaatu the teachers $_{FEM.SPL}$	d͡ʒiʔ**na** come$_{Past.3.FEM.PL}$
d. feminine broken plural	⟶	ʔl-niswatu the-woman $_{FEM.BPL}$	d͡ʒiʔ**na** come$_{Past.3.FEM.PL}$

'The teacher /two teachers / teachers /women came'

In examples 29 and 30, the verb agrees fully with its subject in gender as well as in number, even in the case of broken plural.

This asymmetry in agreement between VS and SV word orders might explain the delay in RTs in the case of the VS word order. In this word order, the subject could be either singular, dual, sound plural, or broken plural, and the sentence will remain grammatically correct if gender is matching except for the broken plural, which allows for optional gender agreement. Thus, when the processor encounters a gender agreement violation in VS sentences s/he has to compute all possible options in order to repair and reconstruct the sentence. This is not the case with gender violation in the SV word order, which definitely requires less steps to repair. This

result provides additional support to previous research that suggest that increase in repair complexity is reflected in the online processing (Alemán Bañón & Rothman, 2016; Barber & Carreiras, 2005; Popov & Bastiaanse, 2018).

4.2 Experiment 2: Event-related potential (ERP)

Introduction

Experiment 2 utilized ERP to investigate the neurophysiological processing of gender agreement in MSA by native speakers. As no previous ERP study has examined gender agreement processing in MSA, this experiment contributes to the ERP literature by providing novel data that will expand our understanding of L1 speakers' gender agreement processing as it unfolds in real time.

As discussed in Chapter 3, the ERP technique has been widely used to investigate how language is constructed and processed in the human brain. Previous ERP research concerning gender agreement processing shows that native speakers consistently demonstrated a P600 effect, which was at times preceded by a LAN effect in response to agreement violations within sentential contexts. This P600 effect is often observed at the beginning, at approximately 500 ms after stimuli onset, and lasts up to 800-1000 ms. This trend has been consistently established across various languages such as Spanish (Barber & Carreiras, 2005), German (Gunter et al., 2000), Hebrew (Deutsch & Bentin, 2001), and Dutch (Hagoort & Brown, 1999). Moreover, researchers have been interested in one of the various factors that may interact with the syntactic processing of gender agreement: the semantic and syntactic processing interaction. Though this has been a topic of interest, the effect of semantic gender on the agreement process is inconclusive in the literature. For example, Deutsch and Bentin's (2001) study on Hebrew reported an N400 effect as a result of semantic gender violations, while Barber et al.'s (2004) study on Spanish did not find such an effect.

In light of this research, the current experiment aims to examine how L1 speakers of MSA process gender agreement and whether their processing is influenced by animacy, noun gender type, and word order. Using ERP, I aim to answer the following specific research questions:

RQ 1) Will participants show sensitivity to gender agreement violations and hence generate a P600 with/without LAN for the ungrammatical sentences as compared to the grammatical ones?

RQ 2) Will participants show any evidence of distinctively processing nouns with a semantic gender (animates) and nouns with grammatical gender (inanimate), and thus generate an N400 effect in response to semantic gender violation?

RQ 3) Will participants show evidence of a word order being the default in MSA or of a word order being considered more complex for them? Relatedly, will there be differences in neurocognitive activities as a result of word order alternations (VS word order versus SV word order)?

RQ 4) Will participants show any evidence of one gender being considered unmarked or being considered a default? Relatedly, will there be differences in amplitude between sentences with masculine nouns and sentences with feminine nouns?

4.2.1 Participants

Twenty native speakers of MSA took part in this experiment (18 males, 2 females).[23] Their ages ranged between 19-35 (mean= 26.7). Participants were recruited from the Saudi community in Ottawa, and were tested at the ERPling lab at the University of Ottawa. All participants speak Saudi Arabic, and have completed their primary and, for some of them, their higher educations in Saudi Arabia. All of them speak English as an L2. They have learned English as an L2 in Saudi, but became more proficient after they arrived in Canada. All participants were right-handed, did not have any visual impairments, and had no history of neurological or linguistic disabilities. One participant was excluded before analysis because of a technical failure. All participants were compensated with CAD $20.

4.2.2 Material

The same materials used in the SPR task were used in this experiment (please refer to section 4.1.2, p.65 for more details).

4.2.3 Procedures

Participants were tested individually in a single session with a break of 10-15 minutes between the lists. During this break, participants were asked to fill out a short background questionnaire that asked for biographical data such as age, country of birth, country of primary and higher education, and information about other languages in their background. Participants began by filling out a consent form. Then, the ERP cap and facial electrodes were placed on

[23] The male participants outnumbered the female due to the nature of the study. The ERP capping procedures requires touching the participant and due to cultural norms, it was difficult to recruit female participants from the Saudi community.

participants' head and face. They were then seated in a soundproof room facing a 20-inch computer screen. Participants were asked to silently read a series of sentences and to judge whether they were a grammatically correct or incorrect. Sentences were presented using the RSVP (Rapid Serial Visual Presentation) method and in random order. Prior to the experimental trials, participant completed eight practice trials. Each trial began with a fixation cross at the center of the screen, which disappeared when the participant pressed the space bar. Then sentences were presented word by word in black font against a white background. Each word remained on the screen for 300 ms and was followed by a blank screen for 200 ms. At the end of each sentence question marks "???" appeared on the center of the screen to prompt the participants to give their judgment about the grammaticality of the previously presented sentence. The question marks remained on the screen until participants pressed one of two keys: the right arrow for correct or the left arrow for incorrect. Then the next trial began after an interval of 300 ms. An example of a trial is shown in Figure 7 below.

Same as in the SPR task, participants were counterbalanced across the stimuli lists. Half of the participants completed lists 1 and 4, and half of them completed lists 2 and 3. Further, half of them started with a VS list (1 or 2), and half of them started with an SV list (3 or 4). Time wise, the experimental task lasted approximately 40-50 minutes. Each list took 15-20 minutes, with a 10 to 15 minute break between them.

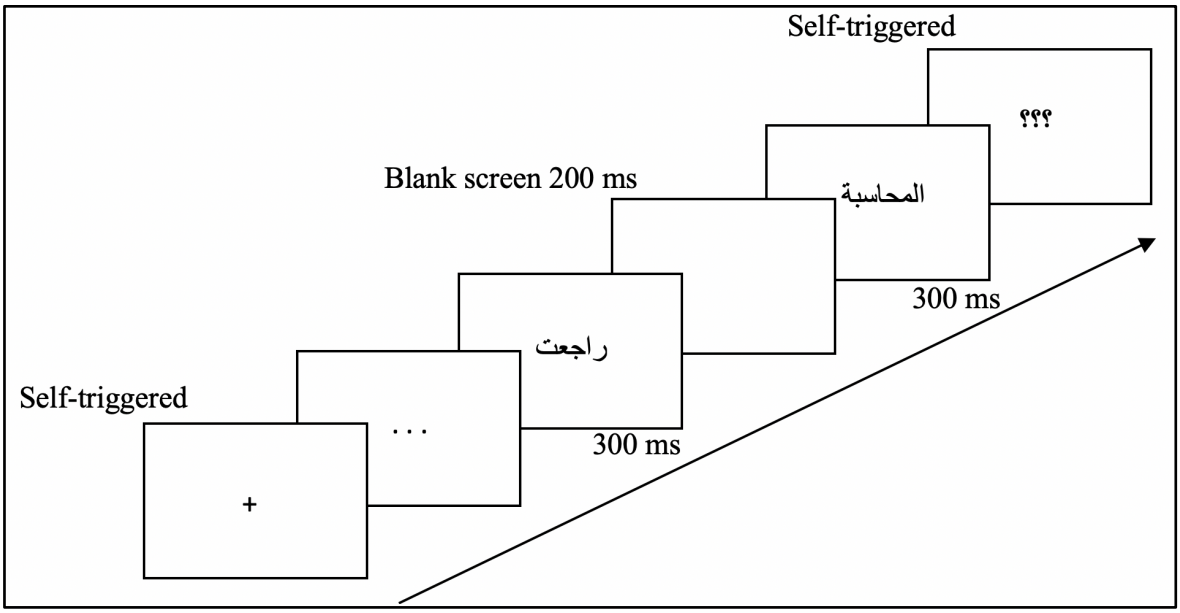


Figure 7. Example of a trial in the ERP (including the verb 'reviewed' and the subject 'the accountant').

4.2.4 Electrophysiological Recording

EEG activity was continuously recorded from 64 scalp electrodes mounted on an elastic cap (Quik-Cap by Compumedics Neuroscan). Six additional facial electrodes were placed on participants' face, that is, two electrodes (hEOGr and hEOGl) were placed on the outer canthus of the eyes to record horizontal eye movement, two electrodes (vEOGu and EOGl) were placed above and below the left eye to record the vertical movement and blinks, and two electrodes (M1 and M2) were placed behind both mastoids. Electrode impedances were kept below 10 KΩ.

For each target word, the continuous data were segmented into 1,150 ms long epochs including a 150 ms pre-stimulus baseline. Average ERP waveforms were time-locked to the onset of the target word. The target word is the word that rendered the sentences to be ungrammatical in the ungrammatical version of the sentences. In a VS word order sentence, the target word is the subject, while in the SV word order sentence the target word is the verb. The

data were re-referenced offline to the average activity of the left and right mastoid, and filtered with a low-pass 0.30 Hz forward filter. Trials with artifacts due to eye movements or excessive muscle activity were rejected prior to analysis. After artifact rejection, approximately the same number of trials were kept per condition, ranging between 7 to 8 out of 10 across conditions.

4.2.5 Analysis

The statistical analyses were carried out on four time-windows based on the previous literature and visual data inspection: 300-450 ms, 450-600 ms, 600-800 ms, and 800-1000 ms. The 300-450 ms time window was chosen for the detection of LAN and N400 effects, which were observed in this time window in previous studies on agreement processing in different languages (Gunter et. al, 2000; Deutsch & Bentin, 2001; Barber & Carreiras, 2005; Caffarra et. al., 2015). The 450-600 ms time window was for the detection of the onset of the P600, which was mainly based on visual inspection. The 600-800 ms time window was for the early P600, and the 800-1000 ms time window was for the late P600. During these two time-windows, the P600 has been robustly documented in response to agreement violation (Kaan, 2007; Swaab et al., 2012). The ERP effects were evaluated via the average of mean amplitudes of nine electrodes, each electrode represented a region of interest as follows: left anterior (F3), left central (C3), left posterior (P3), mid anterior (Fz), mid central (Cz), mid posterior (Pz), right anterior (F4), right central (C4), and right posterior (P4). These regions of interest were included in the statistical analysis as different topographical variables: anteriority, and laterality. For each time window, a repeated measures Analysis of Variance (ANOVA) was conducted on five independent variables, that is, grammaticality with two levels (grammatical, ungrammatical), gender with two levels (masculine, feminine), animacy with two levels (animate, inanimate), anteriority with three levels (anterior, central, posterior), and laterality with three levels (left,

mid, right). Figure 8 below shows the distribution of the electrodes included in the analysis. General significance is assumed at the value $p \leq 0.05$, and a trend toward significance is assumed at the value $p < 0.10$. Greenhouse-Geisser correction of p-values was reported for significant effects with more than one degree of freedom.

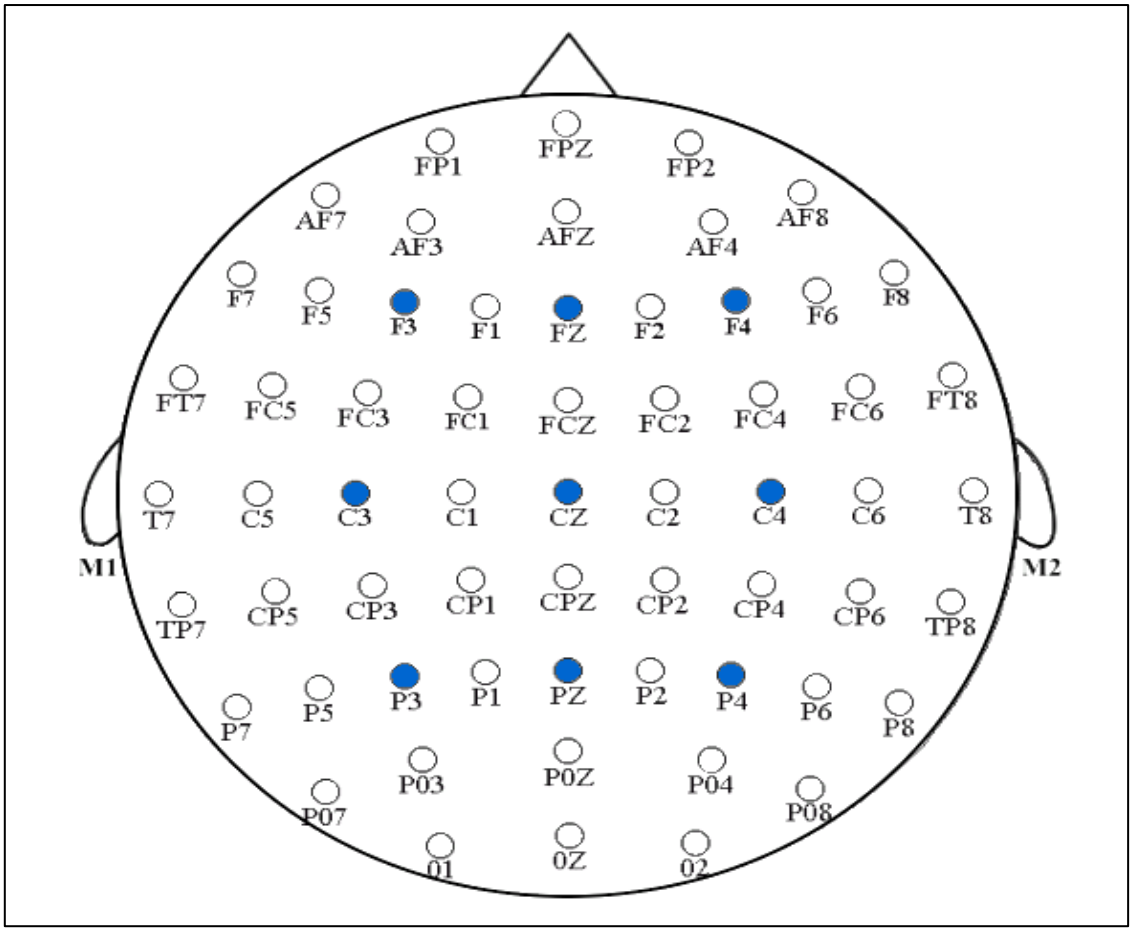


Figure 8. Map of the cap electrodes (coloured electrodes represent the electrodes that were included in the analyses).

Effects related to the topographical variables (anteriority, laterality) were reported only in case of interaction with grammaticality. Separate ANOVAs were conducted on the VS word order and SV word order. The following sections report on the results for each list separately.

4.2.6 Results

4.2.6.1 Behavioural: The grammaticality judgment task

All native participants scored above 90% accuracy on the grammaticality judgment task in both VS and SV lists (Mean: 95.5% and 96.3% respectively). Their scores in the VS list ranged between 90% to 98.75%, while in the SV they ranged between 92.5% and 100. Thus, all 19 participants were included in the analysis.

4.2.6.2 The ERP results: VS word order

A visual inspection of the grand-averaged waveforms showed differences between grammatical and ungrammatical sentences. That is, the ungrammatical sentences elicited greater positivity than the grammatical sentences. This positivity emerged at approximately 480 ms post-stimulus onset, peaked at roughly 700 ms and was evident until approximately 1000 ms. It was larger across central and posterior regions, but with some involvement of the mid and left anterior. The timing and topographical distribution of this positive-going wave are compatible with the P600 effect. Mean amplitudes for the grammaticality condition are shown in Figure 9 and 10 below (Figure 9 shows ERP waveforms at the representative electrodes of each region of interest, while Figure 10 shows mean amplitudes collapsed across all sites at different time windows).

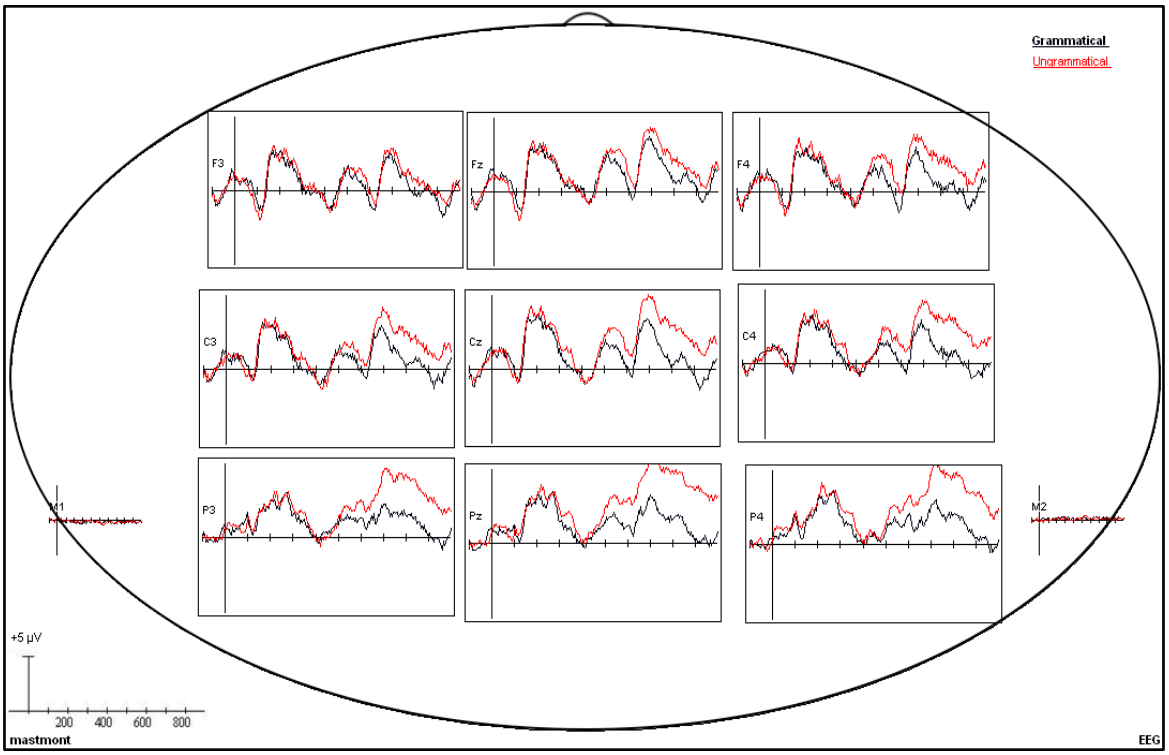


Figure 9. ERP grand-average waveforms for the grammaticality condition at the representative electrodes of each region of interest. Positivity is plotted upward.

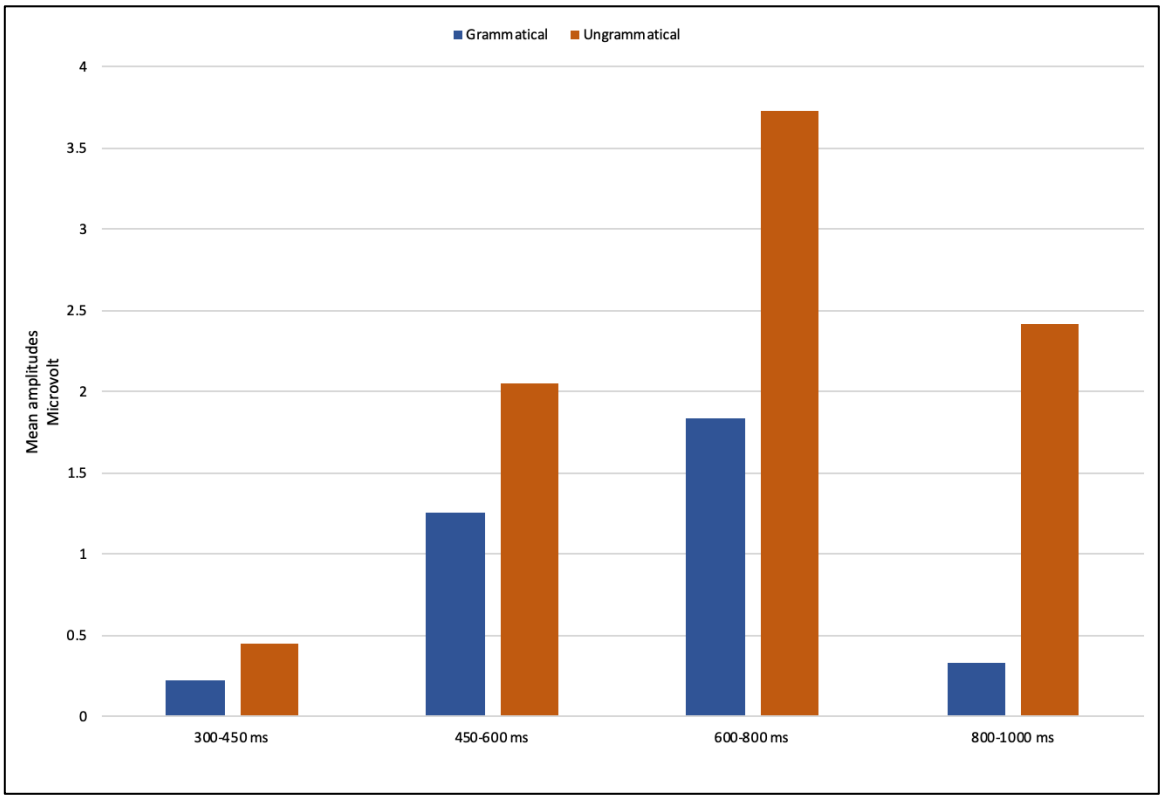


Figure 10. Mean amplitudes for the grammaticality condition is collapsed across all sites at the different time windows.

300-450 ms: A repeated measure ANOVA revealed that there was no significant main effect of grammaticality (F (1, 18) = 0.287, p = 0.599), and no significant main effect of gender (F (1, 18) = 0.274, p = 0.607). There was, however, a significant main effect of animacy (F (1, 18) = 5.989, p = 0.025). The animate nouns elicited greater positivity than inanimate nouns.

In addition, a trend toward a significant interaction was found between grammaticality, animacy, and laterality (F (2, 36) = 3.298, p = 0.068). Follow-up analyses revealed that within grammaticality, an animacy x laterality interaction was significant in ungrammatical sentences only (F (2, 36) = 7.036, p = 0.003). Animacy had a significant main effect over the mid (F (1, 18) = 6.033, p = 0.024) and right regions only (F (1, 18) = 8.794, p = 0.008), but not over the left regions (F (1, 18) = 2.362, p = 0.142). Animate nouns elicited greater positivity than inanimate nouns (see Figure 11). No other significant interactions were found in this time window.

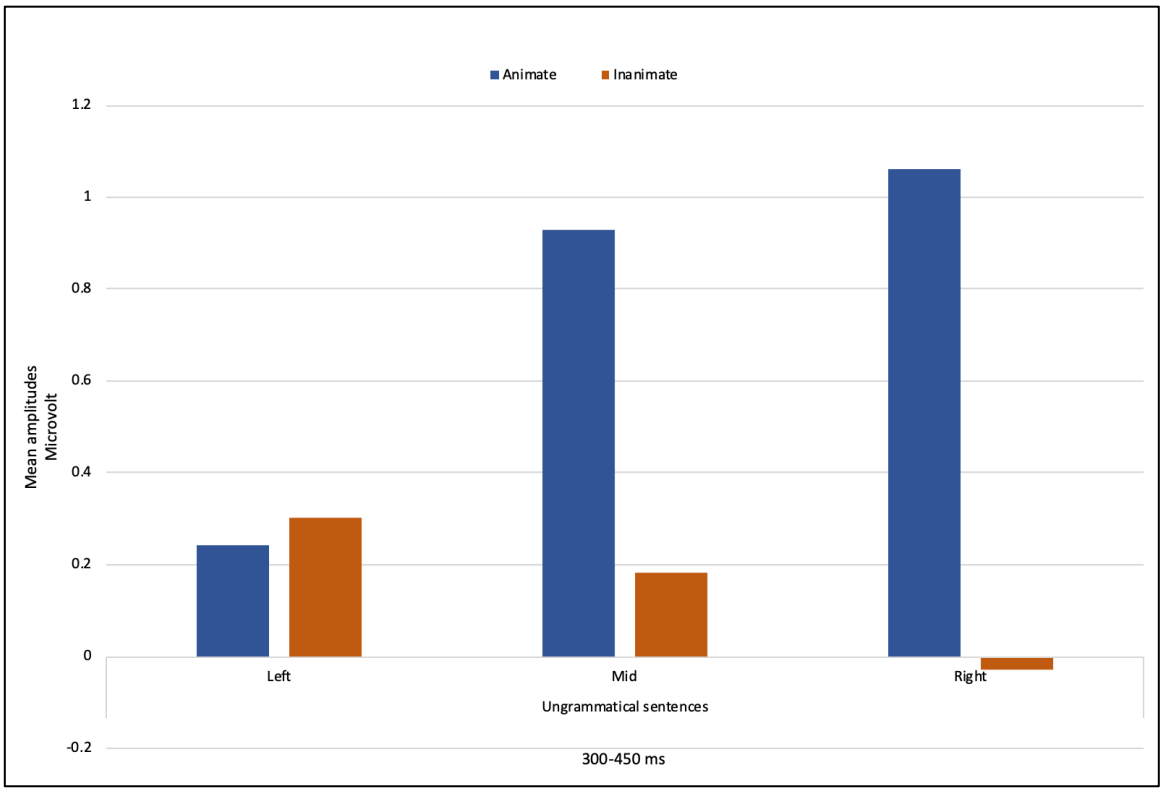


Figure 11. Mean amplitudes by animacy and laterality within ungrammatical sentences

450-600 ms: A repeated measures ANOVA revealed that the main effect of grammaticality was not significant, but that it indicated a trend towards a significant pattern (F (1, 18) = 3.431, p = 0.08). Ungrammatical sentences (M= 2.05 µv) elicited greater positivity than grammatical sentences (M= 1.256 µv).

There was no significant main effect of gender (F (1, 18) = 0.825, p = 0.376). There was, however, a significant main effect of animacy (F (1, 18) = 5.610, p = 0.029). The animate nouns (M= 2.12 µv) elicited greater positivity than inanimate nouns (M= 1.18 µv). No other significant interactions were found in this time window.

600-800 ms: A repeated measures ANOVA revealed a significant main effect of grammaticality (F (1, 18) = 15.133, p = 0.001). Ungrammatical sentences (M= 3.72 μv) elicited greater positivity than grammatical sentences (M= 1.83 μv).

No significant main effect of gender was found (F (1, 18) = 0.348, p = 0.562). There was a significant main effect of animacy (F (1, 18) = 5.266, p = 0.034). Animate nouns (M= 3.28 μv) elicited more positive waveforms than inanimate nouns (M= 2.28 μv).

In addition, the results revealed a significant interaction between grammaticality and anteriority (F (2, 36) = 8.065, p = 0.002). Follow-up analysis revealed that this interaction was significant over the central region (F (1, 18) = 5.916, p = 0.026) and the posterior region (F (1, 18) = 39.105, p < 0.001), and indicated a trend over the anterior region (F (1, 18) = 3.646, p = 0.072). Ungrammatical sentences elicited greater positivity over all regions, but with a significant difference over the posterior region compared to anterior and central regions (see Figure 12). No other significant interactions were found in this time window.

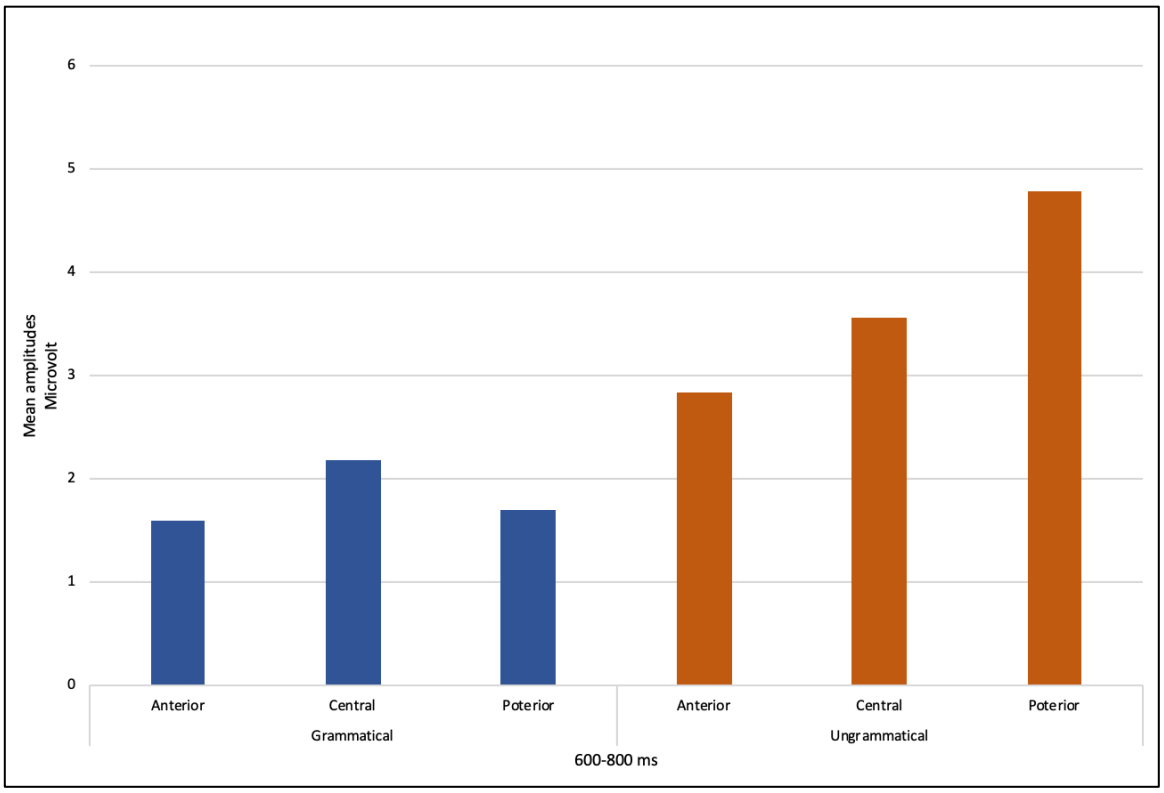


Figure 12. Mean amplitudes by grammaticality and anteriority

800-1000 ms: A repeated measures ANOVA revealed a significant main effect of grammaticality (F (1, 18) = 13.181, p = 0.002). Ungrammatical sentences (M= 2.42 μv) elicited greater positivity than grammatical sentences (M= 0.33 μv).

There was no significant main effect of gender (F (1, 18) = 0.560, p = 0.464) and no significant main effect of animacy (F (1, 18) = 2.926, p = 0.104). There was a significant interaction between grammaticality and anteriority (F (2, 36) = 6.893, p = 0.005). Follow-up analysis revealed that grammaticality had a significant main effect over the central region (F (1, 18) = 7.198, p = 0.015) and the posterior region (F (1, 18) = 26.898, p < 0.001), and indicated a significant trend over the anterior region (F (1, 18) = 3.492, p = 0.078). Ungrammatical sentences elicited greater positivity than grammatical sentences over all regions (see Figure 13).

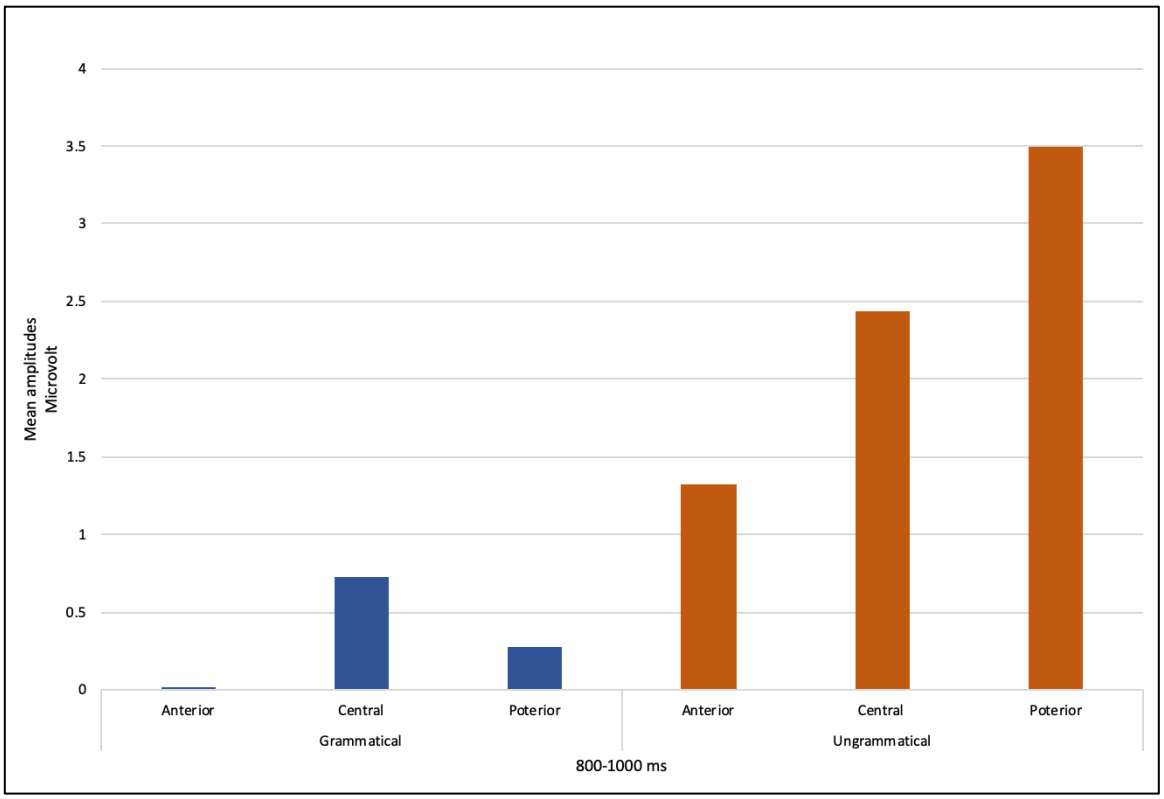


Figure 13. Mean amplitudes by grammaticality and anteriority

In addition, there was a significant interaction between grammaticality, anteriority, and laterality (F (4, 72) = 3.525, p = 0.027). Follow-up analysis revealed that grammaticality had a significant main effect over the right anterior region (F (1, 18) = 8.397, p = 0.01), over the left central region (F (1, 18) = 4.893, p = 0.04), over the mid central region (F (1, 18) = 11.880, p = 0.003), and over all posterior regions (F (1, 18) = 26.898, p < 0.001). Ungrammatical sentences elicited greater positivity than grammatical sentences (see Figure 14). No other significant interactions were found in this time window.

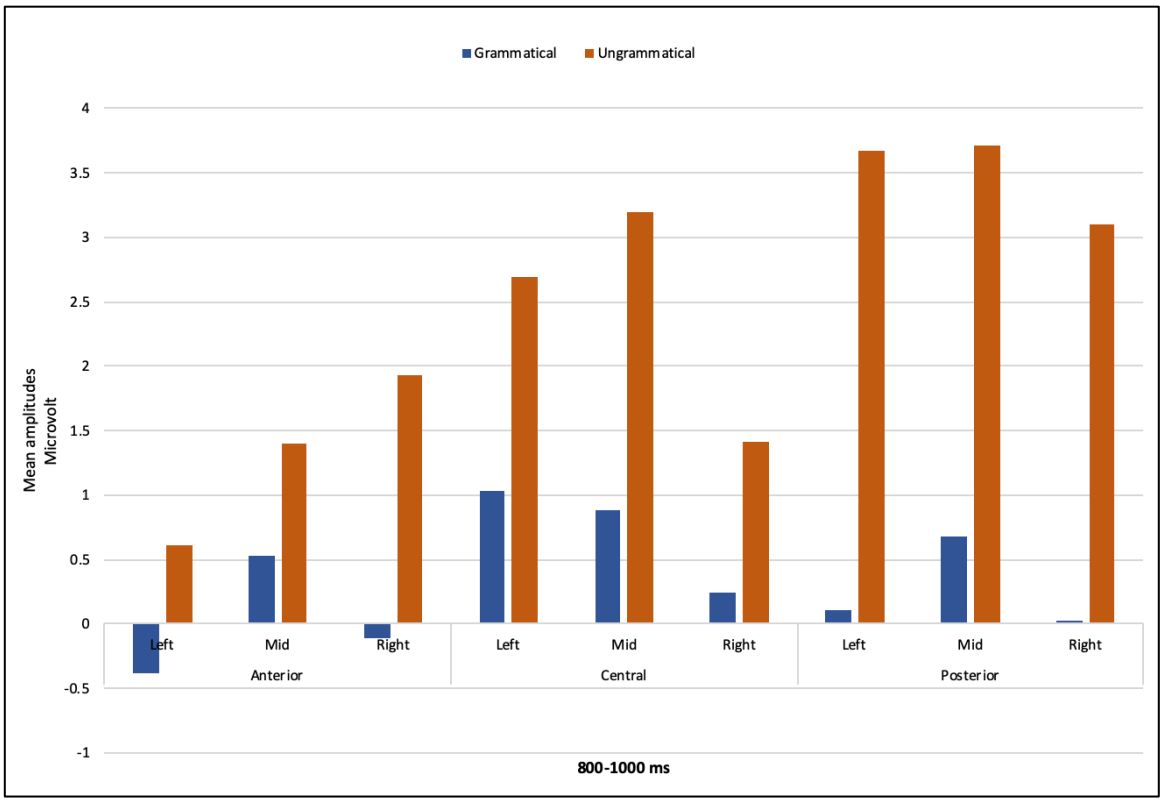


Figure 14. Mean amplitudes by grammaticality, anteriority, and laterality

4.2.6.3 The ERP results: SV word order

A visual inspection of the grand-averaged waveforms showed differences between grammatical and ungrammatical sentences. The ungrammatical sentences elicited greater positivity than the grammatical sentences. This positivity emerged at approximately 530 ms post-stimulus onset, peaked at roughly 700 ms, and was evident until approximately 850 ms. It was larger across posterior regions, but with some involvement of the central region. The timing and topographical distribution of this positive-going wave are compatible with the P600 effect. Figure 15 shows the grand average ERP waveforms at the representative electrodes of each region of interest, and Figure 16 shows and mean amplitudes for the grammaticality condition collapsed across all sites at different time windows.

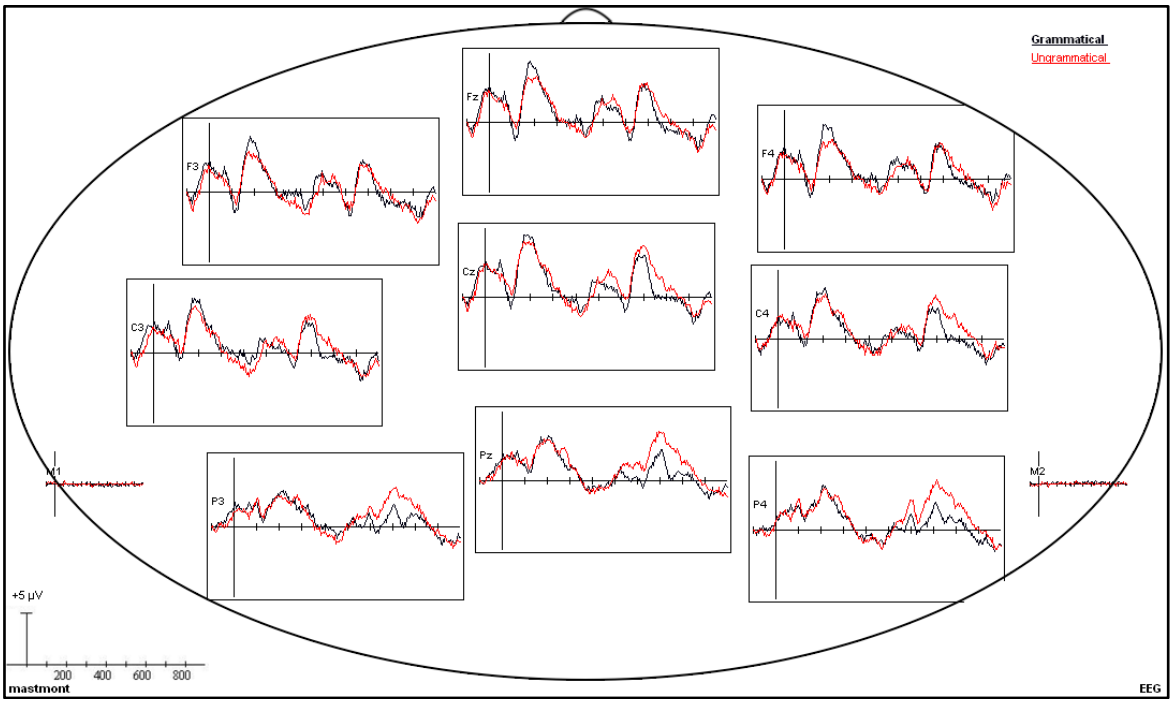


Figure 15. ERP grand-average waveforms for the grammaticality condition at the representative electrodes of each region of interest. Positivity is plotted upward.

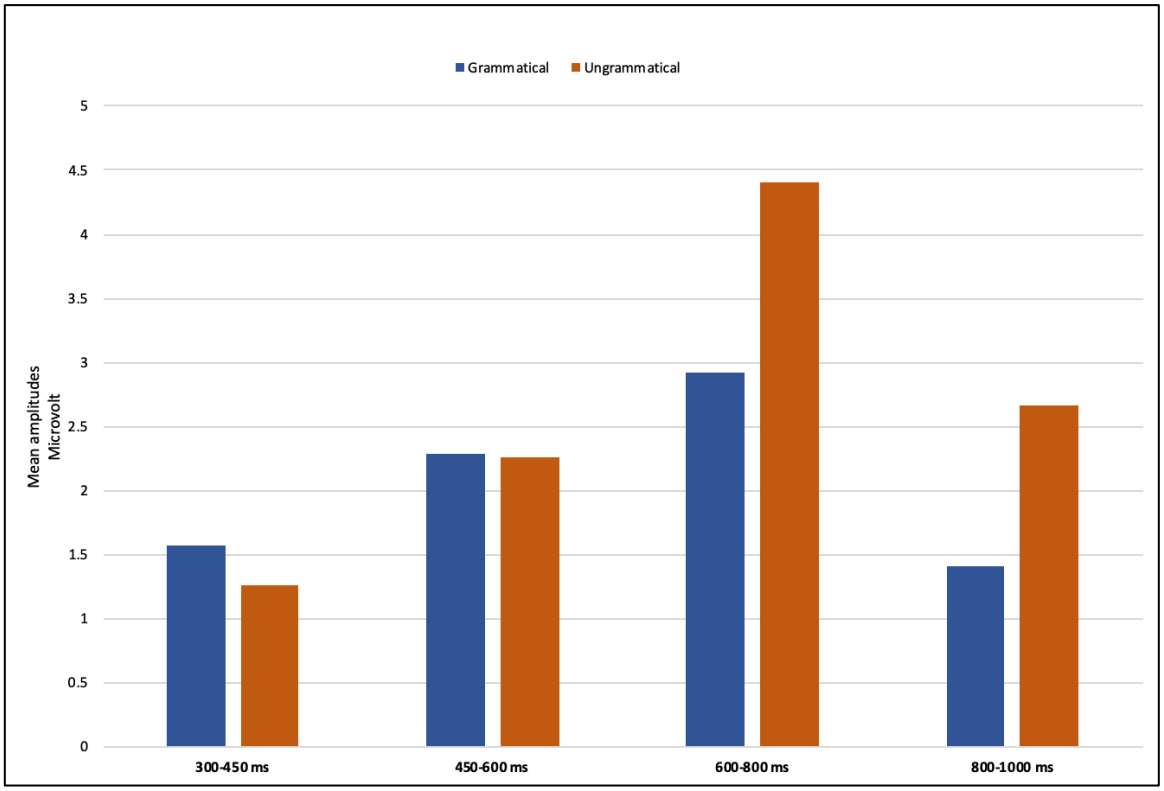


Figure 16. Mean amplitudes for the grammaticality condition are collapsed across all sites at the different time windows.

300-450 ms: A repeated measures ANOVA revealed that there was no significant main effect of grammaticality (F (1, 18) = 0.562, p = 0.463), of gender (F (1, 18) = 1.586, p = 0.224), nor of animacy (F (1, 18) = 2.989, p = 0.101).

However, there was a trend toward a significant interaction between grammaticality, animacy, anteriority, and laterality (F (1, 18) = 3.704, p = 0.079). Follow-up analysis revealed that within grammatical sentences, animacy had a significant main effect (F (1, 18) = 6.460, p = 0.02). This effect of animacy was significant over the anterior regions (F (1, 18) = 8.797, p = 0.008), and was also significant over the mid central region (F (1, 18) = 10.834, p = 0.004) and the right central region (F (1, 18) = 10.809, p = 0.004). Inanimate nouns in the grammatical sentences elicited greater positivity than animate nouns. (see Figure 17). No other significant interactions were found in this time window.

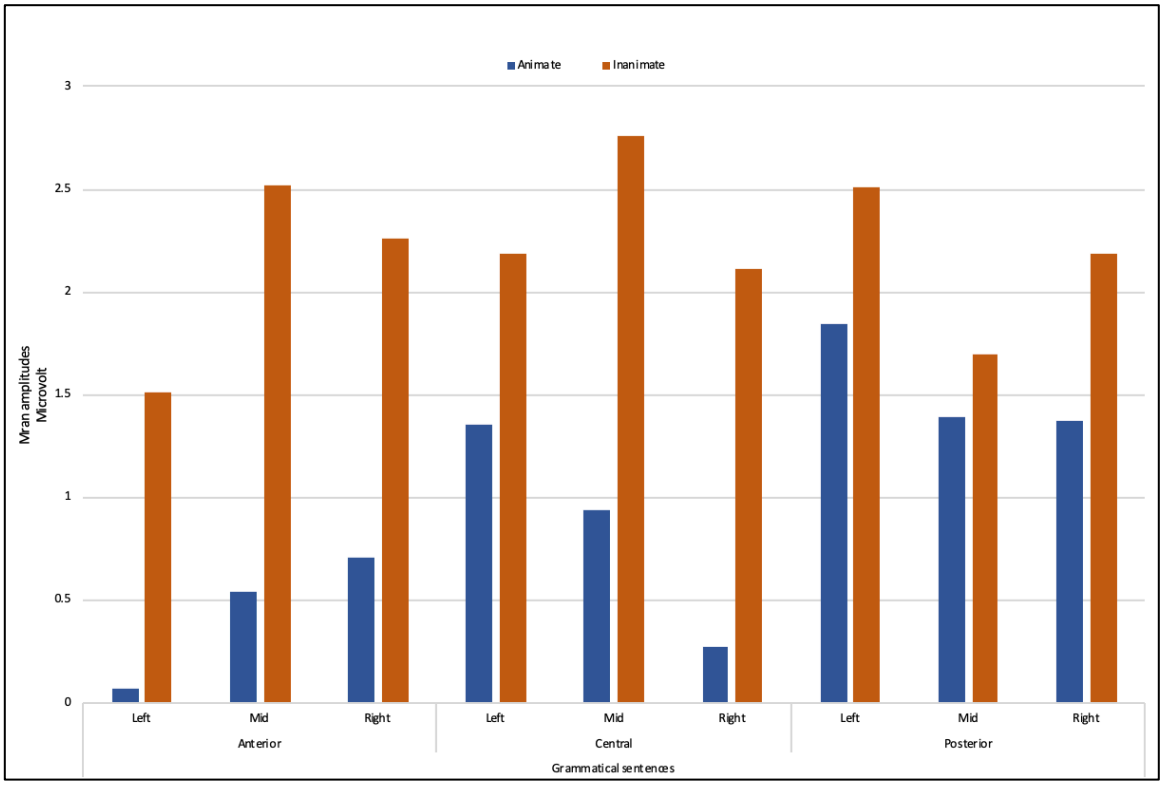


Figure 17. Mean amplitudes by animacy, anteriority, and laterality within the grammatical sentences

450-600 ms: A repeated measures ANOVA revealed no significant main effect of grammaticality (F (1, 18) = 0.002, p = 0.967), of gender (F (1, 18) = 2.177, p = 0.157), or of animacy (F (1, 18) = 1.757, p = 0.202).

There was a significant interaction found between grammaticality and laterality (F (2, 36) = 3.563, p = 0.041). Follow-up analyses revealed that, within grammaticality, there was a significant main effect of laterality within ungrammatical sentences (F (2, 36) = 9.311, p = 0.002), but not within grammatical sentences (F (2, 36) = 2.439, p = 0.102). Ungrammatical sentences elicited greater positivity over the mid region as compared to the left and right regions (see Figure 18).

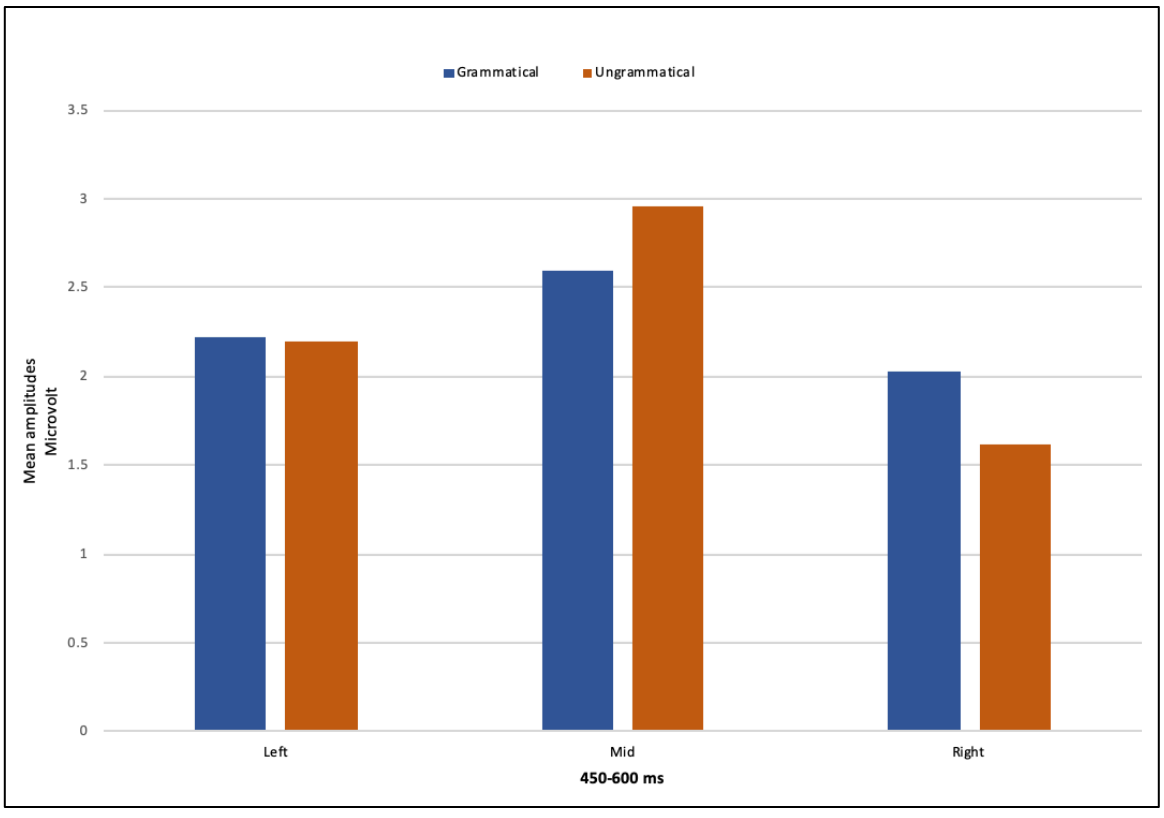


Figure 18. Mean amplitudes by ungrammatical sentence and laterality

There was also a trend toward a significant interaction between grammaticality, animacy, anteriority, and laterality (F (4, 72) = 2.839, p = 0.057). Follow-up analysis revealed that within grammatical sentences, animacy had a significant main effect (F (1, 18) = 7.428, p = 0.014). This effect of animacy was significant over the anterior regions (F (1, 18) = 9.165, p = 0.007) and over the central region (F (1, 18) = 7.947, p = 0.011), and indicated a trend over the right posterior region (F (1, 18) = 4.205, p = 0.055). Inanimate nouns in the grammatical sentences elicited greater positivity than animate nouns (see Figure 19). No other significant interactions were found in this time window.

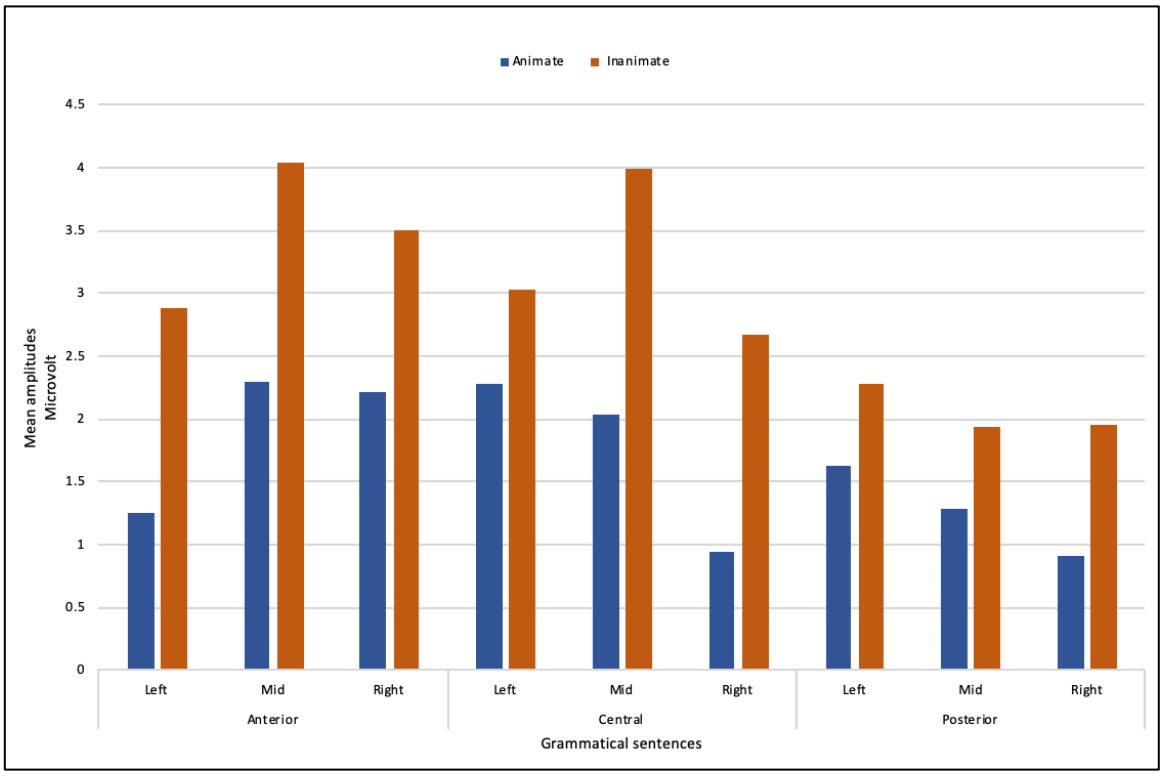


Figure 19. Mean amplitudes by grammatical sentences, anteriority, and laterality

600-800 ms: A repeated measures ANOVA revealed no significant main effect of grammaticality (F (1, 18) = 2.840, p = 0.109), of gender (F (1, 18) = 2.225, p = 0.153), and of animacy (F (1, 18) = 2.984, p = 0.101). There was a significant interaction found between grammaticality and anteriority (F (2, 36) = 11.947, p = 0.001). Follow-up analyses revealed no significant main effect of grammaticality over the anterior region (F (1, 18) = 0.209, p = 0.653) and over the central region (F (1, 18) = 2.512, p = 0.130), but there was a significant main effect over the posterior region (F (1, 18) = 8.495, p = 0.009). The ungrammatical sentences elicited greater positivity than grammatical sentences over all anteriority regions but with a significant difference over the posterior region (see Figure 20).

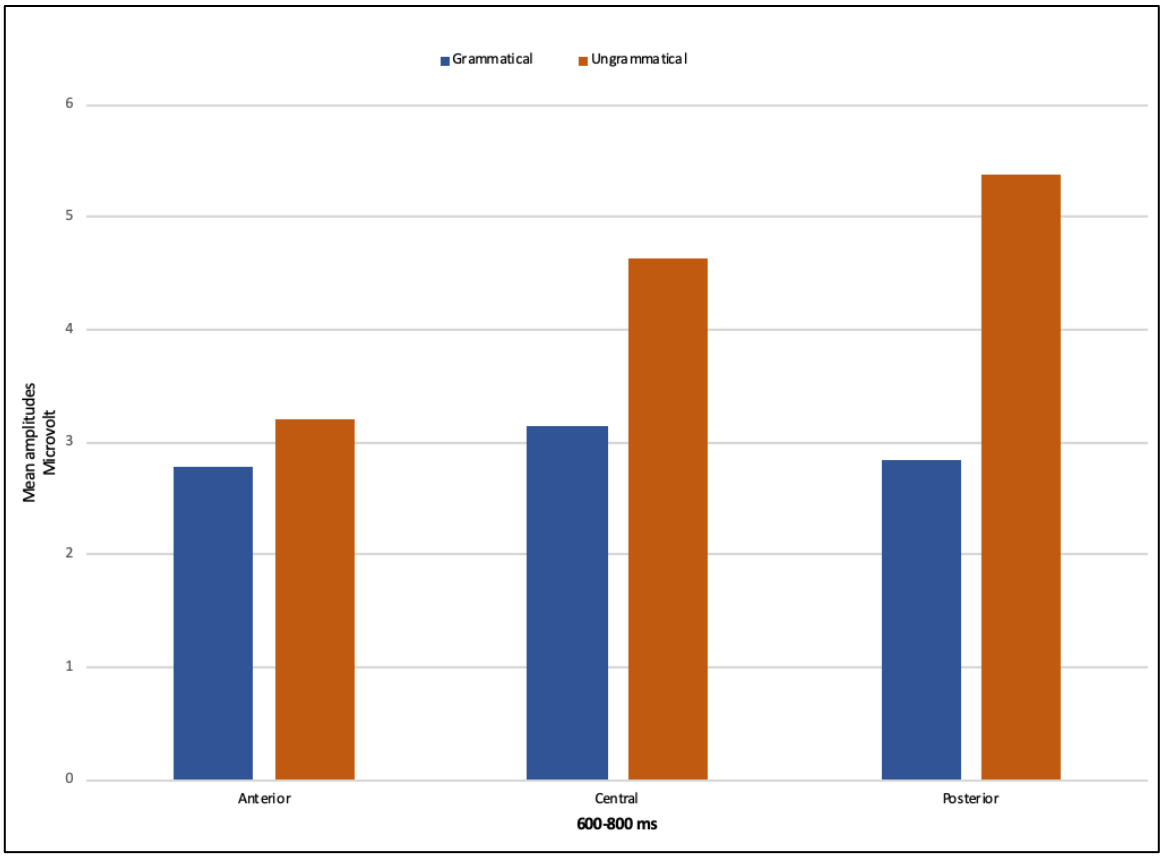


Figure 20. Mean amplitudes by grammaticality and anteriority

There was a trend towards a significant interaction between grammaticality and laterality (F (2, 36) = 3.303, p = 0.052). Follow-up analyses revealed no significant main effect of grammaticality over the left region (F (1, 18) = 2.099, p = 0.165), nor over the right region (F (1, 18) = 1.888, p = 0.186), but there was a significant main effect over the mid region (F (1, 18) = 4.440, p = 0.049). Ungrammatical sentences elicited greater positivity than grammatical sentences over the mid region compared to the left and right regions (see Figure 21). No other significant interactions were found in this time window.

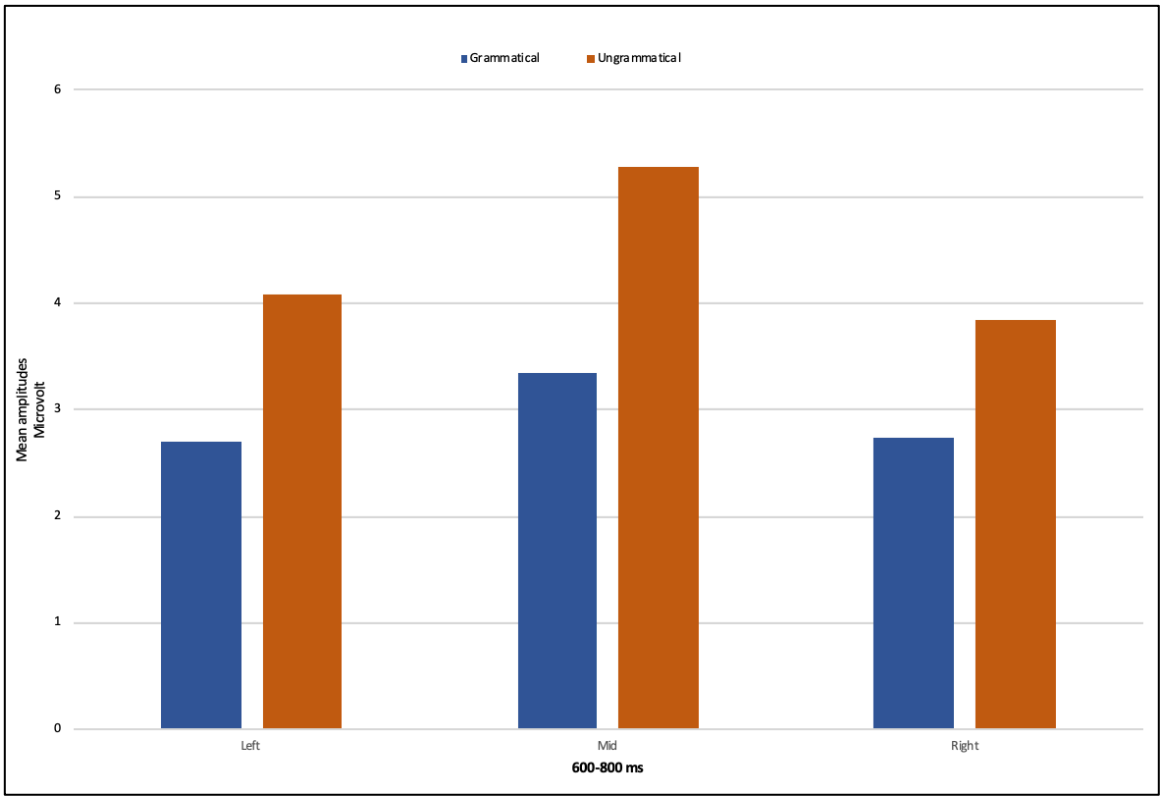


Figure 21. Mean amplitudes by grammaticality and laterality

800-1000 ms: A repeated measures ANOVA revealed no significant main effect of grammaticality (F (1, 18) = 2,460, p = 0.134), no significant main effect of gender (F (1, 18) = 0.628, p = 0.438), and no significant main effect of animacy (F (1, 18) = 1.976, p = 0.177).

There was a significant interaction between grammaticality and anteriority (F (2, 36) = 14.388, p < 0.001). Follow-up analyses revealed a significant main effect of grammaticality over the posterior region (F (1, 18) = 8.507, p = 0.009), but not over the anterior region (F (1, 18) = 0.003, p = 0.958), nor over the central region (F (1, 18) = 2.592, p = 0.125). Ungrammatical sentences elicited greater positivity than grammatical sentence over all anteriority regions, but with a significant difference over the posterior region (see Figure 22).

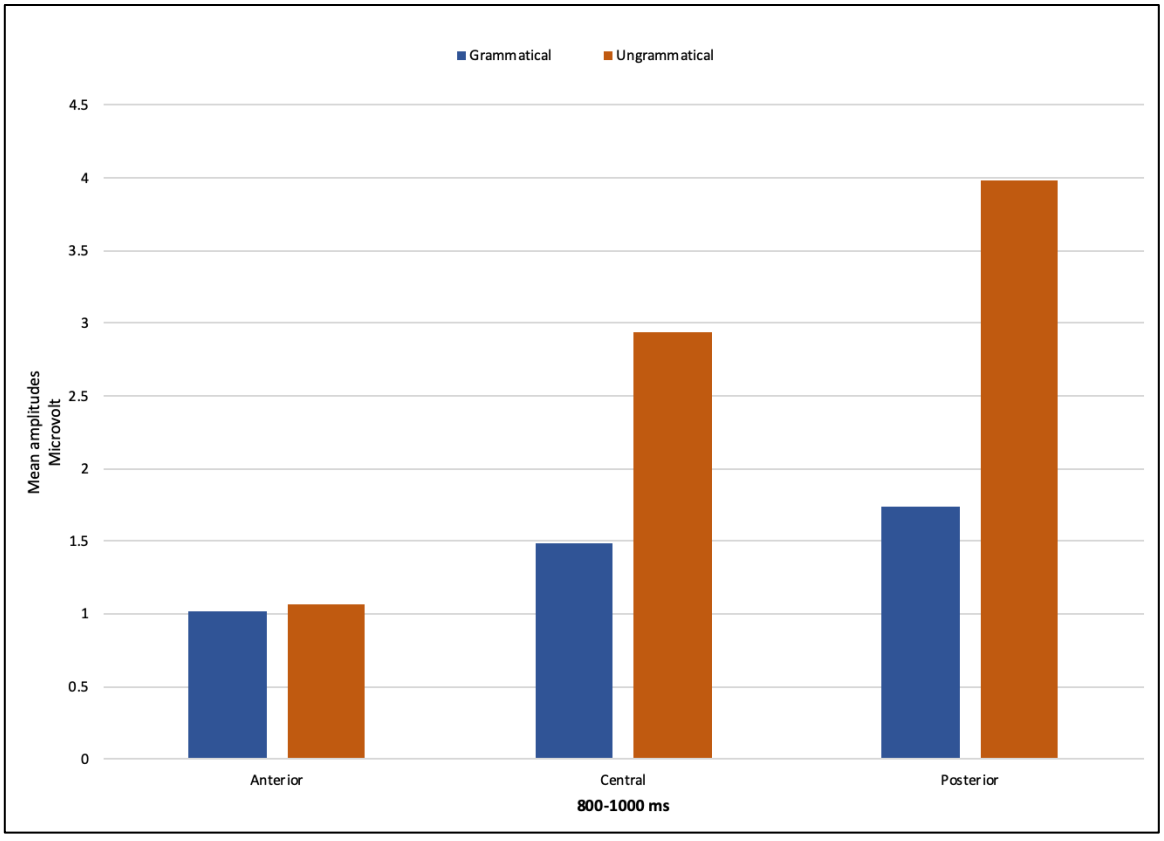


Figure 22. Mean amplitudes by grammaticality and anteriority

There was also a trend toward significant interaction between grammaticality and laterality (F (2, 36) = 2.937, p = 0.072). Follow-up analyses revealed no main significant effect of grammaticality over the left region (F (1, 18) = 1.343, p = 0.262), and no significant effect over the right region (F (1, 18) = 1.733, p = 0.205), but indicated a trend toward significance over the mid region (F (1, 18) = 4.276, p = 0.053). Ungrammatical sentences elicited greater positivity than grammatical sentences over all laterality regions, but with a significant difference over the mid region (see Figure 23). No other significant interactions were found in this time window.

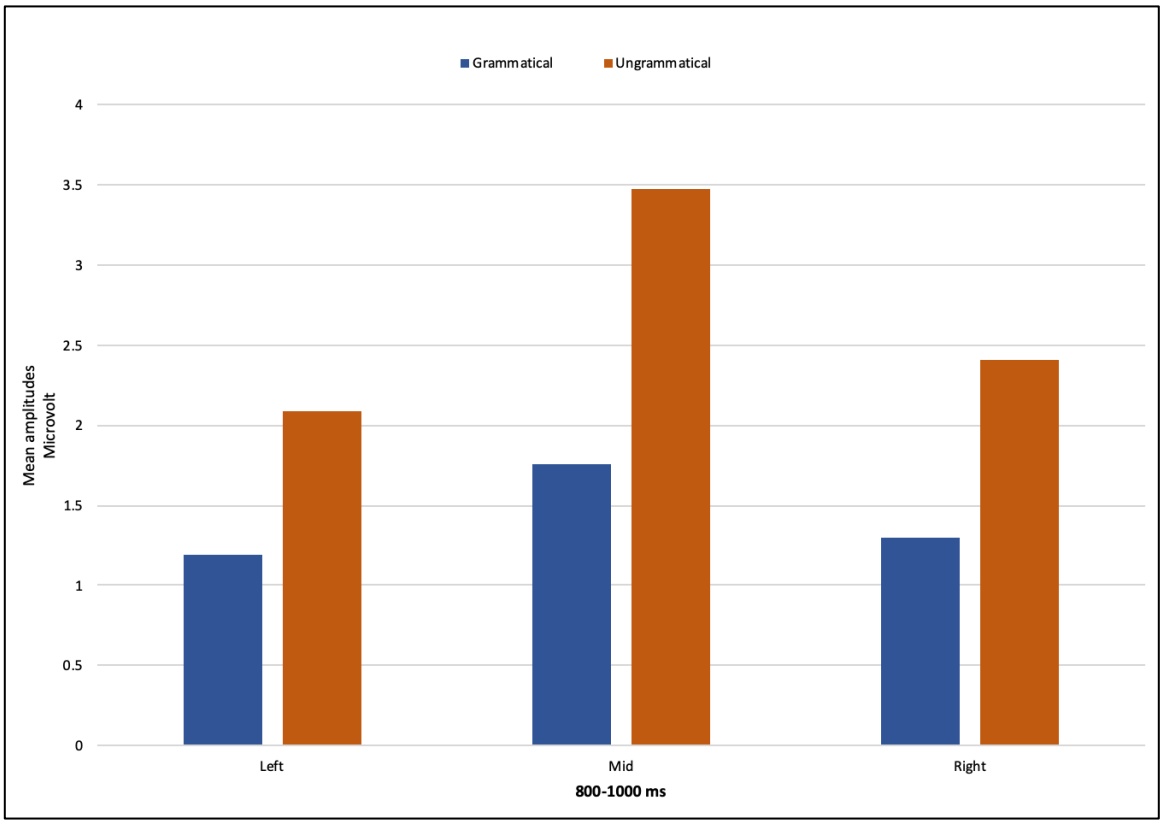


Figure 23. Mean amplitudes by grammaticality and laterality

4.2.6.4 Summary of ERP results:

Before discussing the results, the following table summarizes the ERP results for both VS and SV word orders.

Table 4.6. ERP results for both VS and SV word orders

Time window	Experimental variable	Word order	
		VS	SV
350-400 ms	Grammaticality	No main effect	No main effect
	Gender	No main effect	No main effect
	Animacy	Significant main effect: animate nouns elicited more positivity than inanimate	No main effect *Only within grammatical sentences, inanimate nouns elicited more positivity than animate ones
400-600 ms	Grammaticality	No main effect but there was a trend: ungrammatical sentences were more positive than grammatical ones	No main effect
	Gender	No main effect	No main effect
	Animacy	Significant main effect: animate nouns elicited more positivity than inanimate	No main effect * Only within grammatical sentences, inanimate nouns elicited more positivity than animate ones
600-800 ms	Grammaticality	Significant main effect: ungrammatical sentences were more positive than grammatical ones *significant over central and posterior regions	No main effect *significant over posterior region and mid region: ungrammatical sentences were more positive than grammatical ones
	Gender	No main effect	No main effect
	Animacy	Significant main effect: animate nouns elicited more positivity than inanimate nouns	No main effect

800-1000 ms	Grammaticality	Significant main effect: ungrammatical sentences were more positive than grammatical ones *significant over central and posterior regions	No main effect *significant over posterior region and mid region: ungrammatical sentences were more positive than grammatical ones
	Gender	No main effect	No main effect
	Animacy	No main effect	No main effect

The symbol * indicates a result of an interaction, not of a main effect.

4.2.7 Discussion

The current experiment utilized ERP to examine the processing of gender agreement between the verb and the noun in MSA. Nineteen native speakers of Arabic participated. Overall, the results of this experiment mirrored the results of Experiment 1 (the SPR experiment) in three aspects: (1) native speakers were sensitive to gender agreement violation; (2) there was no effect of gender type; and (3) there was an effect of word order alternation.

My findings in this experiment reveal that native speakers of MSA were sensitive to gender violation. Particularly, the ungrammatical condition elicited different responses compared to the grammatical condition. This effect of ungrammaticality was found between approximately 500-950 ms, and yielded a large positivity with a posterior distribution, which can be reasonably interpreted as a P600 effect. This finding is in line with most previous studies that have investigated the processing of agreement in a sentential context (e.g. Barber et al., 2004; Gunter et al., 2000, Hagoort, 2003). The P600 is interpreted as a stage in which integration and reanalysis take place (Friederici, 2002; Hagoort et al., 1993). When a syntactic integration between two elements in the sentences fails due to a given violation, reanalysis

processes takes place to integrate the deviant element and derive meaning of the sentences. Participants in the current study showed this effect as a result of failing to establish gender agreement between verb and noun due to a gender violation.

Furthermore, the P600 was not preceded by a LAN, which generally emerges in response to morphosyntactic violations (Friederici, 2002; Hagoort & Brow, 1999; Molinaro et al., 2011a). Analyses carried out in the 300-450 ms time window showed no significant effect of gender agreement violation. Moreover, additional analyses were carried out in the 80-200 ms and 200-300 ms time windows to make sure there was no presence of an earlier effect (LAN or ELAN). These additional analyses were conducted for two reasons: first, visual inspections of ERP waveforms in the VS word order showed a left anterior negativity around 100 ms after stimulus onset (see Figure 24). Second, Deutsch and Bentin (2001) examined gender agreement between verb and nouns in Hebrew and reported that ELAN was found in 100-150 ms time window. However, none of the analyses revealed a significant difference between grammatical and ungrammatical sentences.

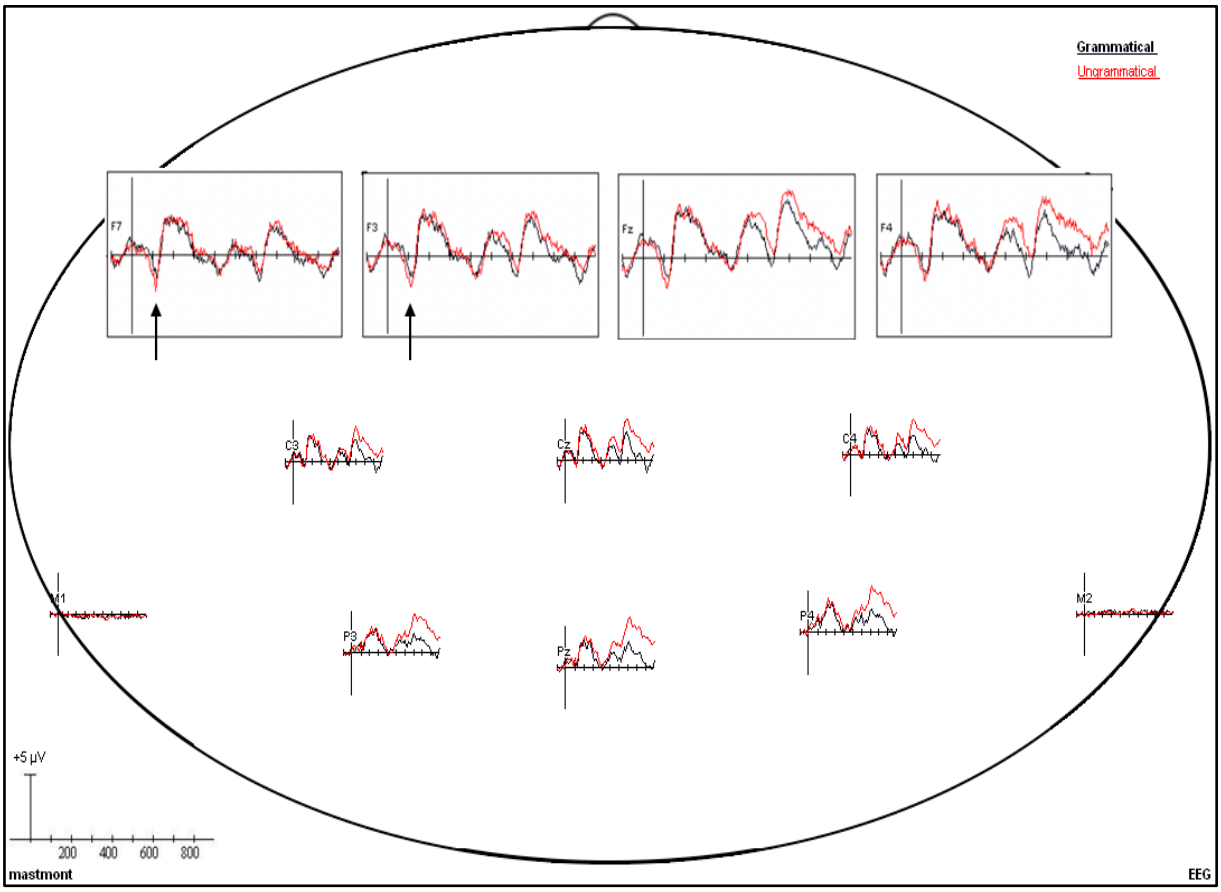


Figure 24. ERP waveforms by grammaticality in the VS word order.

The absence of E/LAN effects in the current study is consistent with a number of studies that did not report this effect for agreement violations in native speakers (Alemán Bañón et al., 2012; Nevins et al., 2007; Wicha et al., 2004). There have been a number of accounts in the literature that have attempted to explain the lack of a LAN. Hagoort and Brown (1999), Molinaro et al. (2011a) and Molinaro et al. (2011b) suggest that only overt morphological violations can elicit a LAN effect. In other words, they proposed that the lack of a LAN in agreement processing studies might be attributed to the absence of morphological cues on the agreeing elements. The finding of the present study did not support this proposal since nouns in MSA are morphologically marked for feminine gender, and thus it follows that the lack of a LAN cannot be due to the nonexistence of morphological cues. In addition, Molinaro et al.

(2015) suggest that choosing the left mastoid as a reference for the EEG recording may influence the presence of LAN. Their proposal is based on the left-lateralization of this component and the fact that studies that referenced to the left mastoid reported the LAN less than studies that referenced to the average of the mastoids. This is not supported by the results of this study either, since the recording was referenced to the average of the mastoids, yet no reliable LAN was observed. The third account proposed another methodological factor, which is that of the averaging procedures. Several ERP studies (Osterhout, 1997; Osterhout et al., 2004; Tanner & van Hell, 2014) found that the LAN effect observed on a single-subject basis did not correspond to the one after averaging the ERP responses across items and subject (also known as the grand average). The results of this study neither supports nor refutes this account, since the data of this study was based on grand average. It might be the case that LAN was present in some individual ERP data but was cancelled due to averaging; confirming this account would require an in-depth analysis of individual data, which is beyond the scope of this study. Regardless, the results of this study concur with a large body of literature that examined agreement processing and found a P600 effect only without a LAN to ungrammatical sentences (Hammer et al., 2008; Nevins et al., 2007; Schmitt et al., 2002; Wicha et al., 2004).

With regard to the effect of gender, this experiment proved it to be insignificant at any time window in both VS order and SV order.[24] In other words, both masculine nouns and feminine nouns were processed in a similar manner regardless of word order. Moreover, both masculine and feminine subject-verb pairs elicited P600 effects in the ungrammatical condition, which is a main finding of the current experiment. This result contributes to the current literature

[24] See Appendix E for interactions between gender and effects related to the topographical variables of anteriority and laterality.

on the effect of gender type on gender agreement processing. In fact, to the best of my knowledge, only one ERP study has investigated this issue so far (Alemán Bañón & Rothman, 2016). Though there have been a number of studies examining the effect of markedness on gender processing, these have concerned the singular form (unmarked) versus the plural (marked), and not the masculine versus feminine (Deutsch & Bentin, 2001; Kaan, 2002), which I have done here. Other studies examined the effect of regular endings versus irregular endings of both masculine and feminine on gender agreement processing (Caffarra & Barber, 2015; De Resende, Mota, & Seuren, 2019). Except for De Resende, Mota, & Seuren's (2019) study, which found no effect when comparing regular versus irregular endings, all other studies found that regular and marked forms elicited different patterns from irregular and unmarked forms. For example, Alemán Bañón and Rothman (2016) examined the effect of gender types (masculine noun being the marked form and feminine noun being the unmarked form) on gender agreement processing in Spanish. They found that both genders elicited P600 effect in response to gender agreement violation. While the P600 amplitude was similar for both types of gender, it started earlier for the violation that contained marked forms. Contrary to these results, my findings suggest that processing gender agreement is independent of the gender of the noun.

With regard to the effect of animacy, the results of this experiment showed that the gender agreement violations of both semantic gender (i.e., animate nouns) and grammatical gender (i.e., inanimate nouns) elicited the same P600. More importantly, no N400 effect was found in response to gender agreement violation related to semantic gender. Previous studies found that, unlike violations of grammatical gender, violation of semantic gender elicited negative waves (N400) in the centroparietal areas (Deutsch & Bentin, 2001; Schmitt et al.,

2002). However, my conclusion is compatible with a large body of studies that did not find N400 effects in gender agreement violations even if they implied semantic gender (Barber et al., 2004; Demestre et al., 1999; Osterhout & Mobley, 1995). That being said, the behaviour of the animacy effect was unstable. Although animacy had no significant effect in the SV word order, it had an apparent main effect at almost every time window in the VS word order. Further, animate nouns elicited greater positivity than inanimate nouns. While there is no clear reason that could explain this behaviour, one possibility is that animate nouns are costlier to access than inanimate ones. Animate nouns in MSA refer to humans or animals, which get their gender based on semantic rule (i.e., male vs. female). In most cases, words that denote the male and female of the same kind, role, or character have similar forms except that the feminine forms are suffixed with a feminine marker (e.g., *ʔmeer* 'prince' & *ʔmeerah* 'princess'; *fataa* 'young boy' & *fataah* 'young girl'; *qiṭʿṭ* 'male cat' & *qiṭʿṭʿah* 'female cat'). Therefore, there are strong semantic and lexical associations between masculine and feminine words that refer to animate nouns of the same kind. Inanimate nouns, on the other hand, refer to non-living objects, and are assigned to gender based on their phonological forms. For this reason, it might the case that gender agreement with animate nouns is more difficult to process because the noun may evoke two counterparts in both masculine and feminine gender. In other words, when participants accessed a word like *ʔlṭʿṭʿalib* 'male student' they in turn activated the referent *ʔlṭʿṭʿalibah* 'female student', which resulted in increased processing costs. Sagarra and Herschensohn (2011) found that monolingual Spanish speakers were slower on sentences with animate nouns compared to those with inanimate ones. They interpreted this difference as evidence that animate nouns are cognitively more demanding than inanimate nouns. I am suggesting a similar possible reasoning to explain the results of this study here as well.

The other possibility is that this difference between animate and inanimate nouns could be due to the nature of the stimuli. The stimuli did not control for the types of animate nouns. The animate nouns list included people names (e.g., Fatimah, Zaid), role nouns (e.g., *ʔatˁtˁabeebah* 'a female doctor', *ʔlmuhandis* 'a male engineer), and animal names (e.g., *ʔlbaqarah* 'a female cow', *ʔaddub* 'a male beer'). In any case, the animacy effect in language processing is still under debate. While some studies showed that inanimate nouns are easier to process than animate nouns (Bruhn de Garavito & White, 2002; Sagarra & Herschensohn, 2011), other studies showed the reverse (Alarcón, 2009; Fernández-García, 1999; Finnemann, 1992), or no difference (Antón-Méndez, Nicol, & Garrett, 2002; Barber et al., 2004).

The final issue to be discussed in this section is the word order effect. The results showed that both VS word order and SV word order produced a P600 effect in response to sentences with a gender violation. However, the timing and distribution of P600 found in the VS order is different from that found in the SV order. In the VS word order, the P600 started around 480 ms and reached its maximum peak around 700 ms onset, and it lasted until 1000 ms after stimulus. It was broadly distributed over the central and posterior regions, with some involvement of mid and left anterior regions. On the other hand, the P600 found in the SV order started around 530 ms, reached its maximum peak around 750 ms, and more importantly ended faster at approximately 850 ms after the stimulus. It was distributed mainly over the posterior regions with some involvement of mid and right central regions. The ERP waveforms are shown in Figure 9 for the VS order and Figure 15 for the SV order, and are repeated below as Figure 25 and Figure 26.

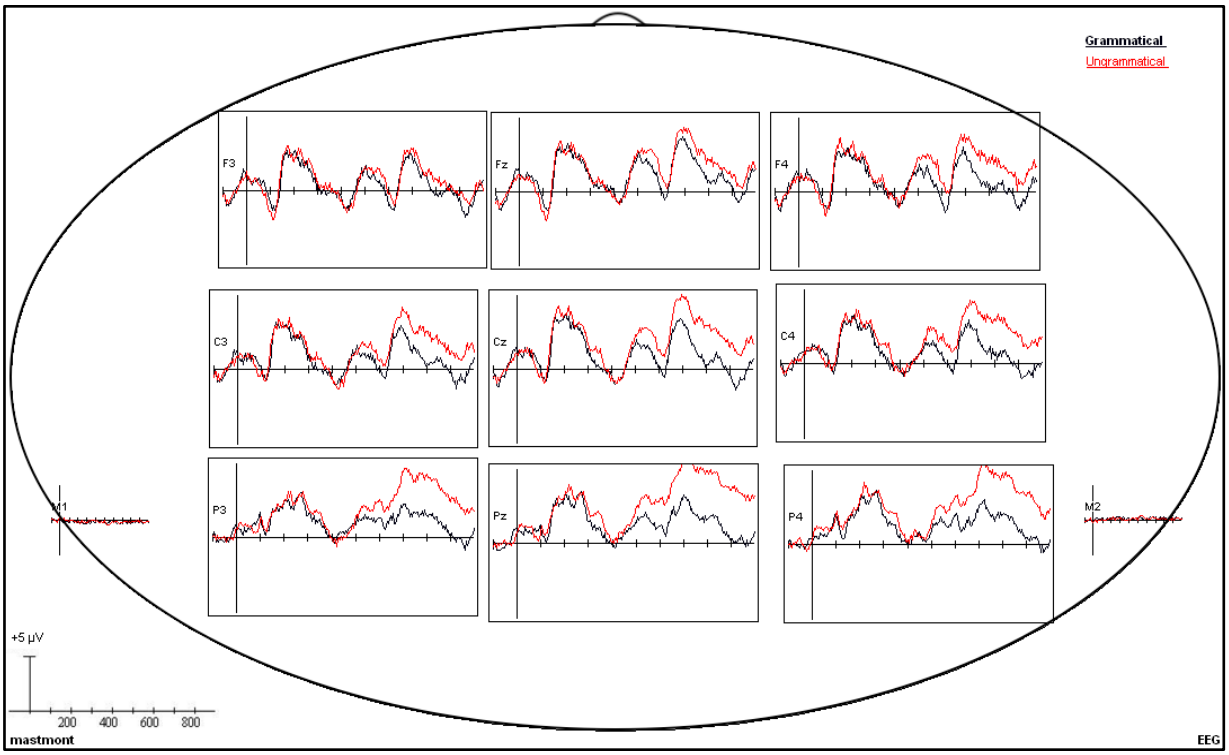


Figure 25. ERP grand-average waveforms for the grammaticality condition in the VS order.

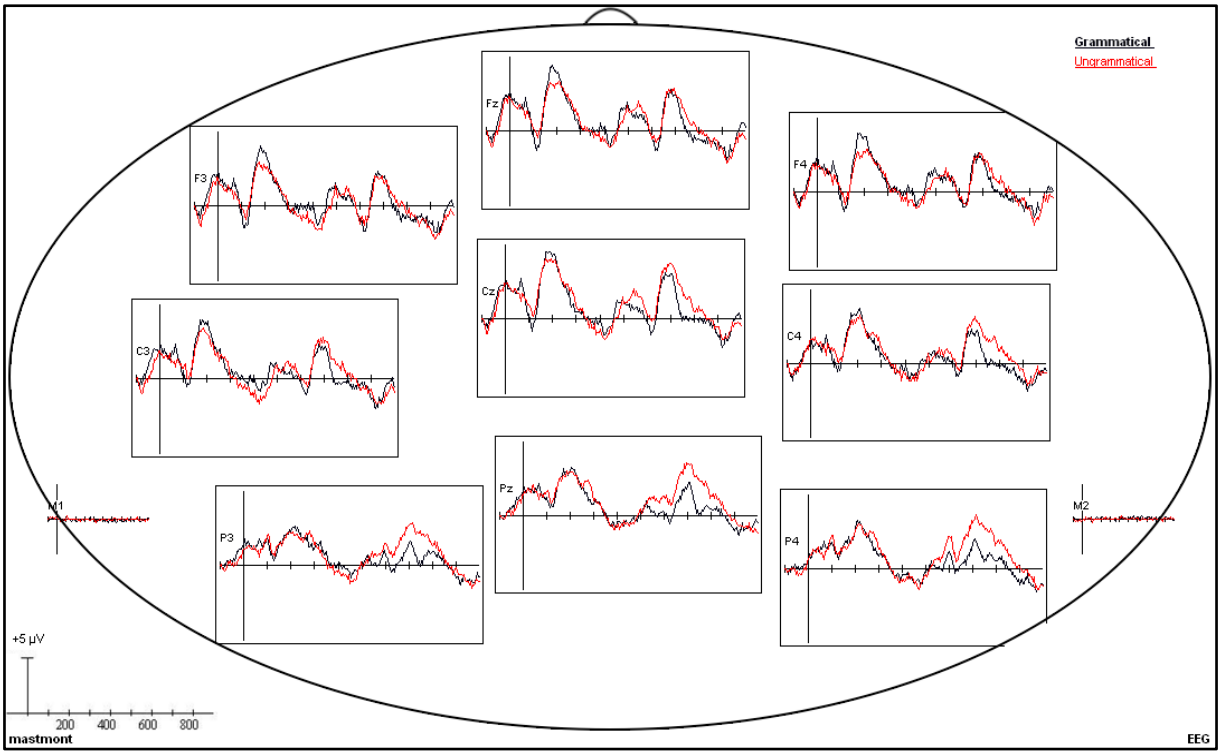


Figure 26. ERP grand-average waveforms for the grammaticality condition in the SV order.

As can be seen from Figures 25 and 26, the effect of grammaticality seems to be different as a result of the word order alternation. This result provides support to the findings from Experiment 1 (the SPR task). As in the SPR task, native speakers in this experiment showed different patterns of processing gender agreement violations in the two orders, which suggests different underlying processes. The P600 effect in the VS order lasted longer than in the SV order, which can be related to the complexity of the agreement system in the VS construction. As discussed earlier, in the VS word order, the verb remains in the singular base form regardless of whether the next subject is singular, dual, or plural. The verb must agree with the subject in gender only, except with broken plural. Thus, when a processor discovers a gender violation at the noun, s/he needs to check this mistake against all alternative options to make sure it is not one of them. This time that the processor takes to repair and reanalyze this syntactic violation is reflected in the P600 effect. In line with this, Popov and Bastiaanse (2018) found that native speakers' processing violations of number agreement and of gender agreement in Dutch elicited different P600 patterns. They interpreted this difference as evidence that increase in repair options results in costlier cognitive processing. Moreover, Hagoort (2003, 2005), in his unification model, suggested that the P600 indexes the amount of time needed to unify the syntactic frame into one phrasal configuration. The time it takes to unify the syntactic frame is affected by an ongoing competition between alternative options. The amplitude and duration of P600 is modulated by the amount of competition. The longer this unification takes, the larger the P600 is. In the current experiment processing gender violations in the VS word order provides more alternative options for repair than in the SV word order, and this may have resulted in the different patterns found for the P600 effects.

To summarize, this chapter reported the results of two experiments investigating the processing of gender agreements in L1 speakers of MSA. In both experiments, native speakers showed sensitivity to gender agreement violations. That is, they showed longer RTs in the SPR task and a P600 effect in the ERP task in responses to sentences that contained gender agreement violations. Further, their processing of gender agreement violations was only modulated by the sentence word order, but not by gender type (masculine, feminine) nor by noun animacy (animate, inanimate). The next chapter of this dissertation reports on Experiment 3 and Experiment 4, which examined the processing of gender agreement in L2 speakers of MSA.

Chapter 5

Gender agreement processing by L2 speakers

Overview

As stated in earlier chapters, one of the main goals of the current dissertation is to examine the acquisition of grammatical gender in late L2 learners of Modern Standard Arabic (MSA). More specifically, it is to examine (1) whether L2 speakers can acquire gender agreement in a native-like manner, and (2) to what extent their acquisition is affected by their first language (L1). Answering these questions contributes to the long-held debate in second language acquisition (SLA) on the ultimate attainment of L2 learners who acquired their L2 after the age of puberty. This debate has resulted in several proposals thus far,[25] however, the current study focuses on two of them: the Failed Functional Features Hypothesis (FFFH) by Hawkins & Chan (1997) and the Full Transfer/ Full Access (FTFA) by Schwartz & Sprouse (1994, 1996). The FFFH proposes that late L2 learners cannot acquire functional features, like gender agreement, that are not instantiated in their L1, and thus L1 will determine the level of acquisition of their L2. The FTFA proposes that late L2 learners have access to universal grammar (UG) and thus can ultimately acquire L2 functional features that are not present in their L1 grammar. In order to examine these claims, I conducted two experiments using different methodologies. The first, Experiment 3, used an offline grammaticality judgement

[25] For a full discussion on the different proposals, please refer to Chapter 3.

task, and the second, Experiment 4, used a self-paced reading task. Each experiment included two groups of L2 speakers, who were compared to a group of native speakers. The L2 speakers were grouped based on the presence (+Gender) or absence (-Gender) of a grammatical gender system in their L1. Question 1, which concerned the ultimate attainment of the L2 learners, will be answered by comparing the L2 speakers' performance to native speakers' performance. Question 2, which concerned the effect of L1, will be answered by comparing the +Gender group's performance to the -Gender group's performance. The following sections report the design and findings of Experiment 3, followed by those of Experiment 4.

5.1 Experiment 3: Grammaticality Judgment task (GJ)

As mentioned above, Experiment 3 employed an offline grammaticality judgment task (GJ). This task has been frequently used in SLA research as a measure to gather data regarding speakers' competence in a particular grammatical structure. In this experiment, I examined L2 speakers' knowledge of grammatical gender in MSA. More specifically, I endeavoured to answer the following research questions:

RQ 1) Will L2 speakers show native-like knowledge of grammatical gender agreement, and thus be able to identify gender agreement violations as accurately as native speakers?

RQ 2) Will any evidence be found regarding the effect of L1 on L2 acquisition? Specifically, will the presence or absence of a gender system in the L2 speakers' L1 influence their knowledge of grammatical gender agreement in MSA, and thus, will there be differences in performance between (+Gender) and (-Gender) groups?

RQ 3) Will L2 speakers demonstrate a preference for nouns with a semantic gender (animate nouns), and thus, will there be differences in L2 speakers' accuracy between sentences with animate nouns and sentences with inanimate nouns?

RQ 4) Will L2 speakers prove to have a preference for a default gender, and thus, will there be differences in their accuracy in relation to sentences with masculine nouns versus those with feminine nouns?

5.1.1 Participants

Forty-one participants took part in this study; 26 L2 speakers of MSA and fifteen native Arabic speakers**.** The twenty-six L2 speakers were recruited at the Arabic Linguistics Institute at King Saud University in Riyadh, Saudi Arabia. All of them were studying Arabic for academic purposes. The institute offers four levels, which require two years of full-time study to complete. All participants in this experiment were at levels three and four at the time of testing. The participants were adults and their age ranged from 21 to 29 (mean age of 24.4 years). They were first exposed to Arabic after puberty, and they had been in Saudi Arabia for two to three years.

This study consisted of two experimental groups and a control group. The L2 speakers were divided into two groups. The –Gender group consisted of learners whose L1 does not have a gender agreement system (e.g., Chinese, English), and the +Gender group consisted of learners whose L1 has this feature (e.g., Urdu, French). The L2 speakers were given an Arabic reading proficiency test (see below for details). Participants who scored 70% and above were included in the study. Five participants were eliminated from the study because their scores on the proficiency test were less than 70% and their scores on the experimental task were too low

to provide meaningful data. Of the original 26 L2 speakers, 21 were kept for the analysis, including 12 participants in the –Gender group and 9 participants in the +Gender group. Table 5.1 provides information on these 21 participants.

Table 5.1. L2 speakers' language background

Group	L1 language family	Country	L1	No. of speakers
-Gender	Malayo- Polynesian	Philippines Indonesia Malaysia	Filipino Indonesian Malay	2 1 2
	Sino- Tibetan/ Chinese	China	Chinese	3
	Germanic languages	England	English	2
	Indo- European/ Indo- Iranian	Tajikistan	Tajik	2
				Total= 12
+Gender	Indo- Iranian/ Indo- Aryan	Nepal Pakistan	Nepali Urdu	2 2
	Romance	France	French	5
				Total= 9

Fifteen adult native speakers of MSA participated in the experiment as the control group. All of them were graduate or undergraduate students, and they were between 21 and 32 years of age (mean age of 25.7 years). All participants speak Saudi Arabic, and have completed their primary and higher educations in Saudi Arabia. All of them were monolinguals, and have no proficiency above a beginner level in any other languages. All participants in this study were male.

5.1.2 Material

5.1.2.1 Proficiency Test

A reading proficiency test was given to the participants to determine their proficiency level in Arabic for this study. The test is part of a standardized Arabic proficiency test

administered by King Saud University. The test consisted of 12 multiple-choice questions divided into two parts: the first part asked participants to read short passages and then answer questions by choosing the correct answer, and the second part asked participants to read long passages and then answer questions by choosing the best answer.

5.1.2.2 Grammaticality Judgment task (GJ) [26]

A written Grammaticality Judgment Task was administered to test participants' comprehension of subject-verb gender agreement in Arabic. Participants were presented with 200 sentences consisting of 120 experimental sentences and 80 fillers. All experimental sentences were in the past tense and VS word order. Half of the 120 experimental sentences were grammatical, and the other half were ungrammatical. The grammatical ones were divided into four categories: 15 sentences with animate-masculine subjects, 15 sentences with animate-feminine subjects, 15 sentences with inanimate-masculine subjects, and 15 sentences with animate-feminine subjects. Complete lists of stimuli are provided in Appendices D.

The following examples are sentences used in the Grammaticality Judgment task:

(31) a. Masculine animate subject:

qafaza **ʔaθ-θaʕlabu** ʕalyan
$\text{jump}_{\text{past.3.MAS}}$ $\text{the-fox}_{\text{MAS.SG.AN}}$ high
'The fox jumped high'

b. Feminine animate subject:

nasiy-at **Fatimatu** kitaba ʔan-naħowi
$\text{forget}_{\text{past-3.FEM}}$ $\text{Fatimah}_{\text{FEM.SG.AN}}$ book the-grammar
'Fatimah forgot her grammar book'

[26] The material used in this experiment is different form the other three experiments conducted in this dissertation because it was the first one in order. This material was improved in the other three experiments to include two lists one with VS word order and one with SV word order, each list had 80 experimental sentences and 60 fillers, and all sentences started with an adverbial or a prepositional phrase.

c. Masculine inanimate subject:

qaddama **ʔl-matˁʕamu** xusˁumatin kabiirah
offer$_{\text{past-3.MAS}}$ the-restaurant$_{\text{MAS.SG.IN}}$ discounts great
'The restaurant offered great discounts'

d. Feminine inanimate subject:

ħaʒab-at **ʔas-saħabatu** noor ʔaʃ-ʃams
block$_{\text{past-3.FEM}}$ the-cloud $_{\text{FEM.SG.IN}}$ light the-sun
'The cloud blocked the sunlight'

The ungrammatical sentences were designed to exhibit disagreement in grammatical gender between the verb and the subject. The ungrammatical sentences also included 15 sentences with animate-feminine subjects, 15 sentences with animate-masculine subjects, 15 sentences with inanimate-feminine subjects, and 15 sentences with inanimate-masculine subjects. Examples of these sentences can be seen below.

(32) a. Feminine animate subject:

*** tasallaqa** **ʔl-qitˁatu** ʔʃ-ʃaʒarata
clibm $_{\text{past.3.MAS}}$ the-cat$_{\text{FEM.SG.AN}}$ the tree
'The cat climbed the tree'

b. Masculine animate subject:

*** sˁanaʕ-at** **ʔan-naʒʒaru** ʔbwaaban ʒamiilah
make$_{\text{past-3.FEM}}$ the carpenter$_{\text{MAS.SG.AN}}$ doors beautiful
'The carpenter made beautiful doors'

c. Feminine inanimate subject:

*** ʔisˁtˁadam** **ʔas-sayyartu** bir-rasˁiif
collide$_{\text{past.3.MAS}}$ the-car$_{\text{FEM.SG.IN}}$ with the sidewalk
'The car collided with the sidewalk'

d. Masculine inanimate subject:

*** taʕatˁal-at** **ʔl-qaribu** wasatˁa ʔan-nahr
stop$_{\text{past-3.FEM}}$ the-boat $_{\text{MAS.SG.IN}}$ middle the-river
'The boat stopped in the middle of the river'

The 80 fillers were designed to draw the participants' attention away from the structure being investigated. Half of these fillers was grammatical, and the other half was not. Since the incorrect part of the ungrammatical experimental sentences was always at the beginning of the sentences, the ungrammatical fillers were designed to show the incorrect part in the middle or at the end of the sentences.

The 200 sentences in the Grammaticality Judgment Task were presented to all participants in the same random order. To ensure that learners knew all of the vocabulary items used in the task, the vocabulary was kept very basic, and learners were instructed to ask any questions they had before or during the task.

Participants were asked to judge the sentences in the Grammaticality Judgment Task in one of three ways: (1) grammatically correct, (2) grammatically incorrect, or (3) I do not know. They were also asked to circle or underline the incorrect part of all sentences they marked as ungrammatical.

5.1.3 Procedures

The data for this study was collected at King Saud University in Riyadh, Saudi Arabia over two weeks. On the first session, participants were asked to complete a consent form, followed by a short background questionnaire that asked for biographical data such as age, L1, length of residency in Saudi Arabia, the age at which they began learning MSA, their points of weakness and strength in MSA, and information about other languages in their background. Then, they were asked to complete the reading proficiency test. These procedures took approximately 40 minutes.

During the second session, each participant received the grammaticality judgment task with a participant ID code printed on each page. The first page of the task contained instructions on how to perform the tests and provided participants with examples. There was no time limit for participants to do the test; however, participants completed the tasks in approximately the same amount of time (with no more than 15 minutes passing between the first and last participant to finish the task). Participants were allowed to ask about any difficult vocabulary while performing the tests.[27]

5.1.4 Result

5.1.4.1 Proficiency Test

As discussed before, the reading proficiency test given to the participants consisted of 12 questions, with each correct question receiving one point. The native control group performed almost perfectly, with a mean of 98.88 %, while the mean score of the L2 speakers was 86.11 %. An independent-samples t-test revealed that this difference in scores is significant (t (34) = -8.2, $p < .001$).

A small difference in scores between L2 groups was found on the proficiency test. – Gender group (M = 87.50 %) outperformed +Gender groups (M = 84.51 %). An independent-samples t-test revealed that this difference is not significant (t (19) = 1.36, p = .187). This result suggests that there is no effect of learners' L1 gender type on L2 proficiency.

[27] After completing the GJ task, participates were given the list of nouns that were included in the task, and were asked to assign gender to each noun (masculine or feminine). All participants were able to assign gender correctly.

5.1.4.2 The GJ task result

A score of 1 was given for a correct response, and 0 for an incorrect or "I do not know" response in the GJ task. A perfect mean score is therefore 1. Results of this task will be presented in two sections. Section 1 presents results for the L2 speaker groups, namely, +Gender group vs. –Gender group. Section 2 presents results for the native control group vs. the L2 speaker groups.

5.1.4.2.1 Results of L2 speakers: +Gender vs. –Gender

The overall results revealed that the -Gender group (M = 0.94) outperformed the +Gender group (M = 0.89). An independent-samples t-test revealed that this difference in scores is significant (t (19) = -2.317, p = .032).

A repeated measure ANOVA was conducted on the effect of three independent variables (grammaticality, gender, and animacy) on participants' performance on the GJ task. Each one of these three variables included two levels, as follow: grammaticality included grammatical and ungrammatical, gender included masculine and feminine, and animacy included animate and inanimate.

A significant main effect of grammaticality was found (F (1, 19) = 9.751, p = 0.006). Overall, the L2 speakers performed better on grammatical sentences (M = 0.94) than on ungrammatical sentences (M = 0.89).

A significant main effect of gender was also found (F (1, 19) = 6.008, p = 0.024). Participants performed better on sentences with masculine nouns (M = 0.92) than on sentences with Feminine nouns (M = 0.90). However, there was a significant interaction between groups

and gender (F (1, 19) = 6.008, p = 0.024). This interaction revealed that gender had a significant main effect only on the +gender group (F (1, 8) = 8.076, p = 0.022). While the –Gender group performed similarly on masculine and feminine, the +Gender group performed better on sentences with masculine nouns than on sentences with feminine nouns (see table 5.2).

Table 5.2. Mean accuracy by groups and gender

Group	Test feature	Mean
-Gender	Masculine	0.94 **(**0.014)
	Feminine	0.94 **(**0.015)
+Gender	Masculine	0.91 (0.016)
	Feminine	0.87 (0.018)

Similarly, a significant main effect of animacy was found (F (1, 19) = 61.849, p < .001). Overall, participants performed better on sentences with animate nouns (M = 0.95) than on sentences with inanimate nouns (M = 0.88). There was no significant interaction between groups and animacy (F (1, 19) = 1.464, p = 0.241).

The results also revealed a significant interaction between grammaticality and gender (F (1, 19) = 4.811, p = 0.041). A follow-up analysis showed that gender had a significant main effect only on ungrammatical sentences (F (1, 19) = 8.467, p = 0.009). Both +Gender and –Gender groups performed better on ungrammatical sentences with masculine nouns than on those with feminine nouns (see Figure 27).

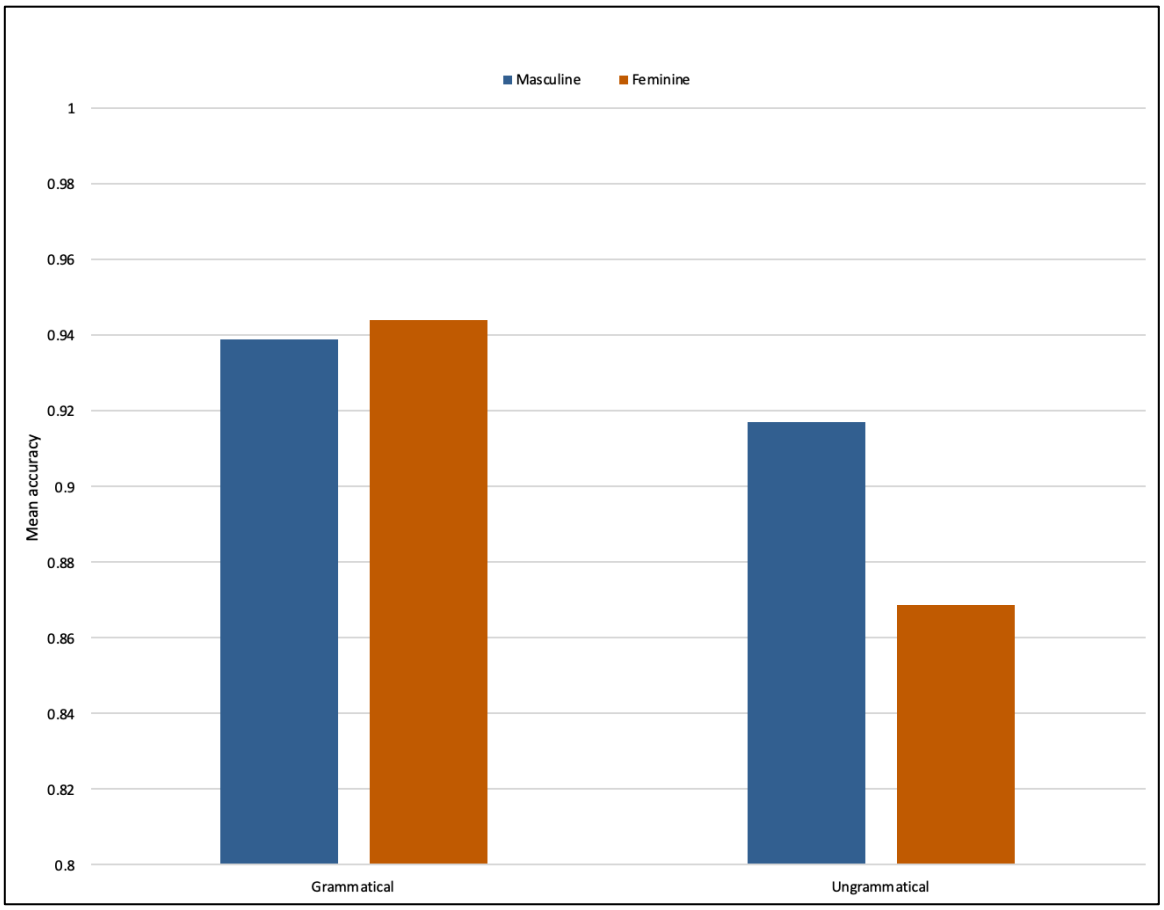


Figure 27. Mean accuracy by grammaticality and gender

There was also a significant interaction between grammaticality and animacy (F (1, 19) = 4.583, p = 0.045). A follow-up analysis showed that grammaticality had a significant main effect on sentences with inanimate nouns (F (1, 19) = 12.632, p = 0.002), and indicated a trend on sentences with animate nouns (F (1, 19) = 4.218, p = 0.054). On sentence with inanimate nouns, participants performed significantly better on grammatical sentences than on ungrammatical sentences (see Figure 28).

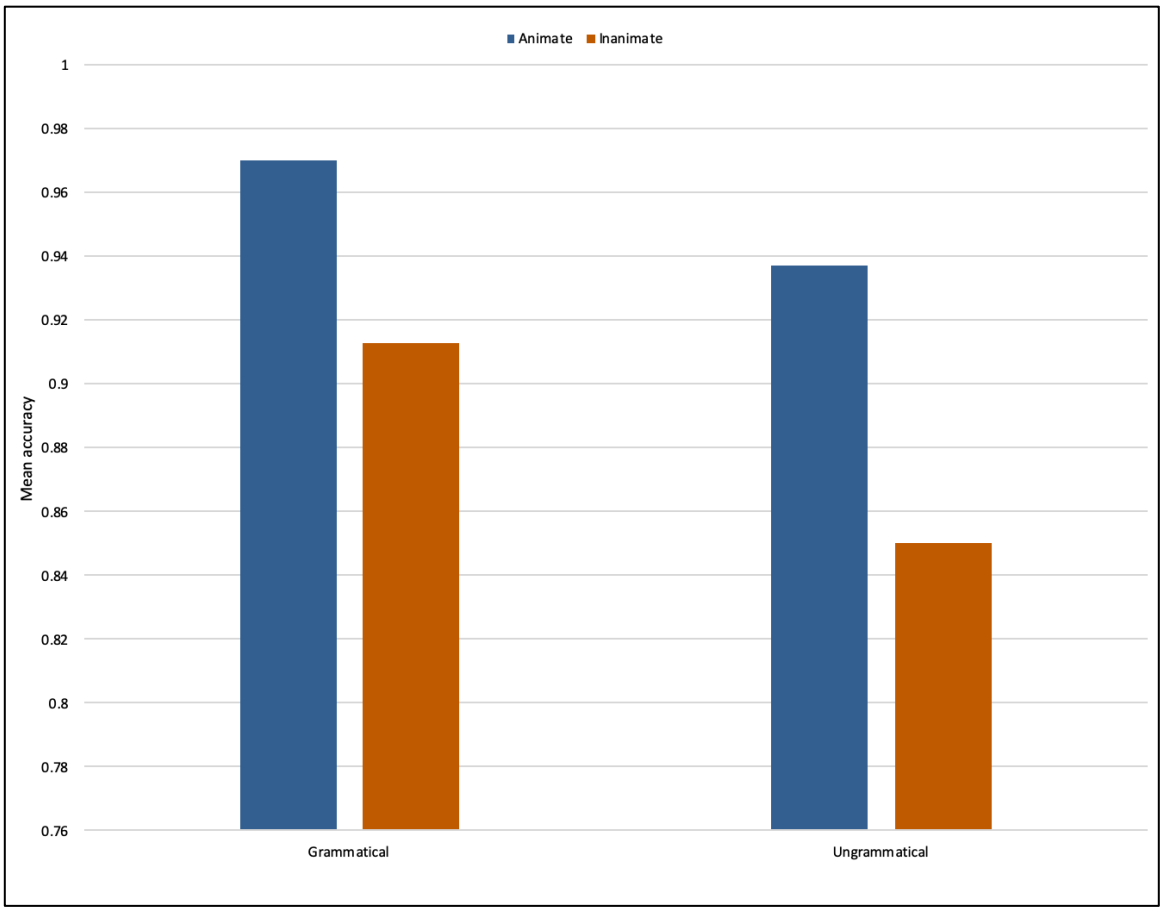


Figure 28. Mean accuracy by grammaticality and animacy

Finally, there was a trend toward a significant interaction between groups, grammaticality, and gender (F (1, 19) = 3.852, p = 0.065). Follow-up analyses showed that in the +Gender group, gender had a significant main effect on the ungrammatical sentences (F (1, 8) = 7.163, p = 0.028). On the ungrammatical sentences, the +Gender group performed better on masculine nouns than on feminine nouns (see Figure 29). No other significant interactions were found.

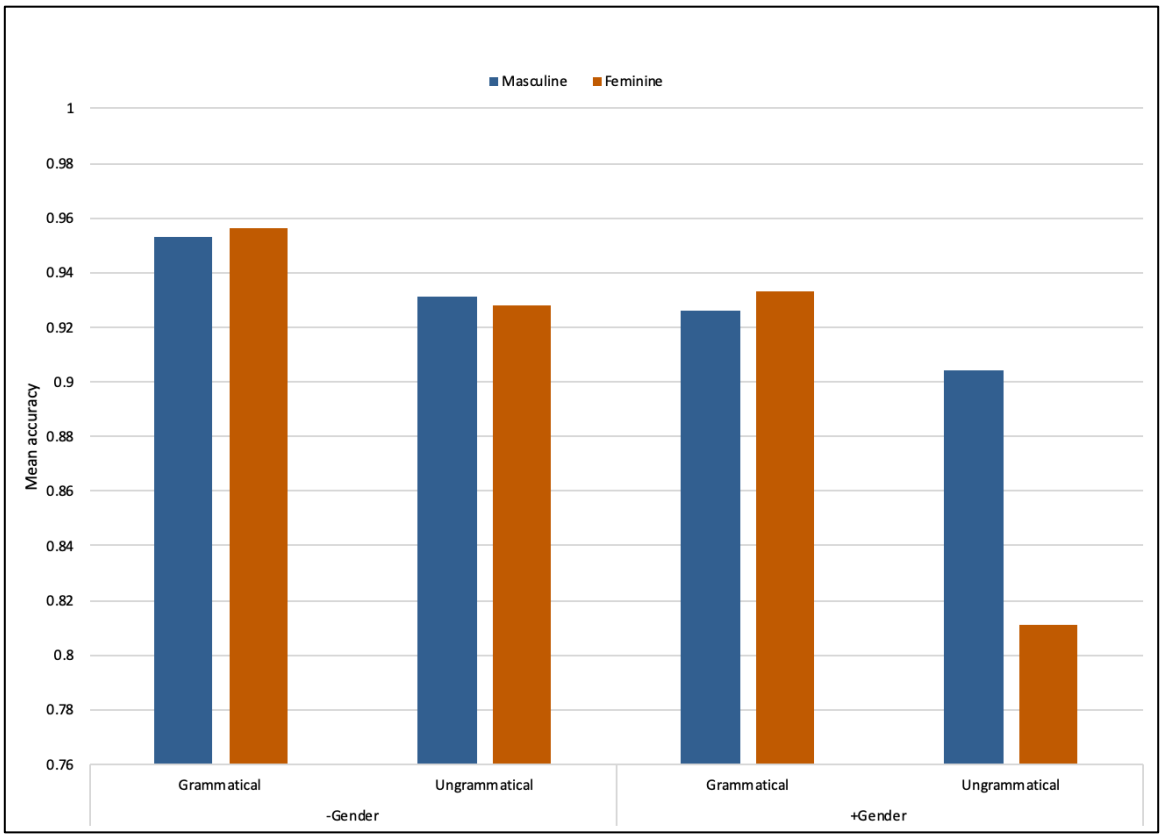


Figure 29. Mean accuracy by groups, grammaticality, and gender

5.1.4.2.2 Results of native speakers vs. L2 speakers

The results revealed that the native control group outperformed the L2 speaker groups. The native control group performed almost perfectly *(M* = 0.99) while the mean score of the L2 speakers was 0.92. An independent-samples t-test revealed that this difference in scores is significant (t (34) = 5.49, $p < .001$).

A 4-way mixed ANOVA was conducted on the effect of four independent variables (grammaticality, gender, animacy, and group) on participants' performance on the GJ task. A significant main effect of grammaticality was found (F (1, 34) = 5.386, p = 0.026). Participants performed better on grammatical sentences (M = 0.97) than on ungrammatical sentences (M = 0.94). However, a significant interaction between groups and grammaticality showed that

grammaticality was a significant main effect for the L2 group only. Unlike the native control group who performed similarly on grammatical and ungrammatical sentences, L2 speakers performed better on grammatical sentences than on ungrammatical sentences. Table 5.3 shows the performance of native speakers and L2 speakers on grammatical vs. ungrammatical sentences.

Table 5.3. Mean accuracy by groups and grammaticality

Group	Test feature	Mean (SD)
Native speakers	Grammatical	0.99 (0.009)
	Ungrammatical	0.99 (0.016)
L2 speakers	Grammatical	0.94 (0.007)
	Ungrammatical	0.89 (0.013)

No main effect of gender was found (F (1, 34) = 1.653, p = 0.207). Participants' performed similarly on sentences with masculine nouns (M = 0.96) and on sentences with feminine nouns (M = 0.95). However, as discussed in the previous section, the effect of gender was found significant on the +Gender group. They performed slightly better on sentences with masculine nouns (M = 0.91) than on sentences with feminine nouns (M = 0.87).

A significant main effect of animacy was also found (F (1, 34) = 44.322, p < .001). Participants performed better on sentences with animate nouns (M = 0.97) than on sentences with inanimate nouns (M = 0.94). There was a significant interaction between group and animacy, which showed that animacy had a significant main effect only on the L2 speaker group (F (1, 20) = 59.024, p < .001). As mentioned earlier, the L2 speakers performed better on sentences with animate nouns than on sentences with inanimate nouns (see Table 5.4). No other significant interactions were found.

Table 5.4. Mean accuracy by group and animacy

Group	Test feature	Mean
Native speakers	Animate	0.998 (0.010)
	Inanimate	0.994 (0.012)
L2 speakers	Animate	0.95 (0.009)
	Inanimate	0.88 (0.010)

5.1.5 Discussion

This experiment was conducted to investigate the acquisition of grammatical gender in L2 speakers of MSA. The result showed that L2 speakers were able to accurately identify grammatical and ungrammatical sentences. Both -Gender and +Gender groups performed very well. Their accuracy rate was relatively high: 92% on average when scores were collapsed across conditions. This result suggests no effect of participants' L1s. This effect may be found at the initial and earlier stages of acquisition, but disappears as the L2 learners reach the advanced levels in their development and progress toward the target language. Although there was no significant difference in the overall result between the -Gender group and the +Gender group, the former was slightly better, as shown in Table 5.5.

Table 5.5. Mean accuracy on the GJ task by the L2 speaker groups

Test feature	Level	-Gender *M (SD)*	+Gender *M (SD)*
Grammaticality	Grammatical	0.95 (0.012)	0.93 (0.014)
	Ungrammatical	0.92 (0.021)	0.85 (0.024)
Gender	Masculine	0.94 (0.014)	0.91 (0.016)
	Feminine	0.94 (0.015)	0.87 (0.018)
Animacy	Animate	0.97 (0.014)	0.93 (0.017)
	Inanimate	0.91 (0.015)	0.85 (0.018)

This small difference between the L2 groups might be due to a proficiency effect, as the proficiency test showed that the –Gender group performed better than the +Gender group. The other possibility is that the presence of a grammatical gender system in the speakers' native language hinders the acquisition of this system in L2. Hence, the poorer performance of the +Gender group in this study might be due to a negative transfer from their L1. In an ERP study, Foucart (2008) examined gender agreement processing in French and found that English speakers showed native-like processing, while German speakers did not. The author attributed this difference to the presence of a competing system in the German L1.

The L2 speakers in the +Gender group scored less than 90% in some conditions. They showed a low accuracy rate on the ungrammatical sentences as compared to the grammatical sentences. This could be due to a 'yes'-bias effect, in which participants tend to choose the 'correct' option when they are not sure what the correct answer is (Sabourin et al., 2006). They also showed a low accuracy rate on sentences with feminine nouns. The preference of masculine over feminine is reasonable as masculine is the default form in MSA. Therefore, it could be that the +Gender group tended to use masculine as the default form and overgeneralized it. Alhawary (2009) also found that participants were using masculine as the default, as they had higher correct answers on masculine rather than on feminine items in his production tasks. Other studies have also reported that L2 learners tend to use one gender (masculine or feminine) as a default (e.g., Sabourin et al, 2006; White et al, 2004).

With regard to animacy, the result showed that both -Gender and +Gender groups performed significantly better on sentences with animate nouns than on those with inanimate ones, which suggests that participants relied on the semantic information encoded within the animate nouns to figure out the correct answer. This result is in line with previous research that

found a strong facilitatory effect of animacy on both accuracy and processing (Alarcón, 2009; Anton-Medez, 1999; Bonin, Gelin, & Bugaiska, 2014; Finnemann, 1992; Vigliocco & Franck, 1999;).

The result also revealed a significant difference between the L2 speakers and the native speakers. Neither the -Gender group nor the +Gender group performed as accurately as the native speaker group. The native speaker group performed at ceiling in all task conditions. This difference in performance between groups was expected since the participants of this study were still learning Arabic and they had not reached target-like performance. However, upon closer examination, it was found that three individual learners did perform as well as native speakers (scored 96.66% and up). All of them were from the –Gender group. This can be interpreted to indicate that attaining native-like performance in Arabic is still possible for Arabic learners regardless of their L1s. Several studies that investigated Arabic SLA have reported that Arabic verbal gender agreement is one of the linguistic structures that are acquired at early stages (e.g., Alhawary, 1999, 2003; Mansouri, 1995; Nielsen, 1997). For example, Alhawary (2003) examined the acquisition of Arabic gender agreement in the third personal singular by beginner L2 Arabic learners who were native speakers of English. He points out that the majority of participants (6 out of 9) acquired subject-verb agreement before noun-adjective agreement. This might explain the high performance of some individuals in the present study.

In summary, the current experiment tested L2 speakers' knowledge of grammatical gender in MSA. The data revealed that L2 speakers hold excellent knowledge of gender agreement, to the extent that some performed similarly to native speakers. That said, showing explicit knowledge of gender agreement similar to native speakers does not necessarily mean

that the underlying processing is similar. In an offline task, such as the one used here, speakers make conscious and controlled decisions about the target structure, which may not reflect their actual language abilities depending on how good their metalinguistics abilities are. To overcome this limitation of the GJ task, an online self-paced reading task was employed in Experiment 4 to measure L2 speakers' unconscious and automatic knowledge of gender agreement. Further, Experiment 4 included more advanced L2 speakers, which will provide more insight into the ability of L2 speakers to reach native-like performance. The features and results of Experiment 4 are addressed in the next section.

5.2 Experiment 4: Self-Paced Reading task (SPR)

Experiment 4 is identical to Experiment 1 which tested Native Speakers of MSA in terms of design, material, condition, and procedure. The only difference is that the present experiment included L2 speakers of MSA only. Thus, native speakers in Experiment 1 served as a control group for the L2 speakers in this experiment.

Similarly to Experiment 3, this experiment investigates whether late L2 speakers can attain native-like competence in their L2, and to what extent L1 influences the L2 acquisition. This experiment employed a self-paced reading task (SPR) in order to measure the participants' implicit and unconscious behaviour of grammatical gender agreement in MSA. As this task records participants' reaction time (RT) for each word, it can reveal processing difficulties at any point within the sentence. The basic premise is that longer RTs indicate processing difficulties. Using the SPR task, I aim to answer the following specific research questions:

RQ 1) Will L2 speakers show native-like processing of grammatical gender agreement, and thus be able to show longer RTs on the ungrammatical sentences as compared to the grammatical ones?

RQ 2) Will any evidence inform us on the effect of L1 in L2 acquisition? Specifically, will the presence or absence of a gender system in the L2 speakers' L1 influence their processing of grammatical gender agreement in MSA, and thus, will there be differences in performance between (+Gender) and (-Gender) groups?

RQ 3) Will L2 speakers show any evidence of nouns with a semantic gender (animate nouns) being easier to process, and thus will there be differences in RTs between sentences with animate nouns and sentences with inanimate nouns?

RQ 4) Will L2 speakers demonstrate that they prefer a specific word order in MSA, and thus, will there be differences in RTs as a result of word order alternations (VS word order versus SV word order)?

RQ 5) Will there be differences in RTs between sentences with masculine nouns and sentences with feminine nouns that would lead to the proposal that L2 speakers assume one gender being considered unmarked/ or as a default?

In the following sections, I will describe the participants involved in this experiment, and then I will report the results. For materials and procedure, please refer to Experiment 1, on p. 63.

5.2.1 Participants

One hundred and six L2 speakers took part in this study. They were all recruited at the King Saud University in Riyadh, Saudi Arabia. As this experiment targeted L2 speakers with a high level of proficiency, it included only L2 speakers who were completing their undergraduate or graduate studies. The participants were adults and their age ranged from 21 to 39 (mean age of 27 years). They were first exposed to Arabic after puberty, and they have been in Saudi Arabia for two to six years.

This experiment had three inclusion conditions: 1) participants had to score 70% and above in the proficiency reading test; 2) they had to score 70% in the grammaticality judgment task that accompanied the SPR; and 3) they had to have at least 7 out of 10 correct answers in each task condition (i.e., participants who made the incorrect grammaticality judgment for more than three sentences in one condition were excluded). As a result of these conditions 53 participants were excluded from the analysis as follows: 15 participants were excluded due to

the first condition, 28 participants were excluded due to the second condition, and 10 participants were excluded due to the third condition. Of the 53 participants that were kept for the analysis, there were 29 participants in the -Gender group and 24 participants in the +Gender group. Table 5.6 provides information on these 53 participants.

Table 5.6. L2 speakers. language background

Group	L1 language family	Country	L1	No. of speakers
-Gender	Malayo- Polynesian	Philippines Indonesia Malaysia	Filipino Indonesian Malay	8 7 6
	Sino- Tibetan/ Chinese	China	Chinese	4
	Germanic languages	England	English	4
				Total= 29
+Gender	Indo- Iranian/ Indo- Aryan	India Pakistan	Urdu	5 3
	Romance	France	French	11
	Indo-European/ East Slavic	Russia	Russian	5
				Total= 24

5.2.2 Procedures

The procedure in this experiment is identical to that of Experiment 1, but I will highlight some minor differences here. First, the data for this experiment was collected over three weeks. Second, unlike for the native speakers in Experiment 1, the L2 speakers were asked to perform a reading proficiency test, which they completed during the break (15-20 minutes) between the VS session and the SV session. Third, while the native speakers took 15-20 minutes to complete each session, the L2 speakers took 20-30 minutes.

5.2.3 Results

5.2.3.1 Proficiency Test

As in Experiment 3, the reading proficiency test consisted of 12 questions, with each correct question receiving one point. After excluding all participants with a low score, the results of this test revealed that the L2 speakers scored 85.02 % on average. Their scores ranged between 73% and 94%, There was no difference in the mean score between the -Gender group (84.45%) and the +Gender group (85.70%). An independent-samples t-test revealed no significant difference between the two groups (t (51) = -1.13, p = 0.262).

5.2.3.2 The VS word order result

5.2.3.2.1 The grammaticality judgment task (GJ)

The result of the GJ task that accompanied the SPR showed that L2 participants' mean accuracy score was 88.16%. This result confirmed that participants were able to identify grammatical and ungrammatical sentences.

The -Gender group and +Gender group had similar accuracy scores of 87.02% for the former and 89.5% for the latter. An independent-samples t-test revealed no significant difference between the two groups (t (51) = 1.42, p = 0.161).

In comparison with the native speakers who scored 98.5% on average, an independent-samples t-test revealed a significant difference between the two groups (t (66) = 6.14, p < 0.001).

5.2.3.2.2 The self-paced reading task: -Gender vs. +Gender

The result revealed that, overall, there was a small difference in RTs between the -Gender group (*mean RT*= 1450.18 ms) and the +Gender group (*mean RT*= 1271.61 ms). Bonferroni pairwise comparisons revealed that this difference is not significant (p= 0.619).

A mixed analysis of variance (ANOVA) was conducted on five independent variables: grammaticality, gender, animacy, group, and word positions. The result showed that there was a significant main effect of grammaticality (F (1, 51) = 16.235, $p < 0.001$). Participants were slower reading ungrammatical sentences (M = 1449.55) compared to grammatical sentences (1272.25). No significant interaction was found between groups and grammaticality (F (1, 51) = 0.605, p = 0.440).

The results also showed that there was a significant main effect of gender (F (1, 51) = 10.261, p = 0.002). However, a significant interaction between gender and groups (F (1, 51) = 8.597, p = 0.005) shows that that gender had a significant main effect only within the -Gender group (F (1, 28) = 20.482, $p < 0.001$). Mean RTs showed that participants in this group were significantly slower on sentences with feminine nouns than on those with masculine nouns by 196.61ms (see Figure 30).

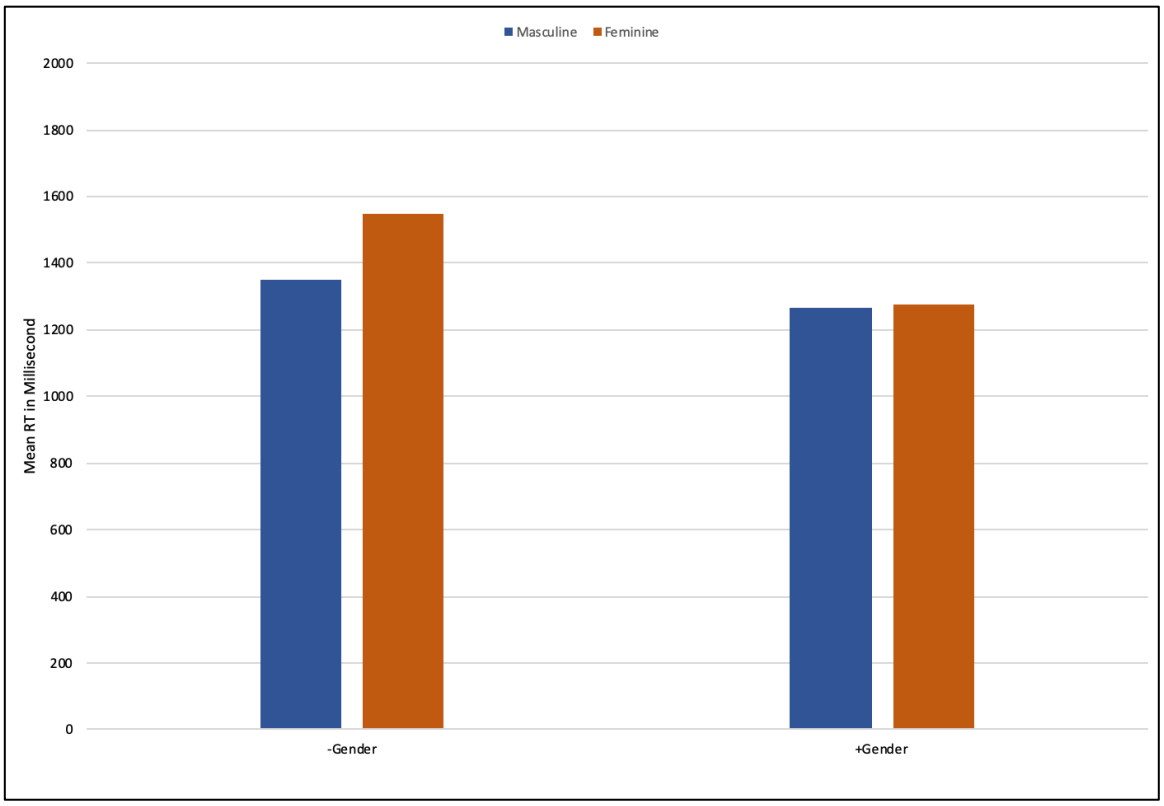


Figure 30. Mean RTs by groups and gender

The result also showed that there was a significant main effect of animacy (F (1, 51) = 5.546, p = 0.022). Participants were slower reading sentences with inanimate nouns (M = 1399.35) compared to sentences with animate nouns (M = 1322.44ms). No significant interaction was found between groups and grammaticality (F (1, 51) = 0.244, p = 0.624).

Moreover, there was a significant main effect of word position (F (2, 102) = 64.083, p < 0.001). Participants were significantly slower at the critical word compared to preceding or following words (see Table 5.7). No significant interaction was found between groups and word positions (F (2, 102) = 1.425, p = 0.245).

Table 5.7. Mean RT according to word positions

	Variable	Mean (SD)
L2 speakers	CW-1	1375 (72.69)
	CW	1569 (94.49)
	CW+1	1137.93 (75.53)

Finally, there was a significant interaction between grammaticality and word position (F (2, 102) = 26.415, $p < 0.001$). Follow-up analysis revealed that grammaticality had a significant main effect at CW (F (1, 51) = 47.049, $p < 0.001$). Participants were slower at CW in the ungrammatical sentences (see figure 31). No other significant interactions were found.

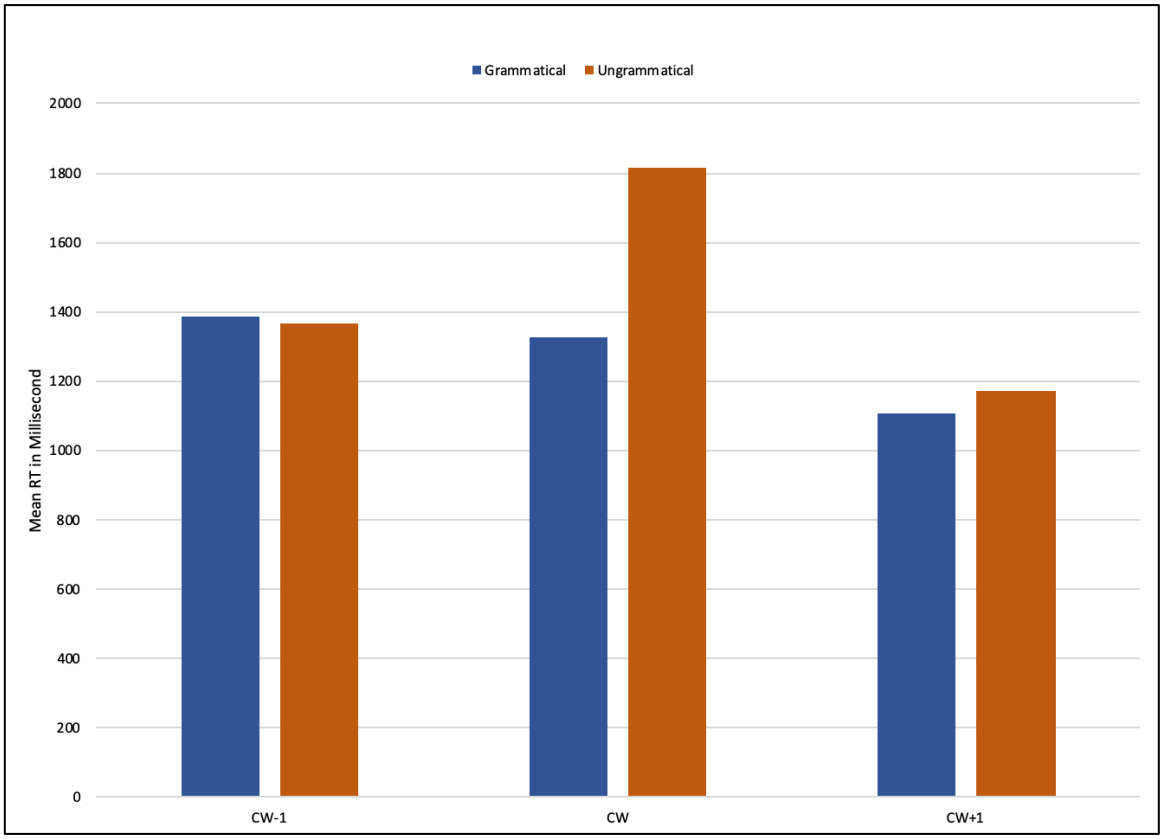


Figure 31. Mean RTs by grammaticality and word positions

5.2.3.3 The SV word order result

5.2.3.3.1 The grammaticality judgment task (GJ)

The L2 participants' mean accuracy score was 85.61% on the GJ task. The -Gender group and +Gender group had similar accuracy scores: 85.04% for the former and 86.72% for the latter. An independent-samples t-test revealed no significant difference between the L2 sub-groups (t (51) = 1.062, p = 0.293). As in the VS word order, the L2 speakers had lower accuracy scores than the native speakers who performed almost perfectly (M = 97.66). An independent-samples revealed that this is significant (t (66) = 7.788, p < 0.001).

5.2.3.3.2 The self-paced reading task: -Gender vs. +Gender

The results revealed that, overall, there was a small difference in RTs between the -Gender group (*mean RT*= 1309.67 ms) and the +Gender group (*mean RT*= 1172.53 ms). Bonferroni pairwise comparisons revealed that this difference is not significant (p= 0.210). A repeated measure of variance (ANOVA) showed that there was a significant main effect of grammaticality (F (1, 51) = 18.440, p < 0.001). Participants were slower reading ungrammatical sentences (M = 1318.40) compared to grammatical sentences (1163.80).

No main effect of gender was found (F (1, 51) = 0.592, p = 0.445). Participants had approximately similar RTs on sentences with masculine nouns (M = 1253.37) and on sentences with feminine nouns (M = 1228.83). Similarly, no main effect of animacy was found (F (1, 51) = 1.634, p = 0.207). Participants had approximately similar RTs on sentences with animate nouns (M = 1214.69) and on sentences with inanimate nouns (M = 1267.50).

The results also revealed a significant main effect of word positions (F (2, 102) = 44.982 $p < 0.001$). Participants were significantly slower at the critical word compared to the preceding or following words (see Table 5.8).

Table 5.8. Mean reaction times according to word positions

	Variable	Mean (SD)
L2 speakers	CW-1	1249.08 (57.42)
	CW	1417.54 (64.86)
	CW+1	1056.67 (51.90)

Finally, there was a significant interaction between grammaticality and word position (F (2, 102) = 34.812, $p < 0.001$) Follow-up analysis revealed that grammaticality had a significant main effect at CW (F (1, 51) = 125.422, $p < 0.001$). Participants were slower at the CW and in the ungrammatical sentences (see Figure 32). No other significant interactions were found.

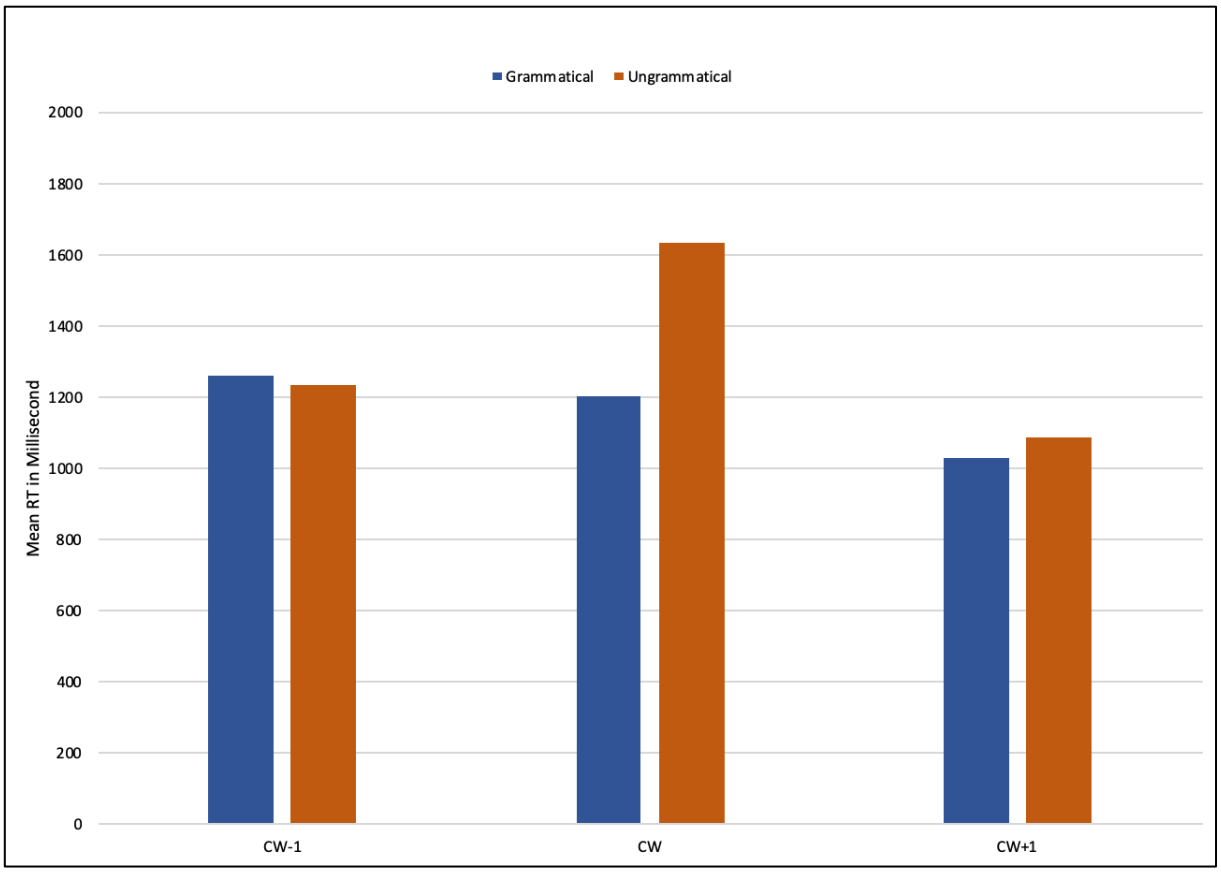


Figure 32. Mean RTs by grammaticality and word positions.

5.2.3.3.3 The self-paced reading task: L2 speakers vs. Native speakers

The result revealed that there is a significant difference between the L2 speaker group and the native speaker group in both the VS word order (F (1, 66) = 28.331, $p < 0.001$) and in the SV word order (F (1, 66) = 45.563, $p < 0.001$). Further, neither of the L2 sub-groups (i.e. -Gender and +Gender) performed similarly to native speakers. Bonferroni pairwise comparisons revealed that the difference between the L2 subgroups and the native speaker group is statistically significant ($p < 0.001$). Mean RTs for these groups are shown in Table 5.9 below.

Table 5.9. Mean RTs for all groups in the VS and SV word orders

Word order	Group		
	Native speaker (n= 15)	**-Gender** (n= 29)	**+Gender** (n= 24)
VS	576.52 ms	1450.18 ms	1271.61 ms
SV	553.95 ms	1309.67 ms	1172.534 ms

In addition, analyses within the -Gender and +Gender groups (i.e., based on L1) showed that all subgroups were significantly slower than native speakers. Even though the Indonesian L1 speakers and the Urdu L1 speakers showed faster RTs than the rest of the L2 speakers, they both were significantly slower than the native speakers. Table 5.10 below shows mean RTs for the L2 speakers based on their L1.

Table 5.10. Mean RTs by L2 speaker subgroups

Word order	Group							
	-Gender					+Gender		
	Filipino (n= 8)	Indonesian (n= 7)	Malay (n= 6)	Chinese (n= 4)	English (n= 4)	Urdu (n= 8)	French (n= 11)	Russian (n= 5)
VS	1260.35 ms	1114.12 ms	1335.32 ms	2396.88 ms	1643.58 ms	990.88 ms	1353.21 ms	1541.24 ms
SV	1382.100 ms	1085.779 ms	1308.552 ms	1495.961 ms	1372.036 ms	973.395 ms	1300.161 ms	1210.376 ms

5.2.4 Discussion

This experiment investigates the processing of grammatical gender in L2 speakers of MSA and can be compared to the results from the previous experiment that tested L2 knowledge. The results of this experiment support the findings from Experiment 3 in terms of sensitivity to gender agreement violation, effect of animacy, and effect of gender.

The L2 speakers in the present experiment showed sensitivity to grammatical gender violations. This is confirmed by their longer RTs in the ungrammatical sentences compared to the grammatical ones. They showed this sensitivity regardless of noun gender (masculine, feminine), noun animacy (animate, inanimate), and word order (VS, SV). Both L2 speaker subgroups (-Gender group and +Gender group) processed gender agreement in a similar manner. Mean RTs revealed no significant difference between them in terms of sensitivity to gender agreement violations, which suggests that the presence or absence of gender agreement system in L1 has no effect on processing gender agreement in L2.

Furthermore, both L2 subgroups showed an effect of animacy. They were slower on sentences with inanimate nouns than on those with animate nouns in the VS word order. This result is similar to the result found in Experiment 3, and is compatible with several SLA studies (Alarcón, 2009; Anton-Medez, 1999; Bonin, Gelin, & Bugaiska, 2014; Finnemann, 1992; Vigliocco & Franck, 1999).

The performance of the L2 speaker subgroups differed with regard to processing masculine and feminine nouns. While the +Gender group showed similar RTs for both gender types, the -Gender group were slower on feminine nouns than masculine ones. Again, this result is in line with the result of Experiment 3, and supports previous research that found marked

forms to be cognitively more costly than unmarked forms (Alemán Bañón & Rothman, 2016; Deutsch & Bentin, 2001; Kaan, 2002).

Further, the results revealed an effect of word order. The L2 groups were slower on VS word order than on SV word order. This result replicates the results found in Experiment 1 and Experiment 2 in the current dissertation, in which native speakers of MSA showed slower RTs and greater P600 effect when processing gender agreement on VS order as compared to SV word order.[28]

Like native speakers, the majority of L2 speakers showed slower RTs on VS word order than on SV word order except native speakers of Filipino (see Table 18 above). Although I argue that the asymmetry in the agreement system between VS and SV constructions is what caused this difference in RTs, there could be another reason in the case of the L2 speakers which is the effect of their L1. Except the Filipino language, all of the L2 speakers' L1s have a base subject-initial order including French, Urdu, Russian, Indonesian, Malay, Chinese, and English. Only in Filipino is the verb always in an initial position. The results of Filipino speakers being slower on the SV word order than on VS word order suggests an effect of their L1.

When comparing L2 speakers' performance to that of native speakers, I found that both L2 speaker groups processed gender agreement in a native-like manner; however, L2 speakers were significantly slower than native speakers. This overall slowdown processing is expected as slower processing in L2 seems to be a general phenomenon. Fraser (2007) points out that, in her study, even advanced L2 speakers were found to be slower than L1 speakers. Geva (1993) suggests that this slowdown among L2 speakers is because they have less automatized

[28] The effect of word order is discussed in more detail in the discussion section of Experiment 1, p. 75.

processing which requires more attention and demands on working memory. L1 speakers, on the other hand, have more unconscious and automatized decoding that requires a lower total cognitive load and leaves more capacity free for higher cognitive processing.

Another important issue is that this slowdown might just mean that the L2 speakers were using their explicit knowledge and not their automatic processing of their L2. The fact that the SPR task in our experiment was untimed might allow for such behaviour. Further, participants were asked to make a grammaticality judgment after each sentence. This might have affected their response time by making them compute all possible options each time they encountered a grammatical mistake in order to make the right judgment. Findings from previous research suggest that using the grammaticality judgment task increases the involvement of explicit knowledge. Leeser, Brandl and Weissglass (2011) investigate gender agreement processing by conducting two SPR experiments, one with grammaticality judgment, and the other with comprehension questions. They found that participants were sensitive to agreement violation only on the task with grammaticality judgment. In any case, this finding highlights the need for a future study that employs physiological measures such as event-related potentials (ERPs) which can offer insights into implicit processes, and measure participants' spontaneous brain responses on real-time language processing.

That being said, the results of this experiment cannot argue that this slowdown is due to a deficit in the L2 speakers' grammatical representation of the L2 grammar and hence, that L2 speakers cannot attain native-like performance. In fact, upon closer examination of L2 speakers' performance, it was found that some participants from both -Gender and +Gender groups performed similarly to native speakers (see Table 5.11). This indicates that it is possible for late L2 learners to reach native-like performance.

Table 5.11. Fastest and slowest RTs by native speakers, and L2 speakers who showed RTs within the native speakers' range

Word order	Native speakers' RT range (mean RT per word)	L2 speakers' information	-Gender group	+Gender group
VS	402-880 ms	Number of participants	2	7
		Proficiency score range	92-94 %	88-94
		RT	674-805 ms	612-820
SV	386-664 ms	Number of participants	2	2
		Proficiency score range	92-94 %	90-94 %
		RT	508-589 ms	489-640

Beside RT speed, the L2 speakers' performance was similar to that of native speakers in two aspects. First, L2 speakers were sensitive to gender agreement violations. Second, they were slower on VS word order as compared to SV word order.

Chapter 6

General Discussion and Conclusion

This dissertation addressed the processing of grammatical gender agreement in native and second language (L2) speakers of Modern Standard Arabic (MSA). More specifically, it explored whether adult L2 speakers can achieve native-like performance and whether their performance is impacted by their native languages. Further, it sought to identify if native and L2 speakers' performance is impacted by noun animacy and word order. To answer these questions, I examined subject-verb gender agreement in verb-subject (VS) and subject-verb (SV) word orders by conducting a series of experiments that included native speakers, and L2 speakers who varied on whether or not their L1 possesses a grammatical gender system.

This dissertation expands the empirical base to arrive at a deeper understanding of many aspects of gender agreement processing in both native speakers and L2 speakers of MSA. In many aspects, it forges novel paths on the subject. First, it was the first study that employed online comprehension tasks to investigate gender agreement processing in MSA for L1 and L2 speakers. Second, to my knowledge, it is the only available research to examine the effect of animacy on gender agreement processing in MSA. Third, this dissertation offers a new direction in MSA studies by being the first of its kind to examine the effect of word order on gender agreement processing in MSA.

In addition, this dissertation contributes to the field of second language acquisition (SLA) by examining the assumptions of two SLA hypotheses (i.e., FFFT & FTFA). It does so by contributing new data generated from L2 speakers with L1s that have not thus far been studied in relation to MSA as an L2.

This concluding chapter summarizes this dissertation's findings in relation to the research questions, which fall under five main headings: native speakers' processing, L2 speakers' processing, FFFT vs. FTFA, effect of animacy on processing, and effect of word order on processing. Finally, I discuss this project's limitations and offer new directions for future research.

6.1 Native speakers' processing

This dissertation included three experiments aiming to examine the representation and processing of gender agreement in native speakers of MSA. Each experiment employed different methods and tested different participants. Results of these three experiments showed that native speakers were sensitive to grammatical gender violations. This was true regardless of noun gender, noun animacy, and word order.

The first experiment employed a SPR task and tested 15 native speakers. Results revealed that the native speakers showed longer reaction times (RT) on ungrammatical sentences than on grammatical sentences. Furthermore, within the ungrammatical sentences, they showed longer RTs at the critical word than at the preceding and following words. This increase in RT at the critical word indicates a relatively higher processing difficulty (Papadopoulou & Clahsen, 2003). The results generated by this experiment are in line with

several studies that had investigated agreement processing in languages other than MSA (Sagarra & Herschensohn, 2011; Foote, 2011; Roberts, 2009).

The second experiment I conducted utilized an event-related potential (ERP) technique and tested 19 native speakers. Results revealed a P600 effect in response to ungrammatical sentences as compared to grammatical ones. It was distributed over the posterior regions, as well as the mid and right central regions. This result is consistent with previous studies that reported a robust P600 effect in response to sentences containing gender agreement violations (Alemán Bañón et al., 2012; Barber & Carreiras, 2005; Deutsch & Bentin, 2001; Hagoort, 2003). Moreover, the P600 effect was not preceded by the LAN effect, which emerges in response to morphosyntactic violations (Barber & Carreiras, 2005; Friederici, 2002; Hagoort & Brow, 1999; Molinaro et al., 2011a). Even though the current experiment included a morphosyntactic violation, it failed to elicit a LAN effect, which is reflective of the results of numerous studies (Alemán Bañón et al., 2012; Nevins et. al., 2007; Popov & Bastiaanse, 2018)

Lastly, the third experiment employed an offline grammaticality judgement task (GJ) and tested 15 native speakers. Participants performed at ceiling in this task. Such a result is expected because the task examined the explicit knowledge of gender agreement and native speakers can clearly identify what is grammatical and ungrammatical in their mother tongue (Bley-Vroman, 1989).

6.2 L2 speakers' processing

In relation to L2 speakers' processing, two experiments were conducted to assess the representation and processing of grammatical gender agreement in L2 speakers who have acquired MSA after the age of puberty. Each experiment included two groups, -Gender and

+Gender, based on the presence or absence of a gender agreement system in the participants' L1.

The first experiment employed an offline GJ task and tested 21 advanced L2 speakers. It revealed that both -Gender and +Gender groups performed well, though the -Gender group showed higher accuracy (94%) than the +Gender group (89%). The -Gender group were better in the proficiency test, which might explain why they outperformed the other group in the GJ task. Their higher achievement could be also due to negative transfer effects from L1 in the case of the +Gender group. In fact, the presence of a competing gender agreement system in L1 could hinder the process of acquiring the L2 gender agreement system (Foucart, 2008).

The second experiment targeting L2 speakers' processing employed a SPR task and tested 53 advanced L2 speakers. The result revealed that all L2 speakers showed sensitivity to gender agreement violations. They showed longer RT for ungrammatical sentences than for grammatical ones. More importantly, no difference was found between the -Gender and +Gender groups, which suggests no interference of L1.

6.3 FFFH vs FTFA

One of the goals of this dissertation was to test the assumptions of the Failed Functional Hypothesis (FFFH) and the Full Transfer/Full Access hypothesis (FTFA). These two hypotheses agree that transfer form L1 occurs at least at the initial state of L2 acquisition, however, they posit different proposals regarding the developmental stages of L2 acquisition as well as ultimate attainment. The FFFH (Hawkins & Chan, 1997) states that certain features of function are subject to maturational constraint, and, therefore, they are inaccessible to L2 adult learners unless they have these features instantiated in their L1. For this reason, any

differences between L2 and L1 performance are due to a representational deficit. Accordingly, the FFFH make three predictions: (1) the L1 will determine the acquisition of the L2 gender system, and thus there will be significant differences between -Gender group and +Gender group at all stages of development; (2) the +Gender group will always outperform the -Gender group, even at the final stage of acquisition; and (3) only the +Gender group can achieve a native-like performance.

In contrast, the FTFA hypothesis (Schwartz and Sprouse, 1994, 1996) claims that all L2 learners still have access to universal grammar (UG), and thus can acquire functional features that are not present in their L1. It also posits that the initial state of the L2 acquisition is based on features that are present in learners' L1, but when learners fail to assign a representation to input data, they will force subsequent restructurings drawing from options of UG. Thus, the FTFA hypothesis makes the following predictions: (1) at the earlier stages, L2 learners with different L1s should represent different knowledge of L2 grammatical gender, and those L2 learners with grammatical gender systems in their L1 will likely be better than those without a grammatical gender system in their L1; (2) L2 learners with no gender system in their L1 will be able to overcome this difficulty and will eventually achieve knowledge of the L2 gender system similarly to L2 learners with a gender system in their L1; and (3) because of their access to UG, all post-puberty L2 learners can achieve a native-like performance regardless of the presence or absence of features in their L1. Under this hypothesis, non-target-like performance is ascribed to other factors such as proficiency level, task demands, communication pressure, cognitive capacity, and processing speed.

The current dissertation provides evidence in favor of the FTFA hypothesis due to two of its findings. First, the L2 speakers in the -Gender group were able to perform as well as their

counterparts in the +Gender group, which indicates that adult L2 speakers can indeed acquire functional features that are not present in their L1. This finding aligns with several available L2 studies (Alhawary, 2011, 2019; Bond et al., 2011; Dowens et al, 2010, 2011; White et al., 2004).

Secondly, the L2 speakers were sensitive to gender agreement violations, as were the native speakers. Although the L2 speakers had lower accuracy and longer RTs as compared to the native speakers, they showed a similar mechanism to that of the native speakers by demonstrating slower RTs on ungrammatical sentences than on grammatical one, and slower RTs on the critical word than on the preceding or following word. In line with the FTFA hypothesis, this dissertation argues that such difference in performance between L2 speakers and native speakers is not a result of L2 speakers' representational deficit, but rather is a result of proficiency effect and/or task demands. This is supported by the fact that some L2 participants perform similarly to the native speakers in terms of accuracy rate and processing speed. The findings are compatible with a host of previous L2 studies (Dekydtspotter, Schwartz, & Sprouse, 2006; Dussias, 2003; Foucart, 2008; Hopp, 2006, 2010; Spino-Seijas, 2017; White et al., 2004), though they challenge the results of many other studies that have found fundamental differences between L2 and L1 speakers performance (Ellis et al., 2012; Franceschina, 2002; Meulman et al., 2014; Sabourin and Stowe, 2008)

6.4 Animacy effect

This dissertation offers groundbreaking evidence of the marked effect of animacy on grammatical gender processing in MSA. The data accumulated from the native speakers in the SPR task and in the GJ task did not show an effect of animacy. They showed similar accuracy rates and similar RTs for both animate and inanimate nouns. However, in the ERP experiment,

the native speakers showed an unclear effect of animacy. Previous ERP studies that have examined animacy effect on gender agreement processing have reported different results: (1) no effect of animacy, which implies that both semantic gender (i.e., that involves animate nouns) and grammatical gender (i.e., that involves inanimate nouns) are processed similarly (Barber, Salillas, Carreiras, 2004; Osterhout & Mobley, 1995); (2) semantic gender violation should elicit N400 effect (Deutsch and Bentin, 2001; Schmitt, 2002). The result of the current ERP study showed no N400 effect in response to semantic gender violation, but showed different neurological responses to animate and inanimate nouns. The animate nouns elicited greater positivity than the inanimate ones in the VS word order in the 350-800 ms time window. This result suggests that the animate nouns may consume more cognitive resources than inanimate nouns. Several studies on gender agreement processing have found animate nouns more difficult to process than inanimate nouns (Bruhn de Garavito & White, 2002; Sagarra & Herschensohn, 2011). In the SV word order, however, no main effect of animacy was found, but only within grammatical sentences, and only in the 300-600 ms time window, the inanimate nouns elicited greater positivity than the animate ones. This inconsistent animacy effect could be due to the word order alternation per se, or it could be due to an uncontrolled factor in our stimuli. Findings of previous research with regard to animacy effect on gender agreement processing is also inconsistent. Some research found animate nouns more difficult to process than inanimate ones (Bruhn de Garavito & White, 2002; Sagarra & Herschensohn, 2011, 2012), while others found the exact opposite (Alarcón, 2009; Finnemann, 1992; Vigliocco & Franck, 1999;). It should be noted that Sagarra & Herschensohn (2011, 2012) and Alarcón (2009) investigated this effect on Spanish, though they came to different conclusions. Thus, this

inconsistent effect of animacy on gender agreement processing highlights the need for more future research.

In the case of L2 speakers, the results revealed that animate nouns are easier to process than inanimate ones. This was reflected in their higher accuracy and faster RTs on animate nouns compared to inanimate ones. This finding is compatible with several studies that have demonstrated that animate entities, because they are more semantically rich, are memorized more quickly (Hargreaves, Pexman, Johnson, & Zdrazilova, 2012), remembered better (VanArsdall, Nairne, Pandeirada, & Blunt, 2013), and processed faster (Alarcón, 2009; Vigliocco & Franck, 1999) than inanimate entities.

6.5 Word Order effect (Verb-Subject vs. Subject-Verb)

In relation to the effect of word order, the results of my experiments confirmed the importance of this feature in gender agreement processing. In the SPR experiment, both native and L2 speakers had longer RTs on sentences with VS word order than on those with SV word order. This result was supported by the ERP experiment findings, which showed that ungrammatical sentences with VS word order elicited earlier and longer P600 than ungrammatical sentences with SV word order. Although the VS and SV results were not directly compared statistically,[29] the differences (in RTs and P600) in gender agreement processing between the two-word orders might lie in the increased repair complexity for VS word order compared to SV word order. Previous studies support this finding by reporting that

[29] Statistical analyses were not conducted to directly compare the VS and SV results because many factors differed between the two-word orders, such as that the CW in the VS is the subject while in the SV it is the verb.

an increase in repair options results in costlier cognitive processing (Barber & Carreiras, 2005; Popov & Bastiaanse, 2018).

6.6 Limitations and future research

Though the above summarized findings contribute in many ways to the study of gender processing in relation to MSA, this dissertation presents some limitations. One of these limitations pertains to the inclusion of native speakers only in the ERP experiment, a choice made only due to the lack of advanced L2 speakers of MSA at the time of testing. Including L2 speakers in the ERP experiment would have provided more solid results and deeper understanding of the qualitative nature of L2 processing. In addition, the SPR task was untimed, which might allow for some involvement of the explicit knowledge, and provide no guarantee that it was actually testing online processing. Moreover, the type of animate nouns was not controlled, which might account for the unstable effect of animacy in the ERP experiment. Future research might address these limitations.

The conclusions that have been reached by the current dissertation can be further investigated in future research in the following aspects. First, this study suggests that late L2 learners can process subject-verb gender agreement in a native like manner. Future research can extend this study to investigate the performance of L2 learners in other types of grammatical gender agreement. This can be done by examining the processing of gender agreement between noun and adjective, noun and pronoun, or noun and verb in long distance dependencies. Conducting such studies would indicate if one type of agreement is less or more difficult for late L2 learners, which in turn can inform whether late L2 learners can reach native-like attainment. Second, this study suggests that processing gender agreement is costlier in VS word

order than in SV word order. Future studies can further explore this by examining gender and number agreement in both VS and SV word orders. If our claim, that this difference is due to more repair options in VS word order, is right, a similar result is expected. That is, processing gender agreement between verb and plural subject would be costlier in VS word order than in SV word order because the same cause remains valid even with a plural subject. The third aspect relates to the methodology. This study suggests that combining grammaticality judgement to the online tasks might have activated the participants' explicit knowledge about the target structure. Therefore, future studies could counteract this effect by replicating this study with a different design (e.g., using comprehension questions as a distracting task). Moreover, this study suggests that, due to L2 speakers' long RTs in the SPR task, there is no guarantee that this task was tapping into participants' implicit knowledge. This conclusion highlights the importance of using ERP in future tasks. Finally, another methodological feature of this study may open possibilities for lessons to be considered in future research. This project employed a written task, and this had two implications: (1) it required participants to read, and reading is a skill that involves a great deal of individual differences especially in the case of L2 speakers; (2) the gender agreement system in MSA is a transparent system in that almost every noun and verb manifests a gender marker when referring to a feminine entity, which makes the process of identifying gender agreement violations easy to some extent. Thus, implementing an auditory task (e.g., self-paced listening, ERP with auditory stimuli) is recommended in future research. Using an auditory task in addition to the written task will provide a better view of how L2 speakers comprehend and process the L2 input in real time.

Appendices

Appendix A

Language Questionnaire for Native Speakers (This is translated from Arabic)

Please answer the following questions:

1- Date of birth:
2- Sex: ☐ Male / ☐ Female
3- Country of origin:
4- What is your native language? (If you grew up with more than one language since birth, please specify)
5- What other languages do you speak? (please specify the age at which you were first exposed to that language)
   1) …….
      - Age of exposure:
      - (Proficiency level: ☐ Beginner ☐ Intermediate ☐ Advanced ☐ Very advanced)
   2) …….
      - Age of exposure:
      - (Proficiency level: ☐ Beginner ☐ Intermediate ☐ Advanced ☐ Very advanced)
   3) …….
      - Age of exposure:
      - (Proficiency level: ☐ Beginner ☐ Intermediate ☐ Advanced ☐ Very advanced)
6- What is your current school level?
7- Where did you complete your primary and higher education?
   - Preschool: .....
   - Elementary school: .....
   - High school: .....
   - College: .....
8- Are you right- or left-handed?
9- Have you ever had any kind of visual impairment?
10- Have you ever had any kind of hearing impairment?
11- Have you ever had any kind of reading impairment?
12- Have you ever had a serious head injury?

Appendix B

Language Questionnaire for L2 Speakers **(This is translated from Arabic)**

Please answer the following questions:

1- Date of birth:

2- Sex: ☐ Male / ☐ Female

3- Country of origin:

4- What is your native language? (If you grew up with more than one language since birth, please specify)

5- What other languages do you speak? (please specify the age at which you were first exposed to that language)
   1) …….
      - Age of exposure:
      - (Proficiency level: ☐ Beginner ☐ Intermediate ☐ Advanced ☐ Very advanced)
   2) …….
      - Age of exposure:
      - (Proficiency level: ☐ Beginner ☐ Intermediate ☐ Advanced ☐ Very advanced)
   3) …….
      - Age of exposure:
      - (Proficiency level: ☐ Beginner ☐ Intermediate ☐ Advanced ☐ Very advanced)

6- What is your current school level?

7- How many months/years did you study Arabic?

8- Have you been in any Arabic-speaking country?

9- What was your age when you first started learning Arabic?

10- How long have you been in Saudi Arabia?

11- What language do you usually speak out of school?

12- Do your parents (or one of them) speak Arabic?

13- Have you ever had any kind of visual impairment?

14- Have you ever had any kind of reading impairment?

Appendix C

Experimental Stimuli: the SPR and ERP experiments

List 1: Verb-subject word order

Grammatical sentences

1) Masculine animate subject

١- بكلِّ ثقة **قرأَ المذيعُ** نشرةَ الأخبار

1- With confidence, the broadcaster $_{MAS}$ read $_{MAS}$ the news

٢- هذهِ الليلة **جاءَ الرجلُ** راكبًا

2- Tonight, the man came $_{MAS}$ riding

٣- قبلَ ساعة **بكى الولدُ** من شدةِ الجوع

3- An hour ago, the boy cried $_{MAS}$ out of hunger

٤- بكلِّ تفان **سهرَ المُمرضُ** على راحةِ المرضى

4- With all effort, the nurse $_{MAS}$ took care $_{MAS}$ of the patients

٥- ليلةَ البارحة **حضرَ الملكُ** في تواضع

5- Last night, the king came $_{MAS}$ in humbleness

٦- دون شربِ الماء **مشَى الجملُ** مسافةً طويلةً

6- Without water, the camel $_{MAS}$ walked $_{MAS}$ a long distance

٧- بعدَ التخرج **اشترى يوسفُ** سيارةً جديدةً

7- After graduation, Yosof $_{MAS}$ bought $_{MAS}$ a new car

٨- بكلِّ سرورٍ **أعطى الأبُ** الطفلَ هديةً

8- With pleasure, the father gave $_{MAS}$ the child a gift

٩- بحرفيةٍ بالغة **صنعَ النجارُ** أبوابا جميلة

9- Proficiently, the carpenter $_{MAS}$ made $_{MAS}$ beautiful doors

١٠- في الغابةِ **صادَ الذئبُ** غزالا

10- At the forest, the wolf $_{MAS}$ hunted $_{MAS}$ a deer

2) Feminine animate subject:

١- من الآن فصاعدًا **منعَت الطبيبةُ** المريضَ من التدخين

1- From now on, the doctor $_{FEM}$ prevented $_{FEM}$ the patient from smoking

٢- في نهايةِ اليوم **راجعَت المحاسبةُ** المستندات

2- At the end of the day, the accountant FEM reviewed FEM the documents

٣- بامتيازٍ **نجحَت هندُ** في مسابقةِ الرياضيات

3- With distinction, Hind FEM succeeded FEM in the math competition

٤- هذا العَام **سجَّلت اللاعبةُ** رقمًا قياسيًا جديدًا

4- This year, the athlete FEM set FEM a new record

٥- بعدَ عملٍ شاقّ **ألّفت الكاتبةُ** روايةً شيقةً

5- After hard work, the author FEM wrote FEM an interesting novel

٦- في نهايةِ العام **كرمَت المديرةُ** الطالبات المتفوقات

6- At the end of the year, the principle FEM honoured FEM the outstanding students

٧- في حقلِ الأزهار **رفرفَت الفراشةُ** بجناحيها الجميلين

7- At the garden, the butterfly FEM fluttered FEM its wings

٨- أمس **ساعدَت الأمُّ** ابنتَها في إعدادِ الطعام

8- Yesterday, the mother FEM helped FEM her daughter preparing the food

٩- في نهايةِ الحفل **ألقَت الشاعرةُ** قصيدةً رائعة

9- At the end of the concert, the poet FEM recited FEM wonderful poem

١٠- في رحلةِ استكشاف **زارَت خديجـةُ** كلَّ البلدان العربية

10- On an exploration trip, Khadijah FEM visited FEM all Arab countries

3) Masculine inanimate subject:

١- قبل أسبوع **فتحَ المتجرُ** أبوابه للزبائن

1- A week ago, the store MAS opened MAS its doors to customers

٢- بسببِ الحريق **توقّفَ المصعدُ** عن العمَل

2- Because of fire, the elevator MAS stopped MAS working

٣- في صلاةِ الفجر **امتلأَ المسجدُ** بالمصلين

3- In the morning prayer, the mosque MAS was MAS full of people

٤- بأمرِ الله **أذهبَ الدواءُ** علةَ المريض

4- By the permission of God, the medication MAS cured MAS the disease

٥- قبلَ سنة **تجمّدَ النـهرُ** بسببِ الصقيع

5- Last year, the river MAS froze MAS because of cold

٦- مع غيابِ الأدلة **نجحَ التحقيقُ** في كشفِ الجريمة

6- In the absence of evidence, the investigation MAS succeeded MAS in uncovering the crime

٧- بسببِ العاصفة **غطّى البحرُ** الشواطئ القريبة

7- Due to the storm, the sea MAS covered MAS the nearby beaches

٨- دون سابقِ إنذار **تعطّلَ القاربُ** وسط النهر

8- Suddenly, the boat MAS stopped MAS in the middle of the river

٩- في حفلِ التخرج **اتسعَ البيتُ** للضيوفِ جميعًا

9- At the graduation ceremony, the house MAS accommodated MAS all guests

١٠- بشكلٍ مفاجئ **انفجرَ الصاروخُ** في الجوّ

10- Unexpectedly, the rocket MAS exploded MAS in the air

4) Feminine inanimate subject:

١- يوم أمس **كانت السماءُ** صافيةً

1- Yesterday, the sky FEM was FEM clear

٢- الموسمُ الماضي **انتجَت المزرعةُ** الكثيرَ من الفواكه

2- Last season, the farm FEM produced FEM a lot of fruits

٣- لغيابِ المتهم **أخّرَت المحكمةُ** الحكمَ في القضية

3- Due to the absence of the accused, the court FEM postponed FEM the case

٤- لحضورِ المهرجان **اكتظّت المدينةُ** بالسياح

4- For attending the festival, the city FEM was FEM overcrowded with tourists

٥- أخيرا **وصَلت الرسالةُ** إلى صديقي

5- Finally, the parcel FEM arrived FEM to my friend

٦- هذا العام **منحَت الجامعةُ** مكافآتٍ للموهوبين

6- This year, the university FEM provided FEM a scholarship to talented students

٧- لأيام عدّة **صمدَت القلعةُ** أمامَ الجيش

7- For many days, the fortress FEM withstood FEM the army

٨- في الصيفِ الماضي **أحرقَت النارُ** جزءًا كبـيرا من الغَابة

8- Last summer, the fire FEM burned FEM a large part of the forest

٩- بسببِ السرعة **اصطدمَت السيارةُ** بالرصيف

9- Because of speeding, the car FEM collided FEM with the sidewalk

١٠- عندَ الظهيرة **حجَبت السحابةُ** نورَ الشمس

10- At noon, the cloud FEM blocked FEM the sunlight

Ungrammatical sentences

1) Masculine animate subject

١- بإتقان بالغ **صمّمت المهندسُ** مبنى جميلا

1- Proficiently, the engineer MAS designed FEM a beautiful building

٢- بكلّ خفّة **انقضّت النمرُ** على فريستِه

2- Fastly, the tiger MAS swooped FEM on its prey

٣- عندَ المساء **انـتهـَت الخـادمُ** من تنظيفِ المنزل

3- Late at night, the maid MAS finished FEM the housework

٤- بعدَ تخطيطٍ متقن **سرقَت اللصُّ** النقودَ

4- After careful planning, the thief MAS stole FEM the money

٥- في مكانِ الحادث **عالجَت المسعفُ** المُصابين

5- At the scene, the paramedic MAS treated FEM the injured

٦- قبلَ سنتين **تخرجَت محمدُ** في الجامعة الإسلامية

6- Two years ago, Mohammad MAS graduated FEM from the university

٧- رغبةً في التنزهِ **خرجَت الأميرُ** مع عائلتِه

7- For a picnic, the prince MAS went out FEM with his family

٨- بكلِّ مشقةٍ **جرَّت الحصانُ** العربة

8- With difficulty, the horse MAS pulled FEM the cart

٩- أخيرًا **وقعت الدبُّ** في فخّ الصياد

9- Finally, the bear MAS fell FEM into the trap of the hunter

١٠- كالعادة **استمتعَت زيدُ** باللعبِ في الماء

10- As usual, Zaid MAS enjoyed FEM playing with water

2) Feminine animate subject

١- عندَ الساعةِ الواحدة **ركبَ المسافرةُ** القطارَ

1- At one o'clock, the passenger FEM boarded MAS the train

٢- بوضُوح تام **شرحَ المعلمةُ** الدرسَ

2- With all clarity, the teacher FEM explained MAS the subject

٣- دون قصدٍ **كسرَ الفتاةُ** نافذةَ الفصلِ

3- Unintentionally, the girl FEM broke MAS the class window

٤- بلطفِ الله **نجى الراكبةُ** من الحادث

4- By the mercy of Allah, the passenger FEM survived MAS the accident

٥- قبلَ أسبوع **أنجبَ البقرةُ** عجلاً صغيرا

5- Last week, the cow FEM gave MAS birth to a small calf

٦- قبل أمس **نسيَ فاطمةُ** كتابَ النحوِ

6- The day before yesterday, Fatimah FEM forgot MAS her grammar book

٧- السنة الماضية **حصلَ أختي** على جائزةِ الشعرِ العربي

7- A year ago, my sister FEM got MAS the poetry award

٨- في حفلةِ البارحة **لـبسَ الـمـرأةُ** فـسـتـانًا أنـيـقـا

8- In the last night party, the woman FEM wore MAS an elegant dress

٩- بتشجيع الوالدَين **فازَ الطالبةُ** في مسابقةِ الإنشاد

9- With parent encouragement, the student FEM won MAS the singing competition

١٠- بمهارةٍ كبـــيرة **تسلقَ القطةُ** الشجرة

10- Skillfully, the cat FEM climbed MAS the tree

3) Masculine inanimate subject

١- في الرّبيع الماضي **اكتسَت الجبلُ** بأشجار الزيتون

1- In the last spring, the mountain MAS was FEM covered with olive trees

٢- قبلَ ساعة **انطلقَت القِطارُ** إلى المحطةِ الأخيرة

2- An hour ago, the train MAS departed FEM to its last stop

٣- قبلَ يومين **ظهرَت القمرُ** بعدَ المغرب مباشرة

3- Two days ago, the moon MAS appeared FEM just after sunset

٤- بشكلٍ مفاجئ **أطفأت الهواءُ** الشمعةَ

4- Suddenly, the air MAS blew FEM out the candle

٥- قبلَ شهر **انتهَت العملُ** في محطةِ القطار

5- Last month, the work MAS finished FEM in the train station

٦- في حلقةِ الأمس **ناقشَت البرنامجُ** موضوعًا مهما

6- In yesterday episode, the program MAS discussed FEM an important topic

٧- في حديقةِ الحيوان **منعَت القفصُ** الأسدَ من الهروب

7- In the zoo, the cage MAS prevented FEM the lion from escaping

٨- في مباراةِ أمس **حققَّت الملعبُ** رقمًا قياسيا في عددِ الحضور

8- In yesterday's game, the stadium MAS set FEM a record for attendance

٩- كما هو معلومٌ **حوت الكتابُ** قواعدَ اللغة العربية

9- As known, the book MAS contained FEM all Arabic language grammar

١٠- في العطلةِ الماضية **قدمَت المطعمُ** خصوماتٍ هائلة

10- Last holiday, the restaurant MAS offered FEM great discounts

4) Feminine inanimate subject

١- للحفاظ على الأمن، **كثف الشرطة** من وجود عناصرها في المهرجان

1- To maintain security, the police FEM increased MAS its presence at the festival

٢- بشكلٍ مفاجئ **سقطَ المطرقةُ** على الأرضِ

2- Suddenly, the hammer FEM fell MAS to the ground

٣- بسببِ الزحام **تأخّرَ الحقيبةُ** في الوصول

3- Due to traffic, the bag FEM did MAS not come on time

٤- قبلَ دقائق **نشرَ الصحيفةُ** أسماءَ الخريجين

4- Minuets ago, the newsletter FEM published MAS the names of the graduates

٥- بسببِ الرياح **وقعَ اللوحةُ** على الأرض

5- Because of wind, the billboard FEM fell MAS on the ground

٦- قبلَ يومين **علِقَ البطاقةُ** في جهازِ صرفِ النقود

6- Two days ago, the card FEM got MAS stuck in the ATM

٧- بسببِ العواصِف **أقلعَ الطائرةُ** في وقتٍ متأخر

7- Due to storms, the plane FEM took MAS off late

٨- بالهدايا **احتفَى المدرسةُ** بالطلابَ الجدد

8- With gifts, the school FEM welcomed MAS the new students

٩- السنةَ الماضية **ساهمَ الحكومةُ** بمبلغ كبـــيرِ لتطويرِ التعليم

9- Last year, the government FEM contributed MAS significantly to the development of education

١٠- صباحَ الأمس **أبحرَ السفينةُ** إلى مصر

10- Yesterday morning, the ship FEM sailed MAS to Egypt

List 2: Verb-subject word order

Grammatical sentences

1) Masculine animate subject

١- في بداية الحصة **وقفَ الطالبُ** احتراما للمعلم

1- At the beginning of the class, the student MAS stood MAS up for the teacher

٢- في وقت قياسي **قبضَ الشرطيُّ** على السارق

2- In short time, the policeman MAS caught MAS the thief

٣- قبل الإقلاع **أعلنَ الطيارُ** عن عطل في الطائرة

3- Before departure, the captain MAS announced MAS a problem with the plane

٤- بشكل مفصل **أعدَّ الصحفيُّ** تقريرا عن تلوث المياه

4- Elaborately, the journalist MAS prepared MAS a report on water pollution

٥- في السرك **رقصَ الفيلُ** على أصوات الطبول

5- At the circus, the elephant MAS danced MAS to the sounds of drums

٦- بعد جهد طويل **أنشأَ هاشمٌ** شركته الخاصة

6- After a long effort, Hashim MAS established MAS his own company

٧- في الجولة الأخيرة **انسحبَ المتسابقُ** من البرنامج

7- In the last round the contestant MAS withdrew MAS from the competition

٨- بناء على الوصفة **صرفَ الصيدليُّ** الدواء

8- According to the prescription, the pharmacist MAS dispensed MAS the medicine

٩- تجنبا للإفلاس **دعا الرئيسُ** إلى اجتماع طارئ

9- To avoid bankruptcy, the president MAS called MAS for an emergency meeting

١٠- في الصباح الباكر **خرجَ العصفورُ** بحثا عن الطعام

10- Early in the morning, the bird MAS came MAS out looking for food

2) Feminine animate subject:

١- لصعوبة القضية **فشلَت المحاميةُ** في الحصول على تسوية

1- Due to the difficulty of the case, the lawyer FEM failed FEM to reach a settlement

٢- البارحة **حكَـت الجدةُ** قصة مفيدة لأحفادها

2- Yesterday, the grandmother FEM told FEM a valuable story for her grandchildren

٣- قبل يومين **افتتحَت الأميرةُ** المتحف العلمي

3- Two days ago, the Princess FEM inaugurated FEM the Science Museum

٤- لإكمال الدراسة **انتقلَت سميةُ** إلى الولايات المتحدة

4- To complete the study, Sumayah FEM moved FEM to the United States

٥- بعد أشهر **عادَت الحمامةُ** إلى مسكنها الأصلي

5- After months, the pigeon FEM returned FEM to its original home

٦- بعد المدرسة **مشَت البنتُ** إلى بيت خالها

6- After school, the girl FEM walked FEM to her uncle's house

٧- هربا من الثعلب **قفزَت الدجاجةُ** فوق الجدار

7- To escape the fox, the chicken FEM jumped FEM over the wall

٨- في المؤتمر السنوي **عرضَت العالمةُ** بحثها الجديد

8- At the annual conference, the scientist FEM presented FEM her new research

٩- في الحفل الأخير **شاركَت عائشةُ** في تنظيم الحضور

9- At the last ceremony, Aisha FEM participated FEM in organizing the audience

١٠- في نهاية العمل **حسبَت الموظفةُ** الأجرة

10- At the end of the work, the employee FEM calculated FEM the fare

3) Masculine inanimate subject:

١- طبقا للإحصائيات **أودى التدخينُ** بحياة الكثير من الأشخاص

1- According to statistics, smoking MAS has taken MAS many lives

٢- في السنة الماضية **خـدمَ المطارُ** مئة ألف مسافر

2- Last year, the airport MAS served MAS 100,000 passengers

٣- بعد مباراة قوية **حصدَ الفريقُ** النقاط الثلاث

3- After a strong match, the team MAS took MAS the three points

٤- بعد صيف جميل **أطلَّ فصل** الخريف بألوانه البهية

4- After a beautiful summer, the autumn MAS came MAS with its colorful trees

٥- نتيجة العطل **وعــدَ البنكُ** بتعويض المتضررين

5- Due to a system failure, the bank MAS promised MAS to compensate those affected

٦- قبل أمس **قطعَ المقصُّ** يد الحلاق

6- The day before yesterday, the scissors MAS cut MAS the barber's hand

٧- بالأمس **تمـزّقَ الشراع** بسبب الرياح

7- Yesterday, the sail MAS was torn MAS by the wind

٨- في منتصف الليل **رنَّ الهاتفُ** مرات عدة

8- At midnight, the phone MAS rang MAS several times

٩- بفعل الزلزال **سقطَ المبنى** في دقائق معدودة

9- Because of the earthquake, the building MAS fell MAS down in a few minutes

١٠- بمناسبة اليوم الوطني **عرضَ التلفازُ** إنجازات الوطن

10- On the occasion of the National Day, the TV MAS broadcast MAS films on the achievements of the nation

4) Feminine inanimate subject:

١- بشكل رائع **التقطت الصورةُ** تفاصيل المنظر

1- Amazingly, the picture FEM captured FEM the details of the scene

٢- في نهاية العام **تحولت الساحةُ** إلى قاعة للاختبارات

2- At the end of the year, the yard FEM turned FEM into an exam auditorium

٣- قبل ساعة **أذاعَـت الجائزةُ** أسماء الفائزين في مجال الفيزياء

3- An hour ago, the prize FEM announced FEM the winner in the field of physics

٤- من زمن قديم **أصبحَـت الدراجةُ** وسيلة نقل ورياضة

4- From a long time ago, the bike FEM became FEM a mean of transport and sport

٥- اليوم **بـــدَأَت القناةُ** في بثِّ برامجها

5- Today, the channel FEM has started FEM broadcasting its programs

٦- بفضل الله **عالجت النظارةُ** الكثير من مشاكل البصر

6- By the grace of God, the glasses FEM treated FEM many of the eye problems

٧- في وقت قصير **عزّزت الدولة** مكانتها الاقتصادية

7- In a short time, the state FEM strengthened FEM its economic position

٨- إبّـــان الحرب **شكّـلَت الغابةُ** ملاذا آمنا لكثير من الأسر

8- During the war, the forest FEM was FEM a safe haven for many families

٩- خلال أسبوع **نقلت العربة** أكثر من خمسين مصابا

9- During the week, the ambulance FEM transported FEM more than fifty injured people

١٠- في الليل **سطعت النجمةُ** بشكل واضح وجميل

10- At night, the star FEM shone FEM brightly and beautifully

Ungrammatical sentences

1) Masculine animate subject

١- للمرة الثانية **حاولَت المجرمُ** الهروب من السجن

1- For the second time, the criminal MAS tried FEM to escape from prison

٢- بمهارة كبيرة **أبعدَت الحارسُ** الكرة عن المرمى

2- With great skill, the keeper MAS kept FEM the ball out of goal

٣- قبل أسبوع **أخذَّت المدرّسُ** التلاميذ إلى المكتبة العامة

3- A week ago, the teacher MAS took FEM the students to the public library

٤- بعد سماع الأدلة **أمرَت القاضيُ** بإطلاق المتهم

4- After hearing the evidence, the judge MAS ordered FEM to release the accused person

٥- العام الماضي **ذهبَت صالحٌ** إلى اليابان

5- Last year, Saleh MAS went FEM to Japan for a scientific visit

٦- بعد الصلاة **جلسَت الإمامُ** لإجابة المستفتين

6- After the prayer, the imam MAS sat FEM to answer questions

٧- في حديقة الحيوان **استطاعَت القردُ** الخروج من القفص

7- At the zoo, the monkey MAS was FEM able to get out of the cage

٨- بشكل بارع **تقمّصَت الممثلُ** شخصية الرجل الشرير

8- Brilliantly, the actor MAS played FEM a character of an evil man

٩- بكل تباه **استعرضَت الطاووسُ** ذيله الملون

9- With pomp, the peacock MAS showed FEM off its colorful tail

١٠- من أجل الملك **حاكَت الخياطُ** ثوبا رائعا

10- For the king, the tailor MAS woven FEM a wonderful cloak

2) Feminine animate subject

١- هربا من الصياد **غاصَ السمكةُ** في أعماق البحر

1- To escape the fisherman, the fish FEM dived MAS deep into the sea

٢- من أجل اللعب **صعدَ الطفلةُ** إلى أعلى التلّ

2- In order to play, the girl FEM climbed MAS up the hill

٣- بعد تفكير طويل **قرّرَ المريضةُ** إجراء العملية

3- After long thinking, the patient FEM decided MAS to do the surgery

٤- في الحلقة الماضية **أعطَى المدربةُ** بعض النصائح حول اللياقة البدنية

4- In the last episode, the trainer FEM gave MAS some advice on fitness

٥- لإنتاج العسل **جمعَ النحلةُ** الرحيق من الزهور

5- To produce honey, the bee FEM collected MAS the nectar from the flowers

٦- بكل تركيز **ذاكرَ التلميذةُ** من أجل الامتحان

6- With all diligence, the student FEM reviewed MAS for the exam

٧- بكل خفة **فرَّ النعامةُ** من قبضة الأسد

7- With all lightness, the ostrich FEM escaped MAS the lion's grip

٨- في محاضرة عامة **تحدَّثَ سارةُ** عن المشكلات الأسرية

8- In a public lecture, Sarah FEM spoke MAS about common challenges on family life

٩- في العيد **أهدَى الزوجةُ** زوجَها سيارةً جديدة

9- On Eid, the wife FEM gave MAS her husband a new car

١٠- طمعا في الأجر **تصدّقَ البائعةُ** على رجل فقير

10- For the sake of God, the salesman FEM donated MAS to a poor man

3) Masculine inanimate subject

١- أمس **استمرَّت المطرُ** في الهطول لست ساعات متواصلة

1- Yesterday, the rain MAS continued FEM for six hours

٢- في حفل الزواج **أثارَت الفستانُ** إعجاب الحاضرين

2- At the wedding, the dress MAS impressed FEM the audience

٣- على عكس المتوقع **افتــقــدَت الجهازُ** الكثيرَ من المزايا

3- Contrary to expectations, the device MAS lacked FEM many features

٤- في نهاية اليوم **امتلأت الصندوقُ** بالنقود

4- At the end of the day, the box MAS was filled FEM with cash

٥- لأهمية الموضوع **مرَّت الوقتُ** دون أن نشعر

5- Because of the importance of the subject, time MAS passed FEM without feeling

٦- لكثرة المراجعين **زادَت المكتبُ** عدد الموظفين

6- Due to high volume of cases, the law firm MAS has increased FEM the number of employees

٧- في فصل الصيف **تهيأَت الفندقُ** للترحيب بالسياح

7- In summer, the hotel MAS was set FEM to welcome tourists

٨- في الليل **أضاءَت المصباح** الطريق للمارّة

8- At night, the lamp MAS lit FEM the roadsides for pedestrians

٩- قبل خمسين عاما **رفرفَت العلمُ** على سطح القمر

9- Fifty years ago, the flag MAS fluttered FEM on the moon

١٠- بشكل جميل **نــظَّـــمَت المركز** دورات تدريبية

10- Wonderfully, the center MAS organized FEM training courses

4) Feminine inanimate subject

١- قبل سنة **نشرَ المـجـلّـةُ** بحثا عن زيادة التصحّر

1- A year ago, the journal FEM published MAS a research on desertification

٢- لمساعدة المحتاجين **أوصلَ الشاحنةُ** أنواعا مختلفة من المعونات

2- To help those in need, the truck FEM delivered MAS various types of aid

٣- في العامين الماضيين **خرَّجَ الكليةُ** دفعات كبيرة من المتميزين

3- In the past two years, the college FEM has graduated MAS large batches of outstanding students

٤- لحسن الحظ **حفظَ الخزنةُ** المستندات من اللصوص

4- Fortunately, the safe FEM kept MAS documents from the thieves

٥- بدقة عالية **سهَّــلَ الطابعةُ** طباعة ونشر الكتب

5- With high accuracy, the printer FEM made MAS it easier to print and publish books

٦- قبل أسبوع **وصَلَ البرقيةُ** إلى ديوان الملك

6- A week ago, the telegram FEM arrived MAS at the King's Court

٧- بفضل الله **نالَ المقالةُ** استحسان القرّاء

7- Thanks to God, the article FEM received MAS the readers' admirations

٨- بشكل منظم **احتوى الحديقةُ** على مرافق رياضية وترفيهية

8- In a structured way, the park FEM had MAS sports and leisure facilities

٩- بكل تشويق **ســردَ القصةُ** معاناة الفقراء

9- Fascinatingly, the story FEM narrated MAS the suffering of the poor

١٠- في العيد **أقامَ السفارةُ** حفلاً مميزًا

10- On Eid, the Embassy FEM held MAS a special ceremony

List 3: Subject-verb word order

Grammatical sentences

1) Masculine animate subject

١- بإتقان بالغ **المهندسُ صمّم** مبنى جميلا

1- Proficiently, the engineer $_{MAS}$ designed $_{MAS}$ a beautiful building

٢- بكلِّ خفّة **النمرُ انقضّ** على فريستِه

2- Fastly, the tiger $_{MAS}$ swooped $_{MAS}$ on its prey

٣- عندَ المساء **الخادمُ انـتهى** من تنظيفِ المنزل

3- Late at night, the maid $_{MAS}$ finished $_{MAS}$ the housework

٤- بعدَ تخطيطٍ متقن **اللصُّ سرقَ** النقودَ

4- After careful planning, the thief $_{MAS}$ stole $_{MAS}$ the money

٥- في مكانِ الحادث **المسعفُ عالجَ** المُصابين

5- At the scene, the paramedic $_{MAS}$ treated $_{MAS}$ the injured

٦- قبلَ سنتين **محمدُ تخرجَ** في الجامعة الإسلامية

6- Two years ago, Mohammad $_{MAS}$ graduated $_{MAS}$ from the university

٧- رغبةً في التنزهِ **الأميرُ خرجَ** مع عائلتِه

7- For a picnic, the prince $_{MAS}$ went out $_{MAS}$ with his family

٨- بكلِّ مشقةٍ **الحصانُ جرَّ** العربة

8- With difficulty, the horse $_{MAS}$ pulled $_{MAS}$ the cart

٩- أخيرًا **الدبُّ وقـعَ** في فخّ الصياد

9- Finally, the bear $_{MAS}$ fell $_{MAS}$ into the trap of the hunter

١٠- كالعادة **زيدُ استمتعَ** باللعبِ في الماء

10- As usual, Zaid $_{MAS}$ enjoyed $_{MAS}$ playing with water

2) Feminine animate subject

١- عندَ الساعةِ الواحدة **المسافرةُ ركبَت** القطارَ

1- At one o'clock, the passenger $_{FEM}$ boarded $_{FEM}$ the train

٢- بوضُوح تام **المعلمةُ شرحَت** الدرسَ

2- With all clarity, the teacher $_{FEM}$ explained $_{FEM}$ the subject

٣- دون قصدٍ **الفتاةُ كسرَت** نافذةَ الفصلِ

3- Unintentionally, the girl $_{FEM}$ broke $_{FEM}$ the class window

٤- بلطفِ الله **الراكبةُ نجَـت** من الحادث

4- By the mercy of Allah, the passenger $_{FEM}$ survived $_{FEM}$ the accident

٥- قبلَ أسبوع **البقرةُ أنجبَت** عجلاً صغيرا

5- Last week, the cow FEM gave FEM birth to a small calf

٦- قبل أمس **فاطمةُ نسيَت** كتابَ النحوِ

6- The day before yesterday, Fatimah FEM forgot FEM her grammar book

٧- السنة الماضية **أختي حصلَت** على جائزةِ الشعرِ العربي

7- A year ago, my sister FEM got FEM the poetry award

٨- في حفلةِ البارحة **المرأةُ لبسَت** فستانًا أنيقا

8- In the last night party, the woman FEM wore FEM an elegant dress

٩- بتشجيع الوالدَين **الطالبةُ فازَت** في مسابقةِ الإنشاد

9- With parent encouragement, the student FEM won FEM the singing competition

١٠- بمهارةٍ كبيرة **القطةُ تسلقَت** الشجرة

10- Skillfully, the cat FEM climbed FEM the tree

3) Masculine inanimate subject

١- في الرّبيع الماضي **الجبلُ اكتسَى** بأشجار الزيتون

1- In the last spring, the mountain MAS was MAS covered with olive trees

٢- قبلَ ساعة **القِطارُ انطلقَ** إلى المحطةِ الأخيرة

2- An hour ago, the train MAS departed MAS to its last stop

٣- قبلَ يومين **القمرُ ظهرَ** بعدَ المغرب مباشرة

3- Two days ago, the moon MAS appeared MAS just after sunset

٤- بشكلٍ مفاجئ **الهواءُ أطفأَ** الشمعةَ

4- Suddenly, the air MAS blew MAS out the candle

٥- قبلَ شهر **العملُ انتهَى** في محطةِ القطار

5- Last month, the work MAS finished MAS in the train station

٦- في حلقةِ الأمس **البرنامجُ ناقشَ** موضوعًا مهما

6- In yesterday episode, the program MAS discussed MAS an important topic

٧- في حديقةِ الحيوان **القفصُ منعَ** الأسدَ من الهروب

7- In the zoo, the cage MAS prevented MAS the lion from escaping

٨- في مباراةِ أمس **الملعبُ حقَّقَ** رقمًا قياسيا في عددِ الحضور

8- In yesterday's game, the stadium MAS set MAS a record for attendance

٩- كما هو معلومٌ **الكتابُ حوى** قواعدَ اللغة العربية

9- As known, the book MAS contained MAS all Arabic language grammar

١٠- في العطلةِ الماضية **المطعمُ قدّمَ** خصوماتٍ هائلة

10- Last holiday, the restaurant MAS offered MAS great discounts

4) Feminine inanimate subject

١- للحفاظ على الأمن، **الشرطة كثفَـت** من وجود عناصرها في المهرجان

1- To maintain security, the police FEM increased FEM its presence at the festival

٢- بشكلٍ مفاجئ **المطرقةُ سقطَت** على الأرضِ

2- Suddenly, the hammer FEM fell FEM to the ground

٣- بسببِ الزحام **الحقيبةُ تأخّرَت** في الوصول

3- Due to traffic, the bag FEM did FEM not come on time

٤- قبلَ دقائق **الصحيفةُ نـشرَت** أسماءَ الخريجين

4- Minuets ago, the newsletter FEM published FEM the names of the graduates

٥- بسببِ الرياح **اللوحةُ وقـعَـت** على الأرض

5- Because of wind, the billboard FEM fell FEM on the ground

٦- قبلَ يومين **البطاقةُ عـلِـقَـت** في جهازِ صرفِ النقود

6- Two days ago, the card FEM got FEM stuck in the ATM

٧- بسببِ العواصِف **الطائرةُ أقلعَـت** في وقتٍ متأخر

7- Due to storms, the plane FEM took FEM off late

٨- بالهدايا **المدرسةُ احتفَـت** بالطلابَ الجدد

8- With gifts, the school FEM welcomed FEM the new students

٩- السنةَ الماضية **الحكومةُ ساهمَـت** بمبلغ كبـــيرٍ لتطويرِ التعليم

9- Last year, the government FEM contributed FEM significantly to the development of education

١٠- صباحَ الأمس **السفينةُ أبحـرَت** إلى مصر

10- Yesterday morning, the ship FEM *sailed* FEM to Egypt

٩- بسببِ السرعة **السيارةُ اصطدمَـت** بالرصيف

9- Because of speeding, the car FEM collided FEM with the sidewalk

١٠- عندَ الظهيرة **السحابةُ حـجَـبَـت** نورَ الشمس

10- At noon, the cloud FEM blocked FEM the sunlight

Ungrammatical sentences

1) Masculine animate subject

١- بكلِّ ثقة **المذيعُ قرأَت** نشرةَ الأخبار

1- With confidence, the broadcaster MAS read FEM the news

٢- هذهِ الليلة **الرجـلُ جاءَت** راكـبًا

2- Tonight, the man came FEM riding

٣- قبلَ ساعة **الولدُ بكَـت** من شدةِ الجوع

3- An hour ago, the boy cried FEM out of hunger

٤- بكلِّ تفان **المُمرضُ سهرَت** على راحةِ المـرضى

4- With all effort, the nurse MAS took care FEM of the patients

٥- ليلةَ البارحة **الملكُ حضرَت** في تواضع

5- Last night, the king came FEM in humbleness

٦- دون شربِ الماء **الجملُ مشَت** مسافةً طويلةً

6- Without water, the camel MAS walked FEM a long distance

٧- بعدَ التخرج **يوسفُ اشترت** سيارةً جديدةً

7- After graduation, Yosof MAS bought FEM a new car

٨- بكلِّ سرورِ **الأبُ أعطَت** الطفلَ هديةً

8- With pleasure, the father gave FEM the child a gift

٩- بحرفيةٍ بالغة **النجارُ صنعَت** أبوابا جميلة

9- Proficiently, the carpenter MAS made FEM beautiful doors

١٠- في الغابةِ **الذئبُ صادَت** غزالا

10- At the forest, the wolf MAS hunted FEM a deer

2) Feminine animate subject:

١- من الآن فصاعدًا **الطبيبةُ منعَ** المريضَ من التدخين

1- From now on, the doctor FEM prevented MAS the patient from smoking

٢- في نهايةِ اليوم **المحاسبةُ راجعَ** المستندات

2- At the end of the day, the accountant FEM reviewed MAS the documents

٣- بامتيازٍ **هندُ نجحَ** في مسابقةِ الرياضيات

3- With distinction, Hind FEM succeeded MAS in the math competition

٤- هذا العَام **اللاعبةُ سجَّلَ** رقمًا قياسيًا جديدًا

4- This year, the athlete FEM set MAS a new record

٥- بعدَ عملٍ شاقّ **الكاتبةُ ألّفَ** روايةً شيقةً

5- After hard work, the author FEM wrote MAS an interesting novel

٦- في نهايةِ العام **المديرةُ كرمَ** الطالبات المتفوقات

6- At the end of the year, the principle FEM honoured MAS the outstanding students

٧- في حقلِ الأزهار **الفراشةُ رفرفَ** بجناحيها الجميلين

7- At the garden, the butterfly FEM fluttered MAS its wings

٨- أمس **الأمُّ ساعدَ** ابنتَها في إعدادِ الطعام

8- Yesterday, the mother FEM helped MAS her daughter preparing the food

٩- في نهايةِ الحفل **الشاعرةُ ألقَى** قصيدةً رائعة

9- At the end of the concert, the poet FEM recited MAS wonderful poem

١٠- في رحلةِ استكشاف **خديجـةُ زارَ** كلَّ البلدان العربية

10- On an exploration trip, Khadijah FEM visited MAS all Arab countries

3) Masculine inanimate subject:

١- قبل أسبوع **المتجرُ فتحَت** أبوابه للزبائن

1- A week ago, the store MAS opened FEM its doors to customers

٢- بسببِ الحريق **المصعدُ توقّفَت** عن العمَل

2- Because of fire, the elevator MAS stopped FEM working

٣- في صلاةِ الفجر **المسجدُ امتلأَت** بالمصلين

3- In the morning prayer, the mosque MAS was FEM full of people

٤- بأمرِ الله **الدواءُ أذهبَت** علةَ المريض

4- By the permission of God, the medication MAS cured FEM the disease

٥- قبلَ سنة **النهرُ تجمّدَت** بسببِ الصقيع

5- Last year, the river MAS froze FEM because of cold

٦- مع غيابِ الأدلة **التحقيقُ نجـحَـت** في كشفِ الجريمة

6- In the absence of evidence, the investigation MAS succeeded FEM in uncovering the crime

٧- بسببِ العاصفة **البحرُ غطّـت** الشواطئ القريبة

7- Due to the storm, the sea MAS covered FEM the nearby beaches

٨- دون سابقِ إنذار **القاربُ تعطّـلَـت** وسط النهر

8- Suddenly, the boat MAS stopped FEM in the middle of the river

٩- في حفلِ التخرج **البيتُ اتسعَت** للضيوفِ جميعًا

9- At the graduation ceremony, the house MAS accommodated FEM all guests

١٠- بشكلٍ مفاجئ **الصاروخُ انفجرَت** في الجوّ

10- Unexpectedly, the rocket MAS exploded FEM in the air

4) Feminine inanimate subject:

١- يوم أمس **السماءُ كان** صافيةً

1- Yesterday, the sky FEM was MAS clear

٢- الموسمُ الماضي **المزرعةُ انتجَ** الكثيرَ من الفواكه

2- Last season, the farm FEM produced MAS a lot of fruits

٣- لغيابِ المتهم **المحكمةُ أخّرَ** الحكمَ في القضية

3- Due to the absence of the accused, the court FEM postponed MAS the case

٤- لحضورِ المهرجان **المدينةُ اكتظّ** بالسياح

4- For attending the festival, the city FEM was overcrowded MAS with tourists

٥- أخيرا **الرسالةُ وصَل** إلى صديقي

5- Finally, the parcel FEM arrived MAS to my friend

٦- هذا العام **الجامعةُ منـحَ** مكافآتٍ للموهوبين

6- This year, the university FEM provided MAS a scholarship to talented students

٧- لأيام عدّة **القلعةُ صمدَ** أمامَ الجيش

7- For many days, the fortress FEM withstood MAS the army

٨- في الصيفِ الماضي **النارُ أحرقَ** جزءًا كبـيرا من الغَابة

8- Last summer, the fire FEM burned MAS a large part of the forest

٩- بسببِ السرعة **السيارةُ اصطدمَ** بالرصيف

9- Because of speeding, the car FEM collided MAS with the sidewalk

١٠- عندَ الظهيرة **السحابةُ حـجَـبَ** نورَ الشمس

10- At noon, the cloud FEM blocked MAS the sunlight

List 4: Subject-verb word order

Grammatical sentences

1) Masculine animate subject

١- للمرة الثانية **المجرمُ حاولَ** الهروب من السجن

1- For the second time, the criminal MAS tried MAS to escape from prison

٢- بمهارة كبيرة **الحارسُ أبعدَ** الكرة عن المرمى

2- With great skill, the keeper MAS kept MAS the ball out of goal

٣- قبل أسبوع **المدرّسُ أخَذَ** التلاميذ إلى المكتبة العامة

3- A week ago, the teacher MAS took MAS the students to the public library

٤- بعد سماع الأدلة **القاضيُ أمرَ** بإطلاق المتهم

4- After hearing the evidence, the judge MAS ordered MAS to release the accused person

٥- العام الماضي **صالحٌ ذهبَ** إلى اليابان

5- Last year, Saleh MAS went MAS to Japan for a scientific visit

٦- بعد الصلاة **الإمامُ جلسَ** لإجابة المستفتين

6- After the prayer, the imam MAS sat MAS to answer questions

٧- في حديقة الحيوان **القردُ استطاعَ** الخروج من القفص

7- At the zoo, the monkey MAS was MAS able to get out of the cage

٨- بشكل بارع **الممثلُ تقمّصَ** شخصية الرجل الشرير

8- Brilliantly, the actor MAS played MAS a character of an evil man

٩- بكل تباه **الطاووسُ استعرضَ** ذيله الملون

9- With pomp, the peacock MAS showed MAS off its colourful tail

١٠- من أجل الملك **الخياطُ حاكَ** ثوبا رائعا

10- For the king, the tailor MAS woven MAS a wonderful cloak

2) Feminine animate subject

١- هربا من الصياد **السمكةُ غاصَت** في أعماق البحر

1- To escape the fisherman, the fish FEM dived FEM deep into the sea

٢- من أجل اللعب **الطفلةُ صعدَ** إلى أعلى التلّ

2- In order to play, the girl FEM climbed FEM up the hill

٣- بعد تفكير طويل **المريضةُ قرّرَ** إجراء العملية

3- After long thinking, the patient FEM decided FEM to do the surgery

٤- في الحلقة الماضية **المدربةُ أعطَى** بعض النصائح حول اللياقة البدنية

4- In the last episode, the trainer FEM gave FEM some advice on fitness

٥- لإنتاج العسل **النحلةُ جمعَ** الرحيق من الزهور

5- To produce honey, the bee FEM collected FEM the nectar from the flowers

٦- بكل تركيز **التلميذة ذاكرَت** من أجل الامتحان

6- With all diligence, the student FEM reviewed FEM for the exam

٧- لسرعتها العالية **النعامةُ فـــرَّت** من قبضة الأسد

7- With all lightness, the ostrich FEM escaped FEM the lion's grip

٨- في محاضرة عامة **سارةُ تحدَّثَت** عن المشكلات الأسرية

8- In a public lecture, Sarah FEM spoke FEM about common challenges on family life

٩- في العيد **الزوجةُ أهـدَت** زوجَها سيارةً جديدة

9- On Eid, the wife FEM gave FEM her husband a new car

١٠- طمعا في الأجر **البائعةُ تصدّقَت** على رجل فقير

10- For the sake of God, the salesman FEM donated FEM to a poor man

3) Masculine inanimate subject

١- أمس **المطرُ استمرَّ** في الهطول لست ساعات متواصلة

1- Yesterday, the rain MAS continued MAS for six hours

٢- في حفل الزواج **الفستانُ أثارَ** إعجاب الحاضرين

2- At the wedding, the dress MAS impressed MAS the audience

٣- على عكس المتوقع **الجهازُ افتـــقـــدَ** الكثيرَ من المزايا

3- Contrary to expectations, the device MAS lacked MAS many features

٤- في نهاية اليوم **الصندوقُ امتلأ** بالنقود

4- At the end of the day, the box MAS was filled MAS with cash

٥- لأهمية الموضوع **الوقتُ مرَّ** دون أن نشعر

5- Because of the importance of the subject, time MAS passed MAS without feeling

٦- لكثرة المراجعين **المكتبُ زادَ** عدد الموظفين

6- Due to high volume of cases, the law firm MAS has increased MAS the number of employees

٧- في فصل الصيف **الفندقُ تهيأَ** للترحيب بالسياح

7- In summer, the hotel MAS was set MAS to welcome tourists

٨- في الليل **المصباح أضاءَ** الطريق للمارّة

8- At night, the lamp MAS lit MAS the roadsides for pedestrians

٩- قبل خمسين عاما **العلـمُ رفرفَ** على سطح القمر

9- Fifty years ago, the flag MAS fluttered MAS on the moon

١٠- بشكل جميل **المـركـزُ نـــظَّـــمَ** دورات تدريبية

10- Wonderfully, the Center MAS organized MAS training courses

4) Feminine inanimate subject

١- قبل سنة **المـجلّـةُ نشرَت** بحثا عن زيادة التصحّر

1- A year ago, the journal FEM published FEM a research on desertification

٢- لمساعدة المحتاجين **الشاحنةُ أوصلَت** أنواعا مختلفة من المعونات

2- To help those in need, the truck FEM delivered FEM various types of aid

٣- في العامين الماضيين **الكليةُ خرَّجَت** دفعات كبيرة من المتميزين

3- In the past two years, the college FEM trained FEM large batches of outstanding students

٤- لحسن الحظ **الخزنةُ حـفـظَت** المستندات من اللصوص

4- Fortunately, the safe FEM kept FEM documents from the thieves

٥- بدقة عالية **الطابعةُ سهَّـــلَت** طباعة ونشر الكتب

5- With high accuracy, the printer FEM made FEM it easier to print and publish books

٦- قبل أسبوع **البرقيةُ وصَلَت** إلى ديوان الملك

6- A week ago, the telegram FEM arrived FEM at the King's Court

٧- بفضل الله **المقالةُ نالَت** استحسان القرّاء

7- Thanks to God, the article FEM received FEM the readers' admirations

٨- بشكل منظم **الحديقةُ احـتـوت** على مرافق رياضية وترفيهية

8- In a structured way, the park FEM had FEM sports and leisure facilities

٩- بكل تشويق **القصةُ ســردَت** معاناة الفقراء

9- Fascinatingly, the story FEM narrated FEM the suffering of the poor

١٠- في العيد **السفارةُ أقامَت** حفلاً مميزًا

10- On Eid, the Embassy FEM held FEM a special ceremony

Ungrammatical sentences

1) Masculine animate subject

١- في بداية الحصة **الطالبُ وقفَت** احتراما للمعلم

1- At the beginning of the class, the student MAS stood FEM up for the teacher

٢- في وقت قياسي **الشرطيُّ قبضَت** على السارق

2- In short time, the policeman MAS caught FEM the thief

٣- قبل الإقلاع **الطيارُ أعلنَت** عن عطل في الطائرة

3- Before departure, the captain MAS announced FEM a problem with the plane

٤- بشكل مفصل **الصحفيُّ أعـدتَّ** تقريرا عن تلوث المياه

4- Elaborately, the journalist MAS prepared FEM a report on water pollution

٥- في السرك **الفيلُ رقصَت** على أصوات الطبول

5- At the circus, the elephant MAS danced FEM to the sounds of drums

٦- بعد جهد طويل **هاشمٌ أنشأَت** شركته الخاصة

6- After a long effort, Hashim MAS established FEM his own company

٧- في الجولة الأخيرة **المتسابقُ انسحبَت** من البرنامج

7- In the last round the contestant MAS withdrew FEM from the competition

٨- بناء على الوصفة **الصيدليُّ صرفَت** الدواء

8- According to the prescription, the pharmacist MAS dispensed FEM the medicine

٩- تجنبا للإفلاس **الرئيسُ دعَـت** إلى اجتماع طارئ

9- To avoid bankruptcy, the president MAS called FEM for an emergency meeting

١٠ في الصباح الباكر **العصفورُ خرجَـت** بحثا عن الطعام

10- Early in the morning, the bird MAS came FEM out looking for food

2) Feminine animate subject:

١- لصعوبة القضية **المحاميةُ فشلَ** في الحصول على تسوية

1- Due to the difficulty of the case, the lawyer FEM failed MAS to reach a settlement

٢- البارحة **الجدةُ حكَـى** قصة مفيدة لأحفادها

2- Yesterday, the grandmother FEM told MAS a valuable story for her grandchildren

٣- قبل يومين **الأميرةُ افـتـتـحَ** المتحف العلمي

3- Two days ago, the Princess FEM inaugurated MAS the Science Museum

٤- لإكمال الدراسة **سميةُ انـتـقـلَ** إلى الولايات المتحدة

4- To complete the study, Sumayah FEM moved MAS to the United States

٥- بعد أشهر **الحمامةُ عـادَ** إلى مسكنها الأصلي

5- After months, the pigeon FEM returned MAS to its original home

٦- بعد المدرسة **البنتُ مـشَـى** إلى بيت خالها

6- After school, the girl FEM walked MAS to her uncle's house

٧- هربا من الثعلب **الدجاجةُ قـفـزَ** فوق الجدار

7- To escape the fox, the chicken FEM jumped MAS over the wall

٨- في المؤتمر السنوي **العالمةُ عرضَ** بحثها الجديد

8- At the annual conference, the scientist FEM presented MAS her new research

٩- في الحفل الأخير **عائشةُ شاركَ** في تنظيم الحضور

9- At the last ceremony, Aisha FEM participated MAS in organizing the audience

١٠- في نهاية العمل **الموظـفـةُ حسـبَ** الأجرة

10- At the end of the work, the employee FEM calculated MAS the fare

3) Masculine inanimate subject:

١- طبقا للإحصائيات **التدخينُ أودت** بحياة الكثير من الأشخاص

1- According to statistics, smoking MAS has taken FEM many lives

٢- في السنة الماضية **المطارُ خـدمَـت** مئة ألف مسافر

2- Last year, the airport MAS served FEM 100,000 passengers

٣- بعد مباراة قوية **الفريقُ حصدَت** النقاط الثلاث

3- After a strong match, the team MAS took FEM the three points

٤- بعد صيف جميل **فصل أطلَّـت** الخريف بألوانه البهية

4- After a beautiful summer, the autumn MAS came FEM with its colorful trees

٥- نتيجة العطل **البنكُ وعـدَت** بتعويض المتضررين

5- Due to a system failure, the bank MAS promised FEM to compensate those affected

٦- قبل أمس **المقصُّ قطعَـت** يد الحلاق

6- The day before yesterday, the scissors MAS cut FEM the barber's hand

٧- بالأمس، **الشراع تمزّقت** بسبب الرياح

7- Yesterday, the sail MAS was torn FEM by the wind

٨- في منتصف الليل **الهاتفُ رنَّـت** مرات عدة

8- At midnight, the phone MAS rang FEM several times

٩- بفعل الزلزال **المبنى سقطَـت** في دقائق معدودة

9- Because of the earthquake, the building MAS fell FEM down in a few minutes

١٠- بمناسبة اليوم الوطني **التلفازُ عرضَـت** إنجازات الوطن

10- On the occasion of the National Day, the TV MAS broadcast FEM films on the achievements of the nation

4) Feminine inanimate subject:

١- بشكل رائع **الصورةُ الـتـقـطَ** تفاصيل المنظر

1- Amazingly, the picture FEM captured MAS the details of the scene

٢- في نهاية العام **الساحةُ تحولَ** إلى قاعة للاختبارات

2- At the end of the year, the yard FEM turned MAS into an exam auditorium

٣- قبل ساعة **الجائزةُ أعـلـنَ** عن الفائزة في مجال الفيزياء

3- An hour ago, the prize FEM announced MAS the winner in the field of physics

٤- من زمن قديم **الدراجةُ أصبحَ** وسيلة نقل ورياضة

4- From a long time ago, the bike FEM became MAS a mean of transport and sport

٥- اليوم **القناةُ بـــدَأَ** في بثِّ برامجها

5- Today, the channel FEM has started MAS broadcasting its programs

٦- بفضل الله **النظارةُ عالجَ** الكثير من مشاكل البصر

6- By the grace of God, the glasses FEM treated MAS many of the eye problems

٧- في وقت قصير **الدولة عزّزَ** مكانتها الاقتصادية

7- In a short time, the state FEM strengthened MAS its economic position

٨- إبّـــان الحرب **الغابةُ شكّـلَ** ملاذا آمنا لكثير من الأسر

8- During the war, the forest FEM was MAS a safe haven for many families

٩- خلال أسبوع **العربة نـقـلَ** أكثر من خمسين مصابا

9- During the week, the ambulance FEM transported MAS more than fifty injured people

١٠- في الليل **النجمةُ سطـعَ** بشكل واضح وجميل

10- At night, the star FEM shone MAS brightly and beautifully

Appendix D

Experimental Stimuli: the GJ experiment

Grammatical sentences

1) Masculine animate subject

١- **قرأ المذيعُ** نشرةَ الأخبار

1- The broadcaster $_{MAS}$ read $_{MAS}$ the news

٢- **جاءَ الرجلُ** راكبًا

2- The man came $_{MAS}$ riding

٣- **بكى الولدُ** من شدةِ الجوع

3- The boy cried $_{MAS}$ out of hunger

٤- **سهرَ المُمرضُ** على راحةِ المرضى

4- The nurse $_{MAS}$ took care $_{MAS}$ of the patients

٥- **حضرَ الملكُ** في تواضع

5- The king came $_{MAS}$ in humbleness

٦- **مشَى الجملُ** مسافةً طويلةً

6- The camel $_{MAS}$ walked $_{MAS}$ a long distance

٧- **اشترى يوسفُ** سيارةً جديدةً

7- Yosof $_{MAS}$ bought $_{MAS}$ a new car

٨- **أعطى الأبُ** الطفلَ هديةً

8- The father gave $_{MAS}$ the child a gift

٩- **صنعَ النجارُ** أبوابا جميلة

9- The carpenter $_{MAS}$ made $_{MAS}$ beautiful doors

١٠- **صادَ الذئبُ** غزالا

10- The wolf $_{MAS}$ hunted $_{MAS}$ a deer

١١- **انسحبَ المتسابقُ** من البرنامج

7- The contestant $_{MAS}$ withdrew $_{MAS}$ from the competition

١٢- **صرفَ الصيدليُّ** الدواء بناء على الوصفة

8- The pharmacist $_{MAS}$ dispensed $_{MAS}$ the medicine

١٣- **دعا الرئيسُ** إلى اجتماع طارئ

9- The president $_{MAS}$ called $_{MAS}$ for an emergency meeting

١٤- **خرجَ العصفورُ** بحثا عن الطعام

10- The bird MAS came MAS out looking for food

١٥- **أعدَّ الصحفيُّ** تقريرا عن تلوث المياه

15- The journalist MAS prepared MAS a report on water pollution

2) Feminine animate subject:

١- **منعَت الطبيبةُ** المريضَ من التدخين

1- The doctor FEM prevented FEM the patient from smoking

٢- **راجعَت المحاسبةُ** المستندات

2- The accountant FEM reviewed FEM the documents

٣- **نجحَت هندُ** في مسابقةِ الرياضيات

3- Hind FEM succeeded FEM in the math competition

٤- **سجَّلت اللاعبةُ** رقمًا قياسيًا جديدًا

4- The athlete FEM set FEM a new record

٥- **ألّفت الكاتبةُ** روايةً شيقةً

5- The author FEM wrote FEM an interesting novel

٦- **كرمَت المديرةُ** الطالبات المتفوقات

6- The principle FEM honoured FEM the outstanding students

٧- **رفرفَت الفراشةُ** بجناحيها الجميلين

7- The butterfly FEM fluttered FEM its wings

٨- **ساعدَت الأمُّ** ابنتَها في إعدادِ الطعام

8- The mother FEM helped FEM her daughter preparing the food

٩- **ألقَت الشاعرةُ** قصيدةً رائعة

9- The poet FEM recited FEM wonderful poem

١٠- **زارَت خديجـةُ** كلَّ البلدان العربية

10- Khadijah FEM visited FEM all Arab countries

١١- **عادَت الحمامةُ** إلى مسكنها الأصلي

11- The pigeon FEM returned FEM to its original home

١٢- **مشَت البنتُ** إلى بيت خالها

12- The girl FEM walked FEM to her uncle's house

١٣- **قفزَت الدجاجةُ** فوق الجدار

13- The chicken FEM jumped FEM over the wall

١٤- **عرضَت العالمةُ** بحثها الجديد

14- The scientist FEM presented FEM her new research

١٥- **شاركَت عائشةُ** في تنظيم الحضور

15- Aisha FEM participated FEM in organizing the audience

3) Masculine inanimate subject:

١- **فتحَ المتجرُ** أبوابه للزبائن

1- The store MAS opened MAS its doors to customers

٢- **توقّفَ المصعدُ** عن العمَل

2- The elevator MAS stopped MAS working

٣- **امتلأَ المسجدُ** بالمصلين

3- The mosque MAS was MAS full of people

٤- **أذهبَ الدواءُ** علةَ المريض

4- The medication MAS cured MAS the disease

٥- **تجمّدَ النهرُ** بسببِ الصقيع

5- The river MAS froze MAS because of cold

٦- **نجحَ التحقيقُ** في كشفِ الجريمة

6- The investigation MAS succeeded MAS in uncovering the crime

٧- **غطّى البحرُ** الشواطئ القريبة

7- The sea MAS covered MAS the nearby beaches

٨- **تعطّلَ القاربُ** وسط النهر

8- The boat MAS stopped MAS in the middle of the river

٩- **اتسعَ البيتُ** للضيوفِ جميعًا

9- The house MAS accommodated MAS all guests

١٠- **انفجرَ الصاروخُ** في الجوّ

10- The rocket MAS exploded MAS in the air

١١- **أطلَّ فصل** الخريف بألوانه البهية

11- The autumn MAS came MAS with its colorful trees

١٢- **وعــدَ البنكُ** بتعويض المتضررين

12- The bank MAS promised MAS to compensate those affected

١٣- **قطعَ المقصُّ** يد الحلاق

13- The scissors MAS cut MAS the barber's hand

١٤- **تمزّقَ الشراع** بسبب الرياح

14- The sail MAS was torn MAS by the wind

١٥- **رنَّ الهاتفُ** مرات عدة

15- The phone MAS rang MAS several times

4) Feminine inanimate subject:

١- **كانت السماءُ** صافيةً

1- The sky FEM was FEM clear

٢- **انتجَت المزرعةُ** الكثيرَ من الفواكه

2- The farm FEM produced FEM a lot of fruits

٣- **أخّرَت المحكمةُ** الحكمَ في القضية

3- The court FEM postponed FEM the case

٤- **اكتظّت المدينةُ** بالسياح

4- The city FEM was FEM overcrowded with tourists

٥- **وصَلت الرسالةُ** إلى صديقي

5- The parcel FEM arrived FEM to my friend

٦- **منحَت الجامعةُ** مكافآتٍ للموهوبين

6- The university FEM provided FEM a scholarship to talented students

٧- **صمدَت القلعةُ** أمامَ الجيش

7- The fortress FEM withstood FEM the army

٨- **أحرقَت النارُ** جزءًا كبـيرا من الغَابة

8- The fire FEM burned FEM a large part of the forest

٩- **اصطدمَت السيارةُ** بالرصيف

9- The car FEM collided FEM with the sidewalk

١٠- **حجَبت السحابةُ** نورَ الشمس

10- The cloud FEM blocked FEM the sunlight

١١- **التقطت الصورةُ** تفاصيل المنظر

11- The picture FEM captured FEM the details of the scene

١٢- **تحولت الساحةُ** إلى قاعة للاختبارات

12- The yard FEM turned FEM into an exam auditorium

١٣- **أذاعَـت الجائزةُ** أسماء الفائزين في مجال الفيزياء

13- The prize FEM announced FEM the winner in the field of physics

١٤- **أصبحَـت الدراجةُ** وسيلة نقل ورياضة

14- The bike FEM became FEM a mean of transport and sport

١٥- **بـــدَأت القناةُ** في بثِّ برامجها

15- The channel FEM has started FEM broadcasting its programs

Ungrammatical sentences

1) Masculine animate subject

١- **صمّمت المهندسُ** مبنى جميلا

1- The engineer MAS designed FEM a beautiful building

٢- **انقضّت النمرُ** على فريستِه

2- The tiger MAS swooped FEM on its prey

٣- **انـتهَت الخادمُ** من تنظيفِ المنزل

3- The maid MAS finished FEM the housework

٤- **سرقَت اللصُّ** النقودَ

4- The thief MAS stole FEM the money

٥- **عالجَت المسعفُ** المُصابين

5- The paramedic MAS treated FEM the injured

٦- **تخرجَت محمدُ** في الجامعة الإسلامية

6- Mohammad MAS graduated FEM from the university

٧- **خرجَت الأميرُ** مع عائلتِه

7- The prince MAS went out FEM with his family

٨- **جرَّت الحصانُ** العربة

8- The horse MAS pulled FEM the cart

٩- **وقعت الدبُّ** في فخّ الصياد

9- The bear MAS fell FEM into the trap of the hunter

١٠- **استمتعَت زيدُ** باللعبِ في الماء

10- Zaid MAS enjoyed FEM playing with water

١١- **أبـعدَت الحارسُ** الكرة عن المرمى

11- The keeper MAS kept MAS the ball out of goal

١٢- **أمـرَت القاضيُ** بإطلاق المتهم

12- The judge MAS ordered FEM to release the accused person

١٣- **استطاعت القردُ** الخروج من القفص

13- The monkey MAS was FEM able to get out of the cage

١٤- **تقمّـــصَت الممثلُ** شخصية الرجل الشرير

14- The actor MAS played FEM a character of an evil man

١٥- **حاكَت الخياطُ** ثوبا رائعا

15- The tailor MAS woven FEM a wonderful cloak

2) Feminine animate subject

١- **ركبَ المسافرةُ** القطارَ

1- The passenger FEM boarded MAS the train

٢- **شرحَ المعلمةُ** الدرسَ

2- The teacher FEM explained MAS the subject

٣- **كسرَ الفتاةُ** نافذةَ الفصلِ

3- The girl FEM broke MAS the class window

٤- **نجى الراكبةُ** من الحادث

4- The passenger FEM survived MAS the accident

٥- **أنجبَ البقرةُ** عجلاً صغيرا

5- The cow FEM gave MAS birth to a small calf

٦- **نسيَ فاطمةُ** كتابَ النحو

6- Fatimah FEM forgot MAS her grammar book

٧- **حصلَ أختي** على جائزةِ الشعرِ العربي

7- My sister FEM got MAS the poetry award

٨- **لبسَ المرأةُ** فستانًا أنيقا

8- The woman FEM wore MAS an elegant dress

٩- **فازَ الطالبةُ** في مسابقةِ الإنشاد

9- The student FEM won MAS the singing competition

١٠- **تسلقَ القطةُ** الشجرة

10- The cat FEM climbed MAS the tree

١٥- **غاصَ السمكةُ** في أعماق البحر

11- The fish FEM dived MAS deep into the sea

١٢- **صعدَ الطفلةُ** إلى أعلى التلّ

12- The girl FEM climbed MAS up the hill

١٣- **قـــرّرَ المريضةُ** إجراء العملية

13- The patient FEM decided MAS to do the surgery

١٤- **أعطَى المدربةُ** بعض النصائح حول اللياقة البدنية

14- The trainer FEM gave MAS some advice on fitness

١٥- **جمعَ النحلةُ** الرحيق من الزهور

15- The bee FEM collected MAS the nectar from the flowers

3) Masculine inanimate subject

١- **اكتسَت الجبلُ** بأشجار الزيتون

1- The mountain MAS was FEM covered with olive trees

٢- **انطلقَت القِطارُ** إلى المحطةِ الأخيرة

2- The train MAS departed FEM to its last stop

٣- **ظهرَت القمرُ** بعدَ المغرب مباشرة

3- The moon MAS appeared FEM just after sunset

٤- **أطفأت الهواءُ** الشمعةَ

4- The air MAS blew FEM out the candle

٥- **انتهَت العملُ** في محطةِ القطار

5- The work MAS finished FEM in the train station

٦- **ناقشَت البرنامجُ** موضوعًا مهما

6- The program MAS discussed FEM an important topic

٧- **منعَت القفصُ** الأسدَ من الهروب

7- The cage MAS prevented FEM the lion from escaping

٨- **حققَّت الملعبُ** رقمًا قياسيا في عددِ الحضور

8- The stadium MAS set FEM a record for attendance

٩- **حوت الكتابُ** قواعدَ اللغة العربية

9- The book MAS contained FEM all Arabic language grammar

١٠- **قدمَت المطعمُ** خصوماتٍ هائلة

10- The restaurant MAS offered FEM great discounts

١١- **افتــقــدَت الجهازُ** الكثيرَ من المزايا

11- The device MAS lacked FEM many features

١٢- **زادَت المكتبُ** عدد الموظفين

12- The law firm MAS has increased FEM the number of employees

١٣- **تهيأَت الفندقُ** للترحيب بالسياح

13- The hotel MAS was set FEM to welcome tourists

١٤- **أضاءَت المصباح** الطريق للمارّة

14- The lamp MAS lit FEM the roadsides for pedestrians

١٥- **نــظَّـــمَت المركز** دورات تدريبية

15- The center MAS organized FEM training courses

4) Feminine inanimate subject

١- **كثف الشرطة** من وجود عناصرها في المهرجان

1- The police FEM increased MAS its presence at the festival

٢- **سقطَ المطرقةُ** على الأرضِ

2- The hammer FEM fell MAS to the ground

٣- **تأخّرَ الحقيبةُ** في الوصول

3- The bag FEM did MAS not come on time

٤- **نشرَ الصحيفةُ** أسماءَ الخريجين

4- The newsletter FEM published MAS the names of the graduates

٥- **وقعَ اللوحةُ** على الأرض

5- The billboard FEM fell MAS on the ground

٦- **علِقَ البطاقةُ** في جهازِ صرفِ النقود

6- The card FEM got MAS stuck in the ATM

٧- **أقلعَ الطائرةُ** في وقتٍ متأخر

7- The plane FEM took MAS off late

٨- **احتفَى المدرسةُ** بالطلابَ الجدد

8- The school FEM welcomed MAS the new students

٩- **ساهمَ الحكومةُ** بمبلغ كبـــيرٍ لتطويرِ التعليم

9- The government FEM contributed MAS significantly to the development of education

١٠- **أبحرَ السفينةُ** إلى مصر

10- The ship FEM sailed MAS to Egypt

١١- **أوصلَ الشاحنةُ** أنواعا مختلفة من المعونات

11- The truck FEM delivered MAS various types of aid

١٢- **خرَّجَ الكليةُ** دفعات كبيرة من المتميزين

12- The college FEM has graduated MAS large batches of outstanding students

١٣- **حفظَ الخزنةُ** المستندات من اللصوص

13- The safe FEM kept MAS documents from the thieves

١٤- **سهَّـــلَ الطابعةُ** طباعة ونشر الكتب

14- The printer FEM made MAS it easier to print and publish books

١٥- **وصَلَ البرقيةُ** إلى ديوان الملك

15- The telegram FEM arrived MAS at the King's Court

Appendix E

Other bar graphs for the effect of gender: ERP experiment

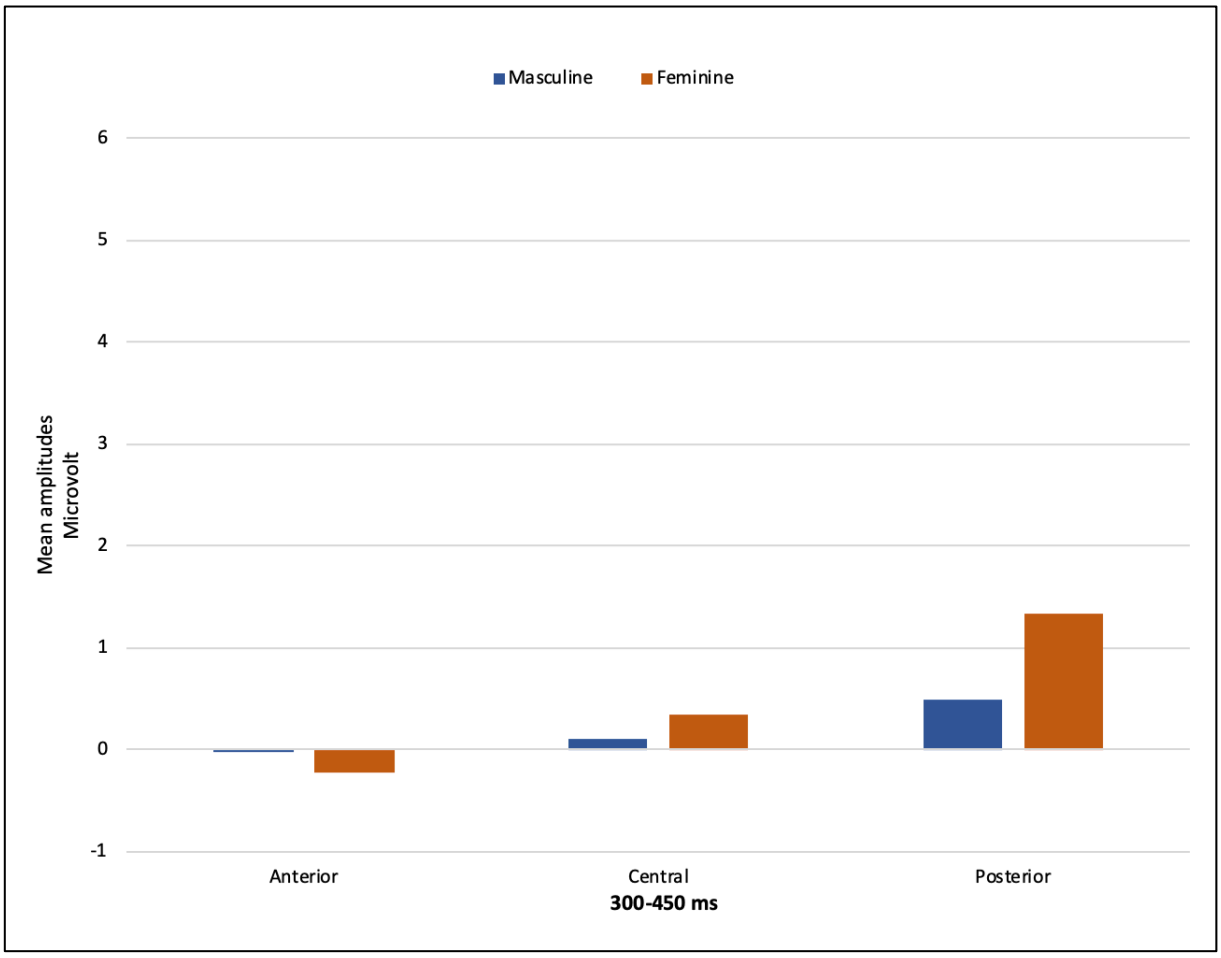


Figure 33. Mean amplitudes by gender and anteriority in SV word order

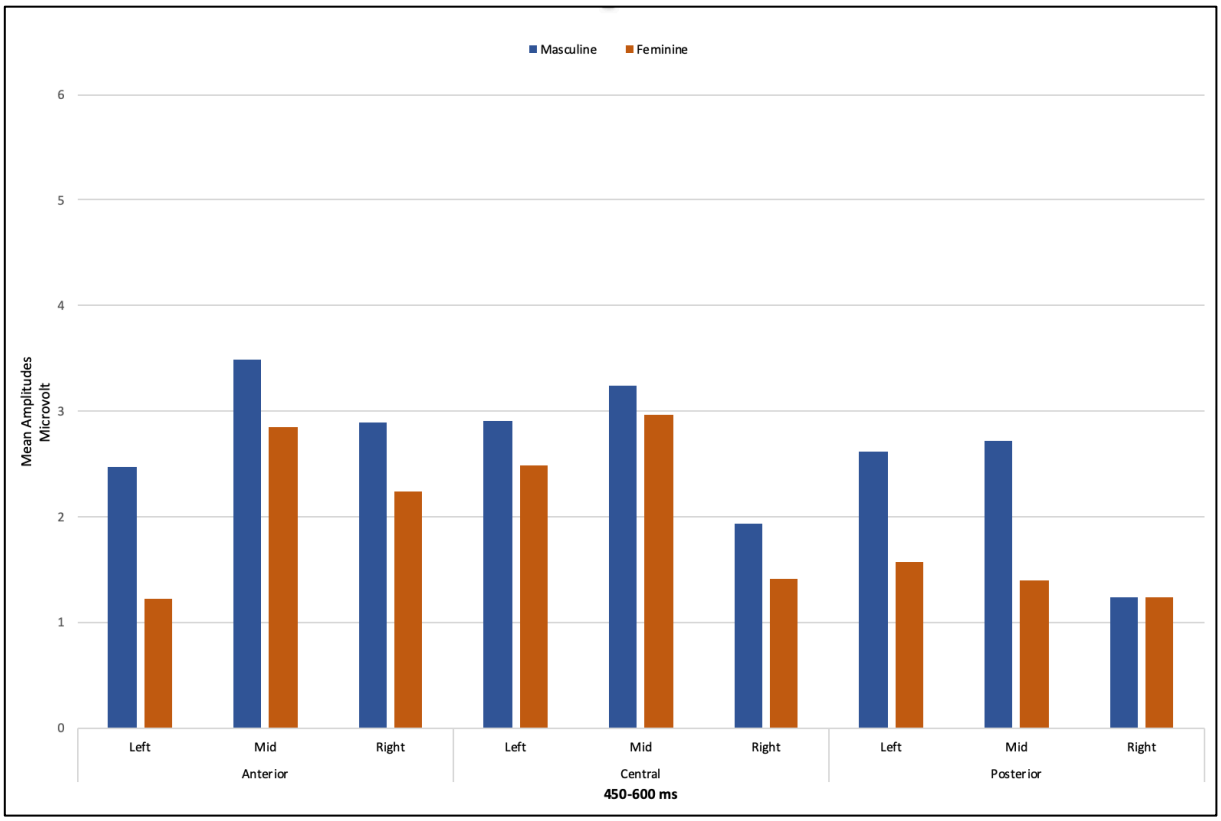


Figure 34. Mean amplitudes by gender and anteriority in SV word order

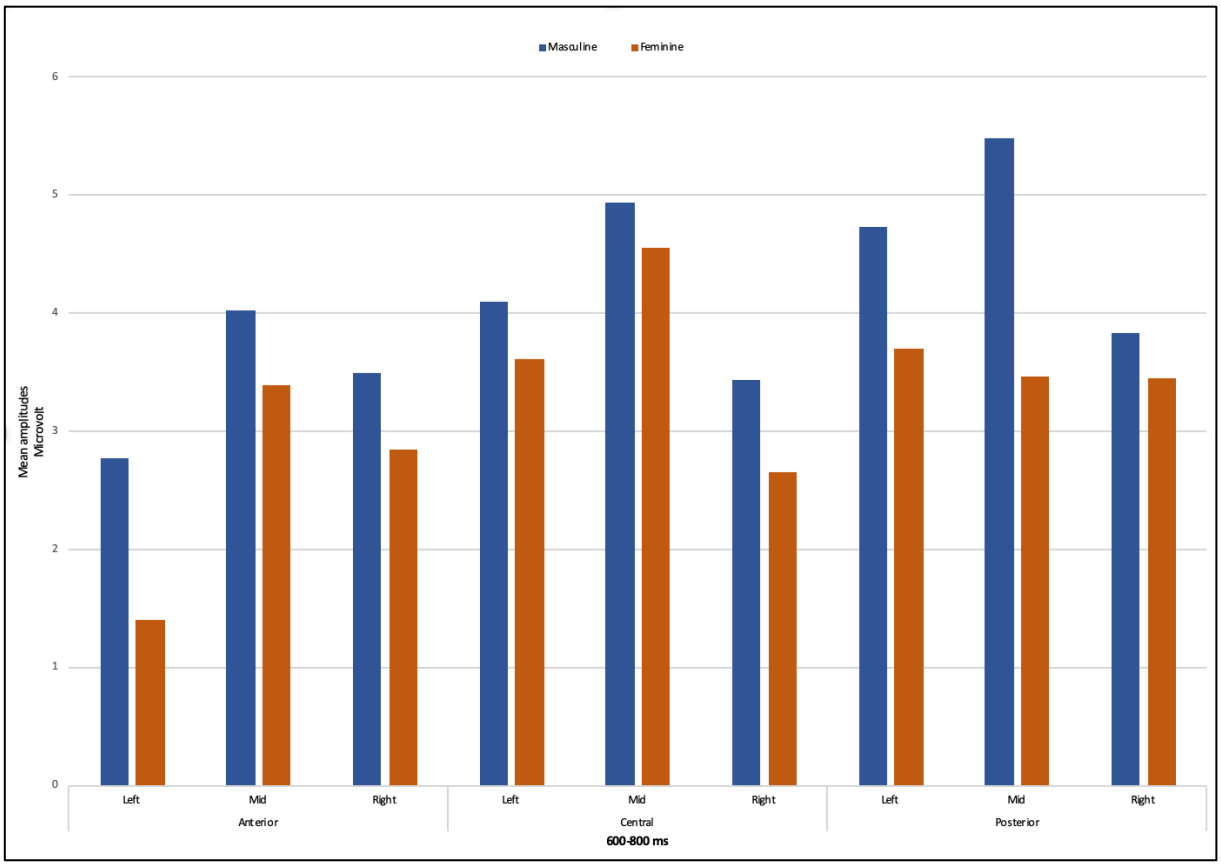


Figure 35. Mean amplitudes by gender, anteriority, and laterality in SV word order

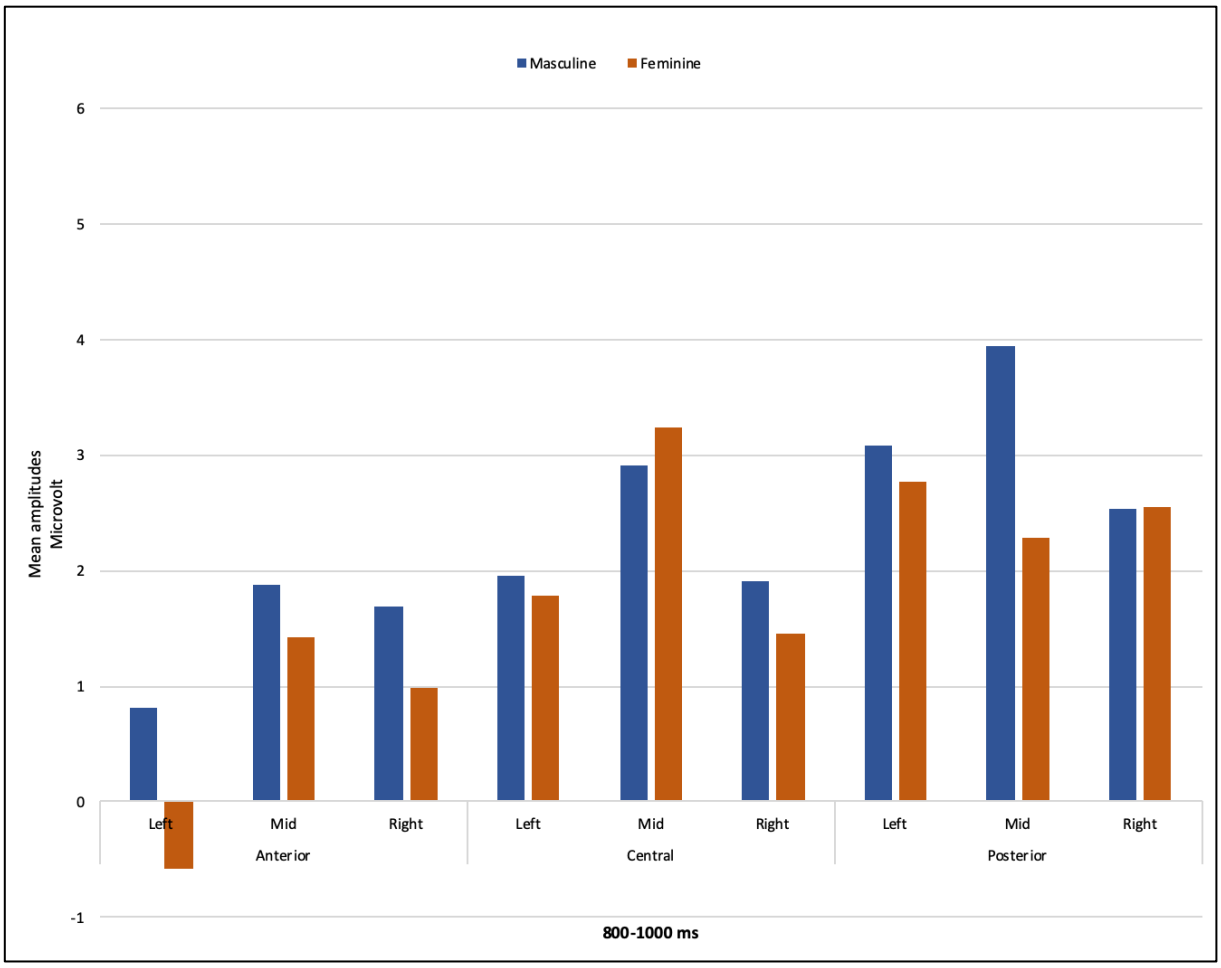


Figure 36. Mean amplitudes by gender, anteriority, and laterality in SV word order

References

Aaronson, D., & Scarborough, H. S. (1976). Performance theories for sentence coding: Some quantitative evidence. *Journal of Experimental Psychology: Human Perception and Performance, 2*, 56-70.

Ainsworth-Darnell, K., Shulman, H. G., & Boland, J.E. (1998). Dissociating brain responses to syntactic and semantic anomalies: Evidence from event-related potentials. *Journal of Memory and Language, 38*, 112–130.

Al-Ani, S. H. (1973). Features of Interference in the Teaching of Arabic Composition. *An-Nashra,* V-VI, 3-13.

Alamry, A. (2014). *The acquisition of gender agreement in adult learners of Arabic.* MA dissertation, Carleton University, Ottawa.

Alarcón, I. (2009). The processing of gender agreement in L1 and L2 Spanish: Evidence from reaction-time data. *Hispania, 92*(4), 814–828.

Alemán Bañón, J., Fiorentino, R., & Gabriele, A. (2012). The processing of number and gender agreement in Spanish: An event-related potential investigation of the effects of structural distance. *Brain Research, 1456*(0), 49–63.

Alemán Bañón, J. & Rothman, J. (2016). The role of morphological markedness in the processing of number and gender agreement in Spanish: an event-related potential investigation. *Language, Cognition and Neuroscience, 31* (10). pp. 12731298.

Alhawary, M. T. (1999). *Testing Processability and Effectiveness of Computer assisted Language Instruction: A longitudinal study of Arabic as a foreign/ second language.* Ph.D. dissertation, Georgetown University.

Alhawary, M. T. (2003). Processability theory: Counter-evidence from Arabic second language acquisition data. *Al-Arabiya*, 36, 107–166.

Alhawary, M. T. (2005). L2 acquisition of Arabic morphosyntactic features: Temporary or permanent impairment? In M. T. Alhawary & E. Benmamoun (Eds.), *Perspectives on Arabic linguistics*, (pp. 273–312). Amsterdam: John Benjamins.

Alhawary, M. T. (2009). *Arabic Second Language Acquisition of Morphosyntax.* Yale University Press.

Alhawary, M. T. (2019). *Arabic second language learning and effects of input, transfer, and typology*. Georgetown University Press.

Andersson, A.-B. (1992). *Second language learners' acquisition of grammatical gender in Swedish*. Ph.D. dissertation, University of Göteborg, Göteborg, Sweden.

Antón-Méndez, M. I., Nicol, J. L., & Garrett, M. (2002). The relation between gender and number agreement processing. *Syntax, 5*, 1–25.

Aoun, J., Benmamoun, E., and Choueire, L. (2010). *The Syntax of Arabic*. New York: Cambridge University.

Audring, J. (2016). Gender. *Oxford Research Encyclopedia of Linguistics.* Retrieved 22 Sep. 2019, from http://oxfordre.com/linguistics.

Barber, H., & Carreiras, M. (2005). Grammatical Gender and Number Agreement in Spanish: An ERP Comparison. *Journal of Cognitive Neuroscience, 17*, 137-153.

Barber, H., Salillas, E., & Carreiras, M. (2004). Gender or genders agreement. In M. Carreiras & C. J. Clifton (Eds.), *The on-line study of sentence comprehension: Eyetracking, ERPs and beyond* (pp. 309–328). New York: Taylor & Francis.

Bartning, I. (2000). Gender agreement in L2 French: Pre-advanced vs. advanced learners. *Studia Linguistica*, *54*, 225–237.

Batterink, L., Neville, H., & Batterink, L. (2013). The human brain processes syntax in the absence of conscious awareness. *The Journal of Neuroscience: the Official Journal of the Society for Neuroscience*, *33*(19), 8528–8533.

Benmamoun, E. (2000). *The Feature Structure of Functional Categories: A Comparative Study of Arabic Dialects.* Oxford: Oxford University Press.

Belacchi, C., & Cubelli, R. (2012). Implicit knowledge of grammatical gender in preschool children. *Journal of psycholinguistic research*, *41*(4), 295-310.

Bley-Vroman, R. (1989). What is the logical problem of foreign language learning? In S. Gass & J. Schacter (Eds.), *Linguistic perspectives on second language acquisition* (pp. 41-68). Cambridge: Cambridge University Press.

Bley-Vroman, R. (1990). The logical problem of foreign language learning. *Linguistic Analysis,* 20, 3–49.

Bond, K., Gabriele, A., Fiorentino, R., and Banon, J. A. (2011). Individual Differences and the Role of the L1 in L2 Processing: An ERP Investigation. In J. Herschensohn and D. Tanner (Eds.), *Proceedings of the 11th Generative Approaches to Second Language Acquisition Conference GASLA*, (pp. 17-29). Somerville, MA: Cascadilla Proceedings Project.

Bonin, P., Gelin, M., & Bugaiska, A. (2014). Animates are better remembered than inanimates: Further evidence from word and picture stimuli. *Memory & Cognition*, *42*(3), 370-382.

Bruhn de Garavito, J., & White, L. (2002). L2 acquisition of Spanish DPs: The status of grammatical features. In A.-T. P´erez-Leroux & J. Liceras (Eds.), *The acquisition of Spanish morphosyntax: The L1/L2 connection* (pp. 153–178). Dordrecht: Kluwer.

Caffarra, S., & Barber, H. A. (2015). Does the ending matter? The role of gender-to-ending consistency in sentence reading. *Brain Research, 1605,* 83–92.

Caffarra, S., Barber, H., Molinaro, N., & Carreiras, M. (2017). When the end matters: influence of gender cues during agreement computation in bilinguals. *Language, Cognition and Neuroscience*, *32*(9), 1069-1085.

Caffarra, S., Janssen, N., & Barber, H. A. (2014). Two sides of gender: ERP evidence for the presence of two routes during gender agreement processing. *Neuropsychologia, 63*, 124–134.

Caffarra, S., Siyanova-Chanturia, A., Pesciarelli, F., Vespignani, F., & Cacciari, C. (2015). Is the noun ending a cue to grammatical gender processing? An ERP study on sentences in Italian. *Psychophysiology*, *52*(8), 1019-1030.

Chomsky, N. (1965). *Aspects of the Theory of Syntax*. Cambridge, MA: MIT Press.

Chow, W. Y., Nevins, A., & Carreiras, M. (2018). Effects of subject-case marking on agreement processing: ERP evidence from Basque. *Cortex*, *99*, 319-329.

Clahsen, H., & Felser, C. (2006). Grammatical processing in language learners. *Applied Psycholinguistics, 27*(1), 3–42.

Clahsen, H., & Muysken, P. (1986). The availability of universal grammar to adult and child learners: A study of the acquisition of German word order. *Second Language Research, 2,* 93-119.

Clahsen, H., & Muysken, P. (1989). The UG paradox in L2 acquisition. *Second LanguageResearch, 5*(1), 1-29.

Corbett, G (1991). *Gender*. Cambridge: Cambridge University Press.

Cornips, L. and Hulk, A. (2008). Factors of success and failure in the acquisition of grammatical gender in Dutch. *Second Language Research,* 24(4), 267-295.

Coulson, S., King, J., & Kutas, M. (1998). Expect the unexpected: Event-related brain responses to morphosyntactic violations. *Language and Cognitive Processes, 13*, 21–58.

Crain, S., & Fodor, J. D. (1985). How can grammars help parsers? In D. Dowty, L. Kartunnen, & A. Zwicky (Eds.), *Natural language parsing: Psychological, computational, and theoretical perspectives* (pp. 94–128). Cambridge: Cambridge University Press.

DeKeyser, R. M. (2000). The robustness of critical period effects in second language acquisition. *Studies in Second Language Acquisition, 22,* 499-533.

Dekydtspotter, L., Schwartz, B. D., & Sprouse, R. A. (2006). The comparative fallacy in L2 processing research. In *Proceedings of the 8th generative approaches to second language acquisition conference (GASLA 2006): The Banff conference* (pp. 33-40).

Demestre, J., Meltzer, S., Garcia-Albea, J. E., & Vigil, A. (1999). Identifying the null subject: Evidence from event-related brain potentials. *Journal of Psycholinguistic Research, 28*(3), 293–312.

Deutsch, A. & Bentin, S. (2001). Syntactic and semantic factors in processing gender agreement in Hebrew: Evidence from ERPs and eye movements. *Journal of Memory and Language, 45,* 200-224.

Dewaele, J. M., & Véronique, D. (2001). Gender assignment and gender agreement in advanced French interlanguage: a cross-sectional study. *Bilingualism: Language and Cognition*, (4), 275-297.

De Resende, N. C. A., Mota, M. B., & Seuren, P. (2019). The Processing of Grammatical Gender Agreement in Brazilian Portuguese: ERP Evidence in Favor of a Single Route. *Journal of psycholinguistic research*, *48*(1), 181-198.

De Vincenzi, M., Job, R., Di Matteo, R., Angrilli, A., Penolazzi, B., Ciccarelli, L., & Vespignani, F. (2003). Differences in the perception and time course of syntactic and semantic violations. *Brain and Language, 85*, 280-296.

Díaz, B., Sebastián-Gallés, N., Erdocia, K., Mueller, J. L., & Laka, I. (2011). On the cross-linguistic validity of electrophysiological correlates of morphosyntactic processing: A study of case and agreement violations in Basque. *Journal of Neurolinguistics, 24*(3), 357–373.

Dong, Y., Wen, Y., Zeng, X., & Ji, Y. (2015). Exploring the cause of English pronoun gender errors by Chinese learners of English: Evidence from the self-paced reading paradigm. *Journal of psycholinguistic research*, *44*(6), 733-747.

Dowens, M. G., Guo, T., Guo, J., Barber, H., & Carreiras, M. (2011). Gender and number processing in Chinese learners of Spanish – Evidence from Event Related Potentials. *Neuropsychologia, 49*(7), 1651–1659.

Dowens, M. G., Vergara, M., Barber, H. A., & Carreiras, M. (2010). Morphosyntactic Processing in Late Second-Language Learners. *Journal of Cognitive Neuroscience, 22*(8), 1870–1887.

Dussias, P. (2003). Syntactic ambiguity resolution in second language learners: Some effects of bilinguality on L1 and L2 processing strategies. *Studies in Second Language Learning 25*, 529-557.

Eichler, N., Jansen, V., & Müller, N. (2013). Gender acquisition in bilingual children: French German, Italian-German, Spanish-German, and Italian-French. *International Journal of Bilingualism*, *17*(5), 550–572.

Eisele, J. C. (2002). Approaching diglossia: Authorities, values, and representations. In A. Rouchdy (Ed.), *Language contact and language conflict in Arabic: Variations on a sociolinguistic theme* (pp. 3-23). London: RoutledgeCurzon.

Eisenbeiss, S. (2010). Production Methods. In E. Blom and S. Unsworth (Eds.), *Experimental Methods in Language Acquisition Research* (pp. 11-34). Amsterdam: John Benjamins.

Ellis, C. (2005). At the interface: Dynamic interaction of explicit and implicit language knowledge. *Studies in Second Language Acquisition, 27*(2), 305-352.

Ellis, C., Conardie, S., and Huddlestone, K. (2012). The acquisition of grammatical gender in L2 German by learners with Afrikaans, English or Italian as their L1. *Stellenbosch Papers in Linguistics,* 41, 17-27.

Eubank, L., Bischof, J., Huffstutler, A., Leek, P. and West, C. (1997). Tom eats slowly cooked eggs: thematic-verb raising in L2 knowledge. *Language Acquisition*, 6, 171-199.

Felser, C., Roberts, R., Gross, R., & Marinis, T. (2003). The processing of ambiguous sentences by first and second language learners of English. *Applied Psycholinguistics*, 24, 453–489.

Ferguson, C. A. (1959). Diglossia. *word*, *15*(2), 325-340.

Fernandez-Garcia, M. (1999). Patterns of gender agreement in the speech of second language learners. In J. Gutierrez-Rexach & F. Martınez-Gil (Eds.), *Advances in Hispanic linguistics: Papers from the 2nd Hispanic linguistics symposium* (pp. 3-15). Somerville, MA: Cascadilla Press.

Ferreira, F., Henderson, J. M., Anes, M. D., Weeks, P. A., & McFarlane, D. K. (1996). Effects of lexical frequency and syntactic complexity in spoken-language comprehension: Evidence from the auditory moving-window technique. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22*(2), 324-335.

Finneman, M.D. (1992). Learning agreement in the noun phrase: the strategies of three first-year Spanish students. *IRAL*, 30, 121–36.

Flynn, S. (1996). A parameter setting to second language acquisition. In Ritchie, W. and Bhatia, T., editors, *Handbook of second language acquisition*. New York: Academic Press, 121-58.

Franceschina, F. (2001). Morphological or syntactic deficits in near-native speakers? An assessment of some current proposals. *Second Language Research,* 17, 213–247.

Franceschina, F. (2002). Case and Φ-feature agreement in advanced L2 Spanish grammars. *EUROSLA Yearbook, 2*, 71–86.

Franceschina, F. (2005). *Fossilized Second Language Grammars*. Amsterdam: JohnBenjamins.

Fraser, Carol A. (2007). Reading Rate in L1 Mandarin Chinese and L2 English across Five Reading Tasks. *Modern Language Journal, 91*(3), 372-394.

Frazier, L., & Clifton, C. J. (1989). Successive cyclicity in the grammar and the parser. *Language and Cognitive Processes*, 4, 93–126.

Frenck-Mestre C., Osterhout, L., McLaughlin, J., & Foucart, A. (2008). The effect of phonological realization of inflectional morphology on verbal agreement in French: Evidence from ERPs. *Acta Psychologica, 128*, 528-536.

Friederici, A. D., Hahne, A., & Mecklinger, A. (1996). Temporal structure of syntactic parsing: Early and late event-related brain potential effects. *Journal of Experimental Psychology: Learning, Memory and Cognition, 22*, 1219–1248.

Friederici, A. D. (2002). Towards a neural basis of auditory sentence processing. *Trends in Cognitive Sciences, 6*(2), 78–84.

Friederici, A. D., Hahne, A., & Saddy, D. (2002). Distinct neurophysiological patterns reflecting aspects of syntactic complexity and syntactic repair. *Journal of Psycholinguistic Research, 31*, 45–63.

Friederici, A. D., Pfeifer, E., & Hahne, A. (1993). Event-related brain potentials during natural speech processing: Effects of semantic, morphological and syntactic violations. *Cognitive Brain Research, 1*(3), 183–192.

Foote, R. (2011). Integrated knowledge of agreement in early and late English-Spanish bilinguals. *Applied Psycholinguistics, 21*, 187-220.

Foucart, A. (2008). *Grammatical Gender Processing in French as a first and second language*. PhD Dissertation, University of Edinburgh and University of Provence, France.

Foucart, A., & Frenck-Mestre, C. (2011). Grammatical gender processing in L2: Electrophysiological evidence of the effect of L1–L2 syntactic similarity. *Bilingualism: Language and Cognition, 14*(3), 379–399.

Foucart, A., & Frenck-Mestre, C. (2012). Can late L2 learners acquire new grammatical features? Evidence from ERPs and eye-tracking. *Journal of Memory and Language, 66*, 226-248.

Gagliardi, A., & Lidz, J. (2014). Statistical insensitivity in the acquisition of Tsez noun classes, *Language*, *90*(1), 58–89.

Geva, Esther; Ryan, Ellen B. (1993). Linguistic and Cognitive Correlates of Academic Skills in First and Second Languages. *Language Learning, 43*(1), 42.

Gouvea, A. C., Phillips, C., Kazanina, N., & Poeppel, D. (2010). The linguistic processes underlying the P600. *Language and Cognitive Processes, 25*(2), 149–188.

Guajardo, L. F., & Wicha, N. Y. Y. (2014). Morphosyntax can modulate the N400 component: Event-related potentials to gender-marked post-nominal adjectives. *NeuroImage, 91*, 262–272.

Gunter, T., & Friederici, A. (1999). Concerning the automaticity of syntactic processing. *Psychophysiology, 36*, 126–137.

Gunter, T., Stowe, L., & Mulder, G. (1997). When syntax meets semantics. *Psychophysiology, 34*, 660-676.

Gunter, T. C., Friederici, A. D., & Schriefers, H. J. (2000). Syntactic gender and semantic expectancy: ERPs reveal early autonomy and late interaction. *Journal of Cognitive Neuroscience, 12*(4), 556–568.

Hagoort, P. (2003). Interplay between syntax and semantics during sentence comprehension: ERP effects of combining syntactic and semantic violations. *Journal of Cognitive Neuroscience, 15,* 883-899.

Hagoort, P. (2005). On Broca, brain, and binding: a new framework. *Trends in Cognitive Sciences, 9*(9), 416–423.

Hagoort, P., & Brown, C. M. (1999). Gender electrified: ERP evidence on the syntactic nature of gender processing. *Journal of psycholinguistic research*, *28*(6), 715-728.

Hagoort, P., & Brown, C. M. (2000). ERP effects of listening to speech compared to reading: The P600/SPS to syntactic violations in spoken sentences and rapid serial visual presentation. *Neuropsychologia, 38*, 1531–1549.

Hagoort, P., Brown, C., & Groothusen, J. (1993). The syntactic positive shift (SPS) as an ERP measure of syntactic processing. *Language and Cognitive Processes, 8*, 439–483.

Hagoort, P., Wassenaar, M., & Brown, C. (2003). Syntax-related ERP-effects in Dutch. *Cognitive Brain Research, 16*, 38-50.

Hahne, A., & Friederici, A.D. (1999). Electrophysiological evidence for two steps in syntactic analysis: Early automatic and late controlled processes. *Journal of Cognitive Neuroscience, 11*, 194-205.

Hammer, A., Jansma, B.M., Lamers, M., & Münte, T.F. (2008). Interplay of meaning, syntax and working memory during pronoun resolution investigated by ERPs. *Brain Research, 1230,* 177-191.

Hargreaves, I., Pexman, P., Johnson, J., & Zdrazilova, L. (2012). Richer concepts are better remembered: Number of features effects in free recall. *Frontiers in Human Neuroscience, 6*(73), 1-11.

Havas, V., Rodríguez-Fornells, A., & Clahsen, H. (2012). Brain potentials for derivational morphology: An ERP study of deadjectival nominalizations in Spanish. *Brain and Language, 120*(3), 332–344.

Hawkins, R., & Franceschina, F. (2004). Explaining the acquisition of and non- acquisition of determiner–noun gender concord in French and Spanish. In: P. Prévost & J. Paradis (Eds.), *The acquisition of French in different contexts: Focus on functional categories* (pp. 175–205). Amsterdam: John Benjamins.

Hawkins, R., & Chan, C. Y.-H. (1997). The partial availability of Universal Grammar in second language acquisition: The **"**failed functional features hypothesis.**"** *Second Language Research*, 13, 187–226.

Hawkins, R. (1998). Explaining the difficulty of French gender attribution for speakers of English. Paper presented at the 8th annual EUROSLA conference, Paris.

Hawkins, R. (2001). The theoretical significance of Universal Grammar in second language acquisition. *Second Language Research*, *17*, 345–367.

Haznedar, B. (1997). L2 acquisition by a Turkish-speaking child: Evidence for L1 influence. In E. Hughes, M. Hughes, & A. Greenhill (Eds.), *Proceedings of the 21st Annual Boston University Conference on Language Development* (pp. 245-256). Somerville, MA: Cascadilla Press.

Haznedar, B. & Schwartz, B.D. (1997). Are there Optional Infinitives in child L2 acquisition? In E. Hughes, M. Hughes & A. Greenhill (Eds.), Proceedings of the 21st Annual Boston University Conference on Language Development, 21, 257-68. Somerville, MA: Cascadilla Press.

Hopp, H. (2009). The syntax-discourse interface in near-native L2 acquisition: Off-line and on-line performance. *Bilingualism: Language and Cognition, 12*(4), 463-483.

Hopp, H. (2010). Ultimate attainment in L2 inflection: Performance similarities between non-native and native speakers. *Lingua, 120*(4), 901-931.

Hoover, M., & Dwivedi, V. (1998). Syntactic processing by skilled bilinguals. *Language Learning, 48*, 1–29.

Hyltenstam, K. & Abrahamsson, N. (2003). "Maturational constraints in SLA." In C.J. Doughty & M. H. Long (Eds.), The Handbook of Second Language Acquisition (pp. 539-599).

Jansen, B., Lalleman, J., and Muysken, P. (1981). The alternation hypothesis: acquisition of Dutch word order by Turkish and Moroccan foreign workers. *Language Learning, 31*,

315-36.

Jegerski, J. (2012). The processing of case markers in near-native Mexican Spanish. Poster presented at the 25th Annual CUNY Conference on Human Sentence Processing, New York, NY.

Jegerski, J. (2014). Self-paced reading. In J. Jegerski & B. VanPatten (Eds.), *Research methods in second language psycholinguistics* (pp. 20-49). New York: Routledge.

Jiang, N. (2004). Morphological insensitivity in second language processing. *Applied Psycholinguistics*, *25*(4), 603-634.

Jiang, N. (2007). Selective integration of linguistic knowledge in adult second language learning. *Language Learning, 57,* 1–33.

Juffs, A. (1998). Main verb versus reduced relative clause ambiguity resolution in L2 sentence processing. *Language Learning, 48*(1), 107-147.

Juffs, A. (2005). The influence of first language on the processing of *wh*-movement in English as a second language. *Second Language Research, 21*, 121–151.

Juffs, A., & Harrington, M. (1995). Parsing effects in second language sentence processing: Subject and object asymmetries in wh-extraction. *Studies in Second Language Acquisition, 17*, 483–516.

Juffs, A., & Harrington, M. (1996). Garden path sentences and error data in second language sentence processing research. *Language Learning, 46*, 286-324.

Just, M., Carpenter, P. & Woolley, J. (1982). Paradigms and processes in reading comprehension. *Journal of Experimental Psychology: General, 111*(2), 228-238.

Kaan, E. (2002). Investigating the effects of distance and number interference in processing subject-verb dependencies: An ERP Study. *Journal of Psycholinguistic Research, 31*, 165–193.

Kaan, E. (2007). Event-related potentials and language processing: A brief introduction. *Language and Linguistics Compass, 1*(6), 571–591.

Kaan, E., & Swaab, T.Y. (2003). Repair, revision, and complexity in syntactic analysis: An electrophysiological differentiation. *Journal of Cognitive Neuroscience, 15*, 98-110.

Kim, J-e., & Nam, H. (2016) Measures of implicit knowledge revisited: Processing modes, time, pressure, and modality. *Studies in Second Language Acquisition,* 1-27.

King, J. W., & Kutas, M. (1995). Who did what and when? Using word- and clause-level ERPs to monitor working memory usage in reading. *Journal of Cognitive Neuroscience, 7*, 376–395.

Kluender, R. & Kutas, M. (1993). Bridging the gap: evidence from ERPs on the processing of unbounded dependencies. *Journal of Cognitive Neuroscience, 5*(2), 196–214.

Kutas, M., & Hillyard, S. A. (1980). Reading senseless sentences: Brain potentials reflect semantic incongruity. *Science, 207*, 203–205.

Kutas, M., & Hillyard, S. A. (1983). Event-related brain potentials to grammatical errors and semantic anomalies. *Memory & Cognition, 11*(5), 539–550.

Kutas, M., van Petten, C. K., & Kluender, R. (2006). Psycholinguistics electrified II (1994–2005). In M. J. Traxler & M. A. Gernsbacher. (Eds.), *Handbook of psycholinguistics* (2nd ed., pp. 1–67). New York: Elsevier Press.

Lado, R. (1957). *Linguistics Across Cultures. Applied Linguistics for Language Teachers*. Ann Arbor. University of Michigan Press.

Leeser, M. J., Brandl, A., & Weissglass, C. (2011). Task effects in second language sentence processing research. In P. Trofimovich & K. McDonough (Eds.), *Applying priming methods to L2 learning, teaching and research.* Philadelphia: John Benjamins.

Lenneberg, E. H. (1967). *Biological foundations of language*. New York: Wiley.

Luck, S. J., & Kappenman, E. S. (2011). *The Oxford handbook of event-related potential components*. Oxford University press.

MacDonald, M. C. (1994). Probabilistic constraints and syntactic ambiguity resolution. *Language and Cognitive Processes, 9*, 121-136.

Mancini, S., Molinaro, N., Rizzi, L., & Carreiras, M. (2011). A person is not a number: Discourse involvement in subject–verb agreement computation. *Brain Research, 1410*, 64–76.

Mansouri, F. (1995). The Acquisition of Subject-Verb Agreement in Arabic as a Second Language. *ARAL,* 18 (2), 65-84.

Marinis, T. (2010). Using on-line processing methods in language acquisition research. In Unsworth, S. & Blom, E. (Eds.). *Experimental methods in language acquisition research* (pp. 139-162). Amsterdam: John Benjamins.

Marinis, T., Roberts, L., Felser, C., & Clahsen, H. (2005). Gaps in second language sentence processing. *Studies in Second Language Acquisition, 27*, 53–78.

Marsden, E., Thompson, S., & Plonsky, L. (2018). A methodological synthesis of self-paced reading in second language research. *Applied Psycholinguistics*, *39*(5), 861-904

Martín-Loeches, M., Nigbur, R., Casado, P., Hohlfeld, A., & Sommer, W. (2006). Semantics prevalence over syntax during sentence processing: A brain potential study of noun-adjective agreement in Spanish. *Brain Research, 1093*, 178-189.

Mecklinger, A., Schriefers, H., Steinhauer, K., & Friederici, A. D. (1995). Processing relative clauses varying on syntactic and semantic dimensions: An analysis with event-related potentials. *Memory and Cognition, 23*, 477–494.

McKinnon, R., & Osterhout, L. (1996). Constraints on movement phenomena in sentence processing: Evidence from event-related brain potentials. *Language and Cognitive Processes, 11*, 495–523.

Mehravari, A.S., Tanner, D., Wampler, E.K., Valentine, G.D., Osterhout, L. (2015) Effects of Grammaticality and Morphological Complexity on the P600 Event-Related Potential Component. *PLoS ONE 10*(10): e0140850.

Meulman, N., Stowe, L., Sprenger, S., Bresser, M., & Schmid, M. (2014). An ERP study on L2 syntax processing: When do learners fail? *Frontiers in Psychology, 5*, 1072.

Mills, Anne E. (1986). *The acquisition of gender: A study of English and German*. New York: Springer.

Molinaro, N., Barber, H.A., & Carreiras, M. (2011a). Grammatical agreement processing in reading: ERP findings and future directions. *Cortex, 97*, 908-930

Molinaro, N., Kim, A., Vespignani, F., & Job, R. (2008a). Anaphoric agreement violation: An ERP analysis of its interpretation. *Cognition, 106*, 963-973.

Molinaro, Barber, Caffarra, & Carreiras. (2015). On the left anterior negativity (LAN): The case of morphosyntactic agreement: A Reply to Tanner et al. *Cortex, 66*, 156-159.

Molinaro, N., Vespignani, F., & Job, R. (2008b). A deeper reanalysis of a superficial feature: an ERP study on agreement violations. *Brain Research, 1228*, 161-176.

Molinaro, N., Vespignani, F., Zamparelli, R., & Job, R. (2011b). Why brother and sister are not just siblings: Repair processes in agreement computation. *Journal of Memory and Language, 64,* 211-232.

Münte, T. F., Matzke, T., & Johannes, S. (1997). Brain activity associated with syntactic incongruencies in words and pseudo-words. *Journal of Cognitive Neuroscience, 9*, 318-329.

Murray, W.S. (2000). Sentence Processing: Issues and Measures. In A. Kennedy, R. Racach, D. Heller, & J. Pynte (Eds.), *Reading as a perceptual process* (pp. 649-666). Oxford: Elsevier.

Neville, H.J., Nicol, J.L., Barss, A., Forster, K.I. & Garrett, M.F. (1991). Syntactically based sentence processing classes – evidence from event-related brain potentials. *Journal of Cognitive Neuroscience 3*, 151–65.

Nevins, A., Dillon, B., Malhotra, S., & Phillips, C. (2007). The role of feature-number and feature-type in processing Hindi verb agreement violations. *Brain Research, 1164*, 81-94.

Newman, A. J., Ullman, M. T., Pancheva, R., Waligura, D. L., & Neville, H. J. (2007). An ERP study of regular and irregular English past tense inflection. *NeuroImage*, *34*(1), 435-445.

Nielsen, H. L. (1997). On Acquisition of Order of Agreement Procedures in Arabic Learner Language. *Al-Arabiya,* 30, 49-93.

Odlin, T (1993). *Language Transfer: Cross-linguistic Influence in Language Learning*. Cambridge, CUP.

Omar, M. K. (1973). *The acquisition of Egyptian Arabic as a native language.* The Hague: Mouton.

O'Rourke, P.L., & Van Petten, C. (2011). Morphological agreement at a distance: Dissociation between early and late components of the event-related brain potential. *Brain Research, 1392,* 62-79.

Osterhout, L. (1997). On the brain response to syntactic anomalies: Manipulations of word position and word class reveal individual differences. *Brain and language*, *59*(3), 494-522.

Osterhout, L., & Holcomb, P. J. (1992). Event-related brain potentials elicited by syntactic anomaly. *Journal of memory and language*, *31*(6), 785-806.

Osterhout, L., Holcomb, P. J., & Swinney, D. A. (1994). Brain potentials elicited by garden-path sentences: Evidence of the application of verb information during parsing. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20*, 786–803.

Osterhout, L., McLaughlin, J., Kim, A., & Inoue, K. (2004). Sentences in the brain: Event-related potentials as real-time reflections of sentence comprehension and language learning. In M. Carreiras & C. Clifton, Jr. (Eds.), *The on-line study of sentence comprehension: Eyetracking, ERP, and beyond* (pp. 271-308). Psychology Press.

Osterhout, L. & Mobley, L. A. (1995). Event-related brain potentials elicited by failure to agree. *Journal of Memory and Language, 34*, 739-773.

Osterhout, L., & Nicol, J. (1999). On the distinctiveness, independence, and time course of the brain responses to syntactic and semantic anomalies. *Language and Cognitive Processes*, 14, 283–317.

Ouhalla, J. (1994). Verb movement and word order in Arabic. In D. Lightfoot and N. Hornstein (ed.), *Verb movement,* 41–72. Cambridge: Cambridge University.

Ouhalla, J. (2003). *Functional categories and parametric variation*. Routledge.

Papadopoulou, D. & Clahsen, H. (2003). Parsing Strategies in L1 and L2 Sentence Processing: A Study of Relative Clause Attachment in Greek. *Studies in Second Language Acquisition* 25: 501-528.

Pérez-Pereira, M. (1991). The acquisition of gender: What Spanish children tell us. *Journal of Child Language*, *18*, 571–590.

Pienemann, M. (1998). *Language Processing and Second Language Development: Processability Theory.* Amsterdam. The Metherlands: John Benjamins.

Popov, S., & Bastiaanse, R. (2018). Processes underpinning gender and number disagreement in Dutch: An ERP study. *Journal of Neurolinguistics*, *46*, 109-121.

Prévost, P., & White, L. (2000). Missing Surface Inflection or Impairment in second language acquisition? Evidence from tense and agreement. *Second Language Research, 16*(2),103-133.

Rayner, K. (1998). Eye movements in reading and information processing: 20 years of research. *Psychological Bulletin, 124*, 372-422.

Resende, N., Mota, M. B., & Manhães, A. G. (2015). The Processing of Gender Transparent and Gender Opaque Nouns in Brazilian Portuguese: An Event-Related Brain Potential Study. In *The Third ANPOLL International Psycholinguistics Congress: Domain Specificity in Language Acquisition and Processing* (p. 143). Rio de Janeiro.

Roberts, L. (2009). The L1 influences the on-line comprehension of tense/aspect in L2 English. Paper presented at the L2 Processing and Parsing Conference, Lubbock, TX.

Rogers, M. (1987). Learners' difficulties with grammatical gender in German as a foreign language. *Applied Linguistics*, 8, 48–74.

Rossi, S., Gugler, M.F., Hahne, A., & Friederici, A.D. (2005). When word category information encounters morphosyntax: An ERP study. *Neuroscience Letters, 384*, 228-233.

Sabourin, L. (2001). L1 effects on the processing of grammatical gender in L2. *Eurosla yearbook, 1*(1), 159–169.

Sabourin, L. (2003). *Grammatical gender and second language processing: An ERP study*. Ph.D. Dissertation, University of Groningen, The Netherlands, Grodil.

Sabourin, L., Brien, C., & Tremblay, M-C. (2013). Electrophysiology of Second Language Processing: The Past, Present and Future. In María del Pilar García Mayo, M. Junkal Gutierrez-Mangado & María Martínez Adrián (Eds.) Contemporary Approaches to Second Language Acquisition (pp. 221-242). John Benjamins.

Sabourin, L., & Stowe, L. A. (2008). Second language processing: when are first and second languages processed similarly? *Second Language Research, 24*(3), 397–430.

Sabourin, L., Stowe L. A. & de Haan G. J. (2006). Transfer effects in learning a second language grammatical gender system. *Second Language Research, 22*(1), 1–29.

Sagarra, N., & Herschensohn, J. (2011). Proficiency and animacy effects on L2 gender agreement processes during comprehension. *Language Learning, 61*(1), 80-116.

Saydawi, Y. (1999). *Al-Kafaf*. Dar Al-Fikr, Damascus, Syria.

Schachter, J. (1990). On the issue of completeness. *Second Language Research, 6*, 93-124.

Schmitt, B., Lamers, M., & Münte, T.F. (2002). Electrophysiological estimates of biological and syntactic gender violation during pronoun processing. *Cognitive Brain Research, 14*, 333-346.

Schneider, W., Eschman, A., & Zuccolotto, A. (2002). *E-Prime reference guide*. Psychology Software Tools, Incorporated.

Schwartz, B. D., & Sprouse, R. (1994). Word order and nominative case in nonnative language acquisition. In T. Hoekstra & B. Schwartz (Eds.), *Language acquisition studies in generative grammar* (pp. 317–368). Amsterdam: John Benjamins.

Schwartz, B.D. & Sprouse, R. (1996). L2 cognitive states and the full transfer/full access model. *Second Language Research, 12*(1), 40–72.

Slabakova, R. (2000). L1 transfer revisited: The L2 acquisition of telicity marking in English by Spanish and Bulgarian native speakers. *Linguistics, 38,* 739-770.

Spino-Seijas, L. (2017). *Grammatical Gender Agreement in L2 Spanish: The Role of Syntactic Context.* ProQuest Dissertations and Theses.

Soltan, U. (2001). *An Argument for Ordered Spec-head Agreement and Selective Targeting Feature Valuation, in a Derivation-by-Phase Framework.* Ms. University of Maryland, College Park.

Soltan, U. (2007). *On Formal Feature Licensing in Minimalism: Aspects of Standard Arabic Morphosyntax*. PhD dissertation, University of Maryland.

Stewart, A. J., Pickering, M. J., & Sanford, A. J. (2000). The time course of the influence of implicit causality information: Focusing versus integration accounts. *Journal of Memory and Language*, 42, 423–443.

Swaab, T. Y., Ledoux, K., Camblin, C. C., & Boudewyn, M. A. (2012). Language-related ERP components. *Oxford handbook of event-related potential components*, 397-440.

Tanner, D., & Van Hell, J. G. (2014). ERPs reveal individual differences in morphosyntactic processing. *Neuropsychologia*, *56*, 289-301.

Tayash, F. A., & Ayouby, K. K. (1992). Arab-American media: Past and present. In A. Rouchdy (Ed.), *The Arabic language in America* (pp. 162-183). Detroit: Wayne State University Press.

Thigpen, N. N., Kappenman, E. S., & Keil, A. (2017). Assessing the internal consistency of the event-related potential: An example analysis. *Psychophysiology, 54*(1), 123–138.

Tsimpli, I. M., & Dimitrakopoulou, M. (2007). The Interpretability Hypothesis: Evidence from wh-interrogatives in second language acquisition. Second Language Research, 23(2), 215-242.

Tsimpli, I. M., & Roussou, A. (1991). Parameter resetting in L2?. *UCL Working Paper in Linguistics,* 3, 149-169.

Tsimpli, I. M., & Mastropavlou, M. (2007). Feature interpretability in L2 acquisition and SLI: Greek clitics and determiners. In J. Liceras, H. Zobl, & H. Goodluck, (Eds.), *The Role of Formal Features in Second Language Acquisition*. Mahwah, NJ: Lawrence Erlbaum.

Trueswell, J. C., & Kim, A. E. (1998). How to prune a Garden Path by nipping it in the bud: Fast priming of verb argument structure. *Journal of Memory and Language, 39*, 102–123.

Vainikka, A. & Young-Scholten, M. (1994). Direct access to X'-theory: evidence from Korean and Turkish adult learning German. In: T. Hoekstra, and B. Schwartz (Eds.), L*anguage acquisition in generative grammar*. Amsterdam/Philadelpia: Benjamins.

Vainikka, A. & Young-Scholten, M. (1996a). Gradual development of L2 phrase structure. *Second Language Research 12*, 7-39.

Vainikka, A. & Young-Scholten, M. (1996b). The early stages in adult L2 syntax: Additional evidence from Romance speakers. *Second Language Research, 12*, 140-176.

VanArsdall, J., Nairne, J., Pandeirada, J., & Blunt, J. (2013). Adaptive memory: Animacy processing produces mnemonic advantages. *Experimental Psychology, 60*(3), 172-178.

Van Petten, C. (1993). A comparison of lexical and sentence-level context effects in event related potentials. *Language and Cognitive Processes, 8*, 485–531.

Vigliocco, G., & Franck, J. (1999). When sex and syntax go hand in hand: Gender agreement in language production. *Journal of Memory and Language, 40*(4), 455-478.

Vos, S.H., Gunter, T.C., Herman, H., Kolk, H.J., & Mulder, G. (2001). Working memory constraints on syntactic processing: An electrophysiological investigation. Psychophysiology, 38, 41-63.

Weber-Fox, C.M. & Neville, H.J. (1996). Maturational constraints on functional specializations for language processing: ERP and behavioural evidence in bilingual speakers. *Journal of Cognitive Neuroscience, 8,* 231–56.

White, L. (1985). The acquisition of parameterized grammar: subjacency in second language acquisition. *Second Language Research, 1* (1), 1-17.

White, L. (1990). Second language acquisition and universal grammar. *Studies in Second Language Acquisition,*12, 121-133.

White, L., Valenzuela, E., Kozlowska-MacGregor, M., & Leung, Y. I. (2004). Gender and number agreement in nonnative Spanish. *Applied Psycholinguistics, 25*(1), 105-133.

Wicha, N. Y., Moreno, E. M., & Kutas, M. (2004). Anticipating words and their gender: An event-related brain potential study of semantic integration, gender expectancy, and gender agreement in Spanish sentence reading. *Journal of cognitive neuroscience*, *16*(7), 1272 1288.

Williams, J., Möbius, P., & Kim, C. (2001). Native and non-native processing of English wh-questions: Parsing strategies and plausibility constraints. *Applied Psycholinguistics, 22,* 509–540.

Wolf, F., Gibson, E. & Desmet, T. (2004). Discourse coherence and pronoun resolution. *Language and Cognitive Processes, 19*(6), 665–675.

Yuan, B. (1998). Interpretation of binding and orientation of the Chinese reflexive *ziji* by English and Japanese speakers. *Second Language Research, 14,* 324-340.

Zawiszewski, A., & Friederici, A. D. (2009). Processing object-verb agreement in canonical and non-canonical word orders in Basque: Evidence from event-related brain potentials. Brain Research, 1284, 161–179.