

The role of gender-marked information in second language processing

by

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Abstract

Two main theoretical approaches have been proposed to explain what causes gender errors in L2 processing. Deficit accounts argue that L2 learners who are NS of languages without grammatical gender cannot acquire gender due to impaired underlying syntactic representations. Accessibility accounts argue that morphological errors are due to production problems or even to gender ‘mapping problems’. Recently, the ‘lexical gender learning hypothesis’ has argued that L2 learners exhibit better performances while being taught the gender of nouns when they are provided with the noun suffix together with the determiner rather than when they learn the endings of each gender class separately from the gender-marked articles. This latter hypothesis is in line with the Competition Model.

This thesis investigates the role of gender-marked information in processing Greek as L2. The target population is adult L2 learners of Greek. For the purpose of this study two tasks were elaborated. In Task 1 a non-word (stimulus) was presented to the participants containing three possible types of gender-marked information: (1) morphological (noun suffix), (2) morphological syntactic (determiner + noun suffix) and (3) morphological extensive syntactic (determiner + adjective + noun suffix). The participants’ reaction (in Greek) to the stimulus was to indicate the gender class of the non-word. The presented stimuli in Task 2 were identical to the Task 1. However, a reply was required in English. The corresponding gender value of the stimulus was indicated by the appropriate personal pronoun in English (he, she, it).

The findings indicate that L2 learners are capable of processing more accurately and faster the grammatical gender of novel nouns when they are provided with morphological and extensive syntactic gender-marked information than when they are provided with morphological and syntactic information or morphological information only. These findings are in line with the lexical gender learning hypothesis and the principles of the Competition Model demonstrating that the quantity of gender-marked information has a positive effect on L2 processing. Our analysis also reveals that beginners and advanced L2 learners do not differ in terms of the employed processing strategies; they both process and use effectively the maximum amount of available gender-marked information.

Declaration

I certify that the work in this thesis entitled ‘The role of gender-marked information in second language processing’ has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree to any other university or institution other than Macquarie University. I also certify that the thesis is an original piece of research and it has been written by me. Any help and assistance that I have received in my research and the preparation of the thesis itself have been appropriately acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis. The research presented in this thesis was approved by Macquarie University Ethics Review Committee (Ref No: 5201300779).

Patricia-Panagiota Koromvokis

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Abbreviations

ANOVA: analysis of variance

AoA: age of acquisition

DP: determiner phrase

ERP: event-related-potentials

FEM (fem): feminine

FFFH: Failed Functional Feature Hypothesis

FonF: focus on form

FT/ FA: full transfer/ full access

IC: inflectional class

L1: first language

L2: second language

MG: Modern Greek

MSC (msc): masculine

MSIH: Missing Surface Inflection Hypothesis

MUH: Morphological Underspecification Hypothesis

NEUT (neut): neuter

NNS: non-native speakers

NP: nominal phrase

NS: native speakers

PI: processing instruction

RDH: Representational Deficit Hypothesis

RT: reaction time

SLA: second language acquisition

SSH: Shallow Structure Hypothesis

TL: target language

UG: universal grammar

VP: verbal phrase

Chapter 1: Introduction

1.1 Theoretical and research background

Grammatical gender is an aspect, which is encoded in some languages (e.g., Greek, German, Spanish, French, Italian) while other languages have only natural gender (e.g., English). In some languages nouns are categorised under three grammatical gender classes, masculine, feminine, neuter (e.g., Greek, German), while in others they are categorised under two grammatical genders, masculine and feminine (e.g., Spanish, French, Italian) or even under more than three (e.g., Swahili has six genders) (Corbett, 1991). Despite the fact that many words in the Indo-European languages have common etymology, their gender value can be different across these languages. For example, ‘the table’ is feminine in French (*la table*), in Italian (*la tavola*) and in Spanish (*la mesa*), but is masculine in German (*der tisch*) and neuter in Greek (*το τραπέζι*).

Grammatical gender involves two important aspects: (1) gender assignment, that is, the classification of nouns to gender classes in the mental lexicon (e.g., *η καρέκλα* ‘the chair’ in Greek is feminine) and (2) gender agreement, that is, the feature-based computation of gender across syntactically related constituents such as determiners, adjectives, pronouns etc. (e.g., *η κίτρινη καρέκλα* ‘the [FEM] yellow [FEM] chair [FEM]’). The grammatical gender of nouns can be realised from semantic information (sex or animacy: male/female, animate/inanimate, human/non-human), from morphophonological information (suffix of a noun) and/or it can be realised morphosyntactically by virtue of agreement between nouns and other agreeing elements in the noun phrase (NP) as well as in anaphoric pronoun reference within and across phrases (Corbett, 1991). We have to underline here that the role of syntactic agreement as a gender cue has also been pointed out in cases of gender ambiguous endings (Oliphant, 1998; Taraban & Kempe, 1999; Ralli, 2002; 2003; Alexiadou, 2004).

Within Corbett’s (1991) categorisation, Greek language belongs to a formal system, as the main aspects for gender assignment of Greek nouns are morphological and phonological rules rather than meaning or syntax. In Greek, as in many other languages (e.g., French, German, Spanish, Italian) the grammatical gender of the head noun governs agreement between the elements of the sentence it co-refers with (e.g., determiner, adjectives, pronouns). Thus, there is an interrelation between the three factors that are involved in the processing of grammatical gender in Greek nouns: semantics (sex), morphology (inflectional class — noun ending) and syntax (gender

agreement between determiners–adjectives–nouns). In other words, noun suffix, gender-marked articles and gender-marked adjectives are the gender-marked information or gender-marked cues in Greek gender processing (excluding the semantic information, which is beyond the scope of this study). This thesis investigates the comparative role of morphological and syntactic information in gender processing of Greek as a second language (L2). In contrast, English relies predominantly on semantic gender and is unmarked in lexical nouns, determiners and adjectives, although it is still marked in pronouns.

In production, some psycholinguists suggest that gender is activated only if it is needed in the syntactic environment (Levelt, Roelofs & Meyer, 1999) while others claim that gender is automatically selected as soon as the lexical node is selected (Caramazza, 1997). Mastropavlou and Tsimpli (2011, p. 32) underline that syntactic agreement is responsible for the realisation of the grammatical gender of all nominal elements within or beyond the phrasal level (involving pronominal elements or adjectival predicates). Regarding Greek gender Ralli (2002, p. 525) underlines that ‘gender is syntactically relevant since it participates in the agreement process between nouns, adjectives and determiners’. One consistent conclusion that has been made across production and comprehension studies is that gender is a syntactic process as ‘the gender of a selected lemma only becomes selected when actually needed in the local syntactic environment of the noun’ (Schriefers & Jescheniak, 1999, p. 578).

Grammatical gender is acquired relatively easily and early with a limited set of descriptive rules by children and native speakers (NS) (Karmiloff-Smith, 1979; Carroll, 1989; Pérez-Pereira, 1991; Lew-Williams & Fernald, 2007). Yet at the same time, it represents a major challenge when it comes to mastering a non-native language. For any learner whose native/first language (L1) does not possess this feature, grammatical gender often seems arbitrary (Dewaele & Véronique, 2001; Franceschina, 2001, 2005; McCarthy, 2008; Alarcón, 2011; Grüter, Lew-Williams & Fernald, 2012; Hopp, 2013).

Learning gender in Greek involves acquiring both the knowledge of a word’s gender (i.e., gender assignment) and how gender is expressed syntactically (i.e., gender agreement). The L2 learner must then develop the capacity to systematically produce and process this knowledge. We can argue that L2 learners’ grammatical gender difficulty could be originated by: (a) difficulty at the level of gender assignment (lexical knowledge) (Franceschina, 2005; Tsimpli, Roussou, Fotiadou & Dimitrakopoulou, 2005; Dimitrakopoulou, Fotiadou, Roussou & Tsimpli, 2006; Tanner, 2008;

Agathopoulou & Papadopoulou, 2011; Grüter et al., 2012; Hopp, 2013; Montrul, de la Fuente, Davidson & Foote, 2012; Montrul, Davidson, de la Fuente & Foote, 2014; Bobb, Kroll & Jackson, 2015); (b) difficulty at the level of gender agreement (syntactic knowledge) (Holmes & Dejean de la Bâtie, 1999; Bruhn de Garavito & White, 2002; Sabourin, Stowe, & de Hann, 2006; Alarcón, 2010); or (c) difficulty with accessing and/or applying this lexical and/or syntactic knowledge within the real-time constraints imposed by the specific context of use (Montrul et al., 2008; Alarcón, 2011) (Grüter et al., 2012, p. 194). The first two could be classified under the spectrum of processing and the third is located mainly in production context.

Taking into consideration the aforementioned L2 gender difficulties, two opposite theoretical approaches have been proposed, mainly arguing about what causes gender errors in L2 processing. According to the deficit accounts L2 learners of gendered languages, whose L1 does not encode gender, cannot process gender in syntactic structures mainly due to impaired underlying syntactic representations (Hawkins & Chan, 1997; Hawkins, 1998; Hawkins & Franceschina, 2004). In contrast, other scholars argue that syntactic representations are present, but morphological errors are due to production problems or gender ‘mapping problems’ forming the Missing Surface Inflection Hypothesis (MSIH) (Haznedar & Schwartz, 1997; Prévost & White, 1999; 2000; Lardiere, 2000). However, all of these linguistic investigations used mainly off-line and oral tasks performed by a small number of L2 learners. Thus, we can conclude that they do not fully investigate the underlying processes that are involved in L2 gender processing. In this thesis we aim to reveal the ‘underlying processes’ in Greek gender processing by using novel words.

Recently, Grüter et al. (2012) offered a ‘lexical gender learning hypothesis’, based on a previous study of Arnon and Ramscar (2009), arguing that L2 gender difficulty may be attributed to the different ways in which nouns were learnt. More specifically, when L2 learners are taught the gender of nouns by being provided at the same time with the noun suffix together with the determiner, they perform better than when they first learn the endings of each gender class separately from the gender-marked articles. The ‘lexical gender learning hypothesis’ thus focuses on the linguistic *input* that L2 learners receive in order to account for gender difficulty in L2. The present thesis also explores the processing effect of morphological and syntactic information in the provided stimulus; in other words the role of input.

Similar to the role of input in L2, according to Competition Model proposed by MacWhinney, (Bates & MacWhinney, 1987; MacWhinney, 2005; 2008) the acquisition of the target language's (TL) characteristics is based on the availability and the reliability of the specific characteristics, as well the existence or absence of competing cues from the L1. In regard to the present study, the level of availability and reliability of the gender-marked cues (noun endings, determiners, adjectives) will determine the level of processing for these cues.

Previous studies have compared the role of different gender cues (semantic, morphological and syntactic) in L2. The majority of these suggest that L1 English L2 learners of gendered languages rely more on syntactic (determiners and adjectives) than on morphological information in L2 Italian (Oliphant, 1998), L2 Spanish (Cain, Weber-Olsen & Smith, 1987; Franceschina, 2005) and L2 Russian (Taraban & Kempe, 1999). More specifically, in Oliphant's (1998) study the rate of gender accuracy increased as the number of gender elements increased while Franceschina (2005, p. 182) points out that syntax is a stronger cue than morphology and semantics.

Moreover, the majority of recent psycholinguistic studies on gender processing in L2 have used experimental tasks involving ungrammatical sentences, testing whether learners are sensitive to mismatches/violations in gender marking between nouns and determiners and/or adjectives in sentence processing or sentence comprehension (Tokowicz & MacWhinney, 2005; Keating, 2009; Gillon Dowens, Guo, Guo, Barber & Carreiras, 2011; Gillon Dowens, Vergara, Barber, & Carreiras, 2010). Some recent studies have also examined the potentially facilitative effects of syntactic gender-marked cues (determiners and/or adjectives) on lexical access in fully grammatical sentences (Lew-Williams & Fernald, 2010; Grüter et al., 2012; Dussias, Valdés Kroff, Guzzardo Tamargo & Gerfen, 2013; Hopp, 2013; 2016). Most of these studies indicate that, even high-proficient L1 English L2 learners of gendered languages (Spanish and German) relied on the gender-marked articles as predictive cues in the processing of novel nouns only when these nouns co-occurred with the articles in the noun phrases of the learning trials in other words in a non-segmented input (Lew-Williams & Fernald, 2010; Grüter et al., 2012; Dussias et al., 2013; Hopp, 2016).

1.2 The present study

None of the previous L2 studies has specifically examined in comparable tasks the relevant processing effect of noun endings (morphological information), articles and/or adjectives (syntactic information) as gender-marked cues in L2 gender processing. Moreover, most of the L2 researchers have so far based their findings on oral tasks and on the processing of familiar nouns while having at the same time low number of participants. Thus, to date, there has been very little research on the processing role of morphological and syntactic gender-marked cues in written production. While it is acknowledged that there is an interrelation between the three factors of semantics (sex-animacy), morphology (inflectional class) and syntax (gender agreement between determiners–adjectives–nouns) that are involved in the processing of grammatical gender in Greek nouns, no L2 Greek study has ever examined them in comparative tasks. This thesis aims to fill this gap by using novel words, an innovative methodology, a large number of materials and finally by having 105 participants who are L2 learners of Greek.

This thesis investigates the role of morphological and syntactic information in gender processing of L2 Greek. Thus, it is the first study, which aims to shed light on the role of morphological noun endings and the role of gender-marked articles and adjectives as cues in Greek L2 gender processing. It investigates the ability of L2 learners, whose L1 does not encode grammatical gender, to realise, process and integrate gender cues upon the production of accurate gender agreement phrases. In this thesis, we use the term ‘processing’ to refer to the realisation of a noun’s gender class (lexical access). However, it must be noted that the main aim of the present study was not to investigate the accuracy of gender agreement production (agreement between determiner–adjective–noun), although this could be applied to and explained by the results obtained.

For the purpose of this study two experimental tasks were used to increase the validity of the results. The presented stimuli in both tasks were identical. However, the required participants’ replies were different. In the first task a reply in Greek (L2) was required while in the second the reply was in English (L1). For both tasks there was variation in the presented stimuli accordingly to two variables:

1 Type of information with three levels:

- (a) only morphological information (noun suffix)
- (b) morphological and syntactic information (determiner + noun suffix)
- (c) morphological and extensive syntactic information (determiner + adjective + noun suffix)

2 Type of noun gender endings with three levels: masculine, feminine, and neuter.

The target population of the study was adult L2 learners, whose L1 does not encode grammatical gender (English). The participants were divided into two groups: beginners and advanced.

Analysis of the data indicates that advanced adult L1 English L2 learners of Greek are more capable of processing correctly and faster the grammatical gender of the presented novel nouns than beginner learners. It can also be concluded that adult L1 English L2 learners of Greek are more capable of processing correctly and faster the grammatical gender of the presented novel nouns when they are provided with morphological and extensive syntactic information (determiner + adjective + noun suffix) than when they are merely provided with morphological and syntactic information (determiner + noun suffix). Additionally, the participants' performance in processing the grammatical gender of the novel nouns is more accurate and needs less time when they are provided with morphological and syntactic information (determiner + noun suffix) than when they are only provided with morphological information (i.e., noun suffix). Furthermore, the interaction between the variables of Greek language competence (advanced vs. beginner learners) and the second independent variable (type of the provided information) revealed that the advantage of the third condition (with noun suffix, determiners and/or adjectives) was present in both conditions of Greek language competence indicating that beginners and advanced employ the same strategies in processing grammatical gender. These results were observed in both tasks which supports the validity of the findings.

In relation to the findings of the present study, interpretation of the results could be based on the concept of activation of cues according to their reliability and strength. The more reliable and available the gender-marked cues (noun suffix, determiners, adjectives) are, the higher the probability of gender activation. Studies in bilinguals and L2 learners (Carroll, 1999; Kilborn & Ito, 1989) revealed that they differ from monolinguals in regard to the use of gender cues. The bilinguals and L2 learners are

sensitive to gender cues ‘when cues are used by parsers to facilitate and speed up parsing’ (Carroll, 1999 p. 43). The experimental condition of morphological and extensive syntactic cues (determiner + adjective + noun ending) has more chance to lead in activation and selection the appropriate gender node than the other two experimental conditions (noun ending and determiner + noun ending). L2 learners thus extract grammatical information from the morphological properties of the noun but the processing and, therefore, the production is highly facilitated by related gender information located in the determiner and the morphology of the adjective. The additional gender information not only confirms the possible gender evaluation based on the noun but also facilitates the whole process. In other words L2 learners process the gender by relying on the noun but will also make full use of the additional information. This tendency is not observed in NS, as the information in the lemma is a sufficient factor for gender classification. The additional information does not provide essential conformation for evaluation. It must be noted here that L2 learners make use of available morphological information (noun suffix). This is obvious in the extraction of the relevant information from both the noun suffix and also the adjective suffix. However, the crucial factor is the quantity of available information. These findings are also in line with the ‘lexical gender learning hypothesis’ (Grüter et al., 2012) as the non-segmented input of determiner + adjective + noun helped the participants to perform better.

Furthermore, the analysis revealed that there is no significant interaction between the factor of Greek language competence and the type of information presented — advanced learners still rely on the availability of the grammatical gender cues, demonstrating the same tendencies as beginners. Beginners and advanced learners differ in regard to accuracy but they do not differ on the processing strategies that they employ.

In relation to reaction time the same interpretation as for accuracy can be applied. However, a clarification must be provided for the observed high required processing time in the experimental condition of morphological noun suffix. L2 learners need more time to process gender when the only available information is the noun suffix, not because they do not process at all grammatical gender information but rather because the non-transparent gender information forces them to evaluate and readjust their decision over the grammatical gender of the noun. According to the Competition Model, the availability and reliability of the gender-related information allows learners

to come up with a reliable decision on the gender of the noun in less time when more information is provided via the gender-marked determiners and adjectives.

In addition, the present findings do not indicate a lack of or impairment in underlying morphosyntactic competence in universal grammar (UG) (Hawkins, 2009; Hawkins & Chan, 1997; Hawkins, 1998; Hawkins & Franceschina, 2004) as the accuracy rates and the reaction times (RT) show that L2 learners of Greek are able to use the gender of determiners and adjectives in order to process accurately and fast the gender of the presented novel nouns. Finally, these results complement the MSIH (Haznedar & Schwartz, 1997; Prévost & White, 1999; 2000) by indicating that morphology does not represent such a valid cue in L2 gender processing as gender-marked determiners and adjectives.

1.3 Overview of the thesis

Chapter 2 provides a theoretical introduction of grammatical gender with a description of gender agreement and assignment systems. The dominant models and theories of language processing are addressed, including Levelt et al. (1999) and Caramazza, Miozzo, Costa, Schiller and Alario (2001). In section 2.2.4 a description of the Competition Model highlights the role of cues in language processing. The subsequent sections present how gender is realised in English and Greek languages. The final section (2.5) aims to summarise all the aforementioned information and connect the findings with the present study.

Chapter 3 provides an overview of a few previous L1 studies on the processing of gender by children and NS. This chapter mainly aims to show that children/NS form strong associations between determiners + nouns after receiving extensive and natural gender-marked input.

Chapter 4 focuses on L2 gender processing. Specifically, the first sections of this chapter contain descriptions of the different theoretical approaches to processing gender in L2 while the following sections present and analyse previous studies using different methodologies (eye-tracking, ERP etc.) which have examined the role of semantic, morphological and syntactic cues in other languages as well as Greek as L2. In particular, this chapter highlights the lack of research regarding gender processing in L2, which we attempt to fill with the two experimental tasks presented in Chapter 5.

The overall methodological framework of the study is presented in Chapter 5. Here the rationale, research questions, hypothesis, design, materials and procedure followed in the two tasks are analysed. In this chapter all the applied and statistical techniques ensuring the reliability and the validity of the two tasks are presented in detail. Chapter 6 then contains the analysis of the collected data.

Finally, in Chapter 7, the results of the study are summarised and the theoretical as well as methodological implications of the findings are addressed. Limitations of the present study are noted and further research proposed.

Chapter 2: Gender as grammatical category

2.0 Chapter overview

Chapter 2 begins by providing definition of what gender is as a grammatical category (2.1). The two main aspects of gender, gender assignment (2.1.1) and gender agreement (2.1.2) are analysed. The acquisition of an L2 introduces the need for consideration of factors with regard to the mental lexicon structure and underlining procedures. The dominant models and theories of language processing are addressed, including that of Levelt et al. (1999) in section 2.2.2 and that of Caramazza et al. (2001) in section 2.2.3. The Unified Competition Model offered by MacWhinney (2005; 2008) is analysed in section 2.2.4 as it addresses more effectively the L2 processing of grammatical gender.

The rest of Chapter 2 offers an analysis on how grammatical gender is realised in English (2.3) and Greek (2.4). The role of semantics, morphology and syntax in Greek gender system are briefly presented in the general notes section (2.4.1) while the semantic, morphological and syntactic rules of gender assignment of Greek nouns are presented in detail according to Greek grammars and theories in section 2.4.2. Section 2.4.3 demonstrates how gender agreement is realised in Greek language. Finally, in section 2.5 we integrate all the aforementioned theories and grammatical rules with the research focus of this thesis.

2.1 Defining grammatical gender

There are two types of genders, ‘natural gender’ and ‘grammatical gender’. Natural or semantic gender reflects the straightforward semantic characteristics of the noun (e.g., male/female, animate/inanimate, human/non-human) while grammatical gender is a classification system for nouns themselves. Corbett defines it as follows:

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-world distinction of sex, at least in part, but often too it does not (‘gender’ derives etymologically from Latin *genus*, via Old French *gendre*, 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).

Although natural gender exists in all languages, grammatical gender is an aspect which is only encoded in some languages (e.g., Greek, German, Spanish, French, Italian). Other languages, such as English, have only natural gender. In some languages nouns are categorised under three grammatical gender classes, masculine, feminine, neuter (e.g., German, Greek) while in others they are categorised under two grammatical genders, masculine and feminine (e.g., Italian, Spanish, French) or even under more than three (e.g., Swahili has six genders) (Corbett, 1991). As previously noted, despite the fact that in Indo-European languages many words have common etymological basis, their gender value can be different.

Corbett (1991) emphasises that grammatical gender is the most intriguing of the grammatical categories that interests non-linguistic scholars as well as linguistic scholars. It is a challenging linguistic category for analysis because it provides a window on both lexical access and syntactic processing (Carroll, 1989; Dahl, 2004; Corbett, 1991). Among other grammatical categories, such as person and number, it is the most puzzling feature and has raised the most questions in the linguistic literature (Corbett, 1991). Audring (2014, p. 6), while investigating gender's complexity, states that 'gender systems defy all three criteria for transparency' by questionable functionality, by form complexity and doubtful semantic content.¹

A variety of definitions of grammatical gender can be found in previous scholarship on the issue. Gender can be defined as:

...a subclass within a grammatical class (as noun, pronoun, adjective, or verb) of a language that is partly arbitrary but also partly based on distinguishable characteristics (as shape, social rank, manner of existence, or sex) and that determines agreement with and selection of other words or grammatical forms (Guillelmon & Grosjean, 2001, p. 503).

Grammatical gender is a morphosyntactic feature as the morphological suffix of a noun reveals its gender class while at the same time it passes on other syntactically related elements (Carroll, 1989). 'It is an intrinsic element of nouns in languages where it is

¹ Gender offers very little to the information part of an utterance, nouns have gender but are also encoded in other words within and beyond the NP. In addition, gender marking expresses 'kind', which is too vague, although it distinguishes gender from other classes of words (Audring, 2014, pp. 6–7).

encoded, but it does not directly or indirectly represent semantic features of natural gender or another meaning' (Τσιμπλή, 2003, p. 172).²

Although the aforementioned definitions focus on the nature or the characteristics of gender as a grammatical category, Franceschina (2005) has made a very interesting list of gender definitions focusing on the different gender aspects. More specifically, she provides a group of definitions which focus on the type of grammatical phenomenon that gender is or isn't:

- 'gender is an exhaustive classification of all nouns', 'gender isn't a meaning-bearing inflectional category like Tense or Number, nor is it a purely formal inflectional category marking dependencies between words, such as agreement or the purely syntactic use of cases ...it isn't a derivational category either';
- definitions which emphasise how gender manifests itself: 'gender is a system in which the class to which a noun is assigned is reflected in the forms that are taken by other elements syntactically related to it';
- definitions regarding the function of gender 'in gender systems nouns are assigned to classes on the basis of inherent features, and a particular NP is tracked through a discourse by virtue of its association with its class', 'gender has an important role in signaling grammatical relations between words in a sentence', 'gender is a grammatical property whereby words are divided into different grammatical classes which play a role in agreement/concord relationships', 'gender functions to divide up the lexicon into classes which govern agreement'; and
- definitions emphasising the classifications that language gender systems exploit: 'gender is a classification of nouns which in most cases is based on perceived properties of the referents of the nouns', 'in many languages the gender assignment of nouns is semantically arbitrary except that for animate nouns or for human nouns gender is predictable from sex', 'many languages have what is called grammatical gender, where words are assigned a gender category (masculine, feminine, neuter) which bears no obvious semantic relation to what the word refers to' (Franceschina, 2005, pp.70–71).

² *‘Είναι ένα εγγενές στοιχείο του ουσιαστικού σε γλώσσες όπου είναι γραμματικοποιημένο, αλλά δεν αντιστοιχεί άμεσα ή έμμεσα στο σημασιολογικό χαρακτηριστικό του φυσικού γένους ή σε κάποια άλλη έννοια’* (Τσιμπλή, 2003, p. 172).

Although, literature provides us with a variety of gender definitions, if we analyse them carefully, we come to the conclusion that all these definitions indicate two aspects of the grammatical gender, which are: (1) gender assignment, that is, the classification of nouns to gender classes in the mental lexicon, and (2) gender agreement, that is, the feature-based computation of gender across syntactically related constituents. These two gender aspects will be further defined and analysed in the following sections.

2.1.1 Gender assignment

According to Chomsky's Minimalist Theory (1995) gender is the intrinsic characteristic of a noun, which means that the grammatical gender of the noun is part of each lemma in the mental lexicon. In other words gender is a lexical property of nouns. Grammatical gender has also been characterised as an interpretable characteristic of the noun which must check the uninterpretable gender of agreeing determiners, adjectives, modifiers in the agreement/concord. Carstens (2000) notes that it is more accurate to characterise gender as an inherent feature of nouns. In addition, Πάλλη (2005) points out that the gender of animate nouns constitutes an interpretable feature as it is directly related to sex, while the gender of inanimate nouns can be characterised as an uninterpretable feature because without a specific element an object can be masculine (*πίνακας* 'board'), feminine (*καρέκλα* 'chair') or neuter (*τραπέζι* 'table') (Πάλλη, 2005, p. 285).³ On the other hand, Ralli, taking into account gender ambiguities in Greek nouns, proposes that gender is an inherent property of stems — it is a feature that belongs to feature bundles characterising nouns stems listed in the mental lexicon (Ralli, 2002, p. 520). This means that the stems of some nouns represent an intrinsic fully specified gender feature, since the same inflectional morpheme may be added to stems of different gender values. Ralli's view will be analysed in details in section 2.4.2.

The question of how first language (L1) and second language (L2) learners acquire knowledge of language gender has been the research subject of many studies. Carroll (1989) argues that when native speakers (NS) realise that determiners and adjectives are distinct lexical elements, the phonological representations are reduced while the morphosyntactic representations are increased pointing out the gender feature. Therefore, gender marking cues like determiners trigger off the activation of the gender

³ *‘Αν πάρουμε για παράδειγμα το γένος διαπιστώνουμε ότι στα ονόματα που δηλώνουν ανθρώπινη ύπαρξη συνιστά ερμηνεύσιμο χαρακτηριστικό αφού συνδέεται άμεσα με το φύλο. Αντίθετα, στα ουσιαστικά που δηλώνουν αντικείμενο είναι μη ερμηνεύσιμο αφού χωρίς συγκεκριμένο κριτήριο ένα αντικείμενο μπορεί να είναι αρσενικού γένους (πίνακας), θηλυκού (καρέκλα) ή ουδέτερου (τραπέζι)’.* (Πάλλη, 2005, p. 285)

node in the mental lexicon. If the gender feature is not needed, it atrophies and disappears. Alternatively, according to Carroll (1989) L2 learners (who are the interest of this study) of gendered languages have to develop mnemonic strategies for pairing nouns and all agreeing elements. In order to develop the appropriate mnemonic strategies, L2 learners thus develop rules which phonologically represent all gender forms. In other words, lexical access is not facilitated by gender marking cues such as determiners and adjectives.

In contrast to Carroll (1989), Corbett (1991) argues that NS do not depend on their mnemonic strength as they make few or no gender mistakes, when applying gender rules to loan words or, even, to invented words. Thus, gender assignment depends on two basic types of information about the noun: its meaning (semantic systems) and its form (formal systems) (Corbett, 1991, pp. 7–8). In particular, there are two major semantic domains on which assignment systems are based: sex and animacy (Corbett, 2011). Formal assignment rules which depend on the form of the nouns are two types: morphological and phonological rules. Corbett (1991) notes that the distinction between morphological and phonological rules is not always understandable: ‘Phonological rules refer just to a single form of a noun, morphological rules require more information; they need to refer to more than one form’ (Corbett, 1991, p. 33). In this thesis we will use the term ‘morphology’ or ‘morphophonology’ to refer to gender-marked endings of nouns.

Although, it is accepted that all gender systems have a semantic core on which gender assignment of nouns depends, there is a distinction between languages in the degree to which they use semantic and morphological criteria for gender assignment. Thus, Corbett (1991) argues that there are:

- strict semantic systems in which the meaning of the noun determines its grammatical gender, and at the same time the gender of the noun reveals the sex of the referent;
- predominantly semantic systems in which the meaning of the noun determines its grammatical gender but there is a great majority of exceptions;
- morphological systems in which phonological representation is insufficient and reference to morphology is required; and
- phonological systems in which gender assignment of the nouns is defined by reference to a single form, in other words by a phonological rule.

Thus, grammatical gender of nouns can be realised from semantics, or just from semantic and phonological information or even from morphological information. Corbett (1991) emphasises that there is a majority of nouns whose gender is not predicted by regular assignment rules. One category of these nouns are the hybrids whose gender assignment rules conflict with the semantic rules. Another group are the double- and multiple-gender nouns which belong to two separate genders. Finally, the epicene nouns which belong in one gender, though they may denote beings of male or female sex. Epicenes usually refer to non-humans.

In addition to gender assignment, grammatical gender is realised morphosyntactically by virtue of agreement between nouns and other agreeing elements in the nominal phase (NP) as well as in anaphoric pronoun reference within and across phrases. The aspect of gender agreement is analysed in the next section.

2.1.2 Gender agreement

Gender agreement is a very important aspect of grammatical gender as ‘it is the way in which gender is realised in language use and provides the basis for defining gender and for establishing the number of genders in a given language’ (Corbett, 1991, p. 105). In this thesis both ‘gender agreement’ and ‘gender concord’ refer to ‘the systematic covariance between a semantic or formal property of one element and a formal property of another’ (Corbett, 1991, p. 105). Gender is an inherent feature of nouns (the controller of agreement) held in the lexicon, which becomes visible through the agreement of prenominal modifiers on determiners and adjectives (the targets of agreement) (Carroll, 1989; Carstens, 2000; Corbett, 2006). Thus, grammatical gender is a morphosyntactic feature as the morphological suffix of a noun reveals its gender class and at the same time passes on other syntactically related elements (Carroll, 1989).

Gender agreement is the feature-based computation of gender across syntactically related constituents. Gender agreement can occur between a wide range of agreeing elements depending on the system of each language (Corbett, 1991). Thus, in the majority of gendered languages gender agreement occurs between the elements of NP, such as between nouns, articles and adjectives (e.g., Greek, German, Spanish), or between the verbs and the nouns (e.g., Russian). In addition, numerals, possessives, participles, relative or personal pronouns and adverbs can also mark gender agreement. In languages like Greek, German, Spanish and French nouns assign gender to determiners, adjectives and participles which modify them as well as to pronouns which co-refer according to the language specific rules (Table 1.).

Singular — Nominative		
	Definite article	Indefinite article
Greek		
MSC	<i>ο βάτραχος</i> (the frog)	<i>ένας βάτραχος</i> (a frog)
FEM	<i>η καρέκλα</i> (the chair)	<i>μια καρέκλα</i> (a chair)
NEUT	<i>το τραπέζι</i> (the table)	<i>ένα τραπέζι</i> (a table)
German		
MSC	<i>der Mann</i> (the man)	<i>ein Mann</i> (a man)
FEM	<i>die Katze</i> (the cat)	<i>eine Katze</i> (a cat)
NEUT	<i>das Fenster</i> (a window)	<i>ein Fenster</i> (a window)
Spanish		
MSC	<i>el libro</i> (the book)	<i>un libro</i> (a book)
FEM	<i>la silla</i> (the chair)	<i>una silla</i> (a chair)

Table 1: Definite and indefinite agreement structures in Greek, German and Spanish.

Apart from the different agreement elements, gender agreement can also be realised as across several syntactic domains. Adjectives can be inside the NP (pre- and post-nominal) or outside the NP (post-verbal, predicative). For example, in languages like Greek and German, gender agreement can only take place between the noun and the attributive adjective or between the noun and the predicative adjective (Table 2). While, in languages like Spanish and French adjectives can also have a post-nominal role (e.g., in Spanish *el* _[MSC] *libro* _[MSC] *grande* _[ADJ-MSC] ‘the big book’, *la* _[FEM] *silla* _[FEM] *amarilla* _[ADJ-FEM] ‘the yellow chair’).

Pre-posed and post-posed adjectives	
Greek	
MSC	<i>ο/ένας πράσινος βάτραχος</i> (the/a green frog)
FEM	<i>η/μία κίτρινη καρέκλα</i> (the/a yellow chair)
NEUT	<i>το/ένα μαύρο τραπέζι</i> (the/a black table)
German	
MSC	<i>der/ein alter mann</i> (the/an old man)
FEM	<i>die/eine schwarze katze</i> (the/a black cat)
NEUT	<i>das/ein kaputtes fenster</i> (the/a broken window)
Spanish (Post-posed adjectives)	
MSC	<i>el/un libro grande</i> (the/a big book)
FEM	<i>la/una silla amarilla</i> (the/a yellow chair)

Table 2: Agreement structures for pre-posed adjectives in Greek, German and post-posed adjectives Spanish.

Predicative adjectives	
Greek	
MSC	<i>ο βάτραχος είναι πράσινος</i> (the frog is green)
FEM	<i>η καρέκλα είναι κίτρινη</i> (the chair is yellow)
NEUT	<i>το τραπέζι είναι μαύρο</i> (the table is black)
German	
MSC	<i>der mann ist alt</i> (the man is old)
FEM	<i>die katze ist schwarz</i> (the cat is black)
NEUT	<i>das fenster ist kaputt</i> (the window is broken)
Spanish	
MSC	<i>el libro es grande</i> (the book is big)
FEM	<i>la silla es amarilla</i> (the chair is yellow)

Table 3: Agreement structures for predicative adjectives in Greek, German and Spanish.

Even though, there are cross-linguistic differences with regard to grammatical gender, there are still certain agreement rules that have to be followed according to each language. So how is gender agreement realised by speakers?

Before we answer this question we have to clarify first what happens from a listener's perspective. Gender information on the agreeing elements appears before the noun, thus from a listener's perspective, the markers do indeed provide new information. However, as Corbett (2006) indicates, the lexical gender knowledge of a noun is primary as it defines the gender of the agreeing elements that have no independent source for this grammatical feature (Corbett, 2006, pp. 10–11). Following common terminology, the words that trigger agreement are called 'controllers or triggers' and the agreeing elements are called 'targets' (Audring, 2014; Franceschina, 2005). In this thesis, the triggers are nouns and the targets are the determiners and the adjectives. Specifically:

triggers are defined as the lexical items containing intrinsic gender values that can be copied onto other lexical items, namely targets, which are not inherently marked for gender and receive this via syntactic agreement. Triggers are nouns and in the majority of cases they are inherently marked for gender, although there are some exceptions in the case of nouns reflecting natural gender. Targets are the lexical items that agree with nouns either present in the linguistic context or tacitly implied by it (Franceschina, 2005, p. 72).

Gender represents an interpretable feature of nouns [\pm feminine], while it is an uninterpretable (e.g., *u*gender) (formal) feature in determiners and adjectives, which must be checked through agreement (Chomsky, 1995). Within syntactic literature, there is agreement that nouns come lexically determined with a gender feature [\pm feminine] (Carroll, 1989; Carstens, 2000). In minimalist terms, gender agreement relies on checking or matching gender relations between the noun's interpretable gender class and uninterpretable gender features on determiners and adjectives deleting the latter (e.g., Carstens, 2000). In language processing, speakers then compute feature-based agreement relations between syntactically related constituents (Franck, Vigliocco, Antón-Méndez, Collina & Frauenfelder, 2008).

According to the Minimalist Framework (Chomsky, 2000, 2001, 2002), L1 speakers acquire lexical categories (e.g., verbs, nouns) and functional categories (e.g., auxiliaries, determiners) which are encoded by grammatical features such as gender and number that can be semantically interpretable or grammatical uninterpretable.

Interpretable features (e.g., for gender [\pm feminine]) are semantically important and necessary and sometimes are linked to the grammatical uninterpretable (*u*features) of syntactically linked items for example to the uninterpretable gender feature (e.g., *u*gender) of adjectives or determiners in a noun–adjective agreement. The general research question of this thesis is how adult L2 learners of Greek process *u*features absent in their L1. According to (Carstens, 2000), the noun having an interpretable gender is the head of the syntactic tree, that is, the NP. The noun then checks or values uninterpretable gender features of determiners and/or adjectives. Thus, although gender is the intrinsic characteristic of a noun (Corbett, 1991; Chomsky, 1995; Τσιμπλή, 2003), gender agreement in languages like Greek is a syntactic feature-checking operation handled by the syntax.

All the aforementioned theories are useful in providing us information about gender agreement in languages. But how is gender processed when people speak, read or write? Current and past psycholinguistic theories and models argue about how gender is processed in production and comprehension and are reviewed in the following section.

2.2 Language processing

2.2.1 Theories and models of language processing

The acquisition of a L2 introduces the need for taking into consideration additional factors in regard to the mental lexicon structure and underlying procedures. Two main dimensions have to be addressed in relation to the establishment of a theory for language production in L1 and L2. Firstly, it is considered absolutely essential for an efficient psycholinguistic theory to account for the storage and retrieval of lexical items from more than one language (Brien & Sabourin, 2012). Additionally, the structure and the rationale of each theory must be in a position to address these issues in L1 and L2 separately and/or in parallel. Secondly specific limitations do not allow the resolution and explanation of relevant effects in regard to the dimension of grammatical gender (Bordag, 2004).

Specific models have been proposed to explain the structure and the underlying procedures in the acquisition of L1 and L2. However, only a few models are considered efficient. In particular, significant models of the mental lexicon have previously been proposed by: Marslen-Wilson (1984); Dell (1986); Bock and Levelt (1994); Gaskell and Marslen Wilson (1997); Caramazza (1997) Levelt et al. (1999); Ullman (2001); Gollan

and Frost (2001); Caramazza et al. (2001); and Jackendoff (2003). The most prominent models of these are Levelt et al. (1999), Caramazza et al. (2001) and Gollan and Frost (2001).

In relation to the present study the Unified Competition Model proposed by MacWhinney (2005 and 2008), the main concepts of the model provide a stable ground for explaining the current findings. The developed versions of the model target the interaction between L1 and L2. The model (especially the cue validity concept) could easily interpret the observable effects of two main variables of this experiment on grammatical gender accurate processing and the reaction time.

Even though, there are significant differences between the proposed models of language processing and production in regard to their structure and the operation of the subsystems, there are overlaps and common notions. For the purpose of this study only the models that are related to the dimension of the grammatical gender in L1 and especially in L2 will be discussed. Under this analysis the most prominent psycholinguistic models and theories introduce the notion that three major processing levels are responsible for language processing and production: conceptualisation, formulation and articulation (Bordag, 2004). It must be noted here that the introduced terminology is not necessarily the adapted term in every model or theory but is only an attempt to summarise the common conception as introduced by Bordag (2004). At the stratum of conceptualisation the lexical information is conceptualised. This stage refers to preverbal information. At the next processing level the formulation process operates. The outcome of the previous stratum is transformed into linguistic forms. At this stage grammatical encoding and phonological encoding processes formulate the additional required information. The extent of activation of the subcomponent of this stage depends on the necessity of the relevant information. Finally, the articulation processing level includes the retrieval from long term memory of the relevant phonetic information and the initiation and execution of the articulation process as well (Bordag, Opitz & Pechmann, 2006).

In relation to the grammatical gender processes the formulation level is the stratum, where all the relevant operations are carried out. The retrieval of lexical information from the mental lexicon (long term memory) is usually called 'lexicalization'. This process includes two sub processes; the lemma selection and the word form (lexeme) retrieval. The lemma selection process refers to the processing and retrieval of grammatical and syntactic information, whereas, the lexeme retrieval refers

to the processes of phonological encoding. In other words the phonological form of the lexical item is accessed and the phonetic form of the intended utterance is computed. The lemma selection includes the activation and the selection of the grammatical gender node.

The activation of the grammatical gender node is not definite but depends on the necessity of the relevant information for required speech production. The activation of the grammatical gender node also depends on the operation of the working memory. According to reintegration theory (Saint-Aubin & Poirier, 1999; Poirier & Saint-Aubin, 1995; Baddeley, 2000, 2003) the retrieval of the verbal information also depends relatively heavily on linguistic and semantic information, especially if the phonological information is not sufficient. Finally, the activation of each node in lemma selection process depends on the necessity of the relevant information.

According to Bordag et al., (2006) the summarisation of language processing models and theories into distinctive stratum allows for variation from theory to theory (Bordag, 2004). It is also significant to note the problematic situation regarding research on grammatical gender as investigated on the basis of cognitive processes. For example, there has been minimum psycholinguistic research so far with regard to addressing the effects of grammatical gender on lemma level stratum (Schriefers & Jescheniak, 1999). This is easily understood if we consider that the main language used in L2 research is English, a language with poor grammatical gender dimension (Bordag, 2004). However, this dimension has been questioned as Bordag et al. (2006, p. 1091) comment: ‘though we may draw such a preliminary conclusion, caution must be taken when making strong inferences from null results. It could be the case that the interaction exists’.

In order to give a solid and efficient explanation for the processing of grammatical gender, the phenomenon has to be addressed within a selected theory or model. In this case, a description of the dominant models and theories of language processing is considered critical. Finally, the Unified Competition Model (MacWhinney, 1987; 2005; 2008) introduces an effective approach to the explanation of phenomena linked to the grammatical gender as it takes into consideration multiple factors. Generally, the specific characteristics of the model provide a relatively stable ground for interpreting specific phenomena in second language acquisition (SLA) as it can account for both L1 and L2 language learning factors.

2.2.2 The model of Levelt, Roelofs and Meyer (1999)

The model of Levelt et al. (1999) is considered as one of most influential theories in speech production as measured according to the number of citations. It is also the only model which has been applied to bilingual speech production (De Bot, 1992), allowing its architecture and function to be partially comparable with the present study. It was developed in order to give a comprehensive explanation of speech production as a staged and feed-forward model. The area that the theory covers ranges from lexical selection to the initiation of phonetic encoding. The model was developed on the basis of a computational model using the programme ‘weaver++’ and is also known as the Syntactic Mediation (SM) model (Bordag et al., 2006). Levelt, et al. (1999) differentiated from previous models and theories on the basis of the implemented supportive data commenting that ‘Rather than basing our theory on the evidence from speech errors, spontaneous or induced, we have developed and tested our notions almost exclusively by means of reaction time research’ (p. 2).

This theory is characterised by a process containing three main stratum; the Conceptual Stratum, the Lemma Stratum and the Form Stratum. Each stratum consists of different stages that function independently, in parallel or in collaboration. Each stage is responsible for the production of specific representations. The stages and the relevant outcomes are lexical concepts, lemmas, morphemes, phonological words and phonetic gestural scores. The lexical processing is considered to be the spreading of activation between links interconnecting the nodes of the different stratum (Schriefers & Jescheniak, 1999). An outline of this theory and description of the stratum and the stages are presented in Figures 1 and 2 below.

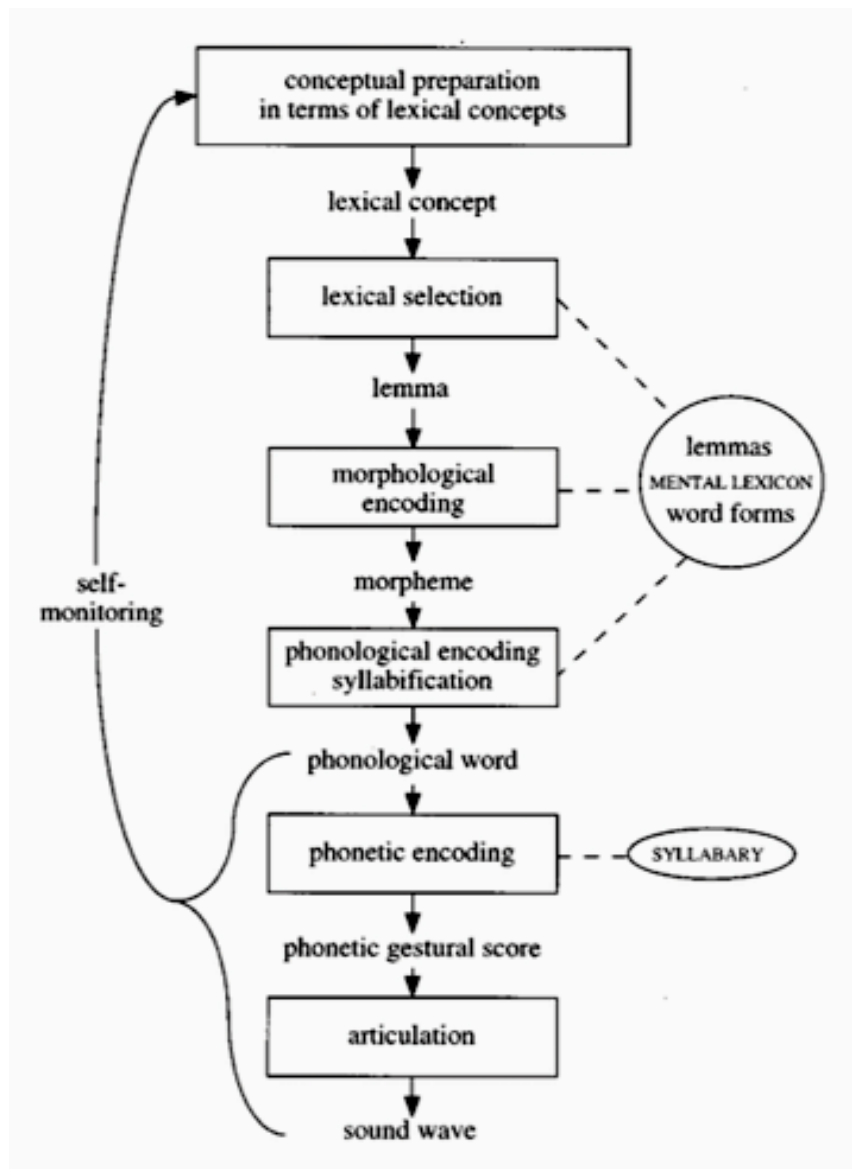


Figure 1: The Levelt theory in outline. The stages are: conceptual preparation, lexical selection, morphological and phonological encoding, phonetic encoding and articulation.

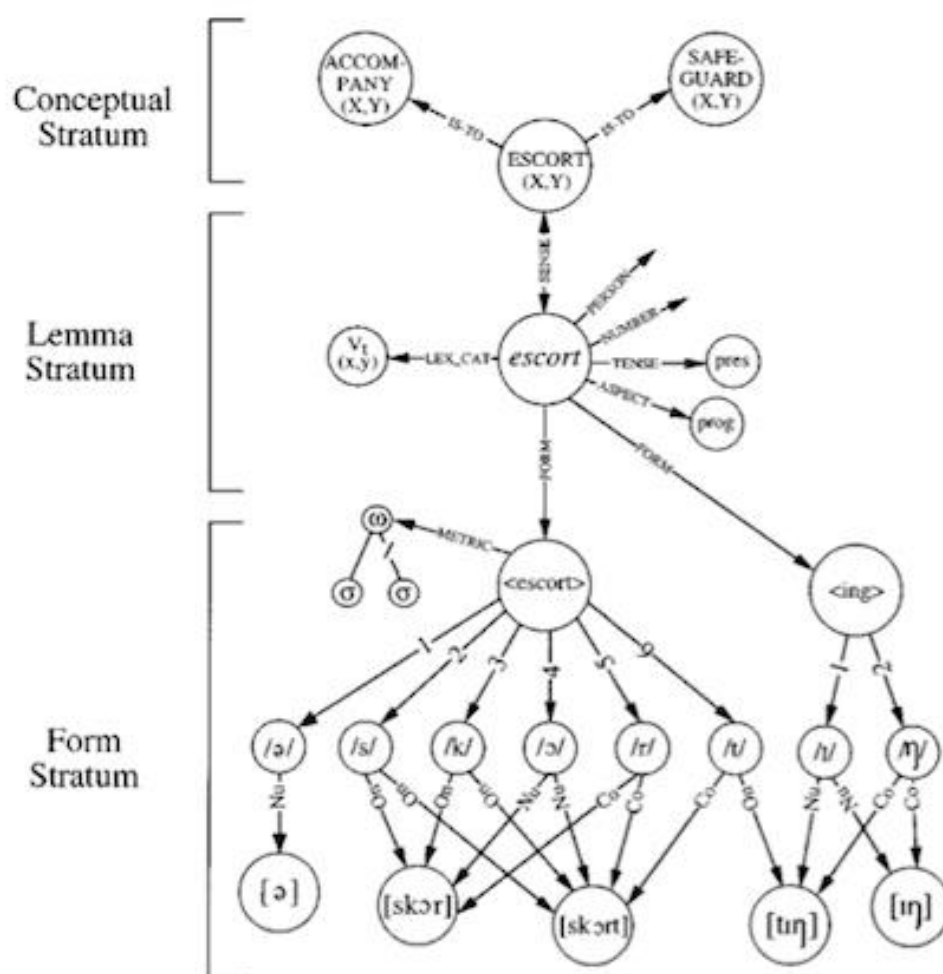


Figure 2: The Levelt theory operation. The feed-forward activation spreading network has three strata.

At the conceptual stratum, information processing could lead to the production of a lexical concept. Language production involves the activation of a lexical concept that is based on the admission that every produced word has to be meaningful. Therefore, it has to be decided what semantic characteristics of the target stimulus/word have to be activated (Schriefers & Jescheniak, 1999); for example, a bus is a vehicle/a media of transport etc. Furthermore, the pragmatic characteristics have to be taken into consideration and activated as well. The output of the conceptual stratum is used as the input for the next level the lemma stratum.

The next stratum, lemma stratum, refers to the lexical access. At this stage the main function is the selection and the activation of the so called lemmas from the mental lexicon. Based on the operation of the conceptual stratum, the highest activated lemma will be selected. Apart from the semantic and pragmatic representation the theory allows the selection of the appropriate lemma on purely syntactic properties. For

example, when processing the word ‘reading’ the selection of the appropriate lemma on syntactic properties will enable further grammatical encoding. This is crucial because it will enable the speaker to decide which lemma is more appropriate, particularly as the word ‘reading’ could be expressed as ‘reader’ or ‘readable’. This process is essential for any tensed expression. Slobin (1987) usefully called this ‘thinking for speaking’.

Therefore, at this stratum, also called syntactic stratum, each lemma node is connected to specific nodes that map the syntactic properties of the target lemma/word. The syntactic properties might be the syntactic, number, case and/or a grammatical category. With regard to the present study this is the stratum where the grammatical gender category of the lemma is located. According to the theory all the nouns of the same grammatical gender are linked to the same gender node. Additionally, the gender node of the target item is linked to all agreement targets of the same gender (e.g., pronouns, definite determiners, etc.) (Levelt et al., 1999; Schriefers & Jescheniak, 1999). The properties of the lemma node are fixed properties of the corresponding lemma and they are lexically specified. Once the syntactic properties of the word have been activated the process of this stratum proceeds to the retrieval of the item’s phonological form from the mental lexicon. This process is classified under the next stratum the form stratum.

The phonological form of the word is called the lexeme node. Levelt et al. (1999, p. 4) describe this step as the progress ‘from the conceptual/syntactic domain to the phonological/articulatory domain’ as one of the main assumptions of the model is seriality and discreteness. However, this assumption does not necessarily indicate that all the lexical–syntactic properties of the lemma are selected every time the corresponding lemma is selected. For example, Levelt and his colleagues note that ‘the gender of a selected lemma only becomes selected when actually needed in the local syntactic environment of the noun’ (Schriefers & Jescheniak, 1999, p. 578). According to this theory, accessing the word form corresponds to the activation of three types of information, the item’s morphological information, its metrical shape and its segmental information.

Therefore, the form stratum includes the morphophonological encoding, the syllabification, the phonetic encoding and finally the articulation. For example, for the lemma ‘καρέκλα’ (chair) the morphemes ‘καρέκλ + α’ have to be encoded. Then the metrical and segmental information of these morphemes has to be integrated. After this the phonological item’s gestural property is computed. Specifically, as Levelt et al. (1999, p. 5) explain this process is performed ‘at different articulatory tiers, a glottal

tier, a nasal tier, and an oral tier'. Finally, the phonological item's gestural property is executed by the articulatory system. Phonological forms (e.g., word endings) have no impact on the selection of grammatical information (e.g., grammatical gender).

However, this approach does not exclude the activation of the grammatical gender (Bordag, 2004). This path order is essential as the grammatical properties of the word should be available before the pronunciation of the word (Bordag et al., 2006). This notion is also supported by other research findings. Badecker, Miozzo and Zanuttini (1995) report that anomic patients are unable to name pictures but are capable of indicating the target word's grammatical gender.

2.2.3 The model of Caramazza

A prominent approach to the architecture and retrieval processes of grammatical gender has been proposed by Caramazza (Navarrete, Mahon & Caramazza, 2010; Caramazza, 1997; Caramazza & Costa, 2000; Caramazza et al., 2001) — the so-called independent network model (IN model). The main difference with the model of Levelt et al. (1999) is the assumption of a certain ordering of stages and more specifically, the feed forward of information from the conceptual representation to the lemma then to the word form (phonological representations) and, finally, to the phonetic gestural.

In relation to the architectural layout of the model proposed by Caramazza (1997) there are no major significant differences to the model of Levelt et al. (1999). However, the retrieval processes and the ordering of stages are essentially different in relation to the function of the lemma and the word form stage. In particular, the conceptual representations directly activate the word form representations and lemma, that is, the lexical syntactic properties in parallel. The model was based on an analysis of information (grammatical and phonological) in so-called tip-of-the tongue states. The model is presented in Figure 3. The model indicates three different networks; the semantic, the syntactic and the word form (phonological). The main difference to the model proposed by Levelt et al. (1999) exists in terms of the direct linking of the semantic representation and the word form. This is achieved without the mediation assistance of the lemma node. The semantic representation primes the syntactic features. However, the conceptual stage is not totally sufficient to allow the selection of syntactic representation. This occurs in parallel with the activation of word's lexeme node selection. The link from the semantic network to the syntactic network is relatively weak but is not excluded as a possible activation ordering. In addition, the activation is a feed forward process only, albeit cascading. In other words, the lexeme nodes

activation is connected directly to their syntactic and phonological content. Therefore, the activation of the syntactic and phonological representations could be performed independently and in parallel.

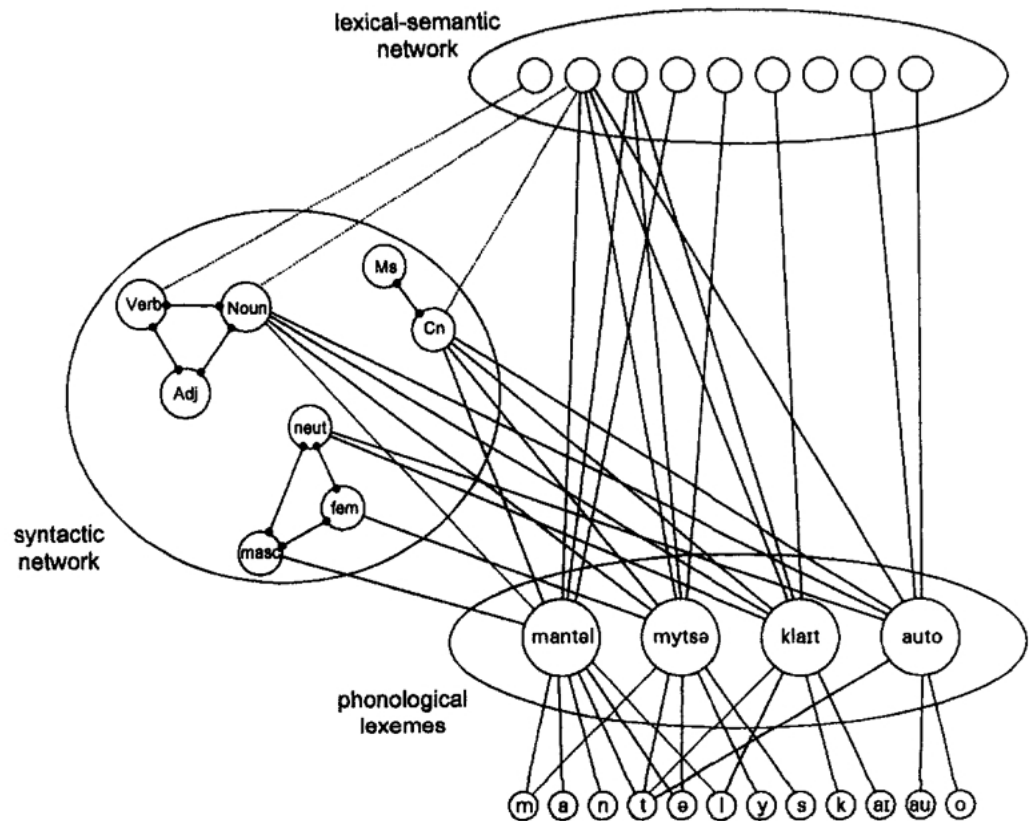


Figure 3: The Caramazza model structure and operation.

2.2.4 Competition Model

The model proposed by MacWhinney (2005 and 2008) is highly relevant to L2 processing, production and to the findings of the present study. It is known as the Unified Competition Model and is based on a previous model (Bates & MacWhinney, 1987). Although the model was developed in order to deal with data from L1 adults and children, the development of the model means it can deal with data from bilinguals as well as L2 learners. It is thus a unified model of linguistic and cognitive systems shared in L1 and L2. The general structure of the model is presented in Figure 4.

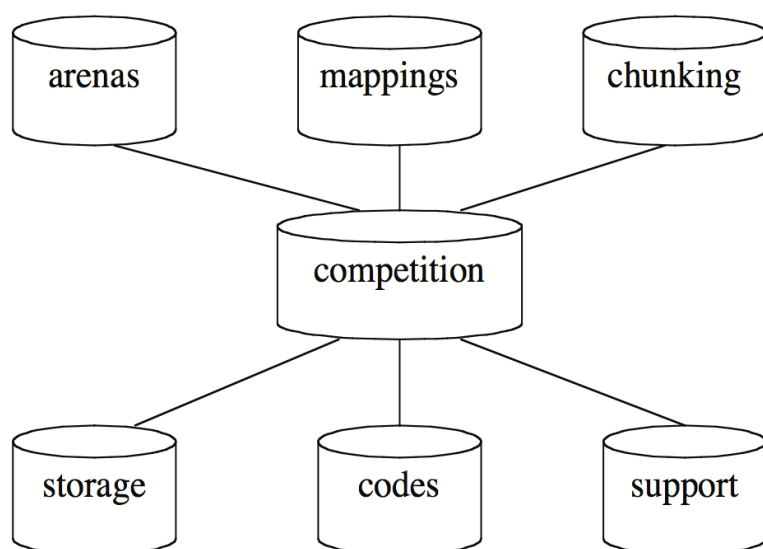


Figure 4: MacWhinney's Unified Competition Model.

The model is based on the idea of a system which activates cues according to their reliability and strength. The key concept, competition, is viewed as a reasoning procedure as well as cue summation (MacWhinney, 2005). Competition occurs within each of the six sections of the model: arenas; cues and mapping; chunking; storage; codes; and resonance. One core section is that of the arenas. The arenas include phonology, lexicon, morpho-syntax and conceptualisation, which are the same as other models of language production, as well as another four arenas (auditory processing, lexical activation, grammatical role decoding, interpretation). The arenas are competitive between themselves. The next section refers to cues and mapping. It is an interaction between forms and functions. Forms compete to reveal the underlying intention. This competition relies on cues from surface forms. Chunking is a combinatorial process of combining syllables, words, and sentences in order to express the mapping stage while mappings are based on storage in short- and long-term memory. New knowledge has to be incorporated into meaningful lexical items. The storage process has the role of validation strengthening each cue. Codes refer to the code selection and activation, that is, the selection of L1 or L2. This could be obtained on the basis of full transfer theory or code selection, switching and mixing. Finally, the most significant part of the model is the resonance or cue support. Learning is achieved with interaction between each of the aforementioned sections during the resonance. The key concept of the model is based on the idea of a strategic plan achieved mainly on resonance.

Further to the general structure of the model, there are five core concepts that determine its function; two-level mapping, cue strength and competition, cue validity, systematic interactions between cues, and processing limitations. The two-level mapping relies on the functionalist claim that language forms aim to communicate. There are two levels of units; the functional level and the formal level. The functional level reflects the meanings and intentions while the formal level represents all the surface forms of the language. In the model, three types of mapping are involved; form-function mappings, form-form mappings and function-function mappings. The first type of mappings refers to the correlations between forms and functions. For example the parser considers configurations of semantics (animacy), morphological cues (agreement) or word order. The form-form mappings enable the learner to understand that certain forms operate the same way in different situations. Finally, the last type of mappings claims, for example, that there is a correlation between an actor and the possibility of being a perpetrator, a supporter of the activity or a causer.

According to the concept of cue strength and competition, forms and functions compete with each other. For example, the cue strength of the preverbal position of the actor is very high resulting in the English speaker trusting word order more than the Italian speaker. This concept is strongly linked to the next concept, cue validity.

The most significant concept of the theory, in relation to L2 learning and the present study, is the concept of cue validity. This concept is a measurable property of the linguistic environment. Cue validity is divided into two components; ‘cue availability (i.e., how often is this piece of information offered during a decision making process?), and cue reliability (i.e., how often does the cue lead to a correct conclusion when it is used?)’ (MacWhinney, 1987 p. 321). Availability is ratio of the conditions where the referent cue is available over the general number of related conditions. For example, the preverbal position of the subject is important in English but not in Greek. This component of cue validity cannot be transferred totally in Greek when L1 is English, as this results in a greater proportion of linguistic mistakes. Cue reliability refers to a similar ratio but is in fact linked to a correct conclusion. Therefore, the preverbal position of the subject in English is highly reliable but not in Greek. In other words, speakers have significantly more chance to attribute the subject correctly based on the position in English while in Greek the chances of accuracy are low.

Cue validity as divided into cue availability and cue reliability can account for the 95% of L2 learning. However, the systematic interactions between cues explain the rest

of the percentage as the construction of the systems in L2 cannot be based solely on attention to cue availability and reliability. The L2 learner, therefore, has to operate on two different systems although this strategy comes at a cost. As a result, the model allows short-cuts in transferring L1 strategies onto L2. At the initial stages of L2 learning this transferability is common but as higher level cues in L2 become more apparent the L1 strategies begin to fossilise. Specific differences related to the structure of languages are thus observed. For example, as English learners of Italian progress, they rely more heavily on animacy in order to attribute subjects dropping the rule in English. In contrary, the use of an animacy strategy is persistent for Italian learners of English. Finally, two types of processing limitations can also be observed; perceivability and assignability are detected even in L1. The clarity of marking is very important in processing. If the marker is not clear its elaboration will be underpinned with rare use.

2.2.5 Processing of grammatical gender in theories and models

Bordag et al., (2006, p. 1090) comment on the aforementioned theories (Levelt et al., 1999; Caramazza, 1997; Navarrete et al., 2010) and propose a common architectural approach in regard to speech production and particularly in relation to grammatical gender processing. However, they differ in their interpretation of the function of interaction between the stratum.

Those models make specific assumptions about the storing, retrieving and processing of grammatical gender. A common assumption is that grammatical gender is a part/subsection of the grammatical properties of the lemma. The activation and the selection of the gender node are thus classified under the function of grammatical encoding (Bordag et al., 2006). Additionally, they claim that grammatical gender is an inherent lexical-syntactic property of the relevant lemma (only the words containing the notion of grammatical gender, syntactically or grammatically). In Greek language grammatical gender is applied on nouns, pronouns, participles, determiners and adjectives. According to the prominent models the words of these categories have one gender class (masculine, feminine, neuter) and they are linked to a single grammatical node (Caramazza et al., 2001; Levelt et al., 1999).

Another central assumption of the models is that grammatical gender is not computed every time this dimension is needed but rather is stored as an inherent lexical-syntactic property. However, there are some approaches supported by relevant studies indicating that the grammatical gender of a noun is computed from its meaning or its

form instead of explicit memorisation (Badecker et al., 1995). In contrast, some studies with anomic patients indicate that this assumption is not possible (Berkum, 1997). Both the models of Levelt and Caramazza support the notion of the spreading activation theory. Under this view, when a node is activated and selected, different semantic or phonological nodes are activated in a relevant extent (Bordag, 2004). The extent of the activation of the others nodes depends on the competition between the nodes.

In relation to grammatical gender processing Levelt et al. (1999) suggest that the gender node is a fixed property of the corresponding lemma. They assume that there is no interaction between the levels of phonological and grammatical encoding. This assumption indicates that grammatical and phonological encoding must be processed in two separate steps (Bordag et al., 2006). According to their hypothesis the selection of the gender node is achieved without the influence of the phonological form of the target noun (Bordag, 2004). In addition, Levelt and his colleagues distinguish between activation and selection of nodes. They clarify that ‘the gender of a selected lemma only becomes selected when actually needed in the local syntactic environment of the noun’ (Schriefers & Jescheniak, 1999, p. 578). For example, in Greek the gender node of a noun is more likely to be selected when speakers have to produce or compute the relevant determiner than when the bare noun has to be processed. In the case of bare noun the lemma will be definitely activated and selected but the gender node might not be selected. According to the theory, all the nouns of the same grammatical gender are linked to the same gender node. Additionally, the gender node of the target item is linked to all agreement targets of the same gender (e.g., pronouns, definite determiners, etc.). Finally, the serial flow of selection and activation from the lemma to the lexeme as well as from lemma to lexical-syntactic properties is unidirectional.

In contrast, in relation to the approach of the model to the activation of gender node, it may be assumed that grammatical gender retrieval can be performed in parallel to phonological retrieval or can be bypassed if there is additional and sufficient information. Here Caramazza may be differentiated from Levelt’s model. He assumes that the gender node is a fixed property of the corresponding lemma. The model allows direct and independent access to the grammatical and phonological dimensions as the lexeme is connected directly to the syntactic and phonological information. In general this model assumes that the gender node is selected as soon as the lexical node is selected. This notion may be summarised in Schriefers and Jescheniak (1999, p. 581) comment that ‘the retrieval of gender information can be bypassed if there is a gender

agreement target, but gender information does not have an explicit reflex in the phonological form of the eventual utterance'. They support this argumentation on the basis of studies done on anomic patients.

As well as the aforementioned models, another model specified for grammatical gender processing has been proposed by Gollan and Frost (2001). It is known as the dual route model and has significant similarities to Caramazza's model (Caramazza et al., 2001). The main assumption states that grammatical gender can be accessed and processed using two independent routes. The first route is based on the morphological marking of a noun's gender and is located at word form level. Gollan and Frost (2001) assume, like Levelt's model, that grammatical gender is an inherent property of nouns. Therefore, grammatical gender cannot be determined on the basis of morphological cues only. A second route has to be incorporated. The gender of the target noun is processed in an abstract form at the lexical level and is the equivalent on Levelt's model gender node. Again, it is assumed that this route operates independently to morphological representations but allows the employment of syntactic information.

The dual route model is also highly compatible to the 'reliable cue hypothesis'. According to this hypothesis, the most reliable gender cues (in Greek language these are determiners and adjectives) sustain a significant role in gender representation and processing (Taft & Meunier, 1998). It is predicted that any difficulty in gender processing arises when the most reliable gender cue is not available. Furthermore, explicitly gender-marked morphology can be elaborated as a mapping cue in determiner retrieval in a post-lexical checking stage (Bates, Devescovi, Pizzamiglio, D'Amico & Hernandez, 1995). In regard to the present study this hypothesis seems to support our findings since in Greek the determiners are considered reliable cues in gender assignment in relation to non-transparent endings. In other words, the available gender cues (noun suffix, determiner, adjective) are correlated and influence gender decision at a post-lexical level. This interpretation as provided by Bates et al. (1995) is known as the 'post-lexical checking hypothesis'.

According to Gollan and Frost (2001), Levelt's model, Caramazza's to some extent, and the 'reliable cue hypothesis' supported by the 'post-lexical checking hypothesis' can all provide an efficient explanation with regard to the processing of grammatical gender in languages such as Italian and Greek. Despite the fact that Levelt's and Caramazza's models assume independent retrieval of syntactic and phonological information. However, in terms of accessing gender these models do not

provide a stable enough ground for explaining all the observed phenomena by themselves alone. The ‘reliable cue hypothesis’ partially solves this problem. The ‘reliable cue hypothesis’ can be used as a possible explanation for the differences between the decomposed (Caramazza model) and the holistic (Levelt model) representations. Levelt’s model predicts that successful retrieval of word’s phonological representation can only occur after the corresponding lemma and its lexical-syntactic properties have been selected. The independent model of Caramazza assumes that a speaker retrieves partial phonological information without necessarily retrieving the word’s lexical-syntactic properties. The ‘reliable cue hypothesis’ introduces an additional significant factor, the importance of gender-marking cues in grammatical gender processing. This approach is compatible with the results of the present study in the context of L2 grammatical gender processing. However, the Competition Model proposed by MacWhinney, (MacWhinney, 2005; 2008; Bates & MacWhinney, 1987) incorporates even more effectively the importance of gender marking cues than the ‘reliable cue hypothesis’.

With regard to the Competition Model proposed by MacWhinney (MacWhinney, 2005; 2008; Bates & MacWhinney, 1987), specific assumptions can be made. According to this model the acquisition of target language characteristics is based on the availability and reliability of the specific characteristics, as well as the existence or absence of competing cues from the L1. Therefore, in terms of the present study, the level of validity cue and its two subcomponents (the availability and reliability of the gender-marked cues, morphology and syntax) will determine the level of cue acquisition. Furthermore, as grammatical gender in English is only based on extralinguistic features, the absence of those characteristics in English has an effect on the related phenomena. This model assumes an important relation between L1 and L2. The typological differences and similarities in terms of grammatical gender between the L1 and L2, and the possibility of cue mapping or transfer of processing strategies between them are quantitative and not qualitative in nature (Sabourin et al., 2006; Jeong, Sugiura, Sassa, Haji, Usui & Taira, 2007).

The minimum presence of grammatical gender features in English results in their deeper acquisition at a higher level of proficiency because their implementation is not as automatic as it is in NS. The L2 learners with English L1 need time to establish a stable notion of the constant presence of gender in nouns. Additionally, stable grammatical gender cues, both morphological and syntactic will result in greater elaboration of those

rules in language production, and thus even higher level of proficiency (Tokowicz & MacWhinney, 2005). In other words, in order to properly assign grammatical gender L2 learners with English L1 need to incorporate more gender marking cues than NS who tend to rely solely on the noun. The more gender-marked cues the easier the gender assignment becomes. It has to be stressed therefore that the importance of the link between gender node and lemma has mainly quantitative characteristics especially in this situation (L1 English L2 Greek). They require not only the lemma of the noun but also all the available gender-marked characteristics in the utterance. They also make use of the morphological information (noun suffix) and the syntactic information (that is, via gender agreement of determiner and/or adjective + noun). In general terms, according to the competition model, L2 learners use all the available information in order to assign gender. Furthermore, they rely on the reliability of those cues. Determiners, for example, provide reliable cues for the grammatical gender of nouns. In relation to the inflectional complexity of Greek nouns, the reliability of the determiners as well as the reliability of the gender agreement between determiners, adjectives and nouns thus provide a stable basis for gender processing.

The theories/models discussed so far lead us the following conclusions. The empirical data indicates that grammatical gender is part of the grammatical property of the lemma and is represented as an abstract lexical-syntactic property. The activation and the selection of the gender node are classified under the function of grammatical encoding (Bordag et al., 2006). Additionally, grammatical gender is an inherent lexical-syntactic property of the relevant lemma although the selection of a noun lemma does not necessarily entail selection of its lexical-syntactic properties such as grammatical gender. This is selected and activated only when it is necessary. Grammatical gender is thus not computed but rather stored. Finally, the local syntactic environment of the noun forces the activation of the gender node and therefore gender selection cannot simply be bypassed (Schriefers & Jescheniak, 1999). This is especially crucial for L2 learners as they need more cues in order to properly assign grammatical gender.

2.3 English grammatical gender

English does not have gender-specified nouns or a rule system controlling gender concord between nouns and other syntactic elements (determiners, adjectives, pronouns) in the extended nominal projection. English marks gender in its pronominal system on the basis of semantic criteria (Corbett, 1991, p. 18).

English is unmarked in lexical nouns, but still marked in pronouns. In general there is no distinction between masculine and feminine in English nouns. However, different forms or different words which are used to refer to people or animals sometimes indicate gender. For example, the words ‘man’, ‘father’, ‘boy’ and ‘uncle’ refer to male human beings and are masculine. The words ‘woman’, ‘mother’, ‘girl’, ‘aunt’ and ‘wife’ refer to female humans and are feminine. Many nouns that refer to people’s roles and occupations can be used for either a masculine or a feminine subject, for example, ‘cousin’, ‘teenager’, ‘teacher’, ‘doctor’, ‘student’, ‘friend’ and ‘colleague’. It is possible to make the distinction for these words by adding the words ‘male’ or ‘female’. While, the words that refer to inanimate objects, such as ‘table’, ‘chair’, ‘book’ and ‘school’, for example, are marked with the neuter gender.

Moreover, while English is unmarked in lexical nouns, determiners and adjectives, it is nevertheless still marked in pronouns. In English the natural, semantic gender is marked by the third-person singular gender-pronouns (‘he’, ‘she’, ‘it’). In particular:

- *he* refers to male or to something to which male characteristics are attributed;
- *she* refers to female or to something to which female characteristics are attributed;
- *it* refers to something inanimate.

English has no grammatical gender and thus operates as an important source of information on how participants without a gender distinction in their L1 process such distinctions in learning a gendered L2. This is the focus of the present study.

2.4 Greek grammatical gender

2.4.1 General notes

The majority of studies which have investigated aspects of grammatical gender have been conducted in languages such as Spanish, German, Italian, Russian and Hebrew. These are all languages with formal gender systems (Corbett, 1991) that rely mainly on a form-based classification. Morphophonological features of nouns in these languages are mapped onto the gender classes in a quite systematic way, with only small subsets of nouns that do not conform to the transparency of form (Corbett & Fraser, 1993; Kempe & Brooks, 2001; Köpcke & Zubin, 1984). In this study we focus on Greek.

Grammatical gender is an important and fundamental aspect of Greek language. All declinable nominal elements (i.e., nouns, determiners, adjectives, pronouns,

numerals, quantifiers) are marked for one of the three grammatical gender values: masculine, feminine, neuter. Moreover, grammatical gender is a significant feature in many functions of Greek language, such as: (a) at a semantic level where we have the division between male, female and inanimate (*ο δάσκαλος* [MSC] ‘male teacher’; *η δασκάλα* [FEM] ‘female teacher’; *το βιβλίο* [NEUT] ‘book’); (b) in morphophonology where the gender of a noun is determined by the inflectional endings (*η καρέκλα* [FEM] ‘chair’); and (c) in syntax through gender agreement (*η* [FEM] *κίτρινη* [FEM] *καρέκλα* [FEM] ‘the yellow chair’)⁴ (Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003).

According to Corbett’s (1991) categorisation, discussed above, Greek belongs to a formal system; the main aspects of gender assignment for Greek nouns are formal rules rather than meaning or syntax. Interestingly, however, in Greek grammatical gender is usually associated with the sex of the entity for nouns representing animates. Most [+human] nouns are masculine if the person is male (e.g., *ο πατέρας* [MSC] ‘father’) and feminine if the person is female (e.g., *η μητέρα* [FEM] ‘mother’) (Τριανταφυλλίδης, 1996; 2002; Holton, Mackridge & Φιλίππáκη-Warburton, 2004). There are also a number of nouns which denote humans although their grammatical gender cannot be determined by relying on semantic criteria (sex/animacy) (e.g., *ο άνθρωπος* ‘human’ is masculine, *το παιδί* ‘child’ is neuter, independent of the natural gender of the person, while *το κορίτσι* ‘girl’ and *το αγόρι* ‘boy’ are also neuter) (Holton et al., 2004). Furthermore, nouns denoting animals, inanimate objects, substances, natural phenomena and abstract concepts can be: masculine (e.g., *ο σκύλος* [MSC] ‘dog’, *ο δρόμος* [MSC] ‘street’, *ο χειμώνας* [MSC] ‘winter’, *ο κίνδυνος* [MSC] ‘danger’); feminine (e.g., *η μέλισσα* [FEM] ‘bee’, *η πόρτα* [FEM] ‘door’, *η βροντή* [FEM] ‘thunder’, *η ειρήνη* [FEM] ‘peace’); or neuter (e.g., *το αρνί* [NEUT] ‘lamb’, *το βιβλίο* [NEUT] ‘book’, *το χιόνι* [NEUT] ‘snow’, *το γλέντι* [NEUT] ‘reception, fun’) (Τριανταφυλλίδης, 2002; Holton et al., 2004). Κλαίρης and Μπαμπινιώτης (1998) suggest that semantic regularities may be useful in gender determination of some nouns. However, they emphasise that ‘grammatical gender as regards semantics is an “empty” category that’s why Greek nouns based on their gender determination are characterized conventional and we can’t predict their gender depending on the meaning’⁵ (Κλαίρης & Μπαμπινιώτης, 1998, p. 61).

⁴ ‘Το τριμερές γραμματικό γένος παραμένει βασικό χαρακτηριστικό του ονόματος, ορατό σε πολλές και σημαντικές λειτουργίες σε μορφοσυντακτικό (συμφωνία, ουσιαστικοποιήσεις), σημασιολογικό-πραγματολογικό (διάκριση φυσικού γένους) και υφολογικό επίπεδο (διάκριση επιπέδων γλώσσας)’. (Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003, pp. 14–15).

⁵ ‘Το γραμματικό γένος, από σημασιολογική άποψη, είναι κενή κατηγορία. Δεν προσθέτει ούτε αφαιρεί τίποτε στη σημασία του ονόματος. Ανεξάρτητα από τα ονόματα στα οποία το γένος δηλώνει το φύλο, τα ονόματα της Νέας Ελληνικής χαρακτηρίζονται ως προς το γένος συμβατικά. Δεν μπορούμε να

Greek grammatical gender ‘does not mean anything; it is just a morphological feature which is useful only for the right choice of forms (for agreement with other grammatical categories and for inflection)’⁶ (Κλαίρης & Μπαμπινιώτης, 1998, p. 53). There are three inflectional classes of masculine and neuter nouns, and two classes of feminine nouns. Masculine nouns mainly end in *-ος*, *-ας* and *-ης* (e.g., *πατέρας* ‘father’), feminine nouns in *-α* and *-η* (e.g., *μητέρα* ‘mother’) and neuter nouns in *-ο*, *-ι*, *-μα*. Although, there is a close correspondence between gender and morphology (declensional suffix), purely morphological criteria are not enough to determine the gender of some Greek nouns.

Because some noun suffixes are common across gender classes, (e.g., *κήπος* [MSC] ‘garden’, *έθνος* [NEUT] ‘nation’), unambiguous gender marking often depends on, for the most part, determiners (definite and indefinite), adjectives and pronouns. Articles, both definite and indefinite, play an important role in the assignment of gender values by speakers (Τριανταφυλλίδης, 1996). Moreover, adjectives, plus a number of pronouns and numerals are the main gender indicators, particularly for ambiguous nouns (Κλαίρης & Μπαμπινιώτης, 1998; Holton et al., 2004). Thus, the ‘Greek grammatical gender system is based on (Τριανταφυλλίδης, 1996) semantic core and very often gender assignment involves a complex interplay of overlapping semantic and formal — morphological and phonological — rules’ (Varlokosta, 2011, p. 323).

Franceschina (2005, p. 72) illustrates very efficiently the interconnections between the concepts of semantic, morphology and syntax in Spanish gender processing. Taking into consideration all the above characteristics and functions of the Greek grammatical gender system, we will now apply it with some changes to Greek gender system (see Table 4).

προβλέψουμε το γένος του ονόματος με βάση τη σημασία του. (Κλαίρης & Μπαμπινιώτης, 1998, p. 61)

⁶ *‘Το γραμματικό γένος στερείται σημασίας, «δεν σημαίνει τίποτα», αποτελεί απλώς μια μορφολογική ένδειξη χρήσιμη μόνο για την επιλογή των κατάλληλων τύπων (συμφωνία με άλλες γραμματικές κατηγορίες και κλίση)’. (Κλαίρης & Μπαμπινιώτης, 1998, p. 53)*

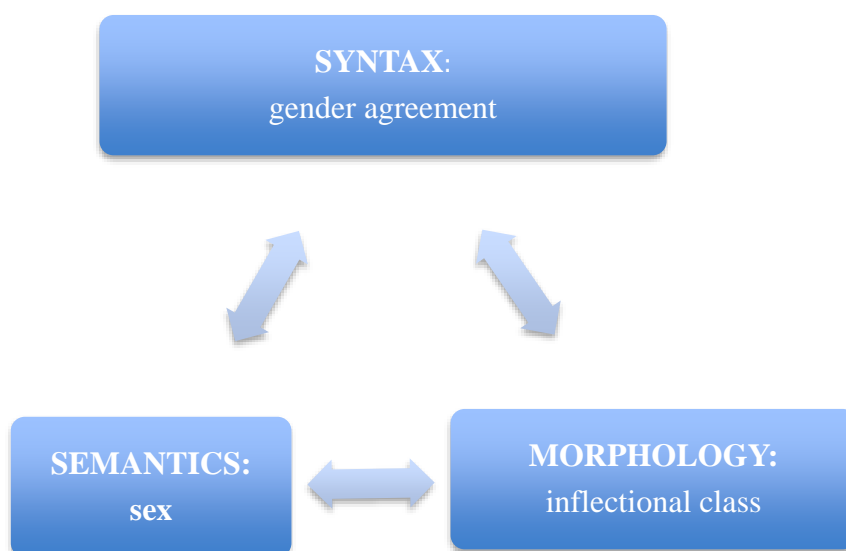


Table 4: The interaction between syntax, semantics, morphology in Greek gender processing.

In this thesis:

- *gender agreement* refers to the feature-based computation of gender across syntactically related constituents (determiners, adjectives, nouns) under a specific gender class/gender feature (masculine, feminine, neuter);
- *inflectional class* (IC) refers to the morphophonological realisations that are the noun endings of each gender class feature (masculine, feminine, neuter); and
- *sex* refers to the natural sex distinctions which are one of the possible semantic bases for gender assignment of nouns when the referent is a human being or sexed animal.

In other words, noun suffixes, gender-marked articles and gender-marked adjectives are the gender-marked information or gender-marked cues in Greek gender processing. It can be seen that the concepts of sex, IC and gender agreement are interrelated in Greek gender and belong to the domains of semantics, morphology and syntax, respectively. As noted above, this thesis investigates the comparative role of morphological and syntactic information in gender processing of L2 Greek. Analyses of the interrelation between the three factors that are involved in the determination of grammatical gender in Greek nouns — semantics, morphophonology and syntax — are therefore discussed in the following section, highlighting the nature of Greek grammatical gender.

2.4.2 Gender assignment of Greek nouns: the role of morphology, semantics and syntax

Gender assignment is the classification of nouns into gender classes in the mental lexicon. In other words, ‘the ability to “work out” the gender of a noun’ (Corbett, 1991, p. 7). Greek language distinguishes three gender classes: masculine, feminine and neuter. As previously mentioned, there is a connection between semantic/natural and grammatical gender in Greek language, although a closer relation seems to exist between gender and morphology or phonology (morphophonology). In this thesis we use the terms morphology or morphophonology to refer to the ending of the nouns or, in other words, to the different IC. As ‘in Greek, gender obeys to an internal necessity for grammatical classification’ (Ralli, 2002, p. 524), Greek grammars present a correspondence between grammatical gender and IC (noun suffix). In terms of classification and description of the nominal declensional system previous scholars have offered the following approaches.

Within the terms of traditional grammar, Greek nouns are divided into three grammatical genders, masculine, feminine, neuter according to a group of declensional endings for each gender value in the nominative case (Joseph & Philippaki-Warbuton, 1987; Τριανταφυλλίδης, 1996; 2002; Holton et al., 2004). A description of the three declensional classes based on grammatical gender is provided in the Table 5. below.

Masculine	Feminine	Neuter
-ας πατέρας (father)	-α θάλασσα (sea)	-ο βιβλίο (book)
-ης κλέφτης (thief)	-η (pl: -ες) κόρη (daughter)	-ι αγόρι (boy)
-ος αδελφός (brother)	-ος είσοδος (entrance)	-ος λάθος (mistake)
-εας κουρέας (barber)	-η (pl: -εις) πόλη (city)	-μα μάθημα (lesson)
-ας (pl: -άδες) μπαμπάς (bad)	-ά (pl: -αδες) μαμά (mum)	-ιμο γράψιμο (writing)
-ης (pl: -ηδες) βαρκάρης (barber)	-ου αλεπού (fox)	
-ες καφές (coffee)	-ω φειδώ (parsimony)	
-ούς παππούς (grandfather)		

Table 5: Gender noun classes in Greek language (Holton et al., 2004, p. 43).

Alternatively, the degree of syncretism is also used as criterion for noun categorisation into gender classes. Greek nouns are divided into two ICs; nouns that employ a two-

way morphological form distinction in the inflectional paradigm, namely between nominative and genitive case (IC1, which contains nouns of the three grammatical values) and nouns which employ a three-way morphological form distinction — nominative, genitive, accusative — (IC2, which contains only masculine and feminine nouns) (Κλαίρης & Μπαμπινιώτης, 1998). See Table 6 below.

NOUNS							
Δικατάληκτα ('two-way morphological form distinction')						Τρικατάληκτα ('three-way morphological form distinction')	
Ισοσύλλαβα ('same number of syllables between cases')			Ανισοσύλλαβα ('different number of syllables between cases')			Ισοσύλλαβα ('same number of syllables between cases')	
MSC.	FEM.	NEUT.	MSC.	FEM.	NEUT.	MSC.	FEM.
ταμίας (cashier)	βρύση (faucet)	ποσό (amount)	παππούς (grandfather)	μαμά (mum)	σώμα (body)	φίλος (male friend)	είσοδος (entrance)

Table 6: Gender classes according to Κλαίρης & Μπαμπινιώτης (1998, p. 17).

Αναστασιάδη-Συμεωνίδη and Χειλά-Μαρκοπούλου (2003, p. 21) argue that, although Greek grammatical gender has been analysed in a great number of Greek grammars and according to different criteria (see above), these descriptions are simple and mainly theoretical. Scholars of Greek linguistics have therefore recently made attempts to form rules regarding gender determination in Greek language based on: the combined role of semantics and morphology (Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003); the role of stems and syntax (Ralli, 2002; 2003); the role of syntax (Alexiadou, 2004); and the role of frequency (Χριστοφίδου, 2003; Αναστασιάδη-Συμεωνίδη, 2012).

Αναστασιάδη-Συμεωνίδη and Χειλά-Μαρκοπούλου (2003) suggest that the process of gender determination is very systematic and relies on prototypicality⁷ and default rules. They introduce the notion of prototypicality by making a distinction between prototypical and non-prototypical nouns. There are central, intermediate and peripheral prototypical groups of Greek nouns. Two are the main and valid characteristics which define the notion of prototypicality: 1) semantic criteria, which concern the distinction between animacy and sex and the meaning of action, property etc. and 2) morphological criteria, which concern the presence of suffixes that represent the ICs (Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003, p. 22). Αναστασιάδη-

⁷ Αναστασιάδη-Συμεωνίδη and Χειλά-Μαρκοπούλου (2003) emphasise the big difference between IC — in terms of Ralli — and prototypical classes by saying that ‘the prototypical inflectional classes are pure regarding gender, semantic and inflectional class’ (p. 23).

Συμεωνίδη and Χειλά-Μαρκοπούλου (2003) highlight the usefulness of prototypicality by pointing out that children and L2 learners acquire first prototypical nouns and the fact that all borrowed or invented nouns are marked in one of the three gender classes.

According to semantic criteria, prototypically masculine nouns indicate a male referent and according to morphological criteria end in *-ς* (e.g., *ο άντρας* ‘man’, *ο ταχυδρόμος* ‘postman’). Non-prototypically masculine nouns are [+animate] masculine nouns that are indeclinable (e.g., *ο κομάντο* ‘the commando’) and [–animate] masculine nouns which end in *-ς* (e.g., *ο άνεμος* ‘wind’) or are indeclinable (e.g., *ο κομπιούτερ* ‘the computer’). Prototypically feminine nouns indicate a female referent and end in *-α*, *-η*, *-ου* (e.g., *η γυναίκα* ‘woman’, *η αδελφή* ‘sister’, *η μαιμού* ‘monkey’). In addition to this, prototypically feminine nouns are also [–animate] abstract nouns which mean an action, a property or collectivity (e.g., *η ενέργεια* ‘action’, *η ευγένεια* ‘politeness’, *η αμμονδιά* ‘sand’). Non-prototypically feminine nouns are: (a) [+animate] nouns which denote a male referent (e.g., *η φρουρά* ‘guard’); (b) [+animate] nouns that end in *-ς* and usually denote a profession (e.g., *η δικηγόρος* ‘solicitor’, *η ταμίας* ‘cashier’); (c) [+animate] indeclinable feminine nouns (e.g., *η σοπράνο* ‘soprano’); (d) [–animate] indeclinable feminine nouns (e.g., *η κουάφ*); and (e) [–animate] declinable nouns ending in *-ς* (e.g., *η άνοδος* ‘increase’, *η άμμος* ‘sand’). According to semantic criteria all the [–animate] nouns are prototypically neuter. According to the morphology, prototypically neuter nouns are the ones which end in *-ο*, *-ι*, *-α*. Also, all the indeclinable nouns are neuter (e.g., *το σίδερο* ‘iron’, *το γράμμα* ‘letter’, *το τραγούδι* ‘song’). Additionally, there is a subcategory of [+animate] neuter nouns with semantic criteria such as those which have derogatory meaning. Non-prototypically neuter nouns are: (a) [–animate] nouns which end in *-ν* (e.g., *το φωνήεν* ‘vowel’) or *-ς* (e.g., *το έθνος* ‘nation’); (b) [+animate] non-diminutive nouns ending in *-ο* and *-ι* that denote animals (e.g., *το πρόβατο* ‘sheep’); and (c) [+animate] indeclinable nouns (e.g., *το γκαρσόν* ‘waiter’). To summarise, in the main core of Greek grammatical gender, the suffix-final *-ς* is considered as a marker of masculine gender, while the suffixes *-α* and *-η* are prototypically feminine and *-ο*, *-ι*, and *-α* are found on neuter nouns, as Table 7. shows.

	Prototypical		Non-prototypical	
	+animate	–animate	+animate	–animate
Masculine	–ς		–ς	
	ο πατέρας ‘father’	—	—	ο χειμώνας ‘winter’
Feminine	–α –η –ου		–ς	
	η μαμά ‘mum’	η επιθυμία ‘desire’	η υπουργός ‘action’	η οδός ‘street’
	η κόρη ‘daughter’	η πράξη ‘action’		
	η αλεπού ‘fox’			
Neuter	–ο –ι –α		–ο –ι	–ς
	το βασιλόπουλο ‘prince’	το βουνό ‘mountain’	το πρόβατο ‘sheep’	το δάσος ‘forest’
	το αγόρι ‘boy’	το τραπέζι ‘table’	το γουρούνι ‘pig’	
	το γατί ‘kitten’	το κύμα ‘wave’		

Table 7: Gender assignment according to Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου (2003, p. 33).

Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου emphasise that the Greek declensional system is systematic and that grammatical gender is mostly determined by the declensional suffix and the declensional class (2003, p. 42). Moreover, they note that the Greek grammatical gender system actually already has ‘default rules’. These are rules which ‘have general application and they apply when special rules are not put into effect’⁸ (Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003, p. 42).

Semantics and morphology can thus be interpreted jointly as the main markers of grammatical gender. This is in contrast to Ralli’s (2002; 2003) assumption that when semantic information and morphology are in conflict, semantic criteria are more important and powerful. Thus, for [+ human] nouns the natural gender of the referent is considered as the main marker of the grammatical gender while for [– human] nouns, morphology is the main marker of grammatical gender. This means that the suffix combined with the IC and the meaning predicts the gender of the noun. The stem of a

⁸ ‘Το σύστημα του γένους της ΝΕ διαθέτει «ερήμην κανόνες» (default rules), δηλαδή κανόνες που έχουν γενική εφαρμογή και ισχύουν όταν δεν τίθενται σε ισχύ ειδικοί κανόνες ... αποδίδουν το γένος με ένα τρόπο ομαλό και προβλεπτό γι’ αυτό και η πλειονότητα των ουσιαστικών ακολουθεί αυτούς τους κανόνες’. (Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003, p. 42)

noun is not a formal indicator of noun's grammatical gender. Here we can again see how semantic criteria [\pm animate], [\pm adult], [\pm action], [\pm property], [\pm collectivity] and derivational suffixes are all involved in the process of gender determination.

Within the terms of generic grammar, Ralli (2002; 2003) — following the feature-based approach — is the first to suggest that Greek gender is an inherent property of some Greek noun stems, in contrast to Αναστασιάδη-Συμεωνίδη and Χειλά-Μαρκοπούλου (2003). She stresses that gender is a lexical feature as it describes lexical items, that is, nominal words, which are inflected or not, derived or not and for nouns independent of any structural dependencies. According to Ralli (2002; 2003) the role of semantics (animacy, sex) in determining the different gender values is important since male humans are generally masculine and female humans are feminine (masculine nouns end in $-ος$, $-ας$ and $-ης$, and feminine nouns in $-α$ and $-η$). However, in non-humans specific gender values are unpredictable. Ralli (2002; 2003) also points out that simple phonological rules based on a particular form of the nominative singular as a determining factor to a specific gender value may apply to some cases, but cannot be applied in cases of ambiguity. Thus, phonology cannot be a reliable aspect for gender determination of Greek nouns. For instance, in nominative singular the nominal ending in $-ος$ can characterise nouns of three gender values (e.g., *ο δάσκαλος* [MSC] ‘male teacher’, *η πρόοδος* [FEM] ‘progress’, *το μέρος* [NEUT] ‘place’), while there are both feminine and neuter nouns ending in $-α$ (e.g., *η μητέρα* [FEM] ‘mother’, *το μάθημα* [NEUT] ‘lesson’) or $-η$ (e.g., *η ψυχή* [FEM] ‘soul’, *το ψωμί* [NEUT] ‘bread’).

According to Ralli (2002; 2003) the ICs in the Greek gender system, the processes of derivation⁹ and compounding of Greek nouns as well as the high degree of familiarity of some Greek nouns indicate that morphology is a determining factor of grammatical gender in Greek. Ralli (1994) distinguishes eight ICs of Greek nouns while trying to reveal some systematic correspondence — except IC1 — between gender and inflection class as shown in Table 8 (Ralli, 2002). Thus, the nouns of IC2 are masculine, while the nouns of IC3 and IC4 are feminine and the nouns of IC5, IC6, IC7 and IC8 are neuter.

⁹ ‘Derivational affixes are gender indicators for derived nouns. For example, deverbal nouns in $-της$ (e.g., *ο κλέφτης* ‘thief’) and $-μος$ (e.g., *ο χαλαζμός*) are masculine, deverbal nouns in $-ια$ (e.g., *η παιδεία* ‘education’) are feminine, denominal nouns in $-ισα$ (e.g., *η γειτόνισσα* ‘female neighbor’) are feminine, and nouns in $-μα$ (e.g., *το φόρεμα* ‘dress’) and $-άκι$ (e.g., *το ανθρώπακι* ‘human being’) are neuter. Also, gender marker is inherited through headedness and percolation, which are responsible for assigning gender to compound words (e.g., *ο νυχοκόπτης* ‘nail clippers’). Finally, in words of high degree of familiarity gender assignment depends on morphological criteria (e.g., *ο αδελφός* ‘brother’, *η αδελφή* ‘sister’).’ (Ralli, 2002, pp. 529–530)

IC1	IC2	IC3	IC4
–ος	–ς	⊗	⊗
MSC/FEM	MSC	FEM	FEM
ο κήπος ‘garden’	–ας: ο πατέρας ‘father’	–α: η πόρτα ‘door’	–η [pl. –is]: η λέξη ‘word’
η πρόοδος ‘progress’	–ης: ο μαθητής ‘student’	–α [pl. –es]: η αγάπη ‘love’	
	–ης: ο καφές ‘coffee’	–ου: η αλεπού ‘fox’	
	–ους: ο παππούς ‘grandpa’		
IC5	IC6	IC7	IC8
–ο	–ι	–ος	–μα
NEUT	NEUT	NEUT	NEUT
το βουνό ‘mountain’	το χαρτί ‘paper’	το πάθος ‘passion’	το κύμα ‘wave’

Table 8: Inflectional classes according to Ralli (1994).

Nevertheless, morphology cannot be the main criterion for gender determination for nouns of IC1, which are either masculine (e.g., ο δάσκαλος [MSC] ‘male teacher’) or feminine (e.g., η κάθοδος [FEM] ‘descent’). IC1 also contains nouns that denote a profession which cannot be determined by morphological basis (e.g., ο/η γιατρός [MSC/FEM] ‘doctor’). Furthermore, some nouns of the same grammatical gender belong to different inflectional categories (e.g., το νερό [NEUT] ‘water’ belongs to IC5, το χιόνι [NEUT] ‘snow’ belongs to IC6, το έδαφος [NEUT] ‘ground’ belongs to IC7, το βήμα [NEUT] ‘step’ belongs to IC8). In addition, some inflectional endings appear in more than one IC (e.g., the suffix –ος represents two different inflectional paradigms, IC1 and IC7, as shown in Table 8.).

Ralli (2002, p. 520), taking into account such ambiguities and following the principles of the featured-based theory proposes that ‘gender is an inherent property of stems, that is a feature that belongs to feature bundles characterizing nouns stems listed in the mental lexicon’. In other words, the gender determination of Greek nouns does not depend on semantic (sex) or morphological (inflectional suffix) information, but is instead stored in the mental lexicon along with the noun stem. This means that the stems of some nouns represent an intrinsic fully specified gender feature, since the same inflectional morpheme may be added to stems of different gender values (e.g., ο δάσκαλος [MSC] ‘male teacher’, η κάθοδος [FEM] ‘descent’) or could appear in more than one inflectional paradigm (e.g., ο δάσκαλος [MSC] ‘teacher’ belongs to IC1 while το μέρος [NEUT] ‘place’ belongs to IC7). She continues by noting that there are nouns whose

stem contains an optional underspecified gender feature which can be specified by another co-occurring feature related to semantic information (e.g., *ο δάσκαλος* [MSC] ‘male teacher’, *η δασκάλα* [FEM] ‘female teacher’) or to morphological information (IC) (e.g., IC2: *ο αγώνας* [MSC] ‘battle, effort’, IC3: *η ελπίδα* [FEM] ‘hope’, IC4: *η λέξη* [FEM] ‘word’, IC5: *το νερό* [NEUT] ‘water’, IC6: *το χιόνι* [NEUT] ‘snow’, IC7: *το έδαφος* [NEUT] ‘ground’, IC8: *το βήμα* [NEUT] ‘step’). If there is a conflict between semantic and morphological information, ‘the second takes the precedence over the first’ (Ralli, 2002, p. 539).

Ralli (2002; 2003) also suggests that Greek nouns denoting a human profession that have the same morphological form for two different gender values (masculine and feminine) are cases of persisting underspecification, which cannot be resolved through the co-occurrence but rather at the phrasal level, that is through agreement with an item marked for a specific gender value (e.g., determiner — *ο/η γιατρός* [MSC/FEM] ‘doctor’). She is the only one who points out the role of syntax in the process of gender determination.¹⁰ Specifically, she emphasises that ‘gender is syntactically relevant since it participates in the agreement process between nouns, adjectives and determiners’ (Ralli, 2002, p. 525).

Alexiadou (2004), following Ralli, states that gender and IC are independent. She suggests that some Greek human nouns carry an inherent gender specification in the lexicon while others are ‘non-fixed gender nouns which are necessarily [+ human/ + animate]’ (p. 41). Nouns are marked to gender via agreement, that is, through the elements of the determiner phase (DP) such as determiners. She does not examine at all the role of morphology in the process of gender assignment, even though she does notes that certain nouns have a feminine form. (Χειλά-Μαρκοπούλου, 2003)

In contrast, Χριστοφίδου (2003) introduces the notion of productivity to categorise Greek noun suffixes. Inflectional productivity has to do with the frequency of use of a particular suffix with one gender value in gender assignment to loans (Χριστοφίδου, 2003, p. 105). She argues that there is a close correspondence between grammatical gender and inflection in Greek language. Thus, the most productive suffixes (representing whole inflectional paradigm) are for masculine nouns the suffix *-ας* (followed by *-ος*), for feminine nouns the suffix *-α* (followed by *-η*) and for neuter nouns the suffix *-ι* (followed by *-ο*). However, after examining the process of gender

¹⁰ Apart from Ralli (2002; 2003) the Greek linguistic scholars Alexiadou & Stavrou (2000) and Anagnostopoulou (2003) suggest that Greek grammatical gender is involved in syntactic procedures.

assignment of loans, she concludes that grammatical gender in Greek is determined first from semantic criteria, then phonology and finally morphology (p. 125). She, further states that feminine nouns ending in *-ος* are connected with masculine gender (Χριστοφίδου, 2003, p. 108).

Αναστασιάδη-Συμεωνίδη (2012) argues that all the existing classifications of Greek nouns do not take into consideration the number of nouns which each IC contains, in other words their frequency (p. 28). She suggests six ICs based on the theory of Paradigm Function Morphology (Stump, 2001); each of which has nouns of the same gender value. Specifically, IC1 includes masculine nouns ending in *-ας, -ης, -ους, -ες*, IC2 includes feminine nouns ending in *-α, -η, -οι*, IC3 includes masculine nouns ending in *-ος*, IC4 includes neuter nouns ending in *-ο, -ι*, IC5 includes neuter nouns ending in *-μα, -ας, -ι*, and IC6 includes neuter nouns ending in *-ος*. In accordance with Χριστοφίδου (2003) Αναστασιάδη-Συμεωνίδη notes that the most productive ICs are IC1 for masculine nouns, IC2 for feminine nouns and IC4 for neuter nouns. She also proposes that nouns in *-ος* represent a category which is no longer useful and incorporates the nouns ending in *-ας* of IC1 (Αναστασιάδη-Συμεωνίδη, 2012, p. 34).

The following section moves on to discuss how gender agreement is realised in the Greek language.

2.4.3 Gender agreement in Greek

As stated in section 2.1.2, gender agreement is a very important aspect of grammatical gender; ‘it is the way in which gender is realised in language use and provides the basis for defining gender and for establishing the number of genders in a given language’ (Corbett, 1991, p. 105). Mastropavlou and Tsimpli (2011) also state that syntactic agreement is responsible for the realisation of the grammatical gender of all nominal elements within or beyond the phrasal level (involving pronominal elements or adjectival predicates). In Greek language therefore, the important role of gender agreement at the syntactic level is related to the realisation of the grammatical gender of all nominal elements within the phrasal level (nouns, articles, adjectives) and also beyond sentence boundaries — involving pronominal elements or adjectival predicates (Κλαίρης & Μπαμπινιώτης, 1998; Ralli, 2002; 2003; Χειλά-Μαρκοπούλου, 2003). Articles, definite and indefinite, play an important role in the assignment of gender values by speakers (Τριανταφυλλίδης, 1996). As has been previously suggested that Greek adjectives, a number of pronouns and numerals are the main gender indicators,

particularly for ambiguous nouns (Κλαίρης & Μπαμπινιώτης, 1998; Ralli, 2002; 2003; Holton et al., 2004).

In Greek, gender agreement can be established in the borders of the DP between an article and/or an adjective and a noun (internal agreement) (Lehmann, 1988). Articles and adjectives appear within the DP before the noun as in (1a) and (1b) below. Agreement can also be established across the borders of the DP, between a noun and a predicate adjective (external agreement) (Lehmann, 1988). Predicate adjectives appear outside the DP and are connected with the noun through a copular verb as in (1c) below. It must be emphasised here that in external agreement cases the article of the noun can be omitted when the predicate is a noun, see (1d) below.

(1a) *ο* [MSC] *αναπτήρας* [MSC] ‘the expensive lighter’

(1b) *ο* [MSC] *ακριβός* [MSC] *αναπτήρας* [MSC] ‘the expensive lighter’

(1c) *ο* [MSC] *αναπτήρας* [MSC] *είναι ακριβός* [MSC] ‘the lighter is expensive’

(1d) *είναι ακριβός* [MSC] *αναπτήρας* [MSC] ‘is expensive lighter’

In the experimental tasks of this study, the participants process syntactic structures similar to (1b) (*ο κόκκινος δανύβος*) or (1d) (*είναι μπέζ δανύβος*). This offers us the opportunity to keep the number of the provided stimuli equal and to control the availability of the provided gender-marked information (noun suffix, gender-marked determiner, gender-marked adjectives). It also means that phrases like (1b) provide morphological information via the inflectional suffix and extensive syntactic information via the agreement between determiner + adjective + noun. In cases like (1b) where the adjective will be indeclinable (see below) the syntactic information is provided only via the agreement between the determiner and the noun. While phrases like (1d) provide only morphological information encoded in the noun suffix as the adjective will be indeclinable (see below). The aforementioned syntactic structures are included in the two experimental tasks investigating the role of morphological and syntactic information in L2 Greek gender processing.

Greek articles (definite and indefinite), adjectives, all categories of pronouns, numerals and quantifiers are marked for the three grammatical gender values masculine, feminine, neuter. Χειλά-Μαρκοπούλου (2003, p. 141) provides a table of agreement morphological markers. She notes that, although, the agreement morphological markers for adjectives are fewer and simpler than those for the IC of nouns, they are similar to the prototypical endings of the three gender values of nouns. Thus, *-ος* is the

prototypical ending for masculine Greek adjectives, *-η* and *-α* the prototypical ending for feminine Greek adjectives and *-ο* the prototypical ending for neuter Greek adjectives. As it was stated earlier, Αναστασιάδη-Συμεωνίδη (2012) argues that *-ος* is an exclusive suffix for adjectives.

Finally, there is a group of Greek adjectives that denote colour which are indeclinable (mainly because they are loan words from other languages) (e.g., *μπεζ* ‘beize’, *μωβ* ‘purple’, *μπλε* ‘blue’). In this thesis we use colour adjectives like these in order to avoid providing morphological information in the adjective. For further analysis and comment on the design of the experimental tasks behind this study see the methodology chapter.

2.5 Summary

Gender is the intrinsic characteristic of a noun (Corbett, 1991; Chomsky, 1995; Τσιμπλή, 2003), while gender agreement in languages such as Greek is a syntactic feature-checking operation handled by the syntax. Thus, grammatical gender can be considered a morphosyntactic feature; the morphological suffix of a noun reveals its gender class and at the same time passes it on to other syntactically related elements (Carroll, 1989).

In terms of production, some psycholinguists suggest that gender is activated only if it is needed in the syntactic environment (Levelt et al., 1999) while others claim that gender is automatically selected as soon as the lexical node is selected (Caramazza, 1997). One consistent conclusion made across both production and comprehension studies is that gender is a syntactic process — ‘the gender of a selected lemma only becomes selected when actually needed in the local syntactic environment of the noun’ (Schriefers & Jescheniak, 1999, p. 578). Mastropavlou and Tsimpli (2011) note that syntactic agreement is responsible for the realisation of the grammatical gender of all nominal elements within or beyond the phrasal level (involving pronominal elements or adjectival predicates). Regarding Greek gender Ralli (2002, p. 525) further states that ‘gender is syntactically relevant since it participates in the agreement process between nouns, adjectives and determiners’.

Taking all of these conclusions into consideration, in the present study the participants were not asked to declare the gender of the nouns. Instead, they were expected to elaborate this parameter in noun processing during the stimulus presentation, especially in cases where the nouns were non-words presented to the

subjects. In this way the participants revealed how they classified the gender of each non-word in English using only the available information by the provided Greek stimulus.

With regard to Greek gender, all declinable nominal elements (i.e., nouns, determiners, adjectives, pronouns, numerals, quantifiers) are marked for one of the three grammatical gender values: masculine, feminine, neuter. Greek gender determination and processing depends on semantics (sex-animacy), morphology (IC) and syntax (gender agreement between determiners–adjectives–nouns etc.). The present study examines the role of morphology and syntax in gender processing by L2 learners of Greek. Semantic information is excluded by using non-words.¹¹ The role of semantics in gender determination of Greek nouns has already been summarised above (see section 2.4.2).

The role of morphology in gender determination is significant in Greek language. For [– human] nouns, which are the focus of the present study, morphology is the main marker of grammatical gender. Most traditional Greek grammars (Joseph & Philippaki-Warbuton, 1987; Τριανταφυλλίδης, 1996; 2002; Holton et al., 2004) present a group of declensional endings for each gender value (masculine, feminine, neuter) suggesting a close correspondence between the inflectional suffixes and the three grammatical gender values. Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου (2003), Χριστοφίδου (2003) and Αναστασιάδη-Συμεωνίδη (2012) also suggest that there is a correspondence between IC and gender by presenting a systematic relation between specific ICs and specific gender values for Greek nouns. Αναστασιάδη-Συμεωνίδη and Χειλά-Μαρκοπούλου (2003) further suggest prototypical groups of gender values combining semantic information (animate–inanimate) and morphological information. According to Ralli (1994; 2002; 2003) morphology is indeed a determining factor of grammatical gender in Greek. She distinguishes eight ICs of Greek nouns while attempting to reveal some systematic correspondence — except IC1 — between gender class (masculine, feminine, neuter) and IC (endings). In much the same way, Αναστασιάδη-Συμεωνίδη (2012) presents six ICs, taking into consideration the number of nouns which each IC contains, that is, their frequency. Χριστοφίδου (2003) further argues that there is a close correspondence between grammatical gender and inflection in Greek language while

¹¹ The terms non-words, novel words and pseudo words refer to invented words which are used in the experimental tasks of this thesis. See Chapter 4 for the construction of non-words described in detail.

highlighting at the same time the role of frequency in much the same way as Αναστασιάδη-Συμεωνίδη (2012).

Concerning the specific inflectional morphemes of each gender class, we can conclude from the above descriptions and the analysis in section 2.4.2 that *-ς* characterises masculine nouns, *-α* and *-η* feminine nouns and *-ο*, *-μα* and *-ι* are common endings for neuter nouns. In terms of greater detail, the inflectional morpheme *-ος* can be said to characterise predominantly masculine nouns due to frequency (Χριστοφίδου, 2003; Αναστασιάδη-Συμεωνίδη, 2012). The suffix *-ος* characterises non-prototypically feminine and neuter Greek nouns (Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου 2003), while the inflectional morpheme *-ι* is a marker of both feminine and neuter nouns. However, we must emphasise here that gender ambiguity is defined differently in written versions due to the distinct orthographic information given to the speakers of Greek language (Mastropavlou & Tsimpli, 2011). Thus, in written versions *-ι* (*-η*) is a pure marker of feminine gender while *-ι* (*-ι*) is a marker of neuter gender. This is one of the reasons that the experimental tasks of this study were provided in written form and not orally. Moreover, there have in the past been different approaches concerning the gender value of the endings *-α* and *-μα*. For the majority of linguistics researchers the suffix *-μα* is usually only associated with neuter nouns^{12, 13} (Ralli, 2002; Varlokosta, 2011). In contrast, Αναστασιάδη-Συμεωνίδη and Χειλά-Μαρκοπούλου (2003), Mastropavlou (2006) and Mastropavlou and Tsimpli (2011)¹⁴ all regard the inflectional suffix *-μα* as ambiguous and between the feminine and neuter genders. Due to these different linguistic opinions regarding the ending *-μα*, Greek novel nouns ending in *-μα* were not included in the experimental tasks related to this thesis. Combining all the above the approaches with the methodology and earlier

¹² As Ralli (2002) points out, Greek nouns ending in *-μα* are neuter derived nouns (e.g., *το φόρεμα* ‘dress’, *το δέμα* ‘parcel’).

¹³ In addition to this, Anastasiadi-Symeonidi (2002) suggests that a small number of feminine nouns ending in *-μα* (18 according to her research, most of which loan words, for example, *η κρέμα* [FEM] ‘cream’, *η φάρμα* [FEM] ‘farm house’) are not derived nouns, that is *-μ-* is part of their stem and *-α* is the feminine suffix just as is the case with other feminine nouns. (cited in Varlokosta 2011, p. 331)

¹⁴ Mastropavlou & Tsimpli (2011), coming from a theoretical point of view, note that *-μα* in neuter nouns is actually not a suffix but rather part of the noun stem. Specifically, neuter nouns ending in *-μα* are considered to carry a zero suffix in the nominative singular form and inflect only in the genitive singular and in the plural: e.g., Nom./Acc. Sing: *δέμα-ø*, Gen. Sing: *δέμα-τος*, Nom./Acc. PL: *δέμα-τα*, Gen. PL: *δεμά-των* (parcel). However, since it is a fact that all neuter nouns in *-α* combine with a stem-final *-μ-*, *-μα* constitutes a phonological ending that can be used by speakers to assign gender to nouns with an underspecified gender value. Yet, *-μα* also occurs in feminine nouns, but much less frequently as the *-μ-* is part of the noun stem and only *-α* is the suffix in these cases (e.g., Nom./Acc. Sing: *λίμ-α*, Gen. Sing: *λίμ-ας*, Nom./Acc. PL: *λίμ-ες*, Gen. PL: *λίμ-ών* (nail trimmer) (Mastropavlou & Tsimpli, 2011, p. 40).

findings of studies on the Greek gender system (to be presented in the following chapter), the Greek gender-marked suffixes which were used in the present study are:

–ας, –ης indicating **masculine gender**

–α, –η indicating **feminine gender**

–ο, –ι indicating **neuter gender**

–ος ambiguous suffix

In terms of this study, ambiguity was only raised when participants had to process novel nouns with the suffix –ος. Different opinions exist regarding the value of suffix –ος. Αναστασιάδη-Συμεωνίδη and Χειλά-Μαρκοπούλου (2003) suggest that feminine nouns ending in –ς belong to the ‘regional’ system of the ‘central’ Greek declensional system. Feminine nouns ending in –ος therefore constitute a ‘close class’, since they include only a small amount of items. In contrast, Ralli (2002) argues that nouns ending in –ος belong to IC1 which includes nouns of both masculine and feminine gender. Indeed, Ralli points out the role of syntax in the determination of gender in nouns while Χριστοφίδου (2003) and Αναστασιάδη-Συμεωνίδη (2012) claim that feminine nouns ending in –ος have discarded any sign of productivity. Χριστοφίδου (2003) also demonstrates that this category of nouns has a tendency to convert into masculine form or to be replaced by participles or derivational suffixes, even though they represent a very frequent category according to Αναστασιάδη-Συμεωνίδη (2012). The most common argument is that the inflectional morpheme –ος characterises predominantly masculine nouns.

Apart from morphology the role of syntax in gender determination is significant in Greek language. Ralli (2002) points out that simple phonological rules cannot be applied to cases of ambiguity. Thus, morphophonology cannot be a reliable aspect for gender determination of Greek nouns ending in –ος in the present study. Also, specific gender values are unpredictable in non-humans, which are the focus of the present study. Having argued that morphology is not always a reliable gender marker, Ralli points out that the stems of some nouns represent an intrinsic fully specified gender feature, since the same inflectional morpheme may be added to stems of different gender values. Additionally, stems contain an optional underspecified gender feature, which can be specified by another co-occurring feature related to semantic or morphological information. However, in the present study the stems of the non-words are not gender specified as such non-words do not contain any relevant semantic

information. Instead, they belong to the cases of persisting underspecification, which cannot be resolved through semantic or morphological information but rather must be dealt with at the phrasal level; through agreement with a cue marked for a specific gender value (e.g., determiner, adjective). Ralli (2002, p. 525) states that ‘gender is syntactically relevant since it participates in the agreement process between nouns, adjectives and determiners’. Alexiadou (2004), following Ralli (2003), underlines the fact that gender and IC are independent.

In the experimental tasks of this study, the participants were asked to process syntactic structures such as (1b) (*ο κόκκινος δανύβος*) or (1d) (*είναι μπέζ δανύβος*) (see 2.4.3). This provided an opportunity to keep the number of the presented stimuli equal and to control the availability of the provided gender-marked information (noun suffix, gender-marked determiner, gender-marked adjectives). Phrases such as (1b) provide morphological information via the inflectional suffix and extensive syntactic information via the agreement between determiner + adjective + noun. In cases like (1d), where the adjective is indeclinable the syntactic information is only provided via the agreement between the determiner + noun. In contrast, in terms of phrases like (1d), they provide only the morphological information encoded in the noun suffix because the adjective is indeclinable. These syntactic structures are included in the two experimental tasks investigating the role of morphological and syntactic information in L2 Greek gender processing.

Overall, the role of syntactic information through the gender-marked determiners and/or adjectives has previously been highlighted by Greek linguistics and grammars only in terms of ambiguity or persisting underspecification cases. Our hypothesis argues that adult L2 learners of Greek will be more accurate and faster in processing the gender of a Greek novel noun not only in cases of ambiguous nouns but also when the provided stimulus is a whole nominal phrase which contains determiner + noun suffix (morphological and syntactic information) or determiner + adjective + noun suffix (morphological and extensive syntactic information).

Our hypothesis is also relevant to the Competition Model (Bates & MacWhinney, 1987; MacWhinney, 2005; 2008) according to which the acquisition of target language characteristics is based on the availability and reliability of the specific characteristics, as well as the existence or absence of competing cues from the L1. Thus, in terms of the present study, which focuses on gender processing, the level of validity cue, availability and reliability of the gender-marked cues, morphology (noun suffix) and syntax (gender

agreement), will all help to determine the level of accuracy and speed processing. Thus, we essentially argue that, according to the Competition Model, L2 learners will be more accurate and faster when gender cues are available in the DP (determiner + noun suffix or determiner + adjective + noun suffix).

The target group of this study is adult learners of Greek with L1 English, which itself has only natural gender. English words that refer to inanimate objects are marked with the neuter gender. Thus, the images which were used in the two experimental tasks, were animate imaginary beings. This manipulation was essential at the second task as the requested answers were in English.

Before we conclude this section we must clarify that the review of studies upon the processing of Greek gender by NS and non-native speakers (NNS) which takes place in the following chapters supports the methodology of the present study.

Chapter 3: Grammatical gender in L1

3.0 Chapter overview

Chapter 3 presents previous studies upon the acquisition and processing of grammatical gender in L1; in other words how gender is processed by both adult and children NS.

The chapter is structured as follows: in section 3.1 we outline the main previous studies of gender processing by children, in section 3.2 we present the findings of studies with participants who are NS of gendered languages, in section 3.3 we review studies in gender processing by children who are NS of Greek, in section 3.4 we present studies of Greek gender processing by adult NS of Greek. Finally, we present summative conclusions of the aforementioned studies.

3.1 Gender processing by children

The studies previously carried out on the acquisition of gender in different languages can be categorised into two theoretical positions. According to the first position gender differentiation is established on the basis of semantic features coming from extralinguistic information (Natural Gender Theory). Children will primarily attribute the gender of words on the basis of information given by semantic features. Therefore, children will first recognise the linguistic distinctions as relevant to non-linguistic gender distinctions (semantic features) (Pinker, 1982; Mulford, 1985; Mills, 1986). The approach of the natural gender theory has its origins in the more general position that language consists of establishing correspondences between forms and meanings (Mulford, 1983; 1985). The alternative theory considers that gender is a phenomenon of the internal laws of language. When establishing the gender of the words, children do not rely on extralinguistic reality (semantics), but on information coming from the linguistic context (syntax and morphology) in which words appear (Karmiloff-Smith, 1979). Children discover grammatical gender as an organising principle by noting regularities in the intralinguistic properties of the linguistic system. They come to recognise, for example, that nouns with particular endings always co-occur with particular articles or pronouns. Such regularities serve as a basis for their developing gender system even before they are able to make natural gender distinctions. This strategy almost dominates the children's gender classifications. This theory has been clearly articulated by Maratsos & Chalkley (1980) and supported by studies across many languages (Levy, 1980, 1983a; Pérez-Pereira, 1991; MacWhinney, 2008).

In the area of gender acquisition two types of studies have previously been carried out: longitudinal or cross sectional and experimental (Pérez-Pereira, 1991). Longitudinal studies consist of observations of children's speech in natural situations. The strengths of those types of studies are the designation of time of acquisition and the analysis of children's errors. The main difficulty related to these researches lies in the aspect of generalisation. Alternatively, experimental studies consist of testing the importance of extralinguistic and intralinguistic cues on children's gender acquisition. The weaknesses of these studies lies in their methodology. Different experimental manipulations can produce different and questionable results. For discussion of the methodological problems in some of these studies see Levy (1988).

A majority of the studies in this area have explored how children use semantic, morphological and syntactic cues to assign nouns to gender classes. Tucker, Lambert & Rigault (1977) demonstrate the capability of French-speaking children to identify the gender of nouns on the basis of their morphological endings. They also prove that children pay attention to the distributional patterns of words. Greek children systematically use the correspondence between noun and article gender from the age of 2;3 (Stephany, 1997). In longitudinal studies it has also been observed that Greek children make the adjective agree with its referent noun very early on (Stephany, 1997). Thus we can see that children are able to use morphological and syntactic (intralinguistic) information from an early age.

As far as the Indo-European language family is concerned, there are no entirely uniform semantic classificatory criteria which would make it possible to predict the gender of more than a handful of lexical groups (Lyons, 1968). However, studies such as Mulford's (1983; 1985) provide strong support for the natural gender theory. She studied Icelandic children in terms of their comprehension of pronouns. She assumes that the availability of the cognitive notion of gender is independent of language; the prediction of early formal learning is that differences in the time and rate at which gender is acquired should be the result of the complexity and predictability of the formal aspects of the system. Therefore, children appear not to succeed in figuring out a stable formal basis for gender categorisation before their non-linguistic cognitive development has led them to attend to natural gender distinctions (Mulford, 1985). However, as Levy (1988) points out, Mulford's study has methodological problems.

The first gender cue that children learn in German is the –e ending (Mills, 1985) which typically indicates feminine gender and, thus, is the most reliable phonological

gender cue in German language. There is sometimes a mismatch between formal gender and natural gender, for example in German ‘mouse’ is feminine gender but may be male in the context of a story. Where this occurs, there is a general tendency to switch to the natural gender (Mills, 1985). It is obvious that the concept of natural gender distinction must be acquired before the linguistic system in cases where it directly reflects those distinctions. There is evidence that the concept of natural gender may therefore precede the acquisition of the linguistic system but does not facilitate it.

MacWhinney (2008) tests gender assignment to real and non-words in children 3–12 years of age. He finds that age positively affects children’s performance. He also claims that German children make little use of semantic information and mainly use formal features of noun endings to determine syntactic gender. However, there are also methodological problems with this study according to Mills (1985). Bohme and Levelt’s (1979) experimental study about the acquisition of gender forms in German found that children aged 3;11–5;5 make extensive use of intralinguistic information and do not attend to the obvious sex of the proper names. For example, when children are shown a new type of person or animal which is clearly masculine or feminine, but which is referred to by a conflicting grammatical determiner. They apparently produce other combinations with the noun on the basis of its grammatical gender, rather than its conceptual gender. Both studies of MacWhinney as well as Bohme and Levelt indicate that children, even at the age of four, tend to use intralinguistic information even when there is in conflict with semantic information (Levy, 1983a).

In terms of Hebrew language acquisition, Levy (1983b) demonstrates the importance of morphological rather than semantic information. She also points out that morphological regularities in Hebrew nouns may serve as the basis for a child’s developing gender system even before the child is able to make natural gender distinctions. An experimental study with Czechoslovak children (Henzl, 1975) confirms the saliency of phonological endings in gender attribution. Children tend to assign gender to nouns according to the morphological information and not according to semantic information.

In Polish, while gender in inanimate nouns is semantically arbitrary, the sex of the referents of animate nouns fully determines their linguistic gender. Therefore, Polish seems to be the most sex-biased of all Indo-European languages. However, studies have shown that children fail to use the necessary semantic distinction, which alone guarantees that the correct marker will be chosen (Levy, 1983a).

In a Russian longitudinal study (Popova, 1973) it was argued that in places where the formal marker on the noun did not correspond to the sex of referents, children were found to be acting predominantly on the basis of the formal properties of the noun, ignoring the natural gender of their referent.

In terms of French language acquisition, Karmiloff-Smith's (1979) experimental study, shows the predominance of morphological information in children up to the age of nine years. Wherever a morphological cue is available, it tends to override both natural gender cues and gender-marked cues from the article. She also notes that the importance of morphological information is gradually replaced by the natural gender and syntactic information, although the morphological information is the last to become explicit and the last to be exploited when children are requested to create words. Pérez-Pereira (1991), using procedures similar to Karmiloff-Smith's study (1979), find that Spanish children pay far more attention to intralinguistic information (morphology and syntax) than to extralinguistic information (sex) in order to recognise the gender of a noun and to establish gender agreement with adjectives, even in cases where gender information is conflicted.

There have been recent psycholinguistic studies which demonstrate that children, like NS of languages with grammatical gender, use syntactic cues — articles and/or adjectives — in real time to identify words on the base of gender meaning. Lew-Williams & Fernald (2007) examined three-year-olds learning Spanish as L1 with the looking-while-listening procedure by presenting them objects with congruent or incongruent grammatical gender while at the same time listening to a Spanish sentence referring to one of the two objects. The eye movement measures show that children were faster to distinguish the referent object on different gender conditions when the article was informative rather than on the same gender conditions when the article was not gender-marked. These findings accord with other findings relating to French and Dutch children (van Heugten & Shi, 2009).

In regard to the acquisition of gender by Greek children, most of the studies that have previously been done have been longitudinal. In Greek, morphology represents one of the language's major challenges for the speakers. Despite that, all of the Greek grammatical categories which are inflectionally expressed begin to emerge before the end of the second year (Stephany, 1997). Although Greek nominal inflection is by far less complex than verbal inflection, there are a considerable number of noun suffixes types to be mastered. Θεοφανοπούλου-Κοντού (2002) demonstrate that the adult system

is not yet fully mastered by 6;6 years. The reason for this is the low frequency input and the stress rules. Greek gender studies which have children as participants will be further analysed in section 3.3.

Therefore, it can be seen that the majority of studies previously done indicate that children rely on morphology to assign gender to nouns. Also, that gender marking on articles affects the speed of lexical access. Overall, children do not rely on extralinguistic reality (semantics), but rather on information coming from the linguistic context/input (syntax and morphology) in which words appear.

3.2 Gender processing by adult NS

The retrieval and processing of grammatical gender by NS has been studied extensively using a variety of psycholinguistic research methodologies. A majority of monolingual studies have investigated gender processing using event-related-potentials (ERP). They all reveal a P600 effect in response to gender agreement violations in sentence context in different gender-marked languages regardless of the gender elements involved (e.g., article–noun, adjective–noun, reflexive–antecedent) or the position of the violations (within the DP or across a syntactic boundary). The NS studied were speakers of French (Foucart & Frenck-Mestre, 2011; Frenck-Mestre, Foucart, Carrasco & Herschensohn, 2009), Dutch (Hagoort & Brown, 1999), German (Gunter, Friederici & Schriefers, 2000) and Spanish (Barber & Carreiras, 2005; Gillon-Dowens et al., 2010).

A number of psycholinguistic studies have also been conducted testing the ability of NS to use gender information marked in the articles to identify words in real time processing. The majority of these studies show that NS are able to use the article information to guide lexical access. In other words, NS anticipate a feminine noun after having processed a feminine gender-marked article (Lew-Williams & Fernald, 2007). Grosjean et al. (1998) prove that L1 speakers of French responded faster to nouns when they were preceded by a correctly gender-marked article rather than to nouns which were not. In Wicha et al. (2004), Spanish NS use gender information in articles and nouns to maintain agreement and build sentence meaning in real time.

Moreover, to date several studies have examined the role of morphology in L1 gender processing, focusing mainly on the facilitative effect of transparent noun endings. Tucker et al.'s (1977) study proves that French NS rely on morphological markers, especially when they have to process new or unfamiliar words. Taraban and Kempe (1999) tested 26 NS of Russian in a forced choice task where the participants

were asked to choose the correct past tense verb, which either matched or mismatched with the gender of the noun. They presented sentences which contained either transparently or opaquely gender-marked. L1 participants found it more difficult to process opaque subject nouns than transparently marked nouns. Similarly, Bates et al. (1995) found that the result of the gender-monitoring task indicated that adult Italian NS are slower when they process opaquely gender-marked Italian nouns. Alternatively, approaches that accept the importance of lexical representation of gender in gender processing, such as Carroll (1989) and Corbett (1991), argue that there are no differences in the processing of ambiguous and unambiguous marked nouns.

In contrast to previous studies, which have suggested that gender-marked endings (whether transparent or non-transparent) affect access to gender, Taft and Meunier's (1998) findings highlight a very important aspect of the use of noun endings in gender termination as gender cues. The results from two gender-monitoring experiments and a grammaticality judgment task indicate that French NS rely on the form of words to determine gender but start to have difficulties when noun suffixes are the most predicative cue of information available (e.g., in the absence of a gender-marked determiners). These findings are compatible with the reliable cue hypothesis indicating that the most reliable gender cues (in this case determiners) sustain a significant role in gender representation. It is predicted that any difficulties arise when the most reliable gender cue is not available. Finally, Gollan and Frost (2001) conducted two experiments, a gender decision task and a grammatical judgment including inanimate Hebrew nouns with either gender typical or gender atypical ending. The findings of this investigation complement those of earlier studies (Bates et al., 1995; Taft & Meunier, 1998), arguing that there are two routes to grammatical gender: one via an abstract gender node and one via phonological forms.

To summarise, NS are sensitive to gender agreement violations in a variety of experimental paradigms; they make use of gender-marked cues such as determiners and adjectives to predict the gender of the nouns in online processing and show facilitative effects of transparent gender marking. NS sensitivity to gender agreement violations and the role of gender marked cues will be also be highlighted in the next chapter in the context of our analysis of studies including NS and L2 learners.

3.3 Greek grammatical gender processing by children

Research on the acquisition of Modern Greek (MG) as L1 started in the early 1970s.

The main problem with these studies is, however, that they were undertaken by linguists or psychologists working separately. Unfortunately this resulted in abstract factors that should have been considered as very important and probably had a significant effect on the quality and quantity of the results (Stephany, 1997).

In languages with complicated morphology, morphological elements can be found very early on (Stephany, 1997). In Greek in particular, all of the grammatical categories inflectionally expressed begin to emerge before the end of the second year (Stephany, 1997). Due to the dependence of case inflection on gender, case marking thus establishes gender distinctions (Θεοφανοπούλου-Κοντού, 2002).

Regarding the acquisition of articles in Greek, children tend to use the definite article with at least some nouns from 2;3 years onwards and, a month later, there are instances of the article in all singular case forms of all genders. Even in younger children (1;10 years) article gender is mostly correct, and some apparent gender errors are probably best explained by vowel harmony. In longitudinal studies it has been observed that Greek children make the adjective agree with its referent noun very early on (Stephany, 1997). Longitudinal studies have also shown that when children use articles incorrectly in relation to a noun's gender, this does not necessarily mean that the child does not know the noun's gender. This tendency is well explained because in other cases the use of noun's gender is correct. From the age of 2;4 years children can use the three-way gender distinction of the indefinite article in the nominative. These studies indicate that article form might serve as a kind of rescue in the absence of case while the same children do not tend to use articles (Stephany, 1997). Θεοφανοπούλου-Κοντού (2002) finds that gender inflection of the adjective occurs only at 2;4 and by the age of 2;10 the three genders of adjective are in use. Although most adjectives agree with their referents in gender this occurs systematically only after the age of 2;10.

Γαβριήλιδου and Ευθυμίου (2003) tested the hypothesis of Αναστασιάδη-Συμεωνίδη and Χειλά-Μαρκοπούλου (2003). According to this hypothesis, there are prototypical masculine, feminine and neuter nouns in Greek language. They examined 27 children aged between 53–72 months, both male and female, asking them to apply the correct definite article to 59 Greek real words; 35 prototypical and 24 non-prototypical. On the basis of their hypothesis, it was predicted that if there are certain semantic and morphological criteria for each gender value, then the number of errors

would be small. The results indicate that children can correctly assign the prototypical masculine, feminine and neuter Greek nouns. In addition to this, the findings reveal that ‘the determination of Greek grammatical gender at least for this age depends mainly in morphological criteria and secondly on semantic’ (Γαβριήλιδου & Ευθυμίου, p. 202).¹

The performance of children of this age indicates that *-ος* and *-ης* represent the main masculine endings used when compared to *-ας*, which in the accusative case is formed as *-α*, an ending similar to the prototypical feminine suffix *-α*. Children have a tendency to assign masculine gender even to nouns which often referred to females (e.g., *αεροσυνοδός* [FEM] ‘air hostess’, *νηπιαγωγός* [FEM] ‘early childhood teacher’) as they base their choices on the suffix *-ος* which is a prototypical masculine suffix. Moreover, the high presentence of feminine assignment to nouns such as *στρατιωτάκι* [NEUT] ‘soldier’, *κοριτσάκι* [NEUT] ‘young girl’, *σώμα* [NEUT] ‘body’ reveals a similar conclusion — that children confuse the neuter ending *-ι* and *-μα* with the feminine endings *-η* and *-α* respectively. Finally, the findings indicate that masculine nouns in *-ος* are ‘more prototypical’ than the ones which end in *-ας* and *-ης*. Also, feminine nouns, which end in *-α* and *-η* are ‘more prototypical’ than the ones which end in *-ου*. In contrast with Αναστασιάδη-Συμεωνίδη and Χειλά-Μαρκοπούλου (2003), the high number of errors in the group of diminutives of people and animals reveals that this group of nouns does not represent a prototypical category of neuter nouns for children at this age, mainly for morphological and semantic reasons.

However, the Γαβριήλιδου and Ευθυμίου (2003) study does suffer from some methodological limitations. Firstly, the number of participants is too small to support the results. Secondly, no description is offered of the procedure that was used in the selection of the words. Thus, the experimental materials included words of high frequency (e.g., *άνθρωπος* ‘person’, *μήλο* ‘apple’) as well as words of low frequency (e.g., *άβυσσος* ‘abyss’, *περίπολος* ‘patrol’). In addition to this, the number of words for each gender value is too small to draw valid conclusions. Thirdly, the presentation of words to the participants is not accompanied by pictures allowing for examination of the role of semantic information, which is an important part of the acquisition of grammatical gender (Mills, 1985; Stephany, 1997).

¹ ‘Το γένος στην ελληνική καθορίζεται, τουλάχιστον για την συγκεκριμένη ηλικία, κύριως με βάση μορφολογικά και δευτερευόντως με βάση σημασιολογικά κριτήρια’ (Γαβριήλιδου & Ευθυμίου, p. 202).

Thus we can see that children NS of Greek start to use very early both morphological and syntactic gender-marked cues correctly, such as the endings of nouns and the definite article.

3.4 Greek grammatical gender processing by adult NS

Only a few attempts have previously been made to test hypotheses concerning the area of the acquisition of grammatical gender and the vast majority of these studies have targeted NS. In order to elucidate this relatively unexplored area of psycholinguistics in Greek language, various assessing techniques and experimental procedures therefore need to be elaborated. These techniques and procedures have been used before in research into other languages. Although these techniques and procedures have been used before and can be considered as reliable and valid methods of testing, no studies have yet elaborated psychometric techniques in order to establish the validity and the reliability of the assessment tools at an advanced level. Nevertheless, the results of these studies can still be used to establish a relatively solid primary approach towards greater understanding of this area of scholarship. The results of research regarding the acquisition of Greek grammatical gender by NS can be summarised as follows.

Plemmenou, Bard and Branigan (2002) examine the effect of prior grammatical gender information through the production of a single noun (prime) on the production of a gender-inflected adjective which does not have any syntactical relationship with the prime noun. As we reviewed in Chapter 2, according to Levelt et al.'s theory (1999), words such as nouns, determiners or adjectives of the same grammatical gender are linked to a common gender node which is merely activated when a single noun is produced and selected only for the computation of syntactical agreement. On the basis of this theory, it is predicted that 'production of a target adjective will be faster following a same gender prime than following a different gender noun prime' (Plemmenou et al., 2002, p. 238). Their hypothesis was tested by conducting a lexical priming task with only 18 NS of Greek. In the main part of the experiment the participants were asked to produce orally either a single noun if the picture was black-and-white or a gender-inflected colour adjective if the object in the picture was in colour.

The results confirm the gender priming hypothesis for masculine items. In other words, 'gender marked responses such as /κόκκινος/ (red, MSC) were faster after a same-gender prime response such as /γιακάς/ (collar, MSC) in the immediately preceding trial than after a different-gender response such as /τούρτα/ (cake, FEM)'

(Plemmenou et al., 2002, p. 239). In contrast, there is no evidence of a gender priming effect for feminine nouns.

Plemmenou et al. (2002) apply these findings to the processing and representation of gender in production highlighting that ‘given the seriality assumption of the Levelt et al. model, processing at the lemma level is completed before processing at the morphophonological level is initiated’ (Plemmenou et al., 2002, p. 240). They argue that grammatical gender processing at an abstract lexical-syntactic level of representation should be affected by morphophonological gender cues and other properties. In particular, the results of the present experiment indicate that gender priming is ‘a facilitated reaccess to a gender node ... which will speed up a function of residual gender node activation due to earlier selection’ (Plemmenou et al., 2002, p. 241). Taking that into consideration we may hypothesise for our study that the more gender-marked cues are in the stimulus (determiner + adjective + noun ending), the more accurate and fast the L2 learner will be.

However, there are some limitations to this study which mainly concern the validity of the results and are due to the extremely low number of participants in relation to the statistical analysis performed. Specifically, the statistical analysis performed is not in accordance with the statistical parameters indicated by the statistic. Only 18 NS speakers of Greek can not validate the present findings. Also, results regarding feminine nouns are not taken into account. The researchers do not include in their explanation any commentary on the absence of the aforementioned tendency in feminine nouns. In addition to this, neuter Greek nouns are not included in the data. Thus, while this research tries to give an explanation of the representation of Greek grammatical gender it does not include all the aspects of the investigated phenomenon.

Mastropavlou (2006) following Trucker et al.’s (1977) model and using Ralli’s (2002; 2003) theoretical analysis of the role of morphology in Greek gender determination sets up an experiment to examine psycholinguistically the role of noun suffixes in the process of gender assignment by NS. She uses pseudo words with existing noun endings in both oral and written version so as to reveal also the degree of suffix gender predictability. Sixty-two adult monolingual college Greek students between the ages of 18–25 participated in the oral task and another 63 adult monolingual college students of Greek between the ages of 18–25 took part in the written version. The study uses 75 novel words combined with all the different noun suffixes of the three grammatical genders in MG in the nominative singular.

Mastropavlou (2006) considers the suffixes $-\eta\varsigma$, $-\alpha$, $-o$ unambiguous as they clearly represent the masculine, feminine and neuter gender respectively. On the other hand, the suffixes $-o\varsigma$, $-\alpha\varsigma$, $-i/-\eta$ and $-\mu\alpha$ provide ambiguous gender marking. More specifically, nouns which end in $-o\varsigma$ are marked either as masculine, feminine or neuter gender, while nouns which end in $-\alpha\varsigma$ are marked either as masculine or neuter gender and nouns which end in $-i/-\eta$ or $-\mu\alpha$ can be interpreted as feminine or neuter. However, the suffix $-i$ in the written form clearly represents the feminine gender ($-\eta$) or the neuter gender ($-i$). The participants had to provide the appropriate definite article for each novel word in order to indicate the corresponding grammatical gender.

The results confirm the hypothesis experimentally. In particular, the findings show that ‘noun endings constitute strong gender cues and should play a significant role in the gender determination and assignment process’ (Mastropavlou, 2006, p. 140). In addition to this, the results reveal the high gender predictability of the noun suffixes. In particular, all unambiguous suffixes both in the oral and written tasks were assigned the target gender value by the majority of the participants. For example, nouns with the unambiguous masculine ending $-\eta\varsigma$ were significantly interpreted as masculine in the oral version (89.4%, $P < .001$) and in the written task (92.2%, $P < .001$). Moreover, suffixes that take more than one gender interpretations gained low predicative values for gender, especially in the written task. For example, nouns ending in $-o\varsigma$ showed low predictive values (0.83 in the oral test and 0.76 in the written one). Despite those findings Mastropavlou notes that ‘suffix ambiguity does not directly affect its gender predictability’ (Mastropavlou, 2006, p. 134), although adult NS are more sensitive to suffix ambiguity when they have to assign written input.

Mastropavlou (2006) also underlines that the high predictability of noun suffixes is consistent with the most frequent value each suffix assumes in the corpus. The only exception are the suffixes $-i/-\eta$ and $-\mu\alpha$. She further explains the majority of neuter interpretations for the suffix $-i$, although the most frequent gender value related to this ending in the corpus is feminine, by highlighting the default role associated with the neuter gender in Greek language. In regard to the extremely low phonological and orthographic predicative values of neuter gender for the suffix $-\mu\alpha$, even though it is the most frequent one, Mastropavlou (2006) states that Greek speakers strongly connect the suffix $-\alpha$ with the feminine gender.

However, Mastropavlou’s (2006) study nevertheless suffers from some methodological limitations. Despite the fact that the main experimental materials for

her research are Greek non-words, she does not provide any description of the criteria (stress, number of syllables etc.) used in order to design the pseudo-words. Relevant to this limitation is the fact that some of the suffixes used in the corpus of the novel words are also derivational affixes. These suffixes are connected with one of the three gender values (*-ίτης*, *-ετής* masculine gender, *-ίδα* feminine gender, *-ίδι* neuter gender).

Mastropavlou and Tsimpli (2011) following Mastropavlou's (2006) experimental model investigate the role of noun suffixes in gender processing and assignment in Greek language and come to similar conclusions. Taking into account the lexicalist approach according to which suffixes are entries stored in the lexicon (Selkirk 1982; Lieber 1992), they pose the question as to whether any gender information is stored along with the endings in the lexicon of a NS. In reaching these conclusions they conducted two tasks — one oral and one written — with 62 college students, adult NS of Greek. The participants were asked to write an agreeing definite article for each pseudo-word they heard in the first session or read in the second session. The researchers used non-words as 'stems of non-words do not contain any semantic (sex) or morphological (IC) information either' (Mastropavlou & Tsimpli, 2011, p. 39). In addition to this, they examined both phonological and orthographic cues for gender assignment because in Greek language, as they correctly state, 'form overlaps between genders are composed differently in each mode' (Mastropavlou & Tsimpli, 2011, p. 39). The 75 non-words, which were used, combined a novel stem with an existing noun suffix of the three gender values of Greek language. Thus, the corpus of non-words contained both ambiguous and unambiguous gender marking. They did not examine the neuter suffix *-μα*, pointing out that *-μα* in neuter nouns is not actually an ending but in fact constitutes a part of the noun stem.

The results indicate that NS of Greek language assign gender to non-words based on their suffix. In other words, 'suffixes are stored in the mental lexicon carrying a gender feature specified for a value which is inherited from nouns with which they frequently and productively co-occur' (Mastropavlou & Tsimpli, 2011, p. 52). In particular, both in oral and written version participants assign the majority of novel nouns with unambiguous endings to the target value. Furthermore, ambiguous suffixes exhibit high predictability both in the oral and written tasks, despite the fact that they occur in more than one gender value. The only exception is the ambiguous suffix *-ι* NEUT/FEM, which although feminine is the most frequent gender value, was assigned to the neuter gender in the oral task by 0.55. The researchers explain this by

emphasising that neuter nouns in *-ι* are used more frequently by speakers than feminine nouns and that the neuter gender is considered to be the unmarked one in Greek. These findings concerning ambiguity are in line with the notions of prototypicality (Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003) and productivity (Χριστοφίδου, 2003).

Furthermore, Mastropavlou & Tsimpli (2011) conclude that the results of this study are in contrast to models of lexical access (e.g., Jescheniak & Levelt 1994), but are in line with the models which suggest a rule-based route as the main strategy to gender assignment. In a deeper analysis, taking into account Ralli's (2002; 2003) claims and terms, they also suggest:

most suffixes are clearly specified for one of the three gender values, but become responsible for the gender value of the word only in cases of underspecification of the stem with respect to gender as well as to all features that can lead to gender specification (i.e. sex and inflectional class) (Mastropavlou & Tsimpli, 2011, p. 52).

Thus, they conclude that the lexical route may be predominant to NS while L2 learners and NNS when they assign novel nouns follow the rule-based route. However, they draw with this conclusion without having tested experimentally how NS assign gender to familiar Greek nouns and without having included L2 learners of Greek in their experimental groups. The present study investigates how morphological and syntactic information helps L2 learners of Greek to process and assign gender to novel nouns.

Mastropavlou and Tsimpli's (2011) study does however suffer from some methodological limitations, mainly in terms of the non-words. Firstly, the only description of the construction of non-words notes that they are designed in a particular way in order to 'avoid close rhyming with extant words in order to eliminate lexical effects' (Mastropavlou & Tsimpli, 2011, p. 40). Phonological criteria such as stress and number of syllables are therefore not taken into account. In addition to this, the two researchers do not avoid derivational affixes which are associated with a specific gender value in Greek. For example, the derivational affixes such as *-ίδα*, *-της*, *-ίτης*, *-ίδι*, *-ισσα* are used as endings in many non-words. Moreover, the same novel words are used both in the oral and written tasks. This, combined with the fact that the same 62 subjects took part in both tasks, may have affected the results as the participants would have already been familiar with the non-words from the oral session before taking part in the written session. Thus, they may have assigned gender to nouns by analogy with the previous oral non-words rather than by rule. Relevant to these limitations is the fact

that the time distance between the two parts is also not mentioned. Finally, there was no statistical analysis done in order to determine any differences between oral and written production.

Varlokosta (2011) examines the role of morphological information in grammatical gender assignment by Greek NS. She tested 82 monolingual adult speakers of Greek between the ages of 18 to 40 by giving them orally 64 novel nouns combined with real suffixes of each gender value and asking them to identify the agreeing definite article. In this way, she investigates the ability of NS to predict gender in pseudo-words in the absence of any semantic information or phrasal information through agreement with elements such as determiners and adjectives.

In contrast to Mastropavlou (2006) and Mastropavlou and Tsimpli (2011), Varlokosta (2011) carefully designs the pseudo words for the experiment in order ‘each novel noun to be sufficiently dissimilar to the real noun it was derived from and not similar to another real noun in the language’ (Varlokosta, 2011, p. 334). She seeks to avoid any activation of lexical entry, and thus to measure the pure effect of morphology carried by the noun suffix. A pre-test was also conducted in order to avoid non-words which activate existing Greek nouns. As a result, 64 real nouns combined with possible inflectional morphemes of Greek nouns (*-ος, -ης, -ας, -ι, -α, -ο, -μα*) were turned into 64 novel nouns by making changes in terms of the place of articulation of consonants and along the height axis of the vowels. In addition to these changes, Varlokosta (2011) takes into account the parameter of stress and number of syllables, noting that ‘stress is a factor that could potentially facilitate the speaker to assign gender to the noun’ (Varlokosta, 2011, p. 333). For the construction of the novel words, which are used in the experimental tasks of the present thesis, we apply changes on the vowels and consonants of the real words that Varlokosta (2011) used (see section 5.4).

The results indicate that NS rely on morphology, specifically on the nouns’ inflectional endings in order to predict grammatical gender in the absence of any semantic or phrasal information. In particular, novel nouns with unambiguous endings are assigned to a particular gender value. Breaking down the results for some inflectional morphemes, Varlokosta (2011) in accordance with Ralli (2002; 2003) and Αναστασιάδη-Συμεωνίδη and Χειλά-Μαρκοπούλου (2003) concludes that the suffix *-ας* is not ambiguous as it is assigned predominately masculine. Moreover, nouns ending in *-ι* (*-η/-ι*) are assigned both feminine and neuter. Nevertheless, neuter responses were more prevalent. Varlokosta (2011) explains the dominance of neuter

answers by underlining the fact that it is the most frequent grammatical gender for (– animate) nouns and loan words. In addition to this, Varlokosta (2011) states that neuter gender is found in metalinguistic use and is the interlanguage gender value in Greek as L2. She uses the unmarked status of neuter gender as an argument for the majority of neuter responses. The expected majority of masculine responses for suffix –*os* confirms and supports the notion of prototypicality, which is a determinant factor for gender assignment in Greek according to Αναστασιάδη-Συμεωνίδη and Χειλά-Μαρκοπούλου (2003).

Furthermore, ‘when morphology gives rise to ambiguities, speakers rely on phonological factors, such as stress position and number of syllables’ (Varlokosta, 2011, p. 344). Results indicate that for the ambiguous suffix –*os* there are typically more masculine responses for tri-syllabic nouns stressed on the ultimate, more feminine responses for tri-syllabic nouns stressed on the antepenultimate and more neuter responses for bi-syllabic nouns stressed on the penultimate. For ambiguous nouns ending in –*i* (–*η*/ –*ι*) there are more feminine responses for tri-syllabic nouns stressed on the ultimate and neuter responses for bi-syllabic nouns stressed on the penultimate. The occurrence of feminine responses for bi-syllabic nouns in –*μα* stressed on the penultimate suggests that speakers use more phonological criteria rather than morphological (Varlokosta, 2011). Thus they assign gender to this category of nouns based on the second segment of the inflectional morpheme –*α*. Finally, she concludes that ‘formal assignment rules determine gender assignment to a great extent and are part of speakers’ linguistic competence’ (Varlokosta, 2011, p. 346).

However, there are some limitations to Varlokosta’s study, mainly in connection with the analysis of the results. Specifically, she conducts an Analysis of Variance in order to test the effects of response type (masculine, feminine, neuter) and syllable number and response type (masculine, feminine, neuter) and stress position. In order to test gender assignment by adult speakers she also uses materials which were part of a test designed to investigate gender assignment of real and novel nouns by pre-school and school children. In our opinion, adults and children cannot have the same level of vocabulary; the way they process words are completely different and cannot be examined within the same corpus. Finally, Varlokosta (2011) validates all of her results from the oral task given to participants. While an oral task can be a secure source for conclusions it cannot be considered a completed one.

All the research discussed above focuses on how NS assign gender to Greek nouns. In particular, previous studies have examined the role of noun suffixes in the way NS process and assign gender to nouns. As was noted in Chapter 2, gender assignment in Greek language is a complex process that depends on a number of parameters such as semantic information (Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003; Ralli, 2002; 2003; Χριστοφίδου, 2003; Alexiadou, 2004), morphophonological information (Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003; Ralli, 2002; 2003; Χριστοφίδου, 2003; Anastasiadi-Symeonidi, 2012) and/or phrasal information (Ralli, 2002; 2003; Χειλά-Μαρκοπούλου, 2003; Alexiadou, 2004). In addition, Mastropavlou (2006), Mastropavlou and Tsimpli (2011) and Varlokosta (2011) all use pseudo words in their experiments in order to examine NS's ability to predict gender using only the morphological information carried by the noun suffix in the absence of any semantic or phrasal clues.

All of the results reveal that NS rely on morphology, specifically on the information carried by the noun endings in order to assign gender to novel nouns both in written and oral tasks. However, Varlokosta (2011), in contrast to the other two studies cited above, also takes into account the phonological factors of stress and number of syllables of the non-words and examines their role in gender assignment. Her results thus highlight the effect of these two criteria in the process of gender assignment especially to ambiguous suffixes.

We can draw some conclusions regarding the acquisition and processing of grammatical gender by NS by breaking down all the findings discussed above. Firstly, all of the results are in line with the notions of productivity (Χριστοφίδου, 2003) and prototypicality (Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003), which both play significant roles in gender assignment of Greek nouns and are part of the NS's linguistic competence (Varlokosta, 2011). The most obvious evidence of this is the ambiguous suffix *-ος* which has clear gender preferences for the masculine gender with which it is associated prototypically (Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003). In addition to this, Varlokosta (2011) concludes that suffix *-ας* is unambiguous as it is prototypically assigned masculine. Secondly, ambiguity is not an obstacle for NS to assign correctly gender to novel nouns (Mastropavlou, 2006; Mastropavlou & Tsimpli, 2011). However, ambiguous suffixes did indicate low predictability when compared to the unambiguous ones, especially in written tasks (Mastropavlou, 2006). Thirdly, NS typically assign gender to nouns with the most frequent gender value of

each suffix (Mastropavlou, 2006; Mastropavlou & Tsimpli, 2011). In other words, NS make representations of noun endings connected with the most frequent gender value. Fourthly, Mastropavlou (2006) and Varlokosta (2011) explain the dominance of neuter responses for novel nouns ending in *-i* (*-η/ -ι*) mainly by emphasising the default role of the neuter gender. In addition to this, they both indicate that NS also assign the feminine gender to nouns ending in *-μα* by relying on the inflectional suffix *-α* which is mainly associated with the feminine value gender. However, it must also be noted that the predictions of the research above were in fact different with respect to the inflectional morphemes *-ας* and *-μα*. In particular, Varlokosta (2011) in contrast with Mastropavlou (2006) and Mastropavlou and Tsimpli (2011) assumes that noun endings in *-ας* and *-μα* are considered unambiguous as they were assigned predominately masculine and neuter respectively.

All of these findings indicate that morphology plays an important role in gender assignment of Greek novel nouns by NS in the absence of semantic or phrasal information. Suffixes constitute a reliable gender indicator in MG (Mastropavlou, 2006). Under this assumption, we can conclude that gender is an intrinsic feature of the noun stem, along the lines of Ralli (2002; 2003). Mastropavlou & Tsimpli (2011) emphasise that the rule-based route is preferable for L2 learners of Greek language — without examining them — or for NS when they deal with unfamiliar/novel words. They state — without proving it experimentally — that NS mostly follow the lexical route for familiar words. Plemmenou et al. (2002) draw the same conclusions by highlighting that morphological gender markers should not affect the way the gender of real words is processed at an abstract lexical-syntactic level by NS. They conclude that gender priming will speed up the process of gender assignment of single familiar words by NS as it is like re-accessing the already activated gender node.

As was previously mentioned, all of the studies discussed above suffer from some methodological limitations (number of participants, design of the variables, design of the experiment etc.). Moreover, although they reveal the important role of morphology they do so without testing or comparing it with the role of semantic or syntactical information in gender assignment. In this thesis we have applied some of the methodological methods of the aforementioned studies into Greek NS. With regard to the suffixes used in the experimental tasks, we take into consideration the findings of these studies (see 2.5), while in terms of the construction of the novel words used in our

experimental tasks, we apply changes to the vowels and consonants of the real words used by Varlokosta (2011) (see 5.4).

3.5 Chapter summary

The majority of studies have shown that children rely mostly on morphology (noun ending) to assign gender to nouns. Also, gender marking on articles affects the speed of lexical access. Overall, children do not rely on semantic information, but rather on information coming from the linguistic context/input (gender-marked determiners and morphology) in which words appear. Adults NS of gendered languages are sensitive to gender agreement violations, make use of gender-marked cues such as determiners and adjectives to predict the gender of the upcoming nouns in online processing and show facilitative effects of transparent gender marking. NS sensitivity to gender agreement violations as well as the role of gender-marked cues in NS gender processing will be also highlighted in the next chapter in the analysis of studies including NS and L2 learners.

Children NS of Greek start very early to use correctly both morphological and syntactic gender-marked cues, such as the ending of the nouns and the definite article. Adult NS of Greek rely on morphology, specifically on the information carried by the noun endings in order to assign gender to novel nouns both in written and oral tasks. Moreover, ambiguity is not an obstacle for NS to correctly assign gender to novel nouns (Mastropavlou, 2006; Mastropavlou & Tsimpli, 2011). However, gender frequency and gender ambiguity does affect gender processing by NS of Greek. Ambiguous suffixes exhibit low predictability when compared to unambiguous ones, especially in written tasks (Mastropavlou, 2006), and NS assign gender to nouns with the most frequent gender value of each suffix (Mastropavlou, 2006; Mastropavlou & Tsimpli, 2011). These findings indicate that morphology plays an important role in gender assignment of Greek novel nouns by NS in the absence of semantic or phrasal information. Suffixes constitute a reliable gender indicator in MG (Mastropavlou, 2006). Finally, Plemmenou et al. (2002) conclude that gender priming speeds up the process of gender assignment of single familiar words by NS as it is like re-accessing the already activated gender node.

Chapter 4: Processing of grammatical gender in L2

4.0 Chapter overview

Taking into consideration the purpose of the present study, this chapter is structured as following:

- A brief overview of the different theoretical approaches of processing grammatical gender in L2 is presented in section 4.1.
- Section 4.2.1 offers a brief outline of previous studies which have tested the accuracy of L2 learners in gender assignment and gender agreement. This overview provides evidence that the accurate assignment of gender to nouns and the implementation of gender agreement can cause challenging difficulties for L2 learners.
- Section 4.2.2 includes presentation and analysis of previous research into the role of semantic, morphological and syntactic cues in L2 gender processing. These studies are relevant to the aim of our thesis.
- Presentation and analysis of the findings of studies that have examined the influence of noun endings in gender processing (transparent vs. non-transparent endings) is in section 4.2.3; particularly the role of suffixes in gender assignment and gender agreement production. These studies are relevant in that we have included ambiguous and unambiguous endings in our experimental tasks.
- Section 4.2.4 focuses on the presentation and analysis of the findings of reading time and event-related-potentials (ERP) studies, which have examined the sensitivity of L2 learners to gender agreement violations. These studies indicate that gender processing correlates with some linguistic factors (e.g., the realisation of grammatical gender marking in L1, proficiency, working memory etc.).
- Previous research which has examined the priming effect of articles and adjectives in sentence comprehension and eye-tracking studies is presented in section 4.2.5. These results reveal under which conditions L2 learners are able to take advantage of gender-marked articles and adjectives in order to identify the gender of the upcoming nouns in predicative comprehension.
- Section 4.3 focuses on the presentation and analysis of the findings of studies that have examined the acquisition and processing of Greek grammatical gender in L2.

- Finally, the findings of few studies that have examined the representation of L1 grammatical gender properties on L2 takes place in section 4.4.

However, before there can be any analysis and presentation of L2 studies, it is essential to clarify three things concerning the profile of the participants and the experimental tasks. Firstly, most of the studies discussed include as a control group NS of the gendered languages under examination. Thus the gender performance differences between NS and NNS describe the underlining factors for the non-accurate performance of NNS. Secondly, the majority of the L2 learners used are NS of English, a language which marks gender in its pronominal system on the basis of semantic criteria (Corbett, 1991). Finally, much of the previous research has compared gender and number agreement using comprehension and production tasks. Taking into consideration the aim of this thesis, we will only present the results concerning the gender performance of the L2 participants.

4.1 Theoretical approaches to processing grammatical gender in L2

The different theoretical accounts of processing grammatical gender in L2 mainly argue for what causes morphological variability. Before presenting the various theoretical perspectives, we first have to elucidate that the term ‘variability’ refers to the consistent or inconsistent behaviour of the language learner in L2, which is contrasted with the accurate performance of the NS (Tsimplici, 1997). Secondly, it is necessary to clarify that there are two opposite accounts for L2 morphosyntactic variability in developing grammars. Some scholars have divided them using different terms. For example:

- *deficit* and *accessibility* approaches (Sagarra & Herschensohn, 2010) predicting opposing possibilities for ultimate attainment of grammatical features;
- *no access* approaches and *full access* approaches (Tsimplici & Dimitrakopoulou, 2007) regarding the availability of universal grammar (UG) on second language acquisition (SLA); and
- *representational accounts of variability* and *computational accounts of variability* (McCarthy, 2008) indicating that the source of variability lies in the faulty representation of syntax or in performance limitations and mapping problems, respectively.

Theoretical representational/deficit accounts such as the Failed Functional Features Hypothesis (FFFH) by Hawkins and Chan (1997), the Representational Deficit Hypothesis (RDH) proposed by Hawkins (2009) and, most recently, the Shallow

Structure Hypothesis (SSH) by Clahsen and Felser (2006) as well as the Interpretability Hypothesis (Tsimplici & Dimitrakopoulou, 2007) propose within the framework of UG that L1 and L2 are fundamentally different. In other words, adult L2 learners no longer have access to UG and the implicit mechanisms. This is mainly due to maturational constraints as their L2 acquisition takes place around or after puberty. According to the representational/deficit accounts L2 learners cannot acquire gender uninterpretable features which are not present in their L1 such as the gender of determiners and/or adjectives, mainly due to impaired underlying syntactic representations.

In contrast, full access/computational accounts of generative L2 acquisition research, such as the Full Transfer/Full Access (FT/FA) Hypothesis (Schwartz & Sprouse, 1996), the Missing Surface Inflection Hypothesis (MSIH) (Prévost & White, 2000) and, most recently, the Morphological Underspecification Hypothesis (MUH) proposed by McCarthy (2008) differ from the representational deficit regarding the role of age, the nature of linguistic representations and the potential ultimate attainment and suggest that L1 and L2 speakers have equal access to UG. The core of these accounts is that syntactic representations are present, but morphological variability surfaces due to production problems, that is, heavy processing demands, or due to mapping problems. With regard to grammatical gender L2 learners are able to acquire the abstract grammatical gender representations but using different mechanisms that access grammatical representations, especially during oral production.

Finally, the ‘lexical gender learning hypothesis’ of non-target-like gender processing by Grüter et al. (2012), based on a previous study by Arnon and Ramscar (2009), argues that gender variability may be attributed to the different ways in which nouns were learnt. This hypothesis focuses on the linguistic input that L2 learners receive in order to account for gender difficulty in L2.

In the following chapter sections different theoretical hypotheses of processing grammatical gender in L2 will be presented, categorised in terms of deficit accounts and accessibility accounts which focus on the accessibility of UG mechanisms, followed by the ‘lexical gender learning hypothesis’ which focuses on the learning environments of grammatical gender.

4.1.1 The deficit accounts

The Representational Deficit Hypothesis (RDF) — The Failed Functional Feature Hypothesis (FFFH)

As was noted in Chapter 2, UG provides a finite set of interpretable syntactic features (Chomsky, 2000) that guide learners in their categorisation of linguistic experience. According to the Minimalist Framework (Chomsky, 2000; 2001; 2002), L1 speakers acquire lexical categories (e.g., verbs, nouns) and functional categories (e.g., auxiliaries, determiners) which are encoded by grammatical features such as gender and number that can be semantically interpretable or grammatical uninterpretable. Interpretable features (e.g., for gender [\pm feminine]) are semantically important and necessary and are sometimes linked to the grammatical uninterpretable (*u*features) of syntactically linked items; for example, to the uninterpretable gender feature (*ugender*) of adjectives or determiners in a noun–adjective agreement. It has been suggested that L2 learners with pre-existing knowledge of the interpretable gender features that are potentially relevant to computing gender agreement in the form of the UG (*ugender*), will show rapid convergence on the target grammar.

A majority of theoretical approaches agree that there is a close interface between syntax and inflectional morphology in SLA. The Representational Deficit Hypothesis (RDH) proposed by Hawkins (2009) suggests that inaccuracy in terms of inflectional morphology reflects missing syntactic features from the UG lexicon (see Smith & Tsimpli, 1995; Tsimpli & Roussou, 1991 for similar proposals). This means that in the processing of gender-marked phrases predictive effects of gender marking should be limited to the memorised exceptions of listed gender–noun associations because gender-marked cues such as determiners are unavailable in adult L2 learners. As a result adult L2 learners of gendered languages pair all nouns with the most frequently occurring article form as the default one and then gradually categorise nouns that they process in their linguistic input with other articles as exceptions to the default. The default gender marker will not act as a predictive cue as the default is not specified for a restricted set of nouns.

Similar to RDH, Hawkins and Chan (1997) examining the theory of Tsimpli and Smith (1991) and Smith and Tsimpli (1995) created the the Failed Functional Feature Hypothesis (FFFH) proposing that

exposure to samples of language during that critical period fixes the values of the features and associates them with particular morphophonological realizations. Beyond the critical

period (roughly adolescence) unspecified features disappear, leaving only those features encoded in the lexical entries for particular lexical items. The principles of UG, however, remain fully available and constrain grammar building (Hawkins & Chan, 1997, p. 216).

Regarding grammatical gender the FFFH predicts that new interpretable features (the noun gender) can be acquired in L2, whereas new uninterpretable features (gender agreement checking) cannot. Therefore, the FFFH predicts that agreement checking should not be possible for learners whose L1 does not possess these features (Hawkins, 1998; Hawkins & Franceschina, 2004).

The results of several observational studies indicate that after the critical period learners are no longer able to acquire abstract grammatical features not available in their L1 (Carroll, 1989; Hawkins & Chan, 1997; Hawkins & Franceschina, 2004).

Franceschina (2001; 2005) and Hawkins and Franceschina (2004) both examine the L2 acquisition of gender agreement within the DP. Franceschina (2005) investigates the gender performance of two groups of adult near-natives with contrasting L1 backgrounds (+gen vs. –gen) and a control group of Spanish NS using six experimental tasks including comprehension, production and metalinguistic judgments.¹

Franceschina's (2005) findings confirm the FFFH indicating clearly the advantage of the +gen group in realising the uninterpretable *ugender* features on determiners and adjectives. According to Franceschina (2001; 2005) gender is acquirable, although without the relevant uninterpretable features L2 learners will never be able to acquire gender agreement. However, specific questions can be raised over the methodology and thus the obtained results of this study. The low number of participants with non-gender languages (–gen) as well as the fact the tested items include exclusively high-frequency nouns may have biased the reliability and validity of the results and thus affected the findings.

Hawkins and Franceschina (2004) examine the spontaneous speech of six L2 learners of Spanish. Half of the participants were L1 English NS and the other half were L1 Italian NS. The results are in line with the FFFH indicating that L1 English speakers do not show facility with gender-marked determiners as their L1 lacks interpretable gender features on determiners and adjectives. L1 English speakers can only learn the

¹ In Test 1 the participants had to choose the correct noun on the basis of gender agreement out of three plausible nouns for the presented sentences containing pronouns or adjectives; in Tests 2 and 3 the participants were asked to fill in the congruent missing items; Test 4 was a grammaticality judgment task; in Test 5 participants were asked to describe the colours of images of imaginary beings combined with non-words; Test 6 was a gender assignment task.

gender of nouns to the extent that its form provides probabilistic cues as to its gender. In the following sections, we will analyse other studies which align with this theoretical approach (Guillelmon & Grosjean, 2001; Sabourin, Stowe & de Hann, 2006) examining L2 learners with different language backgrounds.

Before moving on with our review of the other gender processing hypotheses, we must emphasise that there have been previous studies which relate L2 problems in processing syntactic gender agreement to variability in lexical gender assignment (Carroll, 1989; Tanner, 2008; Hopp, 2013; Grüter et al., 2012; Montrul et al., 2014). Carroll, in particular, argues that the conceptual and lexical knowledge of adult L1 English L2 learners of French ‘overrides’ the phonological status of determiners and other gender-marked clitics due to their linguistic and cognitive maturity (Carroll, 1989). In other words, these L2 learners do not develop the right gender representations, even though they understand the concept of marking. They do not have any difficulty in ‘hearing’ the words that mark gender when parsing speech because they can phonologically represent all forms and carry out lexical look-up. In order to produce gender, they develop mnemonic strategies called ‘rules of thumb’ (Carroll, 1989, p. 578) for pairing nouns and all gender-marked words. Thus late bilinguals cannot call on gender marking to facilitate gender processing.

Tanner’s (2008) interview with an advanced L1 English speaker of German indicated that he was not able to correctly assign nouns to the appropriate gender class. Significantly, there were no differences in the accuracy rates of definite articles versus other gender agreement elements such as adjectives indicating either that he had problems in assigning abstract gender features to nouns in the mental lexicon or that he had difficulty accessing the gender feature during grammatical encoding (Bock & Levelt, 1994; Levelt, 1989).

According to the FFFH and the aforementioned studies, adult L1 English learners of gendered languages may acquire the interpretable gender of nouns but not the uninterpretable gender of determiners and adjectives because grammatical gender is not instantiated in English. Consequently, gender agreement processing never becomes an integral part of their L2 system and is easily affected by other linguistic or extralinguistic factors (e.g., oral — written production). Thus, with regard to the present study the English-Greek participants of this study can be said to accurately process the gender lexical knowledge of nouns, but not to be able to go beyond a probabilistic selection of determiner based on noun phonology.

The Interpretability Hypothesis

In line with FFFH (Hawkins & Chan, 1997), which has suggested that formal features are subject to critical period constraints and, therefore, parameter-resetting in L2 acquisition is problematic, the Interpretability Hypothesis (Tsimplici & Mastropavlou, 2007), which is a reformulation of the SLA theory suggested by Tsimplici and Roussou (1991) in minimalist terms argues that ‘interpretable features are accessible to the L2 learner whereas uninterpretable features are difficult to identify and analyse in the L2 input due to persistent, maturationally-based, L1 effects on adult L2 grammars’ (Tsimplici & Dimitrakopoulou, 2007, p. 217). The fact that adult L2 learners demonstrate poor performance in the use of the definite article when compared with child L2 reveals that the main reasons for inaccessibility of uninterpretable features are critical period constraints or genetically-based deficiencies in the analysis of the input (Tsimplici & Mastropavlou, 2007).

Tsimplici and Mastropavlou (2007) note that the learnability status of interpretable and uninterpretable features differs precisely due to their respective presence or absence in the logical form (LF). In particular, learners will access interpretable features as those features provide cues, which ensure their mapping to conceptual representations. On the other hand, uninterpretable features are restricted to syntactic derivations and do not have any role in the LF. Although the aforementioned distinction is the main difference between L1 and L2 acquisition, Tsimplici and Mastropavlou (2007) conclude that uninterpretable features can be acquired eventually by L2 learners, albeit following a different route from L1 learners.

Shallow Structure Hypothesis (SSH)

Clahsen and Felser (2006) combining the results of their project with that of previous psycholinguistic studies explain how L1 grammatical processing differs from L2 processing. They propose the Shallow Structure Hypothesis (SSH) according to which ‘the sentential representations that adult L2 learners compute for comprehension contain less syntactic detail than those of native speakers’ (Clahsen & Felser, 2006, p. 35).

Specifically, during sentence comprehension L2 learners rely on lexical, semantic, and pragmatic information much as NS do. However, L2 learners compute less detailed syntactic representations, which are mainly restricted to local domains. To support their argument, Clahsen and Felser (2006) use as evidence finding from previous studies on the processing of ambiguous and syntactically complex relative sentences where NS are observed to use phrase structure-based parsing strategies when they have to process

ambiguous sentences in absence of lexical cues. In contrast, L2 participants make use of lexical but not syntactic information in parsing these sentences (Clahsen & Felser, 2006).

4.1.2 The accessibility accounts

The Missing Surface Inflection Hypothesis (MSIH) — The Morphological Underspecification Hypothesis (MUH)

According to MSIH variability in morphology reveals difficulties in identifying the appropriate morphological realisation of functional categories like grammatical gender. This attributes L2 morphological errors to problems with mapping from abstract features to their surface morphological manifestation rather than with impaired underlying syntactic competence (Haznedar & Schwartz, 1997; Prévost & White, 1999; 2000; Lardiere, 2000).

Haznedar and Schwartz (1997), when examining a Turkish child learning English as L2, conclude that the child's non-finite morphological production reveals missing inflection rather than a syntactic deficit. They consider that the problem with realisation of surface morphology might also account for adult L2 acquisition. Moreover, in Lardiere's (1998) study a Chinese NS L2 learner of English exhibiting 100% accuracy rate in nominative case assignment proves that she has acquired the morphological aspects at an abstract level. Therefore, the problems she has are not due to any deficit in functional features but are in fact due to what Lardiere (1998) calls 'mapping problems' between surface forms and abstract features. These 'mapping problems' are responsible for the use of default forms.

Regarding the use of default types, Halle and Marantz (1993) make a clear distinction between grammatical features such as gender on a specific inflected form and its syntactical realisation when constructing the distributed morphology (DM). According to the DM, each inflected form in the narrow lexicon is associated with a bundle of grammatical features such as gender. The feature values of the vocabulary can be specified or underspecified (Carstens, 2000). For lexical insertion to take place, the features of the lexical item must be consistent with the features of the terminal syntactical node in the syntax. At this stage, there is a competition between potential features for insertion. The speaker chooses the form with the most features that match those of the terminal node. However, sometimes the speaker can choose a default type.

Prévost and White (1999), analysing data from the spontaneous production of two adult L2 learners of French and two adult L2 learners of German, argue that 'L2

learners have acquired the relevant features of the terminal nodes in the syntax (from the L1, from UG or motivated by L2 input)' (Prévost & White, 2000, p. 127). On the other hand, they also state that spoken language production in particular is affected by the pressures of real-time processing. Thus 'when more fully specified forms are acquired, they do not always "win" in the competition for lexical insertion, so underspecified forms continue to surface' (Prévost & White, 2000, p. 129). According to MSIH, therefore, L2 morphological variability stems from failure in retrieving the correct morphological forms under real-time processing pressure (Prévost & White, 2000). As a result L2 learners of gendered languages come to rely on default forms or other gender cues as they fall short of mapping the correct target lexical form into the presented syntactical context.

In line with MSIH, Bruhn de Garavito and White (2002) and White, Valenzuela, Kozłowska-Macgregor and Leung (2004) demonstrate that L1 English L2 learners of Spanish, after having enough exposure to Spanish language, were highly accurate with respect to both features of gender and number. In contrast, McCarthy (2008) argues that L2 morphological variability presents a representational issue rather than a production problem. McCarthy (2008) examines L1 English L2 learners of Spanish in the intermediate and advanced level both in comprehension and production tasks of gender agreement, including clitics and adjectives. Intermediate-level participants evidenced variability across comprehension and production tasks. In contrast, advanced-level participants showed less variability.

Following the Morphological Underspecification Hypothesis (MUH) (Montrul et al., 2008), both groups were found to use the masculine gender as the default one. The default strategy reveals the effect of gender knowledge. When the participants know an object to be masculine, they generally do not use the inappropriately feminine value, while the same cannot be said for feminine gender. In other words, participants use the default masculine gender both when the gender is known and when it is not known with regard to feminine nouns. This fundamental asymmetry indicates that correct encoding of gender automatically results in the correct use of agreement. Finally, McCarthy (2008) concludes that asymmetrical representations in the morphology may actually indicate an issue of performance when feature representations are native-like or when feature representations are weak.

Full Transfer/ Full Access (FT/FA)

The main tenet of the Full Transfer/Full Access (FT/FA) model (Schwartz & Sprouse, 1996; White, 1989; 2003) is that the initial state of L2 acquisition replicates the final state of L1 acquisition. In particular, during primary stages of L2 acquisition the representation of grammatical features, such as grammatical gender, is based on the features available in the L1 (full transfer). However, the model suggests that adult L2 learners have ‘full access’ to underlying UG and that new grammatical features, not instantiated in L1, can be acquired, regardless of the age of acquisition. Schwartz and Sprouse (1996) underline the significant role of: the initial state, the type of input, the apparatus of UG and the learnability considerations in the trajectory of L2 morphological development. In other words,

the starting point of L2 acquisition is quite distinct from that of L1 acquisition: in particular, it contends that all the principles and parameter values as instantiated in the L1 grammar immediately carry over as the initial state of a new grammatical system on first exposure to input from the target language (TL). This initial state of the L2 system will have to change in light of TL input that cannot be generated by this grammar; that is, failure to assign a representation to input data will force some sort of restructuring of the system, this restructuring drawing from options of UG (Schwartz & Sprouse, 1996, p. 96).

It is significant that there are two opposite hypotheses to the FT/FA model: the Minimal Trees hypothesis (Vainikka & Young-Scholten, 1996) and the Weak Transfer hypothesis (Eubank, 1993). Both suggest full access but not full transfer of functional categories and of the values associated with functional categories, respectively.

4.1.3 Lexical gender learning hypothesis

Arnon and Ramscar (2009; 2012) analyse the effect of unit size on learning an artificial grammatical gender system. They take as a starting point the concept that adults L2 learners have lexical and grammatical experience from their L1 which they bring to L2 learning. Thus, they are aware of the segments of a language, in other words of the linguistic units and boundaries. In addition to this, Arnon and Ramscar (2012) using as an argument the idea that when adult L2 learners start by learning smaller linguistic units such as noun labels, they then associate the nouns with their specific semantic information. So, semantic cues or the vision of an object leave no space for the article cue’s predictive role in terms of the upcoming noun. This cue-competition subsequently impairs learning and acquiring the associations between an article and a noun in a

nominal phrase. Thus, the tight associations between semantics and noun labels effectively blocks the learning of the article, resulting in gender agreement errors.

Arnon and Ramscar (2012) manipulate the size of the initial linguistic units in order to test their hypothesis. For this purpose, participants were divided into two groups: the learners in the sequence-first group were first exposed to larger units, that is, article + noun sequences in whole sentences in which the boundaries between articles and nouns were unclear, and then to noun labels. While, in the noun-label-first group, learners were first exposed to smaller units such as noun labels and then to full sentences. Fourteen two-syllable novel noun labels for familiar objects, two articles (*sem* and *bol*) and a carrier phrase (*os ferpäl en*) were the components of the artificial language. Full sentences always had the same order: carrier phrase + article + noun.

The researchers simulated acquisition of the language in both sequence-first and noun-label-first conditions by using the Rescorla-Wagner model. Two models were constructed and trained according sequence-first condition and the noun-label-first condition. The results of these simulations highlight the benefit of learning from larger units in the artificial language. Following this, 32 native English speaking undergraduate students were tested under the same conditions. In particular, the experiment contained two phases: learning trials and test trials. In the learning trials, participants in the sequence-first condition heard first ‘less segmented’ input (determiner–noun sequences) and then a block of isolated noun labels. The opposite procedure was followed in the label-first condition. In both conditions, they were asked to repeat the sounds that they heard after seeing pictures of objects on a screen co-occurring with an oral description in the artificial language. Test trials followed the learning trials, where participants were asked to complete a forced-choice task and a production task. In the first one, after seeing a picture and hearing two sentences the participants had to indicate the correct sentence. In the production task, they had to produce orally a full sentence in order to describe the picture that they had seen.

The results showed that when both the participants and the learning models started with bigger linguistic units, the artificial gender system was more effectively learned. Specifically, when the participants were initially presented with ‘less segmented’ units (determiner + noun sequences), they were forced to use distributional information/gender cues to identify the sentence with the correct article in the forced-choice task before they could map a noun to a referent. Similarly, they were more likely to produce the appropriate article for a given noun in the production task. When the

participants were presented with isolated noun-labels, the gender-marking information on the determiner-noun sequences provided no further gender cues to facilitate noun-referent mappings and, thus, they didn't focus on the determiners as gender markers, failing to learn the gender cue encoded (Lew-Williams & Fernald, 2010). Additionally, both groups produced the carrier-phrase in the same degree of proficiency.

To summarise, Arnon and Ramscar (2012), using an artificial language learning experiment prove that different learning conditions affect not only the acquisition of articles as gender markers but also the learners' ability to associate a noun with its gender class. The noun-label-first condition represents the language learning condition mostly encountered by adult L2 learners, who already have lexical and grammatical experience of their L1 and, thus, are able easily to detect word boundaries in speech and 'to focus on what they perceive to be the "meaning-carrying" units (such as the noun-labels) of a new language'. Thus, 'starting from noun-labels should hinder learning about the relation between articles and nouns because learning segments individually comes at the cost of blocking later learning about the relations between segments' (Arnon & Ramscar, 2012, p. 300).

In contrast, the opposite learning schenario where noun-labels and articles co-occur in less segmented input first, which simulates the infant L1 learning conditions, aids learning of gender class information and the mapping between form and meaning develops over time (= used based language models). In line with Ramscar et al. (2010), 'once the semantic dimension of language is taken into account, the way linguistic information is learned, and what gets learned as a result, can shift dramatically' (Arnon & Ramscar, 2012, p. 302).

Grüter et al. (2012), taking into consideration Arnon and Ramscar's (2009) findings, form the 'lexical learning gender hypothesis'² stating that gender processing by L2 learners of gendered languages depends mainly on learning environments. Their study will be discussed in more detail in subsequent chapters.

² Grüter et al. (2012) use the term 'learning schenario'. Hopp (2013, p.38) first used the term/phrase 'lexical gender learning hypothesis' in order to refer to Grüter et al.'s (2012) 'learning scenario' of the nouns' gender.

4.2 Gender processing by adult L2 learners

4.2.1 Accuracy rates in gender assignment and gender agreement

NS systematically acquire grammatical knowledge of gender assignment and of gender agreement rules between syntactically related elements at relatively young age (Carroll, 1989; Pérez-Pereira, 1991). Regarding L2 learners of gendered languages the findings of studies which have examined L2 accuracy in lexical gender assignment and syntactic agreement are for the most part unequivocal. Several studies suggest that the correct assignment of gender of nouns and the implementation of gender agreement represents a major challenge when it comes to mastering a non-native language (Grüter et al., 2012; Hopp, 2013; Alarcón, 2011; Dewaele & Véronique, 2001; Franceschina, 2001; 2005; McCarthy, 2008). However, there are few studies which have proven that grammatical gender is eventually acquirable by L2 learners with or without grammatical gender in their L1 (White et al., 2004; Sabourin et al., 2006).

Late L2 learners, even when learning languages with transparent gender systems like Spanish, have difficulties in lexical gender assignment. Even very advanced L2 learners of Spanish showed non-target assignment of gender to nouns in production, especially when gender is not instantiated in their L1 (Franceschina, 2005). In a elicited production task in the Grüter et al. (2012) study the L2 group of participants produced more assignment errors than gender agreement errors showing that ‘persistent difficulty with grammatical gender experienced by highly proficient L2 learners primarily affects lexical, rather than syntactic aspects of gender’ (Grüter et al., 2012, p. 208). These findings further support the idea that difficulty with the retrieval of gender information in real-time language use is the main reason for the high percentage of gender errors by L2 learners.

Interestingly, studies which examined L2 learners of languages with more opaque gender systems, such as German, demonstrated the same results (Tanner, 2008). Taking into account the fact that every noun is linked under a specific gender node class in the mental lexicon (lexical aspect) and this characteristic is expressed in the syntactic agreement by specific morphophonological gender forms of the related constituents (syntactic aspect), Hopp (2013) tested the connection between lexical and syntactic aspects of gender processing in real-time L2 production and comprehension. This study is the first to explore the online sensitivity to gender marking on determiners in predictive agreement relations in L2 German. By designing two experiments, an elicited production task and a visual world eye tracking comprehension task, Hopp investigates

the possible connection between gender assignment in production and gender agreement in comprehension within the same group of L2 speakers whose L1 does not have grammatical gender, that is English.

Hopp (2013) demonstrates that accuracy in lexical gender assignment depends on the amount of target-language input that the L2 learners have received and reflects their proficiency levels. Moreover, the analysis of gender assignment errors shows that these L2 speakers either mis-assign the nouns or they waver between the different gender forms in production across all the grammatical gender forms. These findings further advance Grüter et al. (2012) results as both of these studies emphasise that the problem with gender in L2 has lexical rather than syntactic reason. The results of both of these studies will be analysed in more detail later in this chapter.

The aforementioned low-accuracy levels in gender assignment in elicited production tasks are contrary to those found by Sabourin et al. (2006) whose study reveals high accuracy levels in a gender assignment task. Significantly their study included L2 speakers from three language backgrounds with different degrees of similarity regarding gender: German has a similar gender system to Dutch, English has no gender, while the Romance languages (French, Italian or Spanish) have different gender rules when compared to Dutch. The researchers tested the gender assignment knowledge of adult advanced L2 learners of Dutch using an off-line gender assignment task investigating the role of L1 transfer. In addition, the frequency effects and the use of default gender were also underlined.

Participants were asked to make a *de* or *het* judgment for each presented Dutch noun, even if they were not sure of the gender. All of the L2 learners, both the German and Romance speakers, and even the English speakers, were able to assign nouns to the correct Dutch gender category at a very high level of accuracy (although the English group performed worst of all). These results indicate that L1 transfer may not be responsible for the accurate gender assignment as all L2 groups performed on average above 80%. However, the better performance of the German group does suggest that surface and deep transfer give the ability to L2 learners to assign nouns to their gender class with more accuracy. Moreover, effects of noun familiarity and default gender strategy were found for all participants as they more easily assigned the higher frequency nouns while also assigning the most frequent gender to the nouns that they didn't know. These findings further confirm the association between the length of exposure — which has to do with the level of noun familiarity — and the accuracy in

gender assignment, while the presence of grammatical gender in L1 does not play an important role. The authors conclude ‘L2 acquisition of grammatical gender is affected more by the morphological similarity of gender marking in the L1 and L2 than by the presence of abstract syntactic gender features in the L1’ (Sabourin et al., 2006, p. 1). However, an important limitation of this study is that only off-line tasks were used which allowed the participants to make a conscious and controlled decision using their explicit knowledge (Marinis, 2010).

Apart from difficulties in gender assignment L2 learners show persistent difficulties with gender agreement. Results from the abovementioned off-line grammaticality judgment task indicate that in contrast to gender assignment the ability to use gender agreement rules depends mainly on the participant’s L1. The researchers conclude by underlining that ‘acquiring lexical gender knowledge (assignment knowledge) is possible even for those whose L1 does not include this feature, but that more syntactic-level agreement knowledge is considerably more difficult’ (Sabourin et al. 2006, p. 26).

Nevertheless, a group of studies have shown that L2 learners can be more accurate with assignment than agreement in different languages such as Spanish (Bruhn de Garavito & White, 2002; Alarcón, 2010) and Dutch (Sabourin et al., 2006) and French (Holmes & Dejean de la Bâtie, 1999). Thus we can see that L2 learners first acquire the inherent lexical gender of a noun (lexical assignment) and then they acquire how to process this knowledge in the syntactic concord among the syntactic related constituents such as determiners and adjectives, in NP and sentence (Alarcón, 2010). On the other hand, Grüter et al. (2012) and Hopp (2013) argue that the problem with gender is mainly lexical problem.

Despite contradictory results among the aforementioned research, there is one clear conclusion. In contrast to the systematic and target-like assignment of lexical gender to nouns in L1 mental lexicon, all studies now argue that L2 learners show partially inaccurate gender assignment and unstable gender agreement. This indicates that L2 learners do not access gender nodes for nouns in the L2 mental lexicon and at the same time they cannot process — at least at a native-like level — gender agreement rules. However, Dussias et al. (2013) argue that despite the fact that L2 learners do not show native-like performance, their accuracy levels are quite high, most often ranging between 80% and 90%. They conclude that ‘learners do, in fact, exhibit a high degree of knowledge of the TL gender system, even if that knowledge is not identical to that of

native speakers who perform at ceiling on the tasks that have been employed' (Dussias et al., 2013, p. 355). This study critically examines, as we will analyse later in the chapter, the question of whether L2 learners of gendered languages are able to access and use their gender knowledge during on-line processing.

4.2.2 The role of morphological, syntactic and semantic information in L2 gender processing

There are number of studies which have examined the role of semantic, morphological and syntactic information in L2 gender processing. Many studies have replicated Karmiloff-Smith's (1979) investigation of how adult L1 English L2 learners of gendered languages, such as Spanish, German, Italian, French and Dutch, use different types of gender-marked cues (semantic, morphological and syntactic) in gender assignment and gender agreement, processing mostly novel nouns; for example, in L2 Italian (Oliphant, 1998), L2 French (Carroll, 1989; Hardison, 1992), L2 Spanish (Cain et al., 1987; Finneman, 1992; Franceschina, 2005), L2 German (Delisle, 1985), L2 Dutch (Zekhnini & Hulstijn, 1995) and L2 Russian (Taraban & Kempe, 1999). However, due to the fact that some of these studies do not incorporate methodological innovations and also that semantic information is beyond the scope of our research focus, only the most recent and relevant studies will be presented below.

Oliphant (1998) tested L1 English speakers who were first and second year L2 students of Italian. Her main research goal was to reveal the role of semantic, morphological and syntactic cues in the gender assignment of Italian nouns. The Italian gender system is a system in which all these gender elements play a very important role. Taking this into consideration, Oliphant used three oral gender assignment tests to examine students' sensitivity to noun endings (morphology), to natural gender (semantic) and to syntactic cues or to a combination of these gender elements.

Test 1 asked the participants to characterise 38 Italian nouns based only on morphophonological cues of noun endings. In Test 2 one more gender cue was added in the gender assignment procedure — the gender-marked definite article of each given noun. The article and noun phrases were given in five different combinations: two like cues (gender-marked article and noun ending in accord), one syntactic cue (gender-marked article without noun ending), one morphophonological cue (gender-marked noun ending but no gender marked article), conflicting cues (gender-marked article and noun ending in discord), and no cues (both article and noun ending unmarked regarding gender). Finally, in Test 3 participants were asked to choose a masculine or feminine

adjective in 21 sentences after they heard combinations of morphophonological, semantic and syntactic cues. There will be no analyse below of the variables and results of the third test, as the role of semantic information is not the focus of the present thesis.

Test's 1 findings indicate that L2 learners are sensitive to those cues in the word's final phonemes that reliably indicate gender, confirming the determining role of transparency. However, analyses of the results also reveals the importance of syntactical cues in gender assignment. Specifically, even though the rate of gender accuracy increases as the number of gender elements increases, in Test 2 the participants were able to choose the correct gender of the given nouns only when they were presented with gender-marked definite articles. When there was an ambiguous syntactic cue combined with a clear gender-marked morphophonological cue, the accuracy level was surprisingly low. Moreover, when a gender-marked article and noun ending were in discord the participants focused on the more reliable syntactic cues. Also, the participants relied on the noun ending only when the article was not marked for gender. Oliphant's (1998) findings reveal the role of transparent endings. In addition to this, L2 learners appear to rely on syntactical cues when they are available, even when they are incongruent with the endings. Oliphant underlines these findings and suggests 'certain tendencies of English speakers when dealing with gender cues in Italian' (Oliphant, 1998, p. 257). Nevertheless, we have to be cautious with Oliphant's results due to the low number of participants and the extremely low number of materials.

Franceschina (2005) replicating Pérez-Pereira's (1991) study investigated the role of semantic, morphological and syntactic cues in gender processing by L1 English L2 learners of Spanish. Specifically, 61 NS and NNS who had diverse language backgrounds³ were asked to describe the colour of imaginary images containing humans, animals and human-like beings which were presented at the same time with their novel nouns. The results clearly indicate that both NS and NNS rely mostly on syntactical cues, especially when there is a conflict between the different types of gender-marked cues. Franceschina concludes: 'the three adult groups have set the relative strength of gender clues in the following order: syntax > morphology > semantics' (Franceschina, 2005, p. 182). However, as we have mentioned before, specific questions could be raised over the methodology used and thus the results

³ In Franceschina's (2005) study one group of NNS participants had as L1 –gen languages and the other NNS had as L1 +gen languages.

obtained. The low number of participants of non-gender languages (–gen) could have biased the reliability and validity of the results have affected the findings.

Taking into consideration the role of ambiguity in gender processing for L1 some researchers suggest that ambiguous gender marking results in slower and more errorful processing relative to those instances when gender marking was less ambiguous (Bates et al., 1995; Tucker et al., 1997). In contrast, approaches that support the lexical representation of gender (Carroll, 1989; 1995; Corbett, 1991) predict no differences in the processing of regularly and ambiguously marked nouns. Research specific to L2 learners reveals that some speakers behave in a manner similar to L1 speakers, relying on phonological gender markers that vary in reliability for classifying gender. Taraban and Kempe (1999) investigate these contrasting hypotheses by examining the processing of Russian sentences requiring gender agreement. They test the processing effects of gender cue marking on nouns (transparent vs. opaque gender termination) and ask whether reliably marked adjectives would reduce the ambiguity associated with opaque nouns. This is the first study to examine the priming effects of gender markers in the subject NP on gender processing in the verb phrase.

Twenty-six native L1 Russian speakers (Experiment 1) and 18 advanced L2 Russian speakers (Experiment 2) read Russian sentences on a computer and were then asked to nominate the appropriately gender-marked verb form in a forced choice task. The verbs either matched or mismatched the gender of the subject NP. Half of the target nouns were ambiguously marked for gender and the other half were regularly marked. In order to test the role of agreement markers, an adjective was used before the subject noun in half of the experimental trials.

Analysis of the data shows that the cue reliability (transparent vs. opaque gender termination) of the subject nouns in experimental sentences affected gender classification of these nouns and gender agreement for associated verbs. Taraban and Kempe (1999) found that ambiguous phonological cues to gender marking led to slower and less accurate sentence processing by both L1 and L2 subjects, while the presence of adjectives reliably marked for gender improved performance for both groups on sentences with phonologically ambiguous nouns. Additionally, a significant pattern is reported. Although, NS and L2 learners benefited from gender-marked adjectives, the L2 learners' performance was slower and less accurate when ambiguous gender morphological cues were present. This pattern indicates that L2 learners rely more than NS on unambiguous gender cues such as adjectives. The authors conclude that

‘individuals may use gender agreement markers in order to bolster gender classification when there is some uncertainty about the inherent gender of nouns, such as opaque nouns in Russian’ (Taraban & Kempe, 1999, p. 143).

Regarding French grammatical gender, Holmes and Dejean de la Bâtie (1999) point out the significant role of morphology. In their study they found that L1 English L2 learners of French were quicker in gender assignment of novel words than real words indicating that ‘they were able to focus on the endings of non words without having to make a time-consuming and possibly fruitless search for lexical information’ (Holmes & Dejean de la Bâtie, 1999, p. 499). Carroll (1999) proves the important role of semantic and morphological patterns in French gender processing. However, Carroll does suggest that L1 English L2 learners of French ‘are especially sensitive to semantic patterning and are capable of mapping from conceptual categories to morphosyntactic ones in ways that francophone infants are not’ (Carroll, 1999, p. 71).

There have also been some older studies which examined the role of gender-marked cues (semantic, morphology and syntax) in language acquisition. In particular, the role of noun endings in gender assignment has been highlighted by many (Delisle, 1985; Cain et al., 1987; Finneman, 1992; Hardison, 1992; Zekhnini & Hulstijn, 1995). Interestingly, in Cain et al.’s (1987) study L2 learners were found to rely more on syntactical information even though they were provided with morphological and semantic information at the same time.

Overall, the majority of the aforementioned studies suggest that L1 English L2 learners of gendered languages rely more on syntactical (determiners and adjectives) than on morphological information in L2 Italian (Oliphant, 1998), L2 Spanish (Cain et al., 1987; Franceschina, 2005) and L2 Russian (Taraban & Kempe, 1999). Moreover, Oliphant (1998) and Taraban and Kempe (1999) underline the role of syntactical cues when L2 learners process ambiguous nouns. Nevertheless, all of the studies examining the role of noun endings in gender processing do suggest that morphophonological transparency affects L2 gender processing. The effect of morphology and, specifically, noun transparency in L2 will be analysed in the following section.

4.2.3 The role of noun ending in gender processing (transparency — non-transparency)

There is a growing body of literature that argues noun transparency affects L2 gender processing of both transparent and opaque language systems. As part of the aim of this

thesis is to examine the role of morphology in L2 Greek gender processing, it is therefore useful to review related studies.

Taraban and Roark (1996) investigate the role of competition between gender categories by manipulating the amount of ambiguity in learning sets of 24 feminine French nouns. They tested L1 English L2 learners of French. The results indicate that participants were slower when masculine nouns created more or less competition in processing noun endings to gender classes. Also, English speakers made fewer mistakes when the morphological cues were more reliable or less ambiguous. This result demonstrates that noun ambiguity of gender marking has an effect not only on learning such nouns but also on learning and processing a whole gender system of a language.

In a recent study, Bobb et al. (2015) investigated the role of noun endings in lexical-level gender processing by native English speakers learning German as L2 and German NS. They designed a speeded metalinguistic task so as to test participants' ability to assign gender explicitly rather than analysing agreement errors like previous studies such as that by Bordag et al. (2006). The participants had to indicate whether the 221 presented bare-stem German nouns were masculine, feminine or neuter in a computer-based gender decision task.

The results from the gender decision task shows that L2 learners of German benefit more from morphophonological cues in order to assign the given nouns correctly. Both NS and NNS of German assigned gender significantly faster and more accurately to typical, rather than ambiguous or atypical, nouns. This may indicate a tendency towards overgeneralisation of specific morphophonological gender patterns. The fact that less-proficient participants relied more on the phonological cues demonstrates that, in contrast with the translation recognition task, the proficiency level was a factor in the gender decision task (Bobb et al., 2015).

All the above mentioned studies have examined the role of morphophonological cues in gender assignment by focusing mainly on speech comprehension tasks. In contrast, Bordag, et al. (2006) tested the role of noun endings in on-line gender processing by NS and NNS of German by combining comprehension and production tasks. Specifically, they examined the effect of noun termination in picture-naming and grammaticality judgment tasks. Three groups of German nouns were used in the experimental tasks: nouns with gender typical termination, nouns with ambiguous termination and nouns with atypical termination. Because the German language relies

more on a meaning-based gender classification, the experimental nouns chosen did not belong to any of the semantic-based gender categories. This enabled the role of phonological gender features to be clearly explored. The reaction times and error rates were analysed in order to reveal if there were any processing differences between the three noun groups.

In the picture-naming task both NS and NNS of German were asked firstly to name a single picture with a bare noun (short condition) and then to characterise the right picture of two presented images by applying an adjective *groß* or *klein* ('big' or 'small') (long condition). Any gender agreement between the noun and the adjective in the long condition would thus reveal the role of phonological cues in gender processing of the three noun groups (Levelt et al., 1999). In the grammaticality judgment task both of the groups were presented with 84 grammatically incorrect noun phrases comprised of a demonstrative pronoun + a noun.

The results confirmed the hypothesis, revealing differences between L1 and L2 gender processing; L2 processing was shown to be affected by the phonological gender cues of the nouns. Breaking down the results, the analyses of the reaction times and error rates in both comprehension and production tasks demonstrate that NS of German are not affected by phonological cues in the processing of gender typical, ambiguous and gender atypical nouns. On the contrary, L2 German speakers with intermediate to advanced knowledge made the most errors in the gender atypical Group C, performed better with the ambiguous Group B, and performed best with the gender typical Group A items in all the experimental tasks. These findings confirm the association between a noun's morphophonological form and the retrieval of correct grammatical gender in L2 processing.

Significantly, the effect of phonological form was not revealed in the short condition. Taking that fact into consideration, we can conclude that as proficiency level increases, links between the phonological cues and the specific gender features become stronger. L2 learners use different gender-processing skills when compared to NS due to the fact that they are at a different learning point. Bordag et al. (2006) note that L2 learners with less language experience — perhaps as children — are more sensitive to phonological cues that play a determinant role on gender retrieval processing. Thus we can see that, at least in the first learning levels, the phonological forms have to be activated in order for L2 learners to compute and then to accurately complete the gender processing. On the other hand, links between the phonological cues and gender nodes

are no longer used, weak or even absent from the processing system of proficient L1 speakers. However it must be noted that the large number of experimental stimuli is a limitation of this study.

Moving to more transparent language systems, a number of studies in L2 Spanish have examined the effect of gender-related linguistic cues such as gender noun class (masculine or feminine), head noun morphology (transparent or non-transparent noun endings), and noun class (semantic or non-semantic) in gender agreement production by using written and oral experimental tasks (Montrul et al., 2008; 2012; Alarcón, 2010; 2011; Foote, 2015).

In their study, Montrul, et al. (2008) examined and compared the knowledge of gender agreement of 69 heritage speakers, 72 adult L2 learners of Spanish with English L1 and 22 native Spanish speakers. The L2 learners were of various proficiency levels and had started studying Spanish after puberty. In Experiment 1 the participants had to recognise nouns on the basis of gender agreement between determiners and adjectives in noun drop structures. In Experiment 2 they had to recognise the correct masculine or feminine form of determiners and adjectives based on the ending of the noun. Finally, their oral production was tested by asking them to describe images using determiner + noun + adjective sequences.

The findings of the three experiments reveal that both heritage and L2 learners of Spanish make systematic agreement errors. However, the English–Spanish learners performed better in the written tasks than in the oral description task confirming the predictions of MSIH. The opposite occurred for the heritage speakers. When the results relating to L2 learners’ written comprehension and oral production of gender agreement in noun phrases were further analysed important insights were observed. These concerned the patterns of errors in terms of gender (masculine, feminine), domain of agreement (determiner, adjective), and noun endings (transparent vs. opaque). Specifically, L2 learners were more accurate with agreement on determiners than on adjectives. Also, they performed better with masculine nouns than with feminine nouns. Finally, both in the written comprehension and the oral picture description task the L2 learners produced a larger number of errors with Spanish nouns that were not transparently marked for gender, particularly when those nouns were feminine.

Alarcón (2011) replicated Montrul et al.’s (2008) tasks in order to investigate the knowledge of Spanish grammatical gender in terms of both comprehension and production. Alarcón tested higher-proficiency level heritage speakers, L2 undergraduate

learners and Spanish NS using only attributive adjectives and determiners. Because of the focus of this thesis we will mainly discuss the results relating to the L2 learners' performance. L2 learners were significantly more accurate in the written comprehension task than in the production task. This indicates, in line with MSIH, that the abstract feature of Spanish gender is part of the L2 mental lexicon and the low accuracy rates can be attributed to performance issues and not to linguistic competence. Both groups performed better when they had to process overtly rather than non-overtly marked nouns, both in the comprehension and production tasks. Alarcón, in agreement with the Competition Model, argues that 'overt morphology is also a valid cue for advanced heritage and L2 learners when establishing gender agreement in the comprehension and production of noun phrases' (Alarcón, 2011, p. 345). Moreover, structures with attributive adjectives and determiners were seen to be processed by L2 learners in a similar way. This contrasts with previous studies which argue that gender agreement with determiners is acquired earlier and more easily than with adjectives (Fernández-García, 1999; Bruhn de Garavito & White, 2002; Montrul et al., 2008), while it does accord with studies which suggest that the agreement dependencies within the NP are acquirable for advanced L2 learners (Keating, 2009; Gabriele, Fiorentino & Alemán Bañón, 2013). To summarise, in contrast to Montrul et al.'s (2008) findings, both groups performed at ceiling level in the written comprehension task. However, in line with Montrul et al. (2008) heritage speakers performed better than L2 learners in the oral task. These results indicate that, although the age of acquisition is an important factor in SLA, gender is an abstract feature in the underlying grammar of L2 learners.

Alarcón (2010) extends her 2009 study and examines the association between gender assignment and gender agreement by exploring the role of noun morphology (overt, non-overt, or deceptive), noun class (semantic or non-semantic) and gender (masculine or feminine) in gender agreement production. In the later study, 107 English speakers who were L2 learners of Spanish at different proficiency levels (low-intermediate, high-intermediate and advanced) were asked to complete a gender assignment task and then an agreement written production task. In particular, they had to indicate the gender of the given noun by filling in the appropriate masculine or feminine definite article and then in a constrained written production task they had to produce a suitable and accurate adjective to modify the noun according to the meaning of the context. However, it must be noted that in Alarcón's (2010) study only familiar words were used in order to control the effect of familiarity because frequency plays an important role in L2 gender acquisition (Sabourin et al., 2006; Andersen, 1984).

To begin, the level of proficiency did affect the L2 learners' performance. The English–Spanish learners were shown to be more accurate in gender assignment than in gender agreement, replicating the results of other studies which indicate that L2 learners first acquire the abstract gender feature of a noun and then are able to apply this knowledge in the other elements such as determiners and adjectives (Bruhn de Garavito & White, 2002; Sabourin et al., 2006; Holmes & Dejean de la Bâtie, 1999). Furthermore, with the nouns they had first assigned correctly, the learners were more accurate in producing gender agreement with the transparently-marked nouns than with the non-transparently nouns. In addition, the L2 learners produced more accurate noun + adjective agreement sequences including masculine than feminine nouns indicating a mapping rather than an underlying representation problem in the L2 learners' mental lexicon. Finally, the L2 learners were shown to rely on morphology only when they had to process non-semantic nouns. 'Learners regard semantic information as a more valid and reliable cue than morphological form, but when the sentential subject lacks a semantic correlate, i.e., refers to an inanimate entity, learners focus on cues such as inflections' (Alarcón, 2010, p. 287). To summarise, L2 learners rely on gender-related linguistic cues of morphology, noun class and gender in gender agreement production. However, in line with the Competition Model they

process animacy and overtness as competing linguistic cues, and choose animacy over morphology (rather than using both cues together) in order to establish a one-to-one mapping between form and meaning. For L2 learners, animacy appears to override morphology when they appear together in the input (Alarcón, 2010, p. 288).

Other studies comparing the gender knowledge and performance between heritage and L2 learners argue that the early language experience is a major factor of linguistic competence only in oral production for heritage speakers (Montrul et al., 2008; Alarcón, 2011). Taking that into consideration, Montrul et al. (2012) examined the importance of the linguistic learning experience of morphology in gender agreement production. By the term 'linguistic experience' they refer to 'the timing, type, modality, frequency and amount of exposure to relevant input and use of the language' (Montrul et al., 2012, p. 88). NS, heritage speakers and L2 learners of Spanish with intermediate to advanced proficiency were tested in elicited production tasks.

The high accuracy rates in agreement production of Spanish NS and heritage Spanish speakers (100% and 65% respectively) in contrast with the low accuracy rates of L2 learners reveals the importance of the age of acquisition, which controls the

amount of exposure. The type of gender errors made was also consistent with the results of previous studies. In particular, heritage speakers were more accurate in oral production than L2 learners (Montrul et al., 2008; Alarcón, 2011). Moreover, errors were more frequent with feminine NPs than with masculine ones revealing the role of masculine gender as the default one in Spanish language as L2 (Alarcón, 2010; Montrul et al., 2008). Furthermore, Montrul et al. (2012) found that L2 learners performed better on agreement production of determiners and adjectives accompanying transparently marked for gender nouns rather than non-transparently ones (Alarcón, 2010; 2011; Montrul et al., 2008). Finally, the pattern of L2 learners being more accurate with gender agreement on determiners rather than on adjectives was found to repeat the earlier findings of several studies (Bruhn de Garavito and White, 2003; Montrul et al., 2008; Fernández-García, 1999).

Finally, Montrul et al., (2012) highlight the role of experience and more specifically, the type of input that L2 learners receive especially in the beginning stages of learning. The majority of gender errors were of the sort **un* [MSC] *nube blanco* [MSC] ‘a white cloud’ (compared with *una* [FEM] *nube* [FEM] *blanca* [FEM]). This indicates that the main reason for inaccurate gender performance is gender noun misclassification as the gender agreement sequence between the determiner and the adjective is correct. The authors argue that ‘gender errors in advanced speakers have a lexical rather than a syntactic etiology’ (Montrul et al., 2012, p. 110).

Montrul et al.’s (2012) study confirms other studies (Grüter et al., 2012; Hopp, 2013) but also contributes additional evidence that highlights the role of input experience. Trying to explain the results, the authors do not focus on the importance of acquisition of gender before or after the critical period but rather point out the importance of the type of input. In particular, they argue that L2 learners are predominantly primarily exposed to both visual and aural input in classroom settings. Visual input affects how gender agreement is processed and learned by providing information about the word boundaries. This may result in L2 learners forming weaker associations between determiners and nouns and, even worse, between adjectives and nouns (Grüter et al., 2012; Hopp, 2013; Arnon & Ramscar, 2009). The authors conclude that ‘input modality affects language representation and processing and may explain why L2 learners are typically less sensitive to gender marking than native speakers’ (Montrul et al., 2012, p. 111).

A very recent study by Foote (2015) examines the role of morphophonological gender transparency in gender agreement production. Spanish NS and English speakers who are intermediate and advanced proficiency L2 learners of Spanish were tested in a sentence fragment completion task vocabulary and gender knowledge task. Specifically, they were asked to repeat complex subject NPs and then complete them with an appropriate verb and adjective. In order to investigate the role of transparency, the head noun of each NP had either more valid/transparent or less valid/opaque gender cues. Apart from the gender cue of the head noun, the experimental manipulation also included the gender class of the head noun (masculine vs. feminine) and gender agreement or disagreement between the head and the local noun.

Analyses of accuracy rates, first of all, indicates that morphophonological cues do not affect the production of gender agreement by Spanish NS. In contrast, the author reports that L2 learners were affected by the transparency of the morphophonological gender cues, confirming the findings of all the previous studies with gender production tasks (Montrul et al., 2008; 2012; Alarcón, 2010; 2011). These results, combined with the answers of the L2 learners in the vocabulary and gender knowledge task, reveal that the gender nodes of specifically opaque feminine nouns are weak. Foote argues that this is due to ‘the learner’s strategy of opting for the default (masculine) when he or she is unsure about the gender of an opaque noun’ (Foote, 2015, p. 367).

The author concludes that the different pattern of agreement errors between NS and NNS of Spanish ‘are due to the nature of the links between nouns and their corresponding gender nodes in the native speaker versus L2 learner lexicon’ (Foote, 2015, p. 368). This hypothesis is in agreement with Arnon and Ramscar (2009), Lew-Williams and Fernald (2010) and Grüter et al. (2012) who have all suggested that different learning conditions between children and L2 learners has an impact on L2 learners’ ability to associate a noun with its gender class. This leads to slower gender retrieval, a decreased usage of gender cues in comprehension and production errors in gender agreement, especially when the L2 learners do not have gender in their L1 (Foote, 2015).

Apart from gender agreement production tasks, the role of morphophonological cues was also examined using on-line comprehension tasks by Alarcón (2009) and Montrul et al. (2014). Alarcón (2009) investigates the role of noun animacy, noun morphological transparency, and noun gender class (masculine or feminine) in the processing speed of an on-line gender agreement comprehension task. In addition to

these linguistic variables Alarcón (2009) extends the scope of her research by also examining the effect of gender congruency between the head noun and the attractor (matched or mismatched). Twenty-two Spanish NS and 139 L2 learners of Spanish whose L1 was English, were shown a sentence on a computer screen and then had to choose which of the two gender forms (masculine or feminine) of the displayed adjectives resulted in a grammatical completion of each sentence. Reaction times (RTs) were recorded.

The results reveal the significant effect of animacy in gender processing. All participants were faster in processing semantic than non-semantic head nouns. Moreover, a noun-class congruency effect was not revealed as beginners and advanced learners were faster in mismatching conditions. In contrast to other findings (Alarcón, 2010; 2011; Montrul et al., 2008; 2012; Foote, 2015), no evidence of morphology was detected. Although transparently marked noun endings were a valid cue for the Spanish NS, this pattern was not replicated for L2 learners. The author, taking into consideration the Competition Model, argues that the role of linguistic cues here is in accordance with that of L1 learners. Thus, learners whose L1 does not have grammatical gender do not rely on morphology while ‘morphology is a more reliable cue for native speakers of inflectionally rich languages like Spanish’ (Alarcón, 2009, p. 822). Another difference with other studies is that in Alarcón’s (2009) study advanced L2 learners were faster in establishing agreement between complex subject and predicative adjective when the head noun was feminine.

Montrul et al.’s (2014) findings further support the association between age of acquisition and gender performance. This is the first study to test this particular association by controlling the modality and degree of explicitness of the tasks. Unlike previous studies which indicated that L2 learners performed quite accurately on gender agreement in written off-line tasks (Grüter et al., 2012; Alarcón, 2011; Montrul et al., 2008), Montrul et al. (2014) focus on more automatic processing using more metalinguistic tasks. More specifically, NS of Spanish, heritage speakers and L2 learners of Spanish with intermediate and advanced proficiency levels were asked to complete three on-line spoken word recognition experiments involving gender monitoring, grammaticality judgment and word repetition. Montrul et al. (2014) replicated Guillelmon and Grosjean’s (2001) experimental tasks by manipulating gender-marking transparency in more metalinguistic tasks.

All groups showed sensitivity to gender-incongruency in the two more explicit tasks (gender monitoring and grammaticality judgment). Although Guillelmon and Grosjean (2001) did not include non-transparent nouns in their experimental tasks, these findings replicate Guillelmon and Grosjean's (2001) results where advanced late learners were insensitive to congruent and incongruent gender cues in determiners. The authors argue that high frequency of transparent nouns is the reason for this tendency. Moreover, L2 learners of Spanish, in contrast to the other two groups, were more inaccurate and slower with non-transparently gender-marked nouns in the word repetition task, confirming previous findings regarding accuracy rates according to nouns' gender-marking transparency (Montrul et al., 2008; 2012; Alarcón, 2010; 2011). Finally, gender misclassification, which is often found in L2 learners (Alarcón, 2011; Gruter et al., 2012; Montrul et al., 2012; Hopp, 2013) can explain why L2 learners repeat non-canonical ending nouns in ungrammatical NPs faster than words in grammatical NPs.

The differences between the two studies of Guillelmon and Grosjean (2001) and Montrul et al. (2014) may be also attributed to the differences in the participants' profile. The L2 learners in Guillelmon and Grosjean's (2001) study were high-proficiency, while, in Montrul et al.'s (2014) study the participants scored in the range of 30–48 (intermediate and advanced) in a written test. Foote (2014) fills the gap between the two studies and examines late learners at more advanced proficiency levels, making use of either type of gender cue, congruent or incongruent, during word recognition, while exploring at the same time the role of morphophonological transparency.

In Foote's (2014) study, only incongruency effects were revealed for all groups, indicating that age of acquisition does not affect the use of gender cues. In particular, high advanced late learners used gender-marked determiners in the word recognition task only when those cues were in conflict with the gender of the noun in the phrase. The authors point out that the lack of congruency effect for L2 learners and the fact that the L2 learners in Montrul et al.'s (2014) study showed sensitivity to gender-incongruency in the two more explicit tasks (gender monitoring and grammaticality judgment) can be explained:

late learners are only able to make use of these cues after word recognition has taken place. This is consistent with the idea that grammatical knowledge tends to be less automatized or implicit in late learners (DeKeyser 2000; Ullman 2001; Paradis, 2004). If

postlexical stages of word recognition are more open to conscious control, then late learners may be able to employ explicit knowledge of gender during those stages, while they cannot do so at earlier stages (Foote, 2014, p. 382).

Also, the nature of the language and the characteristics of the L2 learners are possible explanations of the differences between Foote's (2014) study and Guillelmon and Grosjean's (2001) study. In addition to this, gender marking transparency affects this process. L2 learners of Spanish were better able to make use of gender cues on determiners with transparently-marked nouns than with non-transparent nouns, confirming the results of other studies (Montrul et al., 2008; 2012; Alarcón, 2010; 2011).

As has been demonstrated above, a large and growing body of literature has previously investigated the effect of gender-related linguistic cues such as head noun morphology (transparent or non-transparent noun endings), gender noun class (masculine vs. feminine), and noun class (semantic or non-semantic) in accuracy rates and processing speed of gender agreement production and comprehension. The participants in this thesis are L1 English L2 learners of Greek. Given that Greek and Spanish grammatical gender systems are governed under similar rules, the analysis of research given above has focused on research which tested L1 English L2 Spanish learners. To sum up, morphophonological transparency plays a very important role. Intermediate to high-advanced L2 learners whose L1 is English were more accurate in processing transparently-marked nouns than non-transparently-marked nouns in production tasks (Montrul et al., 2008; 2012; Alarcón, 2010; 2011; Foote, 2015).

The disadvantages of non-transparently-marked nouns has also been confirmed using comprehension tasks. (Foote, 2014; Montrul et al., 2014). In contrast with all the aforementioned studies, Alarcón (2009) suggests that learners whose L1 does not have grammatical gender do not rely on morphology unlike NS of inflectionally rich languages (Alarcón, 2009). This conclusion is however consistent with Sabourin et al.'s (2006) argument indicating that the morphological similarity of gender marking in the L1 and L2 affects more L2 gender processing than the presence of the abstract gender feature in L1 (Sabourin et al., 2006). L2 learners in Alarcón's (2010) study relied on morphology only when they had to process non-semantic nouns. Thus, semantic information is a more secure gender cue than morphology. However, analysis of the role of semantic information is outside the scope of this thesis.

Previous investigations have revealed that the masculine default is a linguistic strategy not only for monolinguals, but also for L2 learners at all proficiency levels (Montrul et al., 2008; 2012; Alarcón, 2010; Foote, 2015). The use of default gender ‘is a mapping problem, related to the surface realization of the abstract feature of gender that is already present in the learners’ interlanguage’ (Alarcón, 2010, p. 289).

L2 learners of Spanish performed better on agreement production of determiners than with adjectives in Montrul et al. (2008) and Montrul et al. and Foote’s (2012) studies confirming the findings of other studies (Bruhn de Garavito & White, 2002; Fernández-García, 1999). In contrast, there was no difference in the accuracy rates of agreement production both with determiners and adjectives in Alarcón (2011). The latter is in line with studies which suggest that the agreement dependencies within the NP are acquirable for advanced L2 learners (Keating, 2009; Gabriele et al., 2013).

Moreover, in Alarcón’s (2010) study English-Spanish learners were more accurate in gender assignment than in gender agreement, replicating the results of other studies which indicate that L2 learners first acquire the abstract gender feature of a noun and then are able to apply this knowledge to the other elements such as determiners and adjectives (Bruhn de Garavito & White, 2002; Sabourin et al., 2006; Holmes & Dejean de la Bâtie, 1999).

However, gender misclassification is nevertheless indicated as one of the most frequently stated problems in a majority of studies. Montrul et al. (2012) argue that ‘gender errors in advanced speakers have a lexical rather than a syntactic etiology’ (p. 110). In a later study L2 learners were shown to repeat with more ease the non-transparent nouns due to gender misclassification (Montrul et al., 2014). In the same way that misclassification is an issue, Foote (2015) points out that L2 learners of Spanish use the masculine default gender. This is due to the fact that the gender links between nouns —especially the feminine — and the gender nodes are ‘weak, non-existent or even erroneous’ resulting in the learner’s strategy of opting for the default gender (Foote, 2015, p. 366).

We must also consider the role of input. As discussed above, Montrul et al. (2012) argue that L2 learners are primarily exposed to both visual and aural input in classroom settings. This affects how gender agreement is processed and learned by giving information about the word boundaries meaning that L2 learners form weaker associations between determiners and nouns and also between adjectives and nouns (Grüter et al., 2012; Hopp, 2013; Arnon & Ramscar, 2009). This insensitivity to gender

marking amongst L2 learners contrasts with sensitivity to incongruent gender marking in two more explicit tasks used by Montrul et al. (2014) and to the word repetition task in Foote (2014) indicating that then late learners may be able to employ explicit knowledge of gender during those stages, while they cannot do so at earlier stages (Foote, 2014).

The majority of the aforementioned studies compare gender performance between early (heritage speakers) and late learners (L2 learners). The age of language acquisition is therefore a significant factor which determines whether learners are able to make use of grammatical gender in native-like way. Many of the studies suggest that early acquisition is thus necessary for native-like gender use (Montrul et al., 2008; 2014; Alarcón, 2011).

4.2.4 Sensitivity to gender agreement violations

Within the psycholinguistic research tradition event-related-potentials (ERP) studies have recently been used extensively in gender processing. With this technique we have been able to considerably extend our knowledge about how and when different aspects of language input (e.g., grammatical gender) are processed in the brain. ERP studies examine if L2 learners are sensitive (i.e., show different brain responses to grammatical and ungrammatical sentences) to gender violations in L2, indicating that sensitivity to agreement violations correlates with some linguistic factors (e.g., the realisation of grammatical gender marking in L1, proficiency, working memory etc.). To contextualise the logic of our own study, we present the results of certain ERP⁴ studies that examined the possible contributions of both L1 and language experience to gender processing in L2 learners.

A very interesting research project was designed by Tokowicz and MacWhinney (2005). They examined L1 effects on L2 gender processing in early stages of L2 sentence comprehension. This is the first study to examine L2 processing by manipulating the L1 and L2 similarity in terms of visually presented Spanish syntactic constructions. Specifically, 20 beginning learners of Spanish with L1 English were asked to make grammaticality judgments on three different types of syntactic violations: constructions which are similar in L1 and L2 (auxiliary omission), L2 constructions

⁴ 'ERP methodology is appropriate to the study of gender processing as violations can elicit either a lexico-semantic effect (N400) or syntactic effects (P600, LAN) and indeed the question has been raised as to whether gender is represented semantically or syntactically' (Foucart & Frenk-Mestre, 2011, p. 379).

which mismatch or compete with the L1 (number agreement on the determiner) and constructions which are unique in L2 (gender agreement on the determiner).

Accuracy levels were approximately the same for all constructions. Beginner English–Spanish learners demonstrated more sensitivity to gender agreement violations between the determiner and the noun (a construction unique to L2) than gender number agreement violations (a construction that differs in L1 and L2). The ERP data revealed a significant P600 effect only for the similar and unique constructions. There was a complete lack of P600 effect for nominal number agreement (largely absent in English). Thus, the authors argue that grammatical aspects and patterns that are not present in the L1 (e.g., the feature of grammatical gender for English NS) should be processed faster than those structures that do not match across languages (e.g., number agreement in English vs. Spanish) in early stages of L2. They conclude by pointing out that, as English lacks the aspect of gender, transfer of determiner gender-marking isn't possible between the two languages. Therefore, English L2 learners of Spanish have no idea how to use gender marking during processing at the beginning of their learning process. However, the accuracy levels in this study do indicate that English-Spanish learners slowly build up relations between the articles and the endings of nouns/adjectives by developing effective implicit processing for L2 (Tokowicz & MacWhinney, 2005).

The association between the representation of grammatical gender knowledge and on-line gender processing in which this knowledge is applied was investigated by Sabourin and Haverkort (2003). They used an off-line grammaticality judgment task and an on-line EEG (electroencephalography measurement) version of the first task to test NS and NNS of Dutch with L1 German on two different kinds of gender agreement constructions within Dutch NPs. The stimulus sentences contained correct or incorrect determiner + noun sequences (definite condition) and correct or incorrect adjective + noun sequences (indefinite condition). The participants were asked to judge the sentences and then to correct the ungrammatical marked ones.

The German participants attained a native-like level only when the NP was definite. For indefinite NPs the German group did not perform well at all. Thus, even though Dutch and German grammatical gender systems are congruent, sharing similar gender categories and morphological gender elements, some constructions were shown to still cause problems for the L2 learner.

In another study, Sabourin et al. (2006) tested L2 learners using lexical gender knowledge in a sentence context. The participants first completed a simple gender

assignment task where all L2 learners, both German and Romance language speakers, and even English speakers, were able to assign nouns to the correct Dutch gender category at a very high level of accuracy. In particular, in the off-line second experiment of their study, 70 L2 speakers were asked to judge and then correct 80 grammatical and ungrammatical sentences containing gender agreement combinations between the noun and the relative pronoun. Transfer L1 effects, frequency effects and the use of default gender were all investigated. The difference between this study and the other gender agreement violation studies is that participants also had to correct the indicated violations.

According to the analysis of variance (ANOVA) analyses of the off-line grammaticality task data, German–Dutch learners demonstrated the best gender agreement performance (although still significantly worse than NS), the Romance–Dutch learners performed well above chance (although not as well as the German group), and the English group performed at chance. However, the findings of this gender agreement task do not support the previous gender assignment task. These results show how L1 transfer affects gender agreement in L2. In addition, the findings reveal association between noun familiarity and gender agreement accuracy. Finally, only the German group used the default strategy. Taken together these findings suggest that gender agreement is more difficult than gender assignment. For L2 learners whose L1 does not have gender, ‘gender agreement is very difficult and may be impossible’ (Sabourin et al., 2006, p. 27). While this finding is in contrast to White et al.’s (2004) study which indicates that English participants can acquire Spanish gender and use it correctly, it does converge with the findings of Franceschina (2001; 2002), who found that the English speakers had persistent problems in learning the Spanish gender system.

Moreover, level of proficiency does not appear to affect the ability to use gender correctly as the advanced level of the participants in Sabourin et al.’s (2006) study did not secure their excellent performance. This study also provides additional evidence with respect to the importance of L1 transfer as the Germans performed the best in both experiments while the English performed the worst. Finally, the findings of both experiments stress the role of frequency; the amount of noun gender input which results in a high level of familiarity and, finally, accurate gender competence. However, specific questions can be raised over the methodology used and the results obtained.

The low number of samples as well as the use of off-line tasks only could be said to bias the reliability and validity of the results.

Sabourin and Stowe (2008) were the first to use ERP to compare Romance and German learners' performance in the on-line processing of the definite article condition in L2 Dutch. In previous studies (Sabourin & Haverkort, 2003; Sabourin et al., 2006) German, Romance and even English speakers reached high accuracy levels in gender assignment of Dutch nouns. In Sabourin and Stowe's (2008) study, in order to highlight the role of L1 and L2 similarity in gender processing, one group of participants had German as L1, a language that has similar assignment and agreement rules within the DP to Dutch. The other group was made up of NS of Romance languages (Italian, Spanish, French), which are completely different at the lexical level. The ungrammatical sentences contained incorrect forms of the definite Dutch determiner although the sentences only become ungrammatical at the noun. High frequency words were used in all of the sentences in order to exclude the factor of frequency. All participants were asked to make a grammaticality judgments on all of the sentences.

The findings did not reveal a P600 effect in gender agreement violations between the determiner and the noun in Dutch for the Romance language learners of Dutch, whereas German–Dutch learners did demonstrate this effect. Sabourin and Stowe (2008) argue that native-like gender processing not only depends on the presence of a cognate gender system in the L1 but also requires overlapping of lexical gender. Thus, transfer was successful for the German proficient late L2 learners of Dutch as German and Dutch have the same agreement rules within the DP. On the other hand, for the Romance proficient late L2 learners of Dutch transfer was less successful due to cross-linguistic differences in agreement rules, even though the aspect of gender is present in their L1. In other words, the transfer gender processing routines are similar when gender constructions are similar in the L1 and L2 and are rule governed in proficient late L2 learners. However, the low numbers used in this study could have biased the reliability and validity of the results.

In a similar study, Foucart and Frenk-Mestre (2011) investigate gender processing in L2 when agreement rules are similar in L1 and L2 and when rules differ across languages, using the same type of DP across experiments. German and French are two languages which can be examined under this research concept as they both have grammatical gender systems. However, the number of genders, the adjective position relative to the noun and agreement of elements within the DP are expressed differently.

Taking these differences into consideration, gender agreement violations were manipulated within the same type of DP in three experiments, between the determiner and the noun (Experiment 1), the post-posed adjective and the noun (Experiment 2) and the pre-posed adjective and the noun (Experiment 3). The participants included 14–16 German NS who were advanced learners of French and 14–16 native French speakers as the control group.

The French NS and L2 learners of French (L1 German) showed sensitivity to gender agreement violations between the definite article and the noun in Experiment 1, especially when the nouns shared the same gender in German and French. However, the L2 learners were less consistent than the NS and only a small group of them showed sensitivity for French nouns that had opposite gender across the two languages. The results from Experiment 2 reveal that, in contrast with the NS, the L2 learners of French did not show any sensitivity to gender violations between the noun and the post-posed adjective. Similarly, the French NS showed a P600 effect in response to gender agreement violations whereas the L2 learners did not reveal any effect in Experiment 3.

These results are in agreement with Sabourin and Stowe's (2008) findings, further supporting the idea that 'automatic, native-like processing of gender will only occur in L2 learners to the extent that their L1 provides a basis for the transfer of both lexical gender and rules of agreement' (Foucart & Frenk-Mestre, 2011, p. 397). Moreover, Foucart and Frenk-Mestre (2011), with regard to the gender processing of DP with determiners, underline the role of proficiency and exposure to the L2 as found in Sabourin and Haverkort (2003). Finally, in terms of the gender processing of DP with adjectives, they argue that adjective agreement in L2 is less accurate and acquired later than determiner agreement, confirming the findings of previous research (Bartning, 2000; Bruhn de Garavito & White, 2002; Dewaele & Véronique, 2001; Grandfeldt, 2000).

Three recent studies using ERP (Gillon-Dowens et al., 2010; 2011) and eye-tracking (Keating, 2009) have investigated gender agreement processing between the noun and the predicative adjective in L2 Spanish. In particular, Gillon Dowens et al. (2010; 2011) offer insights on the role of L1 in L2 processing by obtaining results from different language combinations: English, Chinese and Spanish. Using ERP measures the authors investigated the role of L1 influence, the feature overlap and the L1–L2 transfer as factors which have an impact on L2 morphosyntactic processing in highly proficient late learners of Spanish. These two studies highlighted L1–L2 syntactic

transfer effects by comparing the results from an English L1 group (Gillon Dowens et al., 2010) and a Chinese L1 group (Gillon Downes et al., 2011) as L2 learners — Spanish has an aspect of gender while gender and number are not computed in Chinese and English.

In Gillon Dowens' et al. (2010) study, the 22 highly proficient English–Spanish learners with long exposure to the L2 environment demonstrated a native-like LAN–P600 pattern for gender and number violations in the within-phrase condition (determiner–noun agreement). In the across-phrase condition (noun–post modifying adjective agreement) only P600 effects were evident. However, significant latencies and amplitude differences between the number and grammatical gender processing were noticed in both conditions, across and within phrases. In contrast, NS of Spanish showed LAN and P600 effect in all number and gender conditions. These findings, combined with the fact that number is a morphosyntactic feature present in some English structures while grammatical gender is not present in L1 English, accord with the FT/FA account (Schwartz & Sprouse, 1996) that in high proficiency language levels both grammatical aspects of number and gender aspects can be successfully processed in L2 but not in native levels. However, specific questions can be raised over the methodology followed and the results obtained.

In order to illuminate the possible L1 transfer effects suggested by the previous study of English-Spanish learners, Gillon Downes et al. (2011) conducted a similar study with L1 Chinese learners of Spanish. Chinese is a language where features such as case, gender and number are not marked and so no such inflectional agreement is codified. However, the findings of this study do not support the previous research with English L1 group. The first difference is that the Chinese learners of Spanish demonstrate no significant differences between the P600 effects for gender and the number violations in grammatical decision tasks. A possible explanation for this might be that both of these morphosyntactic features do not exist in Chinese. A second difference is the complete absence of LAN effects. This may be explained by the fact that the Chinese learners were in a L1 Chinese environment, in contrast to English–Spanish learners with long exposure to the L2 environment (Gillon Dowens et al., 2010). However, as the level of Chinese–Spanish learners was observed to be high, both of these aspects have been acquired successfully. Finally, again in this study the results are in agreement both with the approach of FT/FA account (Schwartz & Sprouse, 1996) and the Competition Model (Bates & MacWhinney, 1987; MacWhinney, 2008)

indicating that features which are not present in the L1 can be acquired at higher stages of proficiency and that ‘even at high levels of proficiency as measured by off-line tests, automaticity of processing some language features requires more time and L2 exposure’ (Gillon Dowens et al., 2011, p. 1658).

The effects of structural distance on L2 Spanish was also examined by Keating (2009) using the eye-tracking method. He tested L2 learners’ sensitivity to gender agreement violations between the noun and the predicative adjective in L2 Spanish during an on-line sentence comprehension task. A key strength of the present study — and the main difference from the two aforementioned studies — is the fact that the English-speaking learners of Spanish were classroom learners from three different levels: beginners, intermediate and advanced. The violations between the noun and the post-nominal adjectives were presented in three syntactic structures: in the DP, in the VP and, finally, in the subordinate clause. An English comprehension sentence task followed the grammaticality judgment task in order to confirm that the participants were responding to the stimuli without mechanically repeating gender agreement patterns. The English–Spanish learners’ performance was then compared to the performance of NS of Spanish.

The three cross-sections of L2 learner data indicate that the beginning and intermediate levels learners were not sensitive to gender agreement violations within the DP. Keating (2009) notes that English learners of Spanish with low-proficiency, when they transfer a DP, it is underspecified for gender; ‘hence the lack of gender features to check during language use’ (Keating, 2009, p. 526). However, as in the case of Gillon-Dowens et al. (2010), the advanced learners of Spanish in Keating’s (2009) study demonstrated on-line sensitivity to grammatical gender agreement within the determiner phrase that was in many ways similar to that found for NS, suggesting that late L2 learners do have access to abstract categorical features like grammatical gender that do not exist in the learner’s L1. These findings further support the idea of ‘full access’ theory (Schwartz & Sprouse, 1996). We have to point out here that the longer fixation times in the incorrect condition for advanced L2 learners indicates that L2 learners may be unable to keep the information required for gender processing in working memory and simultaneously process other elements between the noun and the adjective (e.g., the verb). Keating (2009) argues that

this article attributes non native sensitivity to gender agreement anomalies outside the DP to a deficit in processing, where deficit means that L2 learners may not have the

processing resources necessary to hold information about gender in working memory while processing material that intervenes between nouns and adjectives (Keating, 2009, p. 527).

Overall, these results corroborate the SSH offered by Clahsen and Felser (2006) who suggest that L2 learners are unable to compute full syntactic features like NS, but instead rely mainly on lexical, semantic and pragmatic information during sentence comprehension. Thus, Keating (2009) concludes that knowledge of abstract gender is acquirable in late SLA but native-like processing of gender agreement violations in the L2 may not be achievable and one reason for this is structural distance.

The role of working memory and level of proficiency on adult L2 gender processing was further examined by Sagarra and Herschensohn (2010). This study differs from all the other studies which have analysed the role of these two linguistic factors for three reasons. Firstly, the number of participants was extremely large when compared to previous studies (Keating, 2009: 44 L2 learners examining memory; Foucart & Frenck-Mestre, 2012: 14 L2 learners examining proficiency; Gillon Dowens et al., 2011: 26 L2 learners examining proficiency; Gillon Dowens et al., 2010: 23 L2 learners examining proficiency). In this study 196 university students participated: 63 Spanish monolingual speakers plus 69 beginning and 64 intermediate L2 learners. The performance of beginners and intermediate English–Spanish learners was compared to the performance of Spanish monolinguals. Secondly, in contrast with other studies, which tested mainly advanced learners (Foucart & Frenck-Mestre, 2012; Gillon Dowens et al., 2010; 2011), Sagarra and Herschensohn (2010) examined for the first time the role of proficiency and memory in the beginning and intermediate levels. Thirdly, the present study combines both on-line (non-cumulative self-paced reading) and off-line (grammaticality judgments) tasks to investigate both the knowledge of grammar (gender and number) and the ability to apply it in real-time processing. In addition, the L2 learners completed a vocabulary, a grammar test and a working memory test.

A developing pattern of interlanguage grammar was revealed by the results of the first self-paced reading task as the beginner learners were not sensitive to gender agreement violations while the intermediate learners and Spanish monolinguals showed sensitivity to both violation types (i.e., longer RTs for discord than concord). These results support further the FT/FA hypothesis. In line with Sabourin et al., (2006) the

authors also point out the role of exposure that is required for native like gender processing.

Furthermore, the results from RTs and accuracy in terms of comprehension questions indicate no significant difference between gender and number agreement/disagreement for any of the three groups. Contrary to authors' hypothesis, the grammaticality judgments task data revealed higher accuracy levels for beginner and intermediate L2 learners at identifying number agreement errors rather than gender agreement errors and higher confidence levels in dealing with number discord sentences rather than those exhibiting gender discord. The working memory test demonstrated correlation between the intermediate learners' working memory capacity and their sensitivity to gender disagreement. These findings suggest that 'gender disagreement is cognitively more taxing than number disagreement' (Sagarra & Herschensohn, 2010, p. 2034). To summarise, Sagarra and Herschensohn (2010) conclude that 'adult learners with a certain proficiency level can demonstrate grammatical knowledge and implementation that is qualitatively comparable to that of native speakers; that gender agreement is cognitively more taxing than number disagreement; and that working memory facilitates gaining sensitivity to adjective morphology' (Sagarra & Herschensohn, 2010, p. 2035).

Foucart and Frenck-Mestre (2012) tested advanced English–French learners' ability to acquire gender and process agreement on-line in their L2. Taking as a base the results from Tokowicz and MacWhinney (2005), who argued that L2 grammatical aspects that are not present in the L1 (e.g., grammatical gender for English NS) should be processed faster than in early stages of L2, Foucart and Frenck-Mestre (2012) examined advanced L2 learners' sensitivity to agreement violations between the noun and the adjective by manipulating the position (Experiment 1: pre-nominal vs. Experiment 2: post-nominal attributive). Gender is encoded in French but not in English. Also, in both languages adjectives are placed before the noun (pre-posed adjective), while the use of the post-posed adjectives is a unique French structure. Moreover, Foucart and Frenck-Mestre (2012) considering the SSH (Clahsen & Felser, 2006), which suggests that late L2 learners cannot compute agreement in non-local contexts due to lack of processing resources, tested the sensitivity of English–French learners in gender agreement violations by manipulating the syntactic role of the adjective (Experiment 3: attributive vs. Experiment 4: predicative). The English–French

learners' performance was compared to the performance of French NS in three ERP experiments and one eye-tracking task.

Even though the L2 participants revealed a P600 effect for agreement violations within the DP between the noun and the post-posed adjective in Experiment 1, they also revealed an N400 effect for agreement violations between the pre-posed adjective and the noun (Experiment 2). In contrast, the results from Experiments 3 and 4 indicate that English–French learners have difficulty in non-local contexts within the verbal phrase for predicative adjectives. NS of French revealed a P600 effect in all experimental conditions. We have to point out here that the advanced L2 learners of French did demonstrate sensitivity to a large number of gender agreement violations in the eye-tracking experiment but not in the ERP, suggested by the authors as due to memory load. This study therefore shows that L2 learners are able to acquire and process more easily grammatical gender structures which are not present in their L1 (i.e., post-posed for English-French learners) than structures where the surface order is similar in L1 and L2 but the grammatical properties (e.g., noun endings) of the two languages differ. On this last issue, Foucart and Frenck-Mestre (2012) underline the role of proficiency. Finally, L2 learners appear to have more difficulty in processing gender in non-local contexts (i.e., predicative adjectives).

The role of L1–L2 differences, the structural distance and the level of proficiency were also highlighted by the recent study of Gabriele et al. (2013). Using ERP experiments the authors tested the effect of these linguistic factors on grammatical gender processing by English-speaking learners of Spanish at three different levels of proficiency: low, intermediate and advanced, like Keating's (2009) study. In particular, they examined sensitivity to gender violations within the noun phrase and across a verb phrase (Foucart & Frenck-Mestre, 2012; Keating, 2009).

With regard to L1–L2 differences, preliminary results showed that only advanced proficiency learners exhibited sensitivity to gender agreement violations. Secondly, correlation was obvious between syntactical distance and level of proficiency. Specifically, structural distance controlled the processing of gender agreement only in the intermediate and advanced learners. Also, the advanced learners were the only ones who succeeded in establishing agreement dependencies both in the within- and across-phrase conditions. To summarise, the aforementioned findings indicate that proficiency level, distance and L1–L2 differences affect L2 development without constraining ultimate attainment, thus supporting the FT/FA hypothesis (Gabriele et al., 2013).

As noted above, ERP studies have been extensively used in recent investigations of L2 gender processing. These studies examine if L2 learners are sensitive to gender violations in L2, indicating that sensitivity to agreement violations correlates with: L1 grammatical features (Sabourin & Haverkort, 2003; Sabourin & Stowe, 2008; Foucart & Frenck-Mestre, 2011); L2 experience and proficiency level (Sabourin & Stowe, 2008; Keating, 2009; Foucart & Frenck-Mestre, 2011; Gillon Dowens et al., 2010; 2011; Sagarra & Herschensohn, 2010; Foucart & Frenck-Mestre, 2012; Gabriele et al., 2013); and possible competition between L1 and L2 systems (Tokowicz & MacWhinney, 2005; Foucart & Frenck-Mestre, 2011), working memory capacity (Keating, 2009; Sagarra & Herschensohn, 2010) and age of acquisition (AoA) (Gillon Dowens et al., 2010; 2011).

A much debated issue is the degree of ‘nativeness’ of on-line gender performance which varies across studies. Tokowicz and MacWhinney (2005), Keating (2009), Gillon Dowens et al. (2010; 2011), and Foucart and Frenck-Mestre (2012) all conclude that gender can be successfully acquired in high proficiency levels of L2 even if it is not present in L1. This is in line with the FT/FA hypothesis (Schwartz & Sprouse, 1996).

4.2.5 The priming role of gender-marked cues (determiners and adjectives) in L2 gender processing

In the previous sections, we have presented studies which have examined and compared the role of semantic, morphological and syntactic information in L2 gender processing by adult L1 English L2 learners of gendered languages (4.2.2) and also psycholinguistic studies on gender processing in L2 which have used experimental tasks involving ungrammatical sentences, testing whether learners are sensitive to mismatches/violations in gender marking between nouns and determiners and/or adjectives in sentence processing or sentence comprehension (4.2.4). However, some of those studies did not involve any methodological innovations while at the same time violation paradigms have dominated psycholinguistic investigations of grammatical gender in SLA and few studies have examined the potentially facilitative effects of syntactical gender-marked cues (determiners and/or adjectives) on lexical access in fully grammatical sentences (Grüter et al., 2012).

Nevertheless, a number of studies involving lexical access have examined priming effects between modifiers (determiners and adjectives) and nouns in sentence comprehension by NS of English who are learners of gendered languages (Guillelmon & Grosjean, 2001; Scherag, Demuth, Rosler, Neville & Roder, 2004; Bobb et al., 2015).

In addition, the predictive effects of gender agreement relations have also been the research focus of a few eye-tracking studies (Lew-Williams & Fernald, 2010; Grüter et al., 2012; Dussias et al., 2013; Morales, Paolieri, Dussias, Valdes Kroff, Gerfen & Bajo, 2016). Gender-marked determiners and adjectives have been proven to facilitate processing in some cases and to inhibit processing in others, depending on whether they were gender congruent or incongruent with the nouns that followed. All of these aforementioned studies will be presented in more detail below, paying attention to their experimental tasks and results as they reveal the facilitate processing effects of gender-marked cues, determiners and adjectives on the gender processing of nouns. Although in this thesis we do not examine the predictive effect of determiners and adjectives but rather the processing effect, the results of these particular studies will help to reveal under which conditions articles and adjectives do facilitate gender processing.

Guillelmon and Grosjean (2001) confirm previous research on the difficulty with grammatical gender experienced by L2 learners, by examining adult NS of French as well as early and late proficient English–French bilinguals who learnt French either in childhood or in early adulthood, using an auditory naming task. The main research question of their study was how early and late French bilinguals process gender marking in French and if the processing mechanism depends on the starting point of using the gender-marking language on a regular basis.

Thirty-two monolingual French-speaking students and 32 early English–French bilingual students who started using both of the languages on average at the age of 5;4 participated in the first experiment. Thirty-six French nouns (18 masculine, 18 feminine) were used in the two experimental groups: one group contained 18 correct/congruent gender-marked determiners with respect to the noun and 18 neutral stimuli, while the other group contained 18 incorrect/incongruent gender-marked determiners with respect to the noun and 18 neutral stimuli. The masculine determiner ‘*le*’ and the feminine determiner ‘*la*’ activated the gender marking, while the neutral determiner ‘*leur*’ represented the neutral condition. Each participant was tested using only one part of the experiment, either the correct/neutral part to the incorrect/neutral part. They were asked to listen to the determiner noun sequences and to try and repeat the noun as quickly as possible using the adjective ‘*joli(e)*’. Experiment 2 had the same stimuli and procedure. The only difference was that instead of early bilinguals, the participants were late English–French bilinguals who had been using both languages for up to 24 years on average. The reaction time in naming the nouns was obtained and

analysed demonstrating the congruency and incongruency effects of gender marking for each group (monolinguals — early bilinguals — late bilinguals).

The results of the two experiments indicate that NS and early bilinguals of French display gender congruency and gender incongruency effects. In contrast, highly advanced late L1 English L2 learners of French are overall slower and insensitive to both gender congruency and incongruency. In other words, ‘they just cannot use the masculine *le* cue or the feminine *la* cue during the processing of the noun phrase’ (Guillelmon & Grosjean, 2001, p. 508). Guillelmon and Grosjean (2001), using a small follow-up production task conclude that late bilinguals know the French grammatical system of at least familiar nouns and, thus, they can produce it in at accurate level, however they cannot use gender marking in perception. In addition to this, the fact that the bilinguals were faster than the slow monolinguals, shows that the overall speed is not a factor which accounts for the absence of gender-marking. Guillelmon and Grosjean (2001), after comparing the gender-marking effect between early and late bilinguals, point out that late bilinguals make no difference in naming speed according to preceding gender information and this cannot be attributed to speed, production problems, language proficiency level or even age, but rather to the chronological starting period of language acquisition and, in particular, when the gendered language started to be used on a regular basis. Thus, late English–French bilinguals may acquire the gender features but they are not able to activate them in order to facilitate the auditory word recognition process.

In a similar study to Guillelmon and Grosjean (2001) — who did not include in their tasks any non-words⁵ — Scherag et al. (2004), including pseudo words, investigated the effects both of non-use and of late acquisition upon semantic and morphosyntactic language aspects. They examined the congruent or incongruent effect of gender-marked German adjectives in a priming procedure. The participants included long-term German immigrants to the US and English NS who were long-term immigrants to Germany as well as two control groups of native German speakers.

⁵ ‘The reasons that led us to choose naming over lexical decision are linked to the bilinguals. First, some bilinguals (especially late bilinguals) do not always feel secure deciding whether an item is a word or a nonword in their second language, and this probably has an impact on their processing. Second, reaction times to nonwords are longer in bilinguals than in monolinguals, as shown by Soares and Grosjean (1984). They explained this finding by suggesting that bilinguals search both lexicons when confronted with a nonword’ (Guillelmon & Grosjean, 2001, p. 511)

A semantic and morphosyntactic priming paradigm with auditory stimuli and a lexical decision task were used. Ninety-one German adjectives, four familiar German nouns and four pseudo-words for each adjective constituted the materials. Scherag et al. (2004), by a morphosyntactical manipulation, examined the congruent or incongruent effect of gender-marked German adjectives with respect to the following noun in a priming procedure with four conditions (sem + /syn +, sem + /syn –, sem – /syn +, sem – /syn –). The participants had to decide in a lexical decision task whether the target noun was a real one or a pseudo-word.

For the purpose of this thesis we will focus only on the results of the overall decision times and the error rates regarding the gender-marking effect of the prenominal adjectives. L1 German speakers were faster and more accurate in identifying the targets as real German words. L2 learners of German were slower and did not benefit from the preceding adjectives when making lexical decisions on the target nouns, regardless of whether or not the adjective agreed or disagreed with the following noun. Thus, the lack of gender processing effects can be attributed to the later age of exposure to the gender-marking language which results in less experience of processing and speaking of the gendered language and thus less cumulative frequency of hearing gender-marked elements.

In a recent study, Bobb et al. (2015), taking into consideration that sentence-level gender processing in L2 increases specific processing demands, investigated the gender effects in processing individual noun phrases in German. Specifically, 35 NS of German learning English as L2 and 82 native English speakers with intermediate to advanced proficiency in German were tested using 60 simple English nouns. They had to identify whether the German phrase was the correct translation of the English phrase in lexical-level gender processing by a translation recognition and a gender decision task.

Bobb et al.'s (2015) research is the first study to use speeded translation recognition tasks in order to reveal the lexical contexts in which L2 learners will probably show gender sensitivity. Thus the participants were presented with only translations of English determiner + noun phrases to German determiner + noun phrases. Because of this manipulation participants anticipated the German gendered article after seeing the English noun. In the critical trials the German article and noun pair were grammatically correct; although they were the wrong translation of the English word, and matched or mismatched the anticipated gender of the right translation. Using this experimental procedure Bobb et al. (2015) sought to examine

whether translation recognition is sensitive to gender processing or, in other words, whether the participants will show sensitivity to the mismatched gender across conditions. The factor of L2 proficiency was also taken into account.

The difference between the translation mismatch and the translation and gender mismatch condition proves the German NS's sensitivity to grammatical gender. In contrast, preceding effects are not obvious in lexical-level gender processing for L2 learners of German, regardless of German proficiency. Although they showed sensitivity to the semantics congruency, they were completely insensitive to the grammatical gender congruency. More specifically,

late L2 learners, regardless of their proficiency, do not engage in automatic gender processing and rely instead on explicit gender knowledge in making gender decisions. Specifically, they may have adopted a strategy of waiting for the appearance of the noun before making a gender decision (Bobb et al., 2015, p. 510).

The above statement is confirmed by the results from the computer-based gender decision task. The L2 learners of German benefited more from morphophonological cues in order to assign the given nouns correctly.

The researchers conclude that 'L2 learners do not acquire a lexical representation of grammatical gender in German, providing evidence for hard constraints at the lexical level on the late acquisition of grammatical structures not present in the L1' (Bobb et al., 2015, p. 517). These results are consistent with those of Grüter et al. (2012) and Hopp (2013), who suggest that weaker gender links between nouns and their respective genders in the L2 lexicon is the main factor in gender processing problems. Thus, L2 learners rely on language regularities as morphophonological gender cues as to noun endings especially in the early stages of learning a gendered language like German.

In an eye-tracking study, Lew-Williams and Fernald (2010) examined how English NS L2 learners of Spanish in the intermediate level process gender-marked articles in on-line comprehension in three comparable tasks using adults NS of Spanish, L2 Spanish learners as well as 3-year-old children learning Spanish as L1 from an earlier study (Lew-Williams & Fernald, 2007). Experiment 1 compared 26 adults NS of Spanish, 26 adults L2 Spanish and 26 L1 Spanish children in their ability of using the masculine gender '*la*' and feminine gender '*el*' as predictive cues when paired with familiar Spanish nouns. They used the same stimuli and the same child-friendly experimental procedure of their earlier study with Spanish-learning children and their monolingual Spanish-speaking parents (Lew-Williams & Fernald, 2007), while at the

same time they extend it by testing L1 and L2 participants in the looking-while-listening (LWL) procedure. All of the groups of adults viewed 16 familiar objects with names of the same grammatical gender and 16 well-known familiar objects with names of the different grammatical gender while listening to Spanish sentences referring to one object.

Experiment 2 examined the process of gender-marked articles paired with newly-learned object names, thus excluding the differentiating factors of the amount of previous experience regarding article–noun sequences or vocabulary level of the target nouns. This experiment compared 12 L1 adults Spanish–English bilinguals and 12 English NS L2 learners of Spanish in the intermediate level. In the 24 teaching trials, all the participants each saw six times the four combinations of a novel object and noun. In the 32 test trials, participants viewed matchings sets of novel objects and at the same time heard sentences containing sequences of definite articles and the newly-learned nouns. In half of the test trials, the pairings of pictures were in the same grammatical gender, while the other half were in a different grammatical gender. The participants were asked to combine a definite article and a novel noun while in the different-gender trials they had to use the predictive cue of gender-marked articles in order to indentify the correct referent.

In Experiment 3 the participants were tested on novel nouns preceded by definite article, following the teaching trials on novel nouns preceded by an indefinite article. In this way, Lew-Williams and Fernald (2010) were able to test the participants' efficiency in using their grammatical knowledge in real-time processing. Eighteen L1 adults Spanish–English bilinguals and 18 English NS L2 learners of Spanish in the intermediate level were asked to identify the referent of the newly-learned object by using a different article.

Breaking down the results, in Experiment 1 the NS of Spanish were able to use the gender-marked articles '*la*' and '*el*' to facilitate word recognition. While, L2 adults failed to use grammatical gender as a predictive cue to orient faster to the target picture, even though they had shown high familiarity with the nouns used in testing. The L2 adults responding with the same speed in the two trial types were proven faster than the L1 toddlers. In Experiment 2 both L1 and L2 adult participants in different gender trials took advantage of the gender-marked article preceding a newly-learned non-word to identify the correct referent more quickly, while in Experiment 3 L1 adults showed the same processing advantage of the gender-marked definite article in on-line processing

when generalisation was needed as in Experiment 1. In contrast, L2 adults were slower, albeit accurate, when tested using different articles from those used in the training trials.

These three experiments using eye-tracking measures of real-time language processing investigated differences between NS and NNS of Spanish in the speed and efficiency in processing article–noun sequences in relation to familiar and novel referents, including and collating at the same time the results of previous research with Spanish 3-year-old children (Lew-Williams & Fernald, 2007). The L1 adults took advantage of the informative gender-marked articles in order to categorise rapidly and successfully into the appropriate gender class not only familiar but, also, novel nouns. They were also fast and accurate in accessing abstract gender knowledge in real-time processing, when tested with a different article preceding the newly-learned noun. On the other hand, the L2 participants did not take advantage of the gender-marked articles as predictive cues of the target referent unless the articles had also co-occurred with the novel nouns during the learning trials, thus establishing memorisation/generalisation of the nominal sequence. In addition to this, there was a negative correlation between the overall RT and the efficiency of processing, illustrating that L2 adults with slower speed in lexical access did not orient to the target referent even in different-gender trials. Lew-Williams and Fernald (2010) conclude that differences between the nature of L1 and L2 learning environments, as well as the different characteristics of children and adults, such as age and previous language experience, can be significant factors which result in the difference between L1 and L2 learners of Spanish in real-time processing of determiner–noun phrases.

However, specific questions can be raised over the methodology used and the results obtained. The low number of samples as well as the significantly low number of trained and tested items could have an influence on the reliability and validity of the results. In particular, with regard to the methodology, it should be stressed that the exact procedure for construction of novel words is not reported.

According to MSIH advanced learners' difficulties regarding the different aspects of grammatical gender are related mainly to language production problems; they are mainly unable to access the relevant lexical items especially when speaking. Drawing upon this hypothesis, Grüter et al. (2012) designed a variety of experimental tasks combining expressive measures (namely production vs. comprehension tasks) and on-line versus off-line tasks within the same learner group. The goal of this mixed experimental design was to investigate whether the main source of these difficulties lies

in the retrieval of gender information, concerning the use of both expressive and receptive domains of language in real-time.

For the recruitment of the participants three measures of Spanish proficiency were used: self-rating, a written cloze test and the Versant Spanish Test. Nineteen native Spanish-speaking adults and 19 highly proficient L2 learners of Spanish were tested in three experimental tasks. Experimental tasks 1 and 2 replicated Montrul et al.'s (2008) tasks. Specifically, the first task was an off-line sentence–picture matching comprehension task targeted to examine whether learners are able to identify the gender of a noun which is marked only on the determiner and/or the adjective of a null NP. The participants were presented with 32 written noun-drop sentences in which the gender was marked on the determiner and/or the adjective. At the same time they could see three pictures for each of the sentences, each marked with a bare noun. They were asked to choose the image which matched the gender marked on the element(s) in the noun drop sentence.

An elicited production task followed. During this experimental task the participants could see two images of a target noun that were varied in at least one different characteristic (e.g., colour). They were asked to choose between the pictures by naming one of them. Taking into account the fact that the aim of this task was to test the gender assignment and gender agreement in participants' spoken production by eliciting determiner–adjective–noun sequences, no gender cues were present in the questions.

Grüter et al. (2012) replicated Lew-Williams and Fernald's (2010) study in the final on-line comprehension task. During this last task both groups were presented, on a screen, with pairs of pictures of different objects. At the same time they listened to sentences naming one of the pictures — indefinite article + noun. The participants were exposed to 79 noun–object pairs. The aim of this final task was to test whether the gender-marked determiner serves a potentially informative cue to the object being named. In order for this processing advantage to be revealed there were two experimental conditions: the familiar-noun and the novel-noun condition. The use of novel nouns controls 'the amount of previous experience participants in both groups had with each noun' (Grüter et al., 2012, p. 203). Twenty teaching trials of four novel nouns preceded the main experiment. Attempting to replicate the word learning context of the infant L1 learner, the participants were exposed in spoken language to four novel nouns each accompanied by a novel object. All the novel nouns were preceded by an indefinite

article. Another dimension of this final experimental task was that same grammatical gender and different gender trials were also included. Grüter et al. (2012) tested the hypothesis that in the latter case the participants are expected to name the target image more quickly. The participants' eye movements were videotaped while they were presented with pictures on a screen while listening at the same time to sentences naming one of the pictures.

Findings from Experiment 1 indicate that L2 learners performed at a native-like level in an off-line comprehension task targeting gender agreement on the basis of gender marking on determiner and/or the adjective, consistent with former findings by White et al. (2004) and Montrul et al. (2008). Moreover, in the elicited production task (Experiment 2) the L2 group made more assignment errors than gender agreement errors showing that 'persistent difficulty with grammatical gender experienced by highly proficient L2 learners primarily affects lexical, rather than syntactic aspects of gender' (Grüter et al., 2012, p. 208). These findings further support the idea that difficulty with the retrieval of gender information in real-time language use is the main reason for the high percentage of gender errors by L2 learners. This condition lies in the fact that, in contrast with the L1 lexicon where the lexical representation of grammatical gender is shaped by early distributional learning resulting in tight associations between determiners and nouns, in the L2 lexicon 'the associations between nouns and gender class information are unlikely to attain the same strength in L2 as in L1 lexicons, as a result of L2 learners' reliance on cues other than co-occurrence relations during word learning' (Grüter et al., 2012, p. 210)

Finally, regarding the results from the on-line processing of gender-marked determiners (Experiment 3), planned pairwise comparisons between RTs revealed that for the NS group there was a significant difference on the same- versus different-gender trials regarding the familiar-noun experimental condition. In contrast to the MSIH, the RT comparisons for the highly proficient L2 learners of Spanish prove a weakness in the use of grammatical gender cues in their on-line processing of familiar nouns. Interestingly, on the other hand, in the newly learned novel-nouns condition L2 learners relied more on gender cues as predictive elements in on-line processing. These findings are similar to Lew-Williams and Fernald's (2010) study and further support the argument that different learning conditions have an impact on L2 learners' ability to associate a noun with its gender class. In other words, the 20 teaching trials — following the sequence of a novel noun preceded by its indefinite article — which

replicate the word learning procedure of new words for infant L1 learners, enhanced the processing role of the gender-marked determiner as a predicative cue for the 19 highly proficient L2 learners of Spanish. Alternatively, the low RTs in relation to the familiar nouns prove that the typical and common top-down teaching method for literate adult L2 learners actually fails to help the learners to acquire the co-occurrence relations between nouns and gender-marked modifiers.

Grüter et al. (2012) extend the core tenet of MSIH from production to real-time comprehension, combining the non-target performance to gender assignment in production, the selective gender agreement errors and the fact that gender-marked forms do not act as guiding cues in on-line comprehension (Hopp, 2013). Taking into consideration the fact that L2 learners have prior metalinguistic knowledge about nouns and determiners, they provide the possibility of a lexical gender learning hypothesis.⁶ This recommends that L2 learners are taught grammatical gender like children in a non-segmented way with determiners–adjectives–nouns sequences in order to establish strong lexical gender representations. We will discuss this argument further in the conclusions below.

In two recent studies Hopp (2013; 2016), taking into consideration all the aforementioned conclusions, tested the connection between lexical and syntactic aspects of gender processing in real-time L2 production and comprehension. In particular, Hopp (2013) tested the association between gender assignment in production and predictive gender processing in comprehension in L2. The 2016 study then investigated the relationship between lexical gender assignment and the predictive processing of gender agreement in non-native and native German.

Hopp (2013) explores for the first time the on-line sensitivity to gender marking on determiners in predictive agreement relations in L2 German. By designing two experiments, an elicited production task and a visual world eye tracking comprehension task, Hopp (2013) investigates the possible connection between gender assignment in production and gender agreement in comprehension within the same group of L2 speakers whose L1 does not have grammatical gender, that is English. In the elicited production task the participants saw and named four coloured images of inanimate objects. In the 15 difference trials, the target object and the other two were coloured in the same clear recognisable colour. The fourth one was differently coloured. All the

⁶ The term ‘lexical gender learning hypothesis’ was first used by Hopp (2013) in order to refer to the learning scenario suggested by Grüter et al. (2012).

objects except the target one were different in gender from the target gender. Thus, in the question ‘Where is the [MASC/FEM/NEUT] yellow [Noun]?’ only the determiner could facilitate the predictive processing of the target object, as the adjectives which were used in the experiment were ambiguous in gender. In the five same trials, the target object and the other two were coloured in the same obvious colour and were in the same grammatical gender. The fourth one was differently coloured and had different gender from the other three. In the same trials the determiner and the adjective were compatible with the three objects of the same gender. The second experimental then part aimed to investigate whether variability in the use of grammatical gender is related to the speed of lexical access. In the visual world eye tracking comprehension task the participants saw 10 slides presenting objects which were the same distance from a central fixation cross. They were asked to fixate the cross by answering the question ‘where do you see *two* + adjective + noun?’ in order to test how quickly they use lexical cues in predictive processing in real-time comprehension, in contrast to the inflectional cues of the production experimental part.

Hopp’s aim was to reveal the association between gender assignment in production and gender agreement in comprehension which is why he divided the L2 speakers into lexical gender groups taking into consideration their overall gender assignment accuracy. Apart from the control group of the 20 NS, two groups were formed: the gender-variable and the gender-consistent L2 groups. One-way ANOVAs yielded significant differences between the two lexical groups revealing that gender accuracy in lexical gender assignment depends on the amount of L2 input which the L2 learners have received as well as reflecting their proficiency levels. Moreover, the analysis of gender assignment errors showed that L2 speakers either mis-assigned the nouns or wavered between the different gender forms in production across all the grammatical gender forms.

Breaking down the results of the correctly assigned data from the two lexical groups, the gender-consistent L2 group, in contrast to the gender-variable group, demonstrated early and clear effects of predictive gender processing showing significant variation between the difference and same trials. Hopp notes that ‘the natives and the gender consistent L2 group recruit gender as a robust agreement cue, irrespective of the particular gender marker, the findings of the gender variable L2 group illustrate that no gender form acts as a reliable cue in predictive noun processing.’ (Hopp, 2013, p. 48). Finally, the correlations between the mean reaction times in the numeral ‘two’ as a

lexical cue and the mean reaction times to the target picture in difference and same trials point out for both L2 lexical groups and the control group of natives that ‘less automatic lexical access leads to lower levels of predictive use of gender agreement in real-time comprehension’ (Hopp, 2013, p. 48).

Hopp (2013) defines that mastery of the target gender system in production means that the learner is able to assign nouns to their target gender classes by linking them to the accurate abstract gender class features and at the same time using this link not only systematically but also rapidly in real time processing. Combining this definition with the aforementioned findings, we conclude firstly that an overall mastery of lexical gender assignment results an accurate use of the syntactic determiner-noun gender agreement in predictive processing. The groups of natives and L2 learners who used the gender and lexical cues in the predictive processing were those who had correctly assigned the majority of the nouns. Analysing the prerequisites of accurate use of a language gender system: ‘Only the L2 learners who have consistent target-like overall gender assignment in production and whose lexical representations of gender are thus strong enough to be consistently accessed perform target-like on gender agreement in comprehension’ (Hopp, 2013, p. 51).

Secondly, Hopp’s study results indicate that not only the correct gender assignment but also lexical access speed are the main factors responsible for accurate performance in terms of gender agreement for both groups of natives and non-natives. In other words, ‘weaker lexical links and concomitant delays in accessing inflectional forms in adult L2 acquisition, lexical and capacity models together provide a principled account of why predictive syntactic gender agreement is selectively problematic in real-time L2 processing’ (Hopp, 2013, p. 52).

Despite the small sample of participants, the findings of Hopp’s investigation complement those of earlier studies (Prévost & White, 2000; Grüter et al., 2012). Hopp’s study also provides additional evidence with respect to the causes of inflectional variability in L2 acquisition. Specifically, the aforementioned results are in accord with the recent theories of MSIH (Prévost & White, 2000), which indicate failure in retrieving specific inflectional forms is due to production pressure, and the lexical gender learning hypothesis (Grüter et al., 2012), which supports the idea that weaker lexical gender representations — due to the L2 learning environments — are mainly responsible for inflectional variability. Hopp’s findings contribute to the existing theories by providing evidence that the lower levels of activation and the lexical speed

access to gender nodes in the adult bilingual mental lexicon are responsible for the inflectional variability and not the representational deficits in L2 grammars.

Having proven the relationship between gender assignment and predictive processing in gender comprehension, Hopp (2016) — following Arnon and Ramscar's (2009) and Grüter et al.'s (2012) findings, which highlighted the importance of L2 learning environments — this time investigated whether training instruction in terms of lexical gender leads to target predictive agreement processing in L2 German. For this purpose Hopp (2016) designed a training study including a pre-test–post-test of gender production and comprehension based on the author's (2013) experimental tasks. Specifically, a picture description task was used to test the lexical gender assignment in production while a visual-world eye-tracking task was used to assess the predictive processing of gender agreement.

The findings reveal that intermediate L1 English L2 learners of German are able to show predictive processing effects of gender agreement after training in lexical gender assignment and that the accuracy in gender assignment moderates predictive gender agreement (Hopp, 2016). However, the author emphasises the fact that failure in predictive gender processing may reflect error-driven implicit learning or weak gender links in mental lexicon or even the choice of gender in L2 production does not equal the use of gender in (predictive) comprehension (Hopp, 2016).

Two recent studies, Dussias et al. (2013) and Morales et al. (2016), examine the processing effects of gender cues, including in their experiments high proficient bilinguals whose L1 has gender. Dussias et al. (2013), in particular, elucidate the role of L1–L2 similarities and proficiency levels in real-time processing. In contrast to all the other studies, which have examined the role of these two linguistic factors by testing L2 learners' sensitivity to gender agreement violations (Tokowicz & MacWhinney, 2005; Sabourin et al., 2006; Gillon Dowens et al., 2010; 2011; Foucart & Frenck-Mestre, 2011; 2012), Dussias et al. (2013) fill the gap in the literature by employing the eye-tracking method. In addition, while other studies have explored the processing effect of gender cues in simple syntactical structures (Taraban & Kempe, 1999; Guillelmon & Grosjean, 2001; Scherag et al., 2004; Lew-Williams & Fernald, 2010; Gruter et al., 2012; Hopp, 2013), Dussias et al. (2013) respond to areas not previously examined by investigating the facilitate effects of gender-marked articles in more complex syntactical contexts during on-line processing tasks. In order to test the effects of L1 in L2 gender processing the participants of this study were deliberately chosen with different L1

backgrounds: English, a language without grammatical gender and Italian, a language with a gender system that overlaps significantly with the gender system of the L2 Spanish. Spanish NS were used as the control group. In addition, L2 learners were divided in low and high proficiency levels.

Breaking down the results according to the participants' L1, the NS of Spanish showed evidence of using more quickly the gender-marked articles to anticipate upcoming nouns in different gender conditions than in the same gender condition (Lew-Williams & Fernald, 2007). This proficiency was highlighted by the results of the two groups of English–Spanish learners. The advanced proficiency English–Spanish learners were able to quickly track — although not as quickly as the NS — more easily both the masculine and feminine target nouns when the article was informative than when it was not. On the other hand, gender cues on the articles did not facilitate on-line gender processing of Spanish feminine nouns for the low-proficiency L2 participants. Likewise, the Italian–Spanish learners, who had the advantage of the presence of gender in their L1, did not use the gender cue for the masculine gender.

To summarise, Dussias et al.'s (2013) study provides clear behavioural evidence that proficiency plays an important role in gender processing. This is similar to the findings of previous electrophysiological studies (Tokowicz & MacWhinney, 2005; Gillon Dowens et al., 2010; 2011; Foucart & Frenk-Mestre, 2011; 2012; Gabriele et al., 2013). Also, advanced bilinguals can be seen to use gender information encoded in Spanish articles to facilitate the processing of upcoming nouns during lexical selection (Hopp, 2013). Finally, while similarities between L1 and L2 play a role it is not as significant as the proficiency level of the learner. Thus, in contrast to Lew-Williams and Fernald (2010) and Grüter et al. (2012), it can be seen that 'high-proficiency learners of Spanish can achieve qualitatively similar patterns of performance as native monolingual Spanish speakers, even if they are L1 speakers of a language that lacks grammatical gender' (Dussias et al., 2013, p. 381).

In another recent study, Morales et al. (2016) examine the gender-congruency effect in a spoken-word recognition task using eye-tracking. Italian–Spanish proficient bilinguals were asked to listen to nominal Spanish phrases including nouns with (congruent) or different (incongruent) gender in their L1 (Italian), but always with congruent gender in Spanish. Using this manipulation, the predictive role of Spanish-gendered articles was also investigated in gender processing related to the gender-

congruency of the nouns. Participants were asked to click on the object which they had heard.

Regarding the interaction of the bilingual gender systems, the results indicate that ‘the two systems are interrelated in the bilingual mental lexicon’ (Morales et al., 2016, p. 306) either because of the single completed gender system in the mental lexicon (Salamoura & Williams, 2007), or because of the connection of the lexical representations of the two languages (Paolieri, Cubelli, Macizo, Bajo, Lotto & Job 2010). This ‘between-language gender competition effect’ (Morales et al., 2016, p. 294) controls the predictive value of the gender-marked articles in L2 as a cue during the interpretation of spoken instructions. Thus, analysis of the fixations to the target pictures indicates that when two incongruent genders are activated in the bilingual lexicon the gendered determiner of the L2 becomes a ‘less useful cue’ (Morales et al., 2016, p. 306) to the upcoming noun. In contrast, the definite article provides a valid cue in gender processing only in the different-gender condition (where the nouns do not share gender in either of the two languages).

Taken together, in the majority of the aforementioned studies in this section, intermediate to advanced level L2 participants whose L1 does not have grammatical gender fail to take advantage of the gender-marked cues as predictive cues for the target familiar nouns. Specifically, the determiners do not facilitate gender processing (Guillelmon & Grosjean, 2001; Lew-Williams & Fernald, 2010; Grüter et al. 2012; Dussias et al., 2013; Bobb et al., 2015; Hopp, 2013; 2016) and, also, adjectives (Scherag et al., 2004). On the other hand, L2 learners do benefit from informative gender marking on determiners to predict the upcoming nouns only: (i) when the articles co-occur with the novel nouns during the learning trials, establishing memorisation/generalisation of the nominal sequence (Lew-Williams & Fernald, 2010; Grüter et al., 2012; Hopp, 2016); (ii) at an advanced proficiency level when the article is informative rather than when it is not (Dussias et al., 2013); or (iii) when L2 learners have acquired overall target lexical gender knowledge (Hopp, 2013; 2016; Bobb et al., 2015). Finally, intermediate level L2 learners, whose L1 has grammatical gender, use gender marking predictively (Dussias et al., 2013; Morales et al., 2016).

4.3 Processing of Greek grammatical gender in L2

This thesis examines the significant role of morphology and syntax in Greek gender processing by adult L2 learners. Thus, it is necessary to review the methodology and the

results of previous studies which have examined the acquisition of gender in Greek as L2.

Τσιμπλή (2003) analyses the spontaneous oral speech of six bilingual immigrants in order to examine ‘the ultimate attainment’ (Τσιμπλή, 2003, p. 181) of the acquisition of Greek language of NNS who have learned the language in a naturalistic setting. The main goal of her research is to investigate firstly the acquisition level of Greek gender agreement and, secondly, the role of phonology in the acquisition of Greek grammatical gender. As a starting point, and taking into account the minimalistic theory (Chomsky, 1995), she argues in line with Ralli (2002) that the aspect of grammatical gender is an intrinsic, stable and unchanged characteristic of nouns, which does not correlate with any semantic information or any other aspects. Τσιμπλή (2003), in contrast to RDH (Hawkins, 2009) and FFFH (Hawkins & Chan, 1997) argues that the aspect of grammatical gender is activated even from the beginning steps of learning a L2 independently of the presence or not of the aspect in the L1’s grammatical system. She emphasises that this does not indicate that the gender of each noun is automatically acquired. The same assumption is valid for gender agreement. In other words, the feature-based computation of gender across syntactically related constituents is a characteristic of the UG and is automatically activated.

Τσιμπλή (2003), taking into account the fact that semantic information does not always indicate the grammatical gender of each noun in Greek, emphasises that phonology plays an important role in the acquisition of the gender of Greek nouns by L2 learners. She argues that, in languages like Greek, the morphophonological marking is evidence for gender agreement in agreeing elements of the DP, such as determiners and adjectives. Thus, ‘the use of a default type reflects that it is the most frequently occurring gender type’ (Τσιμπλή, 2003, p. 180). With regard to Greek language, Τσιμπλή (2003) points out that the use of the neuter gender as the default one is due to the fact that the majority of Greek nouns are neuter and that the neuter gender in Greek is an uninterpretable gender [\pm animate].

Τσιμπλή (2003) interviewed six bilingual immigrants whose L1 was Turkish and Russian. Her findings were that these L2 learners made more mistakes in gender agreement with adjectives, fewer in gender agreement with the definite Greek article and even fewer with the indefinite article. Moreover, all the participants used the neuter gender as the default one (90% use of neuter gender and 9% of feminine gender) confirming her former hypothesis about the default use of neuter gender and concluding

that ‘the neuter definite article is the most frequent type, characterized as the default one in the grammatical system of Greek language as L2’ (Τσιμπλή, 2003, p. 185). In contrast with the default gender in nouns, only two out of the six participants used the definite neuter article as the default one and did not use the neuter gender as the default one in the wrong adjectival phrases.

Τσιμπλή (2003) concludes that the bilingual participants in her study have acquired the Greek grammatical gender. Although she suggests that ‘the procedure of gender agreement production that the NS follow is the same as the one that NNS follow’⁷ (Τσιμπλή, 2003, p. 179), she also notes, in line with the MSIH (Haznedar & Schwartz, 1997; Prévost & White, 1999; 2000; Lardiere, 2000) that there are extensive differences with NS, arguing that ‘the NS can acquire both the morphology and the lexical knowledge but for the NNS the morphological representations follow a different route from the syntactical representations’⁸ (Τσιμπλή, 2003, p. 187).

However, specific questions can be raised over the methodology used and the results obtained. The low number of participants as well as their profile — they learnt Greek in a naturalistic way — could have biased the reliability and validity of the results. A survey that uses only six NNS speakers of Greek language cannot validate the present findings. In particular, in this study the average rate of errors within the DP increased as a result of the dramatically high inaccurate performance of two out of the six subjects. It should also be stressed that the use of oral interviews as a methodology is not a method for proving if problems with gender have lexical and/or syntactical etiology. In addition to this, the study fails to mention which statistical analysis was performed.

Moreover, there are also limitations concerning the theoretical basis of this study. Τσιμπλή (2003) emphasises that her study ‘is the description and the analysis of the advanced, final level of a language acquisition’ (Τσιμπλή, 2003, p. 181). However, when she concludes that the bilingual participants have acquired the aspect of gender, even though they performed differently from the NS, what does she actually mean? Has this aspect been activated but not acquired due to the fact that the participants made

⁷ ‘η διαδικασία παραγωγής συμφωνίας γένους που προτείνεται για τον ΦΟ υιοθετείται και από τον ομιλητή της Γ2’ (Τσιμπλή, 2003, p. 179)

⁸ ‘για τον ΦΟ η πρόσβαση στο μορφολογικό τμήμα του γλωσσικού συστήματος είναι εξίσου εφικτή με το λεξικό στην περίπτωση του L2er η ανάπτυξη της μορφολογικής γνώσης ακολουθεί εμφανώς διαφορετική πορεία από την εκμάθηση αφηρημένων μορφοσυντακτικών χαρακτηριστικών’ (Τσιμπλή, 2003, p. 187).

mistakes? Or have they acquired the Greek grammatical gender but done so incorrectly as they have not been taught it systematically?

The morphological variability in gender agreement production was at the centre of Tsimpli et al.'s (2005) study. The main goal of this research was to highlight the elements which affect morphological agreement production and, furthermore, to reveal a correlation between length of stay in a country and L2 performance. Thus, the authors analysed the morphological variability in gender agreement production by adult L1 Slavic speakers of Greek, all immigrants who learned Greek in a naturalistic way. The participants were divided into three groups according to their length of stay in Greece in order for the effects of L2 exposure on language development to be clearly revealed.⁹ Taking into account the MSIH (Haznedar & Schwartz, 1997; Prévost & White, 1999; 2000; Lardiere, 2000) and summarising findings from previous studies which suggest that the different types of domains, the locality of the agreement relation and the different types of features interfere with morphological agreement, Tsimpli et al., (2005) analysed agreement mismatches in terms of the different agreement domains, the locality of the antecedent and the type of features involved.

Firstly, their findings reveal the effects of L2 exposure on language performance. In particular, the rate of gender agreement mismatches in different domains decreased in the group with the longer length of stay in Greece. However, interestingly, the groups with the longer exposure to Greek language produced a higher percentage of mismatches when compared to the group with the least exposure to L2 in terms of the agreement between a DP and a predicative adjective.

Breaking down the results according to the effects of locality, the L2 learners made more mistakes when the DP agreement involved one element (determiner or adjective) and the head noun. Chi-square tests on the distribution of errors reveal fewer mistakes in determiner–adjective–noun agreement. Tsimpli et al. (2005) note that significant fewer errors on the head noun indicate that gender assignment is not responsible for the high percentage of agreement mismatches on production in the cases of adjective + noun and determiner + adjective + noun. Thus, in terms of DP dependency, distance is not a determinant factor in the production of agreement mismatches. In addition to this, the results reveal the effect of overt subjects on the

⁹ The first group ... 2.7 years, the second group 6.9 and the third group 13.6.

production of agreement errors is independent of the time of exposure to Greek language.

Although the participants of this study have gender instantiated in their L1, ‘gender seems to cause the most learnability problems even for Group 3’ (Tsimpli et al., 2005, p. 12). In particular, the findings suggest that L2 learners may follow phonological agreement (ελληνικά γλώσσα, ‘Greek language’) or use the neuter determiner gender as the default one (13%). Thus, ‘inaccuracy in gender agreement may be due to the phonological bias stemming from the head noun, which in turn affects the retrieval of the target morphophonological form of the agreeing element’ (Tsimpli et al., 2005, p. 14). Tsimpli et al. (2005) therefore conclude that very extensive exposure to L2 contributes to accurate production through the solid acquisition of surface morphology which cannot always reflect a syntactic deficit. However, the lack of appropriate evaluation of the participants’ Greek language competence is a limitation of this study.

In a very similar study, Dimitrakopoulou, Fotiadou, Roussou and Tsimpli (2006) investigated morphological agreement production in the verbal and nominal domains. In order to analyse the agreement mismatches, they took into account the factor of locality and the type of morphological features which are involved. They interviewed 36 adult Slavic (Russian and Serbian) immigrant speakers who learnt Greek in a naturalistic way. They split them into three groups according to the length of stay in Greece in an attempt to reveal a significant effect of the exposure to L2 on performance. The oral interviews had four parts (discussion based on biographical information relevant to the participants’ exposure to Greek language, storytelling through description of eight sets of images, two instruction-giving tasks and general discussion based on every-day life topics).

The results indicate that verbal agreement is acquired significantly easy and quickly, which is in line with Tsimpli et al. (2005). However, the findings also indicate that L2 learners have more difficulty in gender agreement production which can be explained by the MSIH (Haznedar & Schwartz, 1997; Prévost & White, 1999; 2000; Lardiere, 2000). Apart from gender, all the other features which are involved in the DP — domain agreement (number, case) — were shown to cause less learnability problems. Moreover, analysis of the agreement mismatches indicates that the participants had persistent difficulty with the use of determiners (48–50% of the errors), even though the grade of nominal complexity was not an obstacle. Specifically, 31% of the agreement mismatches were due to phonological harmony and 51.4% of errors were

caused by analogy with the frequent phonological combinations of determiner + noun. In addition to this, 13% of the mismatches indicate default use of the neuter determiner. Thus, the researchers conclude that ‘... inaccuracy in gender agreement may be due to the phonological information of the head noun, which affects the retrieval of the target morphophonological form’ (Dimitrakopoulou et al., 2006, p. 165). Finally, the findings reveal a high correlation between length of stay and L2 development. However, once again the lack of appropriate evaluation of the participants’ Greek language competence is a limitation of this study.

Agathopoulou, Papadopoulou, and Zmijanac (2008) analyse the type of errors in adjective and noun agreement by examining at the same time the effect of input-based, meaning-oriented instruction. Their target group included 24 low proficiency adult learners of Greek with an average length of stay in Greece of 8.6 months. Most of the participants’ L1 employs grammatical gender. The participants were examined in two written production tasks. In the controlled written task the participants had to describe, by using an adjective, one of two same objects, which were in a circle. In the one semi-controlled exercise they had to describe in writing two pictures, using specific nouns and adjectives. In addition to these tasks, the participants were, finally, examined using an oral elicited imitation task which included 36 adjective + noun agreement sentences, 18 of which were grammatical and 18 which were ungrammatical. All of the participants received explicit instruction regarding adjective and noun agreement in Greek. The participants were divided into two groups according to the instructional approach by which they were taught adjective + noun agreement: one through processing instruction (PI) activities and the other one through focus on form (FonF) activities.

The researchers took into account only the unambiguous endings, because some suffixes in Greek can have more than one gender representations (e.g., the phoneme /i/, $-ι$ [NEUT]/ $-η$ [FEM]). In terms of results, the most frequent errors found were overgeneralisation of the suffix $-ο$ on adjectives, mostly in the written task, and phonological matching (*μεγάλες καθρέφτες*, ‘big mirrors’) by repeating the noun’s inflectional suffix on the adjective, mostly in the semi-controlled and oral tasks. Moreover, the percentage of errors regarding gender, case and number were approximately the same, in contrast to the findings of Tsimpli et al. (2005). The fact that in the semi-controlled written production task the learners’ accurate answers significantly outnumbered the inaccurate ones indicates that the type of task can affect

performance. In addition, it was shown that the instructional method plays a significant role in L2. Specifically, the findings reveal that the two types of instruction regarding gender agreement, PI and FonF, positively affected the acquisition of the specific structure. The FonF group's performance was slightly more improved indicating that

Input including both nouns and their modifying adjectives coupled with typographical enhancement of agreement suffixes make detection and cognitive registration of these suffixes easier than when adjectives are presented without the nouns and with no enhancement of the agreement suffixes, as in PI (Agathopoulou et al., 2008, p. 15).

FonF instruction may therefore be more effective in implicit learning while PI is more beneficial in explicit learning.

Finally, Agathopoulou et al. (2008) conclude that low-proficiency L2 learners of Greek can master adjective–noun agreement gradually and any difficulties that they face are due to insufficient knowledge of the L2 required morphology. Thus, they argue that the use of structured-input activities, typographical enhancement of agreement suffixes and focus on meaning rather than on explicit explanation can help in the acquisition of the syntax of adjective–noun agreement.

Nevertheless, apart from the limitations that the writers themselves indicate — the lack of a control group of learners and the fact that the post-test was given to the participants straight after the instruction — the extremely low number of participants does throw into question the validity of the results of this study.

The initial state of nominal agreement of an adult Italian–English bilingual learner of Greek language was examined by Agathopoulou and Papadopoulou (2011). In particular, they tested the ‘Minimal Trees’ hypothesis (Vainikka-Scholten, 1994) and the FT/FA hypothesis (Schwartz & Sprouse, 1994) by examining the presence of the functional categories of inflection and determiners. They analysed the adult's performance on three oral tasks (sentence repetition, storytelling, picture elicitation) and four written tasks (cloze task, multiple choice task, two grammatically judgment tasks).

The findings indicate that an adult L2 of Greek, in the initial state, has acquired the functional categories of inflection and determiners, especially when they are present in his L1 and, thus, there is a positive transfer, confirming the FT/FA theory. In particular, results from the participant's poor performance regarding gender agreement in tasks where there was no gender clue like the storytelling (31%) and picture elicitation tasks (38%) indicate that the learner has difficulties in the gender assignment

of nouns rather than in nominal agreement. However, the participant's agreement mismatches also included overgeneralisation of the neuter definite article (*το* [NEUT] *βιβλιοθήκη* [FEM], 'the library'), phonological harmony (*η ομπρέλα είναι άσπρα*, 'the umbrella is white') and overgeneralisation of the suffix *-ο* (*η* [FEM] *καρέκλα* [FEM] *είναι γαλάζιο* [NEUT], 'the chair is blue'). The participant's performance in the written tasks was better than in the oral ones. Overall, the learner's accuracy was higher in terms of the use of articles.¹⁰ However, the participant performed better on the agreement between adjective + noun than on determiner + noun. Thus, Agathopoulou and Papadopoulou (2011) deduce that morphological complexity in nominal agreement or the interpretability of the features' properties may be the main reasons for the aforementioned results. Finally, Agathopoulou and Papadopoulou (2011) correctly state that the results of a case study like this may not be generally applicable. Also, they emphasise that the participant's high educational level and the possible positive transfer of feature value specifications from his L1 may have affected his performance.

To summarise, the five studies discussed above investigate gender agreement production by NNS of Greek language. It must be noted here that we consider the participants of the aforementioned studies as NNS and not L2 learners, as the majority of the subjects acquired the Greek language in a naturalist way (Τσιμπλή, 2003; Tsimpli et al., 2005; Dimitrakopoulou et al., 2006). The key questions of these studies focus on agreement elements (determiners and adjectives) and the linguistic factors that affect morphological agreement production in the verbal and nominal domain (locality, type of features involved, complexity of the DP, length of stay in Greece). However, we have to emphasise the fact that the small number of participants in all these studies (from 1 to at most 39 participants) and the lack of a variety of experimental tasks (almost included oral interviews) cannot be used to validate such kinds of quantitative findings. Nevertheless, given the similarities between these studies in terms of learner characteristics (e.g., L1 background, L2 proficiency, type of learning Greek language) and in terms of use of approximately the same methodology (oral interviews), it is possible to conclude that the results are convergent.

Firstly, regarding the gender-marked modifiers on which nominal agreement is realised in Greek language (determiners, attributive and predicative adjectives), most of

¹⁰ The high accuracy rates in the use of articles is concluded by the fact that the learner never substituted the indefinite for the definite article and vice versa, and that the learner always provided the indefinite article when needed in the cloze task (Agathopoulou & Papadopoulou, 2011, p. 81).

the studies suggest that L2 learners are less target-like in terms of the type of agreement between determiner + noun rather than adjective + noun (Tsimpli et al., 2005; Dimitrakopoulou et al., 2006; Agathopoulou & Papadopoulou, 2011). In contrast, it must be noted that Τσιμπλή (2003) and Agathopoulou et al., (2008) find that adjective + noun agreement is more problematic in L2.

Although the aspect of grammatical gender is present in all participants' L1s, NNS of Greek seem to follow two strategies. Analysis of errors shows that the participants in the above studies used the neuter determiner gender as the default (Τσιμπλή, 2003; Tsimpli et al., 2005; Dimitrakopoulou et al., 2006; Agathopoulou & Papadopoulou, 2011). Secondly, the participants' errors involved phonological harmony as a result of mostly copying the noun's suffix into the adjective. In addition to this, the low-proficiency learners seem to generalise the suffix *-o* on adjectives, mostly in written tasks (Agathopoulou et al., 2008; Agathopoulou & Papadopoulou, 2011).

Researchers have proposed a number of factors that may determine the rate of success or failure in the bilingual acquisition of Greek gender. First of all, almost all studies argue that inaccuracy in gender agreement is due to difficulty in accessing the morphophonological gender information of the head noun. Specifically, the participants fail to correctly check the gender relation between nouns and determiners and/or adjectives, due to the failure of appropriate vocabulary insertion at the level of morphology. Making this argument even stronger, we note that all the participants in the aforementioned studies were examined mainly through oral interviews. This characteristic, combined with the fact that in Agathopoulou and Papadopoulou (2011) in the written tasks the participant performed better than in the oral tasks, indicates that NNS of Greek probably have more difficulty with accessing and/or deploying the lexical knowledge of a noun and/or syntactic knowledge within the real-time constraints imposed by the specific context of use. This conclusion is in line with the MSIH (Haznedar & Schwartz, 1997; Prévost & White, 1999; 2000; Lardiere, 2000).

Regarding the complexity of the DP and how it affects L2 learners' agreement production, Agathopoulou and Papadopoulou (2011) also argue that morphological complexity in the nominal agreement makes it even more difficult for NNS to check gender relations between the lexical gender feature of the head noun and the functional features on determiners and adjectives. In contrast, Tsimpli et al. (2005) and Dimitrakopoulou et al. (2006) suggest that when there is more than one element in the DP, learners can copy the correct inflectional form to all the gender modifiers.

However, Tsimpli et al. (2005) and Dimitrakopoulou et al. (2006) did not test whether gender errors are in fact due to difficulty at the level of gender assignment (lexical knowledge) or at the level of gender agreement (syntactic knowledge) by adding, for example, a gender assignment task to test the participants' lexical knowledge.

The results of the studies discussed above reveal that learners' characteristics play an important role in the acquisition of the feature of gender. Specifically, the presence or absence of grammatical gender in the learners' L1s may affect the participants' performance. In Agathopoulou and Papadopoulou (2011) there was a possible transfer of the functional gender feature from L1 (Italian) corroborating the FT/FA hypothesis. Also, educational levels (Agathopoulou & Papadopoulou, 2011) and the proficiency level in Greek language or the length of stay in Greece (Dimitrakopoulou et al., 2006; Tsimpli et al., 2005) can all affect language production. In addition to these findings, the type of task can also affect the NNS's performance — in the written tasks the participants performed better than in the oral tasks in the two studies where written tasks were included (Agathopoulou et al., 2008; Agathopoulou & Papadopoulou, 2011). Finally, Agathopoulou et al. (2008) argue that the type of instruction or way of teaching the grammatical aspect of gender plays a significant role in L2.

A significant difference between the findings of these studies regards the effect of nominal features — gender, case, number — on L2 learners' performance. The grammatical gender of nouns seems to be responsible for most agreement mismatches even for the group of participants with the longest stay in Greece (Tsimpli et al., 2005; Dimitrakopoulou et al., 2006). On the other hand, the participants in Agathopoulou et al. (2008) study, after having received instructions about nouns and modifying adjectives (PI and FonF), performed at the same level with respect to gender, case and number of nouns and adjectives.

Apart from the aforementioned studies' methodological limitations, which have been already mentioned, we can observe significant research gaps regarding Greek gender processing by L2 learners of Greek. Firstly, all of the studies above tested the participants' gender production on real nouns. Thus, none of the studies fully reveals the underlying system of gender processing which is a fundamental aspect of this research area. Similarly, none of the studies directly examined the processing effect of morphology and syntax, which are both highly significant gender-marked cues in Greek gender determination and are the research focus of the present study. Furthermore, while all of the findings are in line with the MSIH, they formed conclusions depending

mainly in oral production. In order to have a clear view about Greek gender processing written experimental tasks must be used, as in this thesis.

Moreover, despite the fact that all the studies conclude that NNS have difficulty at the level of gender assignment (lexical knowledge) they do not clarify if gender production errors are due to difficulty at the level of gender assignment (lexical knowledge) or at the level of gender agreement (syntactic knowledge). This could be done by adding, for example, an exclusively gender assignment manipulation. In the present study we use the second experimental task where the L2 learners indicate the corresponding value of the presented novel word by providing the appropriate personal pronoun (he, she, it) in English. By asking the participants to give an answer in L1 we therefore eliminate errors attributed to difficulties in gender agreement production.

Nevertheless, from the results of the five aforementioned studies we can indeed form our hypothesis; participants will be more accurate when they are given extensive syntactical information, that is, determiner + adjective + noun. The present study's methodology will be analysed in Chapter 5.

4.4 Representation of L1 gender properties on L2

Grammatical gender acquisition in L2 learning is a very demanding process. The factors contributing to this difficulty vary across the language systems, the individual differences in learners and the relationship between learner's L1 and L2. One possible but unexplored factor for this problematic situation might be the cross language processing of grammatical gender (Lemhöfer, Schriefers & Hanique, 2010). Previous scholarship has indicated that in L2 learning in relation to grammatical gender there might be interference from the gender system of L1 to the gender processing in L2 (Salamoura, 2007). This question becomes prominent in particular when both languages have complex grammatical gender systems. Even though the possible cross language processing of grammatical gender and its obvious significance for L2 learning is important, only a few studies to date have investigated explicitly the possibility of such an effect. Generally, the question and the findings oscillate between two approaches. The first indicates that the L1 and L2 gender systems are independent in processing, while in contrast the second assumes that the L2 gender system is affected by the grammatical gender representations of the L1 (Lemhöfer et al., 2010). However, there is only one study which supports the first approach (Costa, Kovacic, Fedorenko & Caramazza, 2003). To the best of our knowledge only Costa et al.'s (2003) study examines the effect of L2 grammatical representations in L1, indicating no effect.

However, it must be noted that this study investigates the effect on bilinguals and not L2 learners. Finally, in relation to the present study it has to be clarified that the second task does not consist of a strict representation phenomenon as the experiment does not include known real words but rather non-words. Specific details over the experimental manipulations and the rationale are provided in the methodology chapter of this thesis (Chapter 5). However, it is considered useful to cite the most significant studies in relation to the representation phenomenon from L1 to L2.

Costa et al. (2003) carried out three experiments in order to test any possible influence of L1 gender assignment on L2. Croatian and Italian bilinguals participated in this study. In both languages nouns, determiners and adjectives are gender marked. Analysis of the results reveals L2 grammatical gender processing by the gender representations in L1. In addition, L1 grammatical gender processing was not influenced by L2 gender values. Costa et al. (2003) do not interpret their results in order to establish language shared or independent gender systems. However, they suggest autonomy of gender systems. It has to be clarified that this study contains significant methodological parameters that do not allow for the extension of findings to L2 learners (Salamoura, 2007).

In particular, Salamoura (2007) claims that the participants in the Costa et al. (2003) study were highly proficient, resulting in the indication of independent gender systems, whereas L1 gender nodes significantly influence the L2 gender system in L1 dominant bilinguals. Secondly, Salamoura (2007) raises questions over the possible effect of the determiners retrieval process in the study. It has been noted that in specific languages (Romance languages) determiner selection takes place too late (Caramazza et al., 2001). Therefore the existence of the gender congruency effect in relation to determiners remains invisible, minimising the potential effect of L1 on L2. Finally and most importantly, the L1 gender effect is highly affected by the characteristics of L2 gender assignment system. It has been shown (Holmes & Dejean de la Batie, 1999) that the highly transparent formal principles of gender assignment in L1, that is the formal classification of nouns into gender classes, increases the superficial processing of L2 gender.

Paris and Weber (2004) required their study participants to choose a target object from a display tray containing gender competitor objects. They report that L2 learners do not use L2 gender information in order to reduce competitor effects. In contrast they employ L1 gender information in order to reduce competitor activation during L2

listening. The results indicate that this tendency was observed in cognate and non-cognate distractors (Paris & Weber, 2004).

Another study investigating the gender congruency effect was carried out by Sabourin et al. (2006). The experimentation was based on an off-line task. They report that the L2 learners' accuracy in gender assignment was higher for nouns having the same grammatical gender rather than nouns with different gender. However, Salamoura (2007) comment that this might be due to the effect of the task characteristics. It was an off-line task requiring different strategies in gender retrieval.

Important findings in L2 grammatical gender retrieval were reported in a study carried out by Bordag (2004). He demonstrates that in contrast to native speakers, L2 learners use gender cues extensively when easy and clear gender rules in L2 are available. This assumption indicates that in L2 gender tasks the L1 gender influences could be overruled, or might not even be present. However this assumption is not indicative of independent gender systems as the findings are present in relation to distractor/competition hypothesis (Lemhöfer et al., 2010). Furthermore, Bordag (2004) notes that the participants' reaction on L2 nouns was slower when the L2 gender noun was different to L1. These findings were interpreted as a proof for L1 interference in L2 gender processing.

One of the main questions in Bordag's (2004) study concentrates on the possible effect of using bare nouns and nouns phrases (Salamoura, 2007). However, this possible obstacle in obtaining reliable results was avoided in the studies of Lemhöfer et al. (2010) and Lemhöfer, Dijkstra, Schriefers, Baayen, Grainger and Zwitserlood (2008). They report that the participants' reaction with regard to L2 nouns was slower when the L2 gender noun was different to L1. This effect was observed in cognate and non-cognate pairs of L1 nouns and their translation. The interpretation here is again that there is L1 interference in L2 gender processing.

There have been two studies in the Greek gender system (Salamoura & Williams, 2007; Salamoura, 2007). Both studies refer to L1 Greek L2 German gender systems. The first study required participants to translate bare nouns from Greek to German as well as utterances including blocks of noun + adjective. The sample group consisted of bilinguals. The aim of the study was to test the language shared or language independent grammatical gender system. The selection of those two languages is highly significant as both of them require early gender selection in processing. Use of determiners was avoided in order to exclude the possibility of a priming effect

emergence (Lemhöfer et al., 2008). The results revealed, as expected, that participants were faster in translation when the pairs of nouns had the same gender than when they were different. This effect was present in the utterances including blocks of noun + adjective. Additionally, the findings indicate a significant main effect due to morphological similarity, that is, cognate versus non-cognate nouns. As other studies have revealed (Paris & Weber, 2004; Lemhöfer et al., 2008), there was no significant difference in reaction times between cognate and non-cognate nouns, indicating the importance of the grammatical gender factor. However, there was a significant interaction between the factors of word form similarity and gender congruency. In the condition of cognate nouns the errors were more in terms of gender incongruent nouns than congruent nouns. This indicates a shared L1–L2 gender system while also revealing that the process of cognate nouns relies more on the L1 gender system.

Salamoura's (2007) study sought to answer the question of whether L1 and L2 have an integrated gender system. The rationale behind the experiment was based on the idea that 'accessing the gender of a noun in one language will subsequently affect accessing the gender of a different noun with the same gender value' (Salamoura, 2007, p. 110). For the purpose of this study nouns that were neither translation equivalent nor semantically related were used. Additionally, these hypotheses were tested in terms of both production and comprehension. The findings demonstrate that in L1 and L2 there is an observable and significant gender congruency effect. Using as a dependent variable the participants' judgment on grammaticality, Salamoura notes that the participants were faster in processing nouns preceded by a noun having the same gender in L1 and L2, indicating that gender specifications are shared between languages. The second experiment had as a dependent variable the time reaction in oral production. The results reveal that participants were faster in naming an object when the distractor word was gender congruent rather than when it was gender incongruent. Finally, the ability to name a picture in L2 was shown to be faster after presentation of a semantically unrelated noun in L1 with the same gender. The results of the second experiment also support the idea of a shared gender system between L1 and L2.

In summary, it can be concluded that there is observable and significant interference from the gender system of L1 on gender processing in L2. Scholars who support the theoretical position that the L2 gender system is affected by the grammatical gender representations of the L1 include Paris and Weber (2004), Salamoura (2007) and Lemhöfer et al. (2010).

4.5 Chapter summary

We can argue that L2 learners' grammatical gender difficulty can find its origins in: (a) difficulty at the level of gender assignment (lexical knowledge) (Franceschina, 2005; Tsimpli et al., 2005; Dimitrakopoulou et al., 2006; Tanner, 2008; Agathopoulou & Papadopoulou, 2011; Grüter et al., 2012; Hopp, 2013; Montrul et al., 2012; 2014; Bobb et al., 2015); (b) difficulty at the level of gender agreement (syntactic knowledge) (Holmes & Dejean de la Bâtie, 1999; Bruhn de Garavito & White, 2002; Sabourin et al., 2006; Alarcón, 2010); or (c) difficulty with accessing and/or applying this lexical and/or syntactic knowledge within the real-time constraints imposed by the specific context of use (Montrul et al., 2008; Alarcón, 2011). The first two can be classified under the spectrum of processing and the third is located mainly in production context. Regarding Greek language, most of the L2 Greek studies argue that inaccuracy in gender agreement is due to difficulty in accessing the morphophonological gender information of the head noun. Specifically, the participants fail to correctly check the gender relations between nouns and determiners and/or adjectives due to the failure of appropriate vocabulary insertion at the level of morphology. This is in line with MSIH (Haznedar & Schwartz, 1997; Prévost & White, 1999; 2000; Lardiere, 2000).

Taking into consideration the aforementioned L2 gender difficulties, two opposite theoretical approaches have been proposed. According to the deficit theory L2 learners of gendered languages whose L1 does have grammatical gender cannot process gender in syntactic structures, mainly due to impaired underlying syntactic representations: the FFFH (Hawkins & Chan, 1997) and the RDH (Hawkins, 2009). In contrast, other accounts argue that syntactic representations are present, while morphological errors are due to production problems or gender 'mapping problems' forming the MSIH (Haznedar & Schwartz, 1997; Prévost & White, 1999; 2000; Lardiere, 2000). Recently, the 'lexical gender learning hypothesis' by Grüter et al. (2012) who based their work on a previous study by Arnon and Ramscar (2009) argues that L2 gender difficulty may be attributed to the different ways in which nouns were learnt. Specifically, when L2 learners are taught the gender of nouns by being provided at the same time with the noun suffix together with the determiner, they demonstrate a better performance than when they first learn the endings of each gender class separately from the gender-marked articles.

Overall, even intermediate to advanced L2 learners have difficulties in both lexical gender assignment and syntactic gender agreement. A group of studies has

shown that L2 learners are more accurate with assignment than agreement in different languages like Spanish (Bruhn de Garavito & White, 2002; Alarcón, 2010), Dutch (Sabourin et al., 2006) and French (Holmes & Dejean de la Bâtie, 1999). L2 learners first acquire the inherent lexical gender of a noun (lexical assignment) and then they acquire how to process this knowledge in syntactic concord among the syntactic related constituents such as determiners and adjectives in NPs and sentences (Alarcón, 2010). Alternatively, other scholars suggest that the problem with gender is mainly a lexical problem (Lew-Williams & Fernald, 2010; Grüter et al., 2012; Hopp, 2013; Carroll, 1989; Tanner, 2008). These differences in observation may be attributed to the different methodologies applied.

Regarding the role of morphological, syntactic and semantic information, a majority of previous studies suggest that L1 English L2 learners of gendered languages rely more on syntactical (determiners and adjectives) rather than morphological information in L2 Italian (Oliphant, 1998), L2 Spanish (Cain et al., 1987; Franceschina, 2005) and L2 Russian (Taraban & Kempe, 1999). Moreover, Oliphant (1998) and Taraban and Kempe (1999) underline the role of syntactical cues when L2 learners process ambiguous nouns. We note here that all the studies examining the role of noun endings in gender processing suggest that morphophonological transparency affects L2 gender processing.

Thus, we can see that the role of noun endings is very important in L2 gender processing. Unambiguous endings result in more accurate and faster gender assignment by L2 learners. Morphophonological transparency plays a very important role. Intermediate to highly-advanced L2 learners whose L1 is English are more accurate in processing transparently-marked nouns than non-transparently-marked nouns in production tasks (Montrul et al., 2008; 2012; Alarcón, 2010; 2011; Foote, 2015). The disadvantages of non-transparently-marked nouns has also been confirmed by comprehension tasks (Foote, 2014; Montrul et al., 2014). Finally, regarding the effect of proficiency levels in morphophonological gender processing, Bordag et al. (2006) and Bobb et al. (2015) conclude that less proficient learners rely more on morphophonological cues than more proficient learners.

Furthermore, there are numerous of factors that play significant roles in accuracy rates and in processing speed in L2 gender processing. Several ERP studies examined if L2 learners were sensitive to L2 gender violations finding that sensitivity to agreement violations correlates with L1 grammatical features (Sabourin & Haverkort, 2003;

Sabourin & Stowe, 2008; Foucart & Frenck-Mestre, 2011), L2 experience and proficiency level (Sabourin & Stowe, 2008; Keating, 2009; Gillon Dowens et al., 2010; 2011; Sagarra & Herschensohn, 2010; Foucart & Frenck-Mestre, 2011; 2012; Gabriele et al., 2013), and possible competition between L1 and L2 systems (Tokowicz & MacWhinney, 2005; Foucart & Frenck-Mestre, 2011), working memory capacity (Keating, 2009; Sagarra & Herschensohn, 2010) and AoA (Gillon Dowens et al., 2010; 2011).

Moreover, there are a few priming effect studies where intermediate to advanced L2 participants whose L1 does not have grammatical gender failed to take advantage of the gender-marked cues as predictive cues of the target familiar nouns; determiners did not facilitate gender processing (Guillelmon & Grosjean, 2001; Grüter et al., 2012; Lew-Williams & Fernald, 2010) and adjectives (Scherag et al., 2004; Bobb et al., 2015). On the other hand, L2 learners do benefit from informative gender marking on determiners or adjectives in order to predict the upcoming nouns only when the articles also co-occur with the novel nouns during learning trials establishing memorisation/generalisation of the nominal sequence (Lew-Williams & Fernald, 2010; Grüter et al., 2012; Hopp, 2013; 2016).

Similar to the importance of type of learning (Grüter et al., 2012) is the role of input in gender processing. Visual input affects how gender agreement is processed and learned by giving information about the word boundaries (Montrul et al. 2012). This may result in L2 learners forming weaker associations between determiners and nouns and, even worse, between adjectives and nouns (Arnon & Ramscar, 2009; Grüter et al., 2012; Hopp, 2013).

Apart from the accuracy rates of L2 learners in gender assignment and gender agreement, the analysis of errors in experimental tasks reveals some linguistic strategies. The masculine default appears to be a linguistic strategy not only for monolinguals, but also for L2 learners at all proficiency levels (Montrul et al., 2008; 2012; Alarcón, 2010; Foote, 2015). In studies regarding L2 Greek, although the aspect of grammatical gender is present in all participants' L1, learners seem to follow two strategies; using the neuter determiner gender as the default one (Τσιμπλή, 2003; Tsimpli et al., 2005; Dimitrakopoulou et al., 2006; Agathopoulou & Papadopoulou, 2011) and phonological harmony, mostly copying the noun's suffix into the adjective. In addition to these strategies, low-proficiency learners seem to generalise the suffix *-o*

on adjectives predominantly in written tasks (Agathopoulou et al., 2008; Agathopoulou & Papadopoulou, 2011).

In addition to this, L2 learners of Spanish were seen to perform better on agreement production of determiners than with adjectives in Montrul's et al.'s (2008; 2012) studies, confirming the findings of other studies (Bruhn de Garavito & White, 2002; Fernández-García, 1999). In contrast, there was no difference in the accuracy rates of agreement production both with determiners and adjectives in Alarcón (2011). The latter is in line with studies which suggest that the agreement dependencies within the NP are acquirable for advanced L2 learners (Keating, 2009; Gabriele et al., 2013). Regarding the gender-marked modifiers on which nominal agreement is realised in Greek language (determiners, attributive and predicative adjectives), most of the studies indicate that L2 learners are less target-like on the type of agreement between determiner + noun than with regard to adjectival agreement (Tsimpli et al., 2005; Dimitrakopoulou et al., 2006; Agathopoulou & Papadopoulou, 2011).

In summary, from the gender representation studies discussed above, it can be concluded that there is an observable and significant interference from the gender system of L1 to gender processing in L2. This advantages the theoretical position that assumes the L2 gender system is affected by the grammatical gender representations of the L1 (Paris & Weber, 2004; Salamoura, 2007; Lemhöfer et al., 2010).

With regard to L2 performance according to the type of tasks (oral or written) required, all L2 learners appear to perform better in written tasks (Guillelmon & Grosjean, 2001; Montrul et al., 2008; Alarcón, 2011; Grüter et al., 2012). In addition to these findings, L2 learners of Greek as participants also performed better in written rather than oral tasks in the two studies where written tasks were included (Agathopoulou et al., 2008; Agathopoulou & Papadopoulou, 2011).

Finally, a much debated issue is the degree of 'nativeness' of on-line gender performance which varies across studies. Guillelmon and Grosjean (2001), Tokowicz and MacWhinney (2005), Sabourin et al. (2006), Keating (2009), Alarcón I. (2009), Gillon Dowens et al. (2010; 2011), and Foucart and Frenck-Mestre (2012), all conclude that gender can be successfully acquired even if it's not present in L1 in high proficiency levels of L2. This is in line with the FT/FA hypothesis (Schwartz & Sprouse, 1996).

The hypothesis of the present study (see 5.1.2) has thus been formed after taking into consideration key findings of previous L2 gender processing research. The results

of the present thesis are discussed in relation to the abovementioned theories and studies in Chapter 7.

Chapter 5: Methodology of the experiment

5.0 Chapter overview

Chapter 5 is concerned with the methodology used for this study and presents: the rationale, gap, hypothesis and research questions (5.1); the design (5.2); the characteristics of the participants and demographic questions (5.3); the construction of materials (pseudo-words and images) used in this study (5.4); the validity of the tasks (5.5); the construct validity of the first task (5.5.1); the construct validity of the second task (5.5.2); the concurrent validity (5.5.3); the cross validation of the first and the second task (5.5.4); the principal component analysis for nouns with *-oç* ending in the first and the second task (5.5.5); the face validity (5.5.6); the procedure for experimental tasks (5.6); the ethics approval and the construction of the consent form (5.7); and the pilot study (5.8).

5.1 Rationale

This thesis focuses on the significant role of gender-marked cues in L2 gender processing. Specifically, the role of morphological noun endings and gender-marked articles and adjectives as cues in L2 gender processing is investigated and evaluated. In this thesis, we use the term processing to refer to the realisation of a noun's gender class (lexical access). The ability of L2 learners whose L1 does not encode grammatical gender to realise, process and integrate gender cues is examined in relation to the production of accurate gender agreement phrases. It has to be stressed here that the main aim of the study is not to investigate the accuracy and underlying procedures of gender agreement in production (agreement between noun, determiner and adjective), although this can be surfaced and explained by the obtained results.

According to current theories and models in language production, and specifically in grammatical gender processing (Bates & MacWhinney, 1987; Levelt et al. 1999; Caramazza et al., 2001; Gollan & Frost, 2002; MacWhinney, 2008), grammatical gender is part of the grammatical properties of the lemma and is represented as an abstract lexical-syntactic property. Additionally, grammatical gender is an inherent lexical-syntactic property of the relevant lemma (Bordag et al., 2006).

Therefore, in language production the grammatical gender characteristics of the referent noun are activated and selected on the basis of the lemma and more specifically the link between the lemma and the gender node (Salamoura, 2007). According to the Competition Model proposed by MacWhinney (Bates & MacWhinney, 1987;

MacWhinney, 2005; 2008) the process and appropriate use of grammatical gender is based on the availability and the reliability of the relevant cues, as well as the existence or absence of competing cues from the L1. Therefore, in regard to the present study, the level of availability and reliability of the gender-marked cues (noun endings, determiners, adjectives) will determine the level of these cues' processing.

In summary, we can trace the link between the lemma and the specific gender node in two ways. This can be done either by asking the L2 learner to exclusively assign the gender of the noun (name the gender class of the provided noun) or by revealing the gender node link on the basis of gender agreement phrases (gender agreement between noun endings and gender-marked articles and/or adjectives). The second option is considered more appropriate as this experimentation requires natural behaviour from the participant in regard to language use.

Taking into consideration the literature review, we can assume that L2 learners' grammatical gender difficulty and potential errors could be originated by:

- difficulty at the level of gender assignment (*lexical knowledge*) (Franceschina, 2005; Tsimpli et al., 2005; Dimitrakopoulou et al., 2006; Tanner, 2008; Agathopoulou & Papadopoulou, 2011; Grüter et al., 2012; Hopp, 2013; Montrul et al., 2012; 2014; Bobb et al., 2015);
- difficulty at the level of gender agreement (*syntactic knowledge*) (Holmes & Dejean de la Bâtie, 1999; Bruhn de Garavito & White, 2002; Sabourin et al., 2006; Alarcón, 2010); or
- difficulty with accessing and/or applying this lexical and/or syntactic knowledge within the real-time constraints imposed by the specific context of use (Montrul et al., 2008; Alarcón, 2011).

The first two can be classified under the spectrum of processing and the third is located mainly in production context.

Therefore, for the purpose of this study two tasks were elaborated in order to increase the validity of the results. The presented stimuli in both tasks were identical. However, the required participants' replies were different. In the first task a reply in Greek (L2) was required but in the second task a reply in English (L1) was required. For the first task, the gender value in the participant's reply was indicated by the gender-marked adjective accompanying the referent noun. For the second task, the participant indicated the corresponding gender value of the stimulus by providing the

appropriate personal pronoun in English (he, she or it). The elaboration of the second task derived mainly from one methodological question; does production in Greek L2 (task 1) reflect the participants' performance regarding the gender assignment of novel words (lexical knowledge)? Or are the participants' errors attributable to difficulty at the level of gender agreement (syntactic knowledge)? The methodology in task 2 specifically aims to secure the elimination of this consideration. By asking the participant to give an answer in L1, we eliminate errors attributed to difficulty in gender agreement production.

The rationale behind the first task is straightforward. After the presentation of the stimulus, according to Levelt et al. (1999), a lexical concept is represented and stored in the so-called lemma. This representation consists of a conceptual representation, grammatical representations (within which the gender node exists) and a morphophonological representation. During the production stage the participant is required to produce a gender agreement phrase. Therefore, they are required to recall the referent lemma and also necessarily the referent gender node in order to produce the appropriate adjective and/or determiner agreement with the referent non-word. This process reveals the specific gender node to which they link the presented non-word. Their answer is evaluated upon the gender agreement between the used adjective and the referent noun.

However, any potential error can originate from one of the three aforementioned reasons. Therefore, the second experimentation was created to allow for the precise projection of the assignment process during stimulus presentation. This experimentation is innovative and had not been used before. The validity and reliability of the task were tested and have been found satisfactory. Additionally, the concurrent validity between the two tasks validates our assumptions that the first task measures gender assignment processing as the second task can only project the specific process and not gender agreement.

Even though the second experimentation requires a switch of language use, it is clear that this procedure reveals the class of the stored gender node of the referent non-word (masculine, feminine, neuter). According to the literature, the absence of grammatical gender in English is considered as a facilitative factor in tracing the link between the referent lemma and the specific gender node in L2. In particular, when specific and exclusive rules in L2 (for this study Greek) indicate the assignment of grammatical gender, L1 (English) influences might be overruled, or not even arise in

the first place (Paris & Weber, 2004; Salamoura & Williams, 2007). Additionally, Lemhöfer et al. (2010) shows that when there is an unstable gender representation, as in this case (the non-words do not have natural gender characteristics), then the cross-language compatibility effects are magnified. L1 gender information (assignment is based exclusively on semantic characteristics) cannot be used as an indicative cue as the stimulus does not contain such characteristics and is in fact a novel word without representation in English. Furthermore, L2 learners do not initially select the language-appropriate lexicon before making a lexical search, but rather both lexicons are activated and searched simultaneously (De Bot, 1992; Bordag, 2004; Salamoura, 2007). Therefore, the absence of lexical representation of the presented non-word indicates reliance on the characteristics of the lexical representation in L1. These characteristics are only morphosyntactic and not semantic.

Additionally, the rationale for this manipulation is supported by studies on verbal working memory. As the computation of grammatical gender in English is based only on semantic characteristics, it was decided to exclude any visual information in order to prevent any attempt of the subjects to process the non-words on this basis. In other words, according to the hypothesis of the experimentation, the participants process the grammatical gender of the non-words in English using only the available information. In our case, the lexical representation can only be estimated on the previous process in terms of Greek language. Each non-word is linked to a specific gender node (Levelt et al., 1999; Caramazza et al., 2001) using only the provided morphological (noun endings) and/or syntactical information (determiners and/ or adjectives). After this process each lexeme is crystallised and linked to the appropriate gender node and the relevant conceptual representation. This information is made available at the phase of translation. Therefore, the exclusion of any visual information prevents the recalculation of the natural gender of the non-words, allowing us in this way to track the representation and grammatical gender as this has already been computed in Greek. This hypothesis is also confirmed by the results (tendency of the participants performance) and more importantly by the concurrent validity analysis, which confirms the relationship between the factors of both tasks. Finally, Lemhöfer et al. (2010) demonstrates that when there is an unstable gender representation, as in this case (the non-words do not have natural gender characteristics), then the cross-language compatibility effects are magnified. Therefore, as was expected the gender representations of the non-words in Greek were employed in English.

In summary, both tasks were elaborated in order to track to which specific gender node each participant linked the referent non-word. Since both tasks secured this measurement, it is apparent that any variation in participants' accuracy and time reaction should have arisen due to factors relating to the provided role of gender-marked cues. Therefore, the role of morphophonological noun endings and gender-marked articles and/or adjectives as cues in L2 gender processing can be evaluated.

5.1.1 Gap

The literature review above (Chapter 4) reveals that none of the L2 studies previously completed has specifically examined, using a comparable task, the relevant processing effect of noun endings (morphological information), articles and/or adjectives (syntactic information) as gender-marked cues in L2 gender processing. Moreover, most prior L2 research has based its findings on oral tasks and the processing of familiar nouns, while having at the same time a low number of participants. So far, there has been very little research on the processing role of morphological and syntactic gender-marked cues in written production. While there is an interrelationship between the three factors of semantics (sex-animacy), morphology (inflectional class) and syntax (gender agreement between determiners — adjectives-nouns) involved in the processing of grammatical gender in Greek nouns, no previous L2 Greek study has ever examined them in comparative tasks. This thesis aims to fill this gap by using novel words, an innovative methodology, a large number of materials, and, finally, 105 participants who are L2 learners of Greek.

5.1.2 Hypothesis

Our main research hypothesis is that L1 English learners of Greek will be more accurate and faster when they process stimulus containing morphological and extensive syntactic information (determiner + adjective + noun suffix) than when they process morphological and syntactic information (determiner + noun suffix) or only morphological information (noun suffix).

Our hypothesis is relevant to the Competition Model (Bates and MacWhinney, 1987; MacWhinney, 2005; 2008) according to which acquisition of the TL characteristics is based on the availability and reliability of the specific characteristics, as well as the existence or absence of competing cues from the L1. Therefore, in regard to the present study, which focuses on gender processing, the level of availability and reliability of gender-marked cues will determine the level of accuracy and speed processing.

We formed our hypothesis by taking into consideration the results of previous studies which indicate that even highly-proficient L1 English L2 learners of gendered languages (Spanish and German) rely on the gender-marked articles as predictive cues in the processing of novel nouns only when these nouns co-occur with the articles in the noun phrases of learning trials, in other words in a non-segmented input (Lew-Williams & Fernald, 2010; Grüter et al., 2012; Dussias et al., 2013; Hopp, 2016). This is in line with the ‘lexical gender learning’ hypothesis (Grüter et al., 2012). In addition to this, there are other studies which compare the role of different gender cues (semantic, morphological and syntactic) in L2. The majority of these studies suggest that L1 English L2 learners of gendered languages rely more on syntactic (determiners and adjectives) than morphological information in L2 Italian (Oliphant, 1998), Spanish (Cain, Weber-Olsen & Smith, 1987; Franceschina, 2005) and Russian (Taraban & Kempe, 1999). According to Greek linguistic surveys, participants rely heavily on syntactic information when they process ambiguous endings (Ralli, 2003; Alexiadou, 2004). Our hypothesis is also in line with most L2 Greek studies which suggest that L2 learners of Greek are less target-like on the type of agreement between determiner + noun than on adjective + noun (Tsimpli et al., 2005; Dimitrakopoulou et al., 2006; Agathopoulou & Papadopoulou, 2011).

Finally, on the basis of previous studies it is expected that advanced L2 learners will have better performance and be faster in processing than beginners. It is expected that there will be no difference between masculine, feminine and neuter information overall.

5.1.3 Research questions

The present experimental tasks aim to answer the following research questions:

- 1 What is the role of the gender elements — noun suffix, determiners and adjectives — as informative cues to the process of the grammatical gender of a novel Greek noun for adult L1 English L2 learners of Greek?
- 2 Does the level of Greek language proficiency level have an effect on grammatical gender processing?
- 3 Does the noun gender class have an effect on grammatical gender processing?
- 4 Could additional gender-marked cues overcome the obstacles of processing nouns with transparent marked endings?

5.2 Design

The survey consisted of four sections. The first section contained information about the survey and the consent form. The second section was a general questionnaire about the demographic characteristics of the sample. The other two sections consisted of two tasks targeting the main research questions. Each task was made up of two parts. The first part contained non-words with unambiguous endings on the basis of grammatical gender clues and the second part targeted non-words with ambiguous endings.

In regard to the first task, the design of the experiment can be divided into two parts. For the first part, the experiment was a (2X3X3X2) factorial four-way mixed analysis of variances. There were two dependent variables. The first dependent variable was the accuracy of participants' answers on the grammatical gender of the provided non-words. The criteria the participants used to assign the grammatical gender were made apparent by the gender agreement of the determiners and/or adjectives the participants produced in order to accompany each given non-word. Therefore, in each condition the maximum mark that could be obtained was 2 and the minimum was 0. The second dependent variable was the participants' reaction time to the provided stimulus. The level of Greek language competence was the between participants factor. This factor had two levels: (1) beginners and (2) advanced learners. The type of information was the first within subjects factor. This factor had three levels related to the gender-marked information (cues): (1) morphological information (noun suffix), (2) morphological and syntactic information (determiner + noun suffix), and (3) morphological and extensive syntactic information (determiner + adjective + noun suffix). The second within subjects factor was the grammatical gender and it had three levels: (1) masculine, (2) feminine and (3) neuter. Finally, the third within subjects factor was the ending of the nouns, two possible endings for each gender (for masculine: $-\alpha\varsigma$, $-\eta\varsigma$, for feminine: $-\alpha$, $-\eta$ and for neuter: $-\iota$ $-ο$). Therefore, each participant was assessed in 18 conditions. Each participant received all the experimental items. The 18 conditions were analytically as follows: non-word with masculine gender ending $-\alpha\varsigma$, non-word with masculine gender ending $-\eta\varsigma$, non-word with feminine gender ending $-\alpha$, non-word with feminine gender ending $-\eta$, non-word with neuter gender ending $-\iota$, non-word with neuter gender ending $-ο$, masculine determiner + non-word with masculine gender ending $-\alpha\varsigma$, masculine determiner + non-word with masculine gender ending $-\eta\varsigma$, feminine determiner + non-word with feminine gender ending $-\alpha$, feminine determiner + non-word with feminine gender ending $-\eta$, neuter determiner + non-word with neuter gender ending $-\iota$, neuter determiner + non-word

with neuter gender ending $-o$, masculine determiner + adjective with masculine ending $-o\varsigma$ + non-word with masculine gender ending $-a\varsigma$, masculine determiner + adjective with masculine ending $-o\varsigma$ + non-word with masculine gender ending $-\eta\varsigma$, feminine determiner + adjective with feminine ending $-\eta$ + non-word with feminine gender ending $-\alpha$, feminine determiner + adjective with feminine ending $-\eta$ + non-word with feminine gender ending $-\eta$, neuter determiner + adjective with neuter ending $-o$ + non-word with neuter gender ending $-\iota$ and neuter determiner + adjective with neuter ending $-o$ + non-word with neuter gender ending $-o$.

The second part of the first task can be divided into two subsections on the basis of the independent variable of the provided information. For the first subsection, the experiment was a (2X2X3) factorial three way mixed analysis of variances. The first dependent variable was the accuracy of participants' answers with regard to the grammatical gender of the provided non-words. The criteria the participants used to determine the attribution of noun grammatical gender were made apparent by the gender agreement between the adjectives they produced in order to accompany each given noun. Therefore, in each condition the maximum mark that could be obtained was 2 and the minimum was 0. The second dependent variable was participants' reaction time to the provided stimulus. The level of Greek language competence was the between subjects factor, this factor had two levels: (1) beginners and (2) advanced learners. The type of provided information was the first within subjects factor. This factor had two levels: (1) morphological and syntactic information (determiner + noun suffix), and (2) morphological and extensive syntactic information (determiner + adjective + noun suffix). The second within subjects factor was the grammatical gender and it had three levels: (1) masculine, (2) feminine and (3) neuter. In contrast to the first part there was only one ending for the non-words, that is $-o\varsigma$. Each participant was assessed in six conditions and received all the experimental items. The six conditions were analytically as follows: masculine determiner + non-word with gender ending $-o\varsigma$, feminine determiner + non-word with gender ending $-o\varsigma$, neuter determiner + non-word with gender ending $-o\varsigma$, masculine determiner + adjective with masculine ending $-os$ + non-word with ending $-o\varsigma$, feminine determiner + adjective with feminine ending $-\eta$ + non-word with ending $-o\varsigma$, and neuter determiner + adjective with neuter ending $-o$ + non-word with ending $-o\varsigma$.

The second subsection of the second part of the first task included stimulus of non-words with ambiguous endings $-o\varsigma$. This means that any non-word could be

correctly classified as masculine, feminine or neuter because for this section there was no other grammatical gender information. Therefore, the responses consist of categorical data. On the basis of these characteristics, analysis of the experiment aims to measure the probability of association (Robson, 2002) or the independence of facts (Dancey & Reidy, 2002). In other words, it aims to measure the discrepancy between the observed results and some hypothetically expected results. In particular, the experiment targets how participants process the grammatical gender of nouns when the only provided information is morphological (*-ος*). This approach was applied to all the six provided examples. This was necessary as there was no other methodological approach for this type of categorical data (Dancey & Reidy, 2002; Anastasi & Urbina, 1997).

The second task of the survey was almost identical to the first. With regard to the second task, the design of the experiment could be divided into two parts. The two parts were identical in regard to the provided stimulus but the required reactions of the participants were different. However, both parts were targeted to assess the same abilities, which was the participants' possession of grammatical gender. The two parts were identical in regard to the assessed abilities in order to allow for a comparison. This manipulation was made possible by further statistical analysis in order to establish the Concurrent Validity of the tasks. For the first part, the experiment was a (3X3X2X2) factorial four-way mixed analysis of variances. There were two dependent variables. The first dependent variable was the gender agreement between the gender of the provided non-word of the Greek sentence and the gender of the personal pronoun in English, which the participants used in their answers. Specifically, the criteria the participants used to determine the attribution of noun grammatical gender were made apparent by the personal pronoun they chose in order to create a sentence in English. The answers didn't include the provided non-words of the Greek sentence. Therefore, in each condition the maximum mark that could be obtained was 2 and the minimum was 0. The second dependent variable was the participants' reaction time to the stimulus. The level of Greek language competence was the between participants factor. This factor had two levels: (1) beginners and (2) advanced learners. The type of information was the first within subjects factor. This factor had three levels related to the gender-marked information (cues): (1) morphological information (noun suffix), (2) morphological and syntactical information (determiner + noun suffix), and (3) morphological and extensive syntactical information (determiner + adjective + noun suffix). The second within subjects factor was the grammatical gender and it had three

levels: (1) masculine, (2) feminine and (3) neuter. Finally, the third within subjects factor was the ending of the nouns, two possible endings for each gender (for masculine: $-\alpha\varsigma$, $-\eta\varsigma$, for feminine: $-\alpha$, $-\eta$ and for neuter: $-\iota$ $-o$). Therefore, each participant was assessed in 18 conditions. Each participant received all the experimental items. The 18 conditions were analytically as follows: non-word with masculine gender ending $-\alpha\varsigma$, non-word with masculine gender ending $-\eta\varsigma$, non-word with feminine gender ending $-\alpha$, non-word with feminine gender ending $-\eta$, non-word with neuter gender ending $-\iota$, non-word with neuter gender ending $-o$, masculine determiner + non-word with masculine gender ending $-\alpha\varsigma$, masculine determiner + non-word with masculine gender ending $-\eta\varsigma$, feminine determiner + non-word with feminine gender ending $-\alpha$, feminine determiner + non-word with feminine gender ending $-\eta$, neuter determiner + non-word with neuter gender ending $-\iota$, neuter determiner + non-word with neuter gender ending $-o$, masculine determiner + adjective with masculine ending $-\alpha\varsigma$ + non-word with masculine gender ending $-\alpha\varsigma$, masculine determiner + adjective with masculine ending $-\alpha\varsigma$ + non-word with masculine gender ending $-\eta\varsigma$, feminine determiner + adjective with feminine ending $-\eta$ + non-word with feminine gender ending $-\alpha$, feminine determiner + adjective with feminine ending $-\eta$ + non-word with feminine gender ending $-\eta$, neuter determiner + adjective with neuter ending $-o$ + non-word with neuter gender ending $-\iota$ and neuter determiner + adjective with neuter ending $-o$ + non-word with neuter gender ending $-o$.

The second part of the second task can be divided into two subsections on the basis of the independent variable of the provided information. For the first subsection, the experiment was a (2X2X3) factorial three-way mixed analysis of variances. The first dependent variable was the agreement between the grammatical gender of the provided non-word of the Greek sentence and the grammatical gender of the personal pronoun in English, which the participants used in their answers. Therefore, in each condition the maximum mark that could be obtained was 2 and the minimum was 0.

The second dependent variable was the participants' reaction time to the provided stimulus. The level of Greek language competence was the between subjects factor, this factor had two levels: (1) beginners and (2) advanced learners. The type of the provided information was the first within subjects factor. This factor had two levels: (1) morphological and syntactic information (determiner + noun suffix), and (2) morphological and extensive syntactic information (determiner + adjective + noun suffix). The second within subjects factor was the grammatical gender and it had three

levels: (1) masculine, (2) feminine and (3) neuter. In contrast to the first part there was only one ending for the non-words, that was $-o\varsigma$. Therefore, each participant was assessed in six conditions. Each participant received all the experimental items. The six conditions analytically were as follows: masculine determiner + non-word with gender ending $-o\varsigma$, feminine determiner + non-word with gender ending $-o\varsigma$, neuter determiner + non-word with gender ending $-o\varsigma$, masculine determiner + adjective with masculine ending $-os$ + non-word with ending $-o\varsigma$, feminine determiner + adjective with feminine ending $-\eta$ + non-word with ending $-o\varsigma$, neuter determiner + adjective with neuter ending $-o$ + non-word with ending $-o\varsigma$.

The second subsection of the second part of the second task included stimulus of non-words with ambiguous endings $-o\varsigma$ this meant that any non-word could be correctly classified as masculine, feminine or neuter as for this section there was no other grammatical gender information. Therefore, the responses consisted of categorical data. On the basis of these characteristics, the analysis of the experiment aims to measure the probability of association (Robson, 2002) or the independence of factors (Dancey & Reidy, 2002). In other words, it aims to measure the discrepancy between the observed results and some hypothetically expected results. Specifically, the experiment targeted on how participants processed the grammatical gender of nouns when the only provided information was morphological ($-o\varsigma$). Furthermore, the grammatical gender attribution is reflected in their first language, which is English. This approach was applied to all of the six provided examples. This was necessary as there was no other methodological approach for this type of categorical data (Dancey & Reidy, 2002; Anastasi & Urbina, 1997).

5.3 Participants — demographic characteristics

The sample group for the research consisted of university students or graduated L2 learners of Greek at beginner, intermediate and advanced levels. The survey was advertised at three Australian universities. The majority of the participants were students from Macquarie University, Sydney University and UNSW. However, other participants were not excluded as long as they had learnt Greek at university level. The survey was administrated online using the application QUALTRICS. This application was chosen as it is provided by Macquarie University to cater for the needs of researchers. The URL of the survey was accessed 151 times although only 109 participants finished the survey by providing information for all of the questions. The information provided by the 42 unfinished surveys was excluded in order to prevent

confounding the analysis with missing data (Αλεξόπουλος, 1998; Anastasi & Urbina, 1997). Additionally, the 109 responses were analysed qualitatively with regard to the demographic characteristics of the participants. This analysis was performed in order to prevent the inclusion of data provided by participants with L1 Greek. As a result of this analysis, five participants were excluded. Two were excluded because Greek was their L1, while data which originated from the other three participants was not taken into consideration as they were evaluated as bilinguals. The remaining sample consisted of 105 individuals. The participants' first language was mainly English: 103 participants had English as first language while the other two had other languages as L1. The demographic characteristics of the sample with regard to their L1 are presented in Table 9. All the 105 participants had learnt Greek during their tertiary education. This was a criterion for inclusion in the sample.

	Frequency	Percent	Valid Percent	Cumulative Percent
First Language English	103	98.1	98.1	98.1
Other Language	2	1.9	1.9	100.0
Total	105	100.0	100.0	

Table 9. Participants' first language.

Demographic characteristics of the main sample

The participants were all adults. There was a relatively equal number in terms of gender representation: 46 females and 59 males. The demographic characteristics of the sample with regard to gender are presented in Table 10.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Male	46	43.8	43.8	43.8
Female	59	56.2	56.2	100.0
Total	105	100.0	100.0	

Table 10. Participants' gender.

Participants were allocated into four groups according to their age. The four groups included the following age ranges: 18–25, 26–35, 36–45 and over 46. The demographic characteristics of the sample with regard to age are presented in Table 11.

		Frequency	Percent	Valid Percent	Cumulative Percent
Age range	18–25	56	53.3	53.3	53.3
	26–35	30	28.6	28.6	81.9
	36–45	16	15.2	15.2	97.1
	over 46	3	2.9	2.9	100.0
	Total	105	100.0	100.0	

Table 11. Participants' age group.

Greek language competence

Special consideration was given to the homogeneity of the sample. Therefore, it was ensured that the level of Greek language competence did not approach the level of NS. Specific questions were analysed in relation to this issue. In particular, a qualitative analysis was performed in order to allocate each participant to two categories according to their level of Greek language competence. On the basis of previous research, it was decided to allocate the participants into either the group of beginners or advanced learners. The aforementioned questions estimated the participants' level of Greek language competence, taking into consideration which language was spoken at home, the parents' L1, and what language the participants customarily spoke with their friends. Other questions included: how many years they had studied Greek, whether they had HSC-level Greek, which level of Greek language they were learning at the University and whether they had spent more than six months in Greece. The descriptive statistics for these questions are presented in Tables 12, 13, 14, 15, 16, 17, 18, 19.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	English	68	64.8	64.8	64.8
	Greek	35	33.3	33.3	98.1
	Other	2	1.9	1.9	100.0
	Total	105	100.0	100.0	

Table 12. Father's first language.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	English	73	69.5	69.5	69.5
	Greek	27	25.7	25.7	95.2
	Other	5	4.8	4.8	100.0
	Total	105	100.0	100.0	

Table 13. Mother's first language.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	English	100	95.2	95.2	95.2
	Greek	4	3.8	3.8	99.0
	Other	1	1.0	1.0	100.0
	Total	105	100.0	100.0	

Table 14. Spoken language at home.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	English	102	97.1	97.1	97.1
	Greek	1	1.0	1.0	98.1
	Other	2	1.9	1.9	100.0
	Total	105	100.0	100.0	

Table 15. Spoken language with friends.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	9	8.6	8.6	8.6
	2.00	9	8.6	8.6	17.1
	3.00	23	21.9	21.9	39.0
	4.00	8	7.6	7.6	46.7
	5.00	56	53.3	53.3	100.0
	Total	105	100.0	100.0	

Table 16. Years of studying Greek.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Level 1	16	15.2	15.2	15.2
	Level 2	31	29.5	29.5	44.8
	Level 3	58	55.2	55.2	100.0
	Total	105	100.0	100.0	

Table 17. HSC.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Beginners	35	33.3	33.3	33.3
	Intermediate	26	24.8	24.8	58.1
	Advanced	44	41.9	41.9	100.0
	Total	105	100.0	100.0	

Table 18. University level of Greek language.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	More than six months	16	15.2	15.2	15.2
	Less than six months	89	84.8	84.8	100.0
	Total	105	100.0	100.0	

Table 19. Months living in Greece.

5.4 Materials: Images and non-words

As was discussed in Chapter 2, Greek gender determination and processing depends on semantics (sex-animacy), morphology (inflectional class) and syntax (gender agreement between determiners–adjectives–nouns etc.). The present study examines the role of morphology and syntax in gender processing by L2 learners of Greek. Thus, semantic information is excluded by using non-words/pseudo-words. Mastropavlou (2006), Mastropavlou & Tsimpli (2011) and Varlokosta (2011) also utilised pseudo-words in their experiments in order to examine NS's ability to predict gender using only the morphological information carried by the noun suffix and in the absence of any semantic or phrasal cues. This is the first research which aims to examine NNS's

ability to assign gender to novel nouns solely on the basis of morphological information carried by the nouns' endings and/or gender cues marked on the dependent constituents on the noun by virtue of gender agreement, that is, determiners and adjectives.

In order to test our hypothesis and to answer the main research questions, the materials which were used in the experiment were 45 sets of four almost identical although different-coloured drawings of imaginary beings with no gender characteristics and 45 nonsense words, which nevertheless obey the rules of phonemic combinations in Greek, as artificial names for these beings. Thus, 45 items for the two experimental tasks were produced (each item constituted by one non-word noun and a set of four images/drawings).

The way the images and novel words were constructed and, finally, chosen is analysed in the following sections.

Images

The 45 different-coloured drawings of imaginary beings were downloaded from the site www.shutterstock.com. In order to test our experimental hypothesis the images were chosen as animate figures although not human ones. In Greek for [+ human] nouns the natural gender of the referent is considered as the main marker of the grammatical gender since male humans are generally masculine and female humans are feminine (Alexiadou, 2004; Ralli, 2002; Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003; Χριστοφίδου, 2003). However, specific gender values are unpredictable in non-humans (Ralli 2002; 2003). For [– human] nouns, morphology is the main marker of grammatical gender (Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003). Therefore, the vectors were collected with the criteria that none of these images was to have any gender characteristics, masculine or feminine. In addition to this, the target group of this study is adult learners of Greek with L1 English, which has only natural gender. English words that refer to inanimate objects are marked with the neuter gender. Thus, the images, which were used in the two experimental tasks, were necessarily animate imaginary beings. This manipulation was essential for the second task, as the requested answers were in English.

After the collection of the images, a graphic designer was appointed to copy them, change their size, exclude any sexual features and, finally, to colour them. Each image was reproduced four times in four different colours. Colours such as blue or purple, which are usually regarded as male or female respectively, were avoided. Thus, the final colours for each image were beige, red, green and yellow. All the Greek adjectives of

the aforementioned colours, apart from beige, are inflected to clearly represent masculine, feminine and neuter gender. In other words, they are marked with one of the three inflectional morphemes *-ος*, *-η*, *-ο* accordingly to the gender of the noun which they accompany (red/ *κόκκινος*–*κόκκινη*–*κόκκινο*, green/ *πράσινος*–*πράσινη*–*πράσινο*, yellow/ *κίτρινος*–*κίτρινη*–*κίτρινο*).

For the first task, the implementation of the respective imaginary beings images in the experimental procedure was absolutely crucial. According to Levelt et al.'s (1999) theory, language production involves the activation of a lexical concept that is based on the admission that every produced word has to be meaningful. Once the conceptual status of the word is activated then the gender node can only be activated if it receives direct activation from the level of lexical representation, the so-called lemma. After this the lexical form will be activated. During language comprehension, according to the model of Levelt et al. (1999), the opposite procedure is followed (Gollan & Frost, 2001); the lexical form activates the lexical concept of the word. Then and only then the lemma will be activated and the lemma will in turn activate the gender node (Bordag, 2004; Bordag et al., 2006). Thus it can be seen that it was absolutely essential to provide the participants with a conceptual representation of the target non-word. This was achieved using the unique corresponding image. Although this was not essential for the phase of production (answering) it was crucial for the phase of stimulus presentation, securing, as it did, activation of the lexical concept.

For the second task, a variation to the first experimentation was introduced. This manipulation was dependent upon the parameters indicated by stable and efficient models of working memory (Saint-Aubin & Poirier, 1999; Baddeley, 2007; Larigauderie, Michaud & Vicente, 2011; Poirier, Saint-Aubin, Mair, Tehan & Tolan, 2015). In particular, it was decided to exclude the visual stimuli (the corresponding to the non-words image of imaginary beings). This was because the second task required the operation of dual language systems (both English and Greek), and as such there was an increased demand on working memory capacity (Salamoura, 2007). This manipulation eliminated the information retained on the visual sketchpad but left intact the information retained in the phonological loop (Baddeley, 2007). At the same time the episodic buffer was able to operate and consequently to retrieve semantic, grammatical and syntactical information from long term memory. According to Poirier et al. (2015) this undisturbed operation enabled full retrieval and processing of the lexical concept from the episodic buffer (Larigauderie et al., 2011). In other words the

manipulation reduced the demand for working memory capacity and at the same time allowed more space for operation in terms of semantic, syntactic and grammatical information. It therefore reduced any difficulties caused by the demands of switching between language systems.

Finally, this manipulation was considered essential on the basis of representation of grammatical gender in L1 and L2. As the computation of grammatical gender in English is based solely on semantic characteristics, the exclusion of visual information prevented any attempt by the subjects to process the non-words on this basis. In other words, according to the hypothesis of the experiment, the participants then had to process the grammatical gender of the non-words in English using only the available information. Thus the gender characteristic could only be estimated using the previous process of Greek language. Each non-word was linked to a specific gender node (Levelt et al., 1999; Caramazza et al., 2001) using only the provided morphological and syntactical information. After this process each lexeme was crystallised and linked to the appropriate gender node and the relevant conceptual representation. This information would also have been available at the phase of translation. Therefore, the exclusion of visual information prevented the recalculation of the natural gender of the non-words, allowing us in this way to track the representation and the grammatical gender as already computed in Greek.

This hypothesis was also confirmed by the results (the tendency of the participants performance) and more importantly by the Concurrent Validity analysis, which confirmed the relationship between the factors of both tasks. Although the literature indicates the autonomy of gender systems between L1 and L2, in the present experimentation this is not the case because there is no representation of the non-words in the L1 mental lexicon (Salamoura, 2007). Finally, Lemhöfer et al. (2010) demonstrate that when there is an unstable gender representation, as in this case (the non-words do not have natural gender characteristics) then the cross-language compatibility effects are magnified. Therefore it was expected that the gender representations of the non-words in Greek would be employed in English. This tendency was intentionally supported by the absence of the relevant images.

Non-words

Guillelmon & Grosjean (2001) do not include non-words in their experimental tasks in order to avoid making their bilingual participants feel insecure as a result of having to

decide whether an item is a real or a non-word¹ which may affect their processing speed. However, the central research aim of this thesis is to investigate L2 learners' ability to process gender in the absence of any semantic information. The use of nonsense words in this thesis, therefore, offers opportunities to measure the pure effect of the factors which are elaborated during the assignment of gender values based on morphological and/or syntactic cues.

The use of non-words has many benefits. Firstly, any previous knowledge remains outside the scope of this research. The use of real words cannot eliminate the possibility of participants' established knowledge disorienting data. The stems of non-words do not contain any semantic (sex) or morphological information either. Thus, the novel noun condition controls the amount of previous experience that the participants have with real nouns and reveals the underlying system of gender processing as has been shown in previous studies (Holmes & Dejean de la Bâtie, 1999; Scherag et al., 2004; Franceschina, 2005; Lew-Williams & Fernald, 2010; Gruter et al., 2012). In Greek studies, Mastropavlou (2006), Mastropavlou & Tsimpli (2011) and Varlokosta (2011) all use pseudo-words in their experiments in order to examine NS's ability to predict gender using the morphological information carried by the noun suffix in the absence of any semantic or phrasal cues. Similarly, the NNS participants of this research will try to process the grammatical gender of the presented pseudo-words by relying either on the morphological form of the nouns' suffixes and/or on the gender-marked information in the syntactic related constituents, that is, determiners and adjectives. Secondly, the use of nonsense words allows for the manipulation of variables such as word length, letter alternation regularity and semantic information.

To that end 70 pseudo-words were created by combining a novel stem with an existing noun suffix. For the construction of the novel words, the linguistic factors of syllable, stress, case, stem and suffix were also taken into consideration, so as to avoid any gender marking.

Seventy real words, each three syllables long, formed the initial set, including low-frequency and high-frequency items, from the Hellenic National Corpus (Gathercole, Willis & Baddeley, 1991; Maridaki-Kassotaki, 2002; Protopapas, 2006). All of the nouns were in the nominative case, because in the nominative singular case the suffixes of nouns, adjectives and determiners provide three different gender-marking

¹ Non-words/novel words/pseudo-words/nonsense words are all terms which are used in this study in order to refer to non-real words.

forms (Τσιμπλή, 2003; Mastropavlou, 2006; Varlokosta, 2011; Mastropavlou & Tsimpli, 2011; Hopp, 2013).

In some instances of ambiguous gender marking speakers rely on phonological factors, such as stress position and number of syllables (Varlokosta, 2011). Thus, in order to clearly investigate the role of morphology and syntax, such cases were excluded and all of the non-words used are therefore stressed at the penultimate syllable (Protopapas, 2006), for example, *πιμάρος*. In addition, all of the chosen real words have three syllables which are characterised by the sequence consonant–vowel, consonant–vowel, consonant–vowel, so as to ensure that the L2 participants did not have any difficulty in reading/decoding them. The novel words were especially created to avoid close rhyming with existing words, so that any lexical effects (e.g., frequency) could be eliminated. In addition, derivational affixes (e.g., *-της*, *-ίτης*, *-ίσσα*, *-είο* etc.) which are considered as gender markers, were also avoided.

Taking into consideration the research aim, any activation of the lexical entry also had to be avoided. Thus, each novel noun had to be sufficiently dissimilar to the real noun it was derived from while also not being similar to another real noun in the Greek language (Varlokosta, 2011). Taking into consideration Ralli's (2002, p. 537) suggestion that 'gender feature is an intrinsic property of stems and not of inflectional affixes', the stem of each three syllable real noun was turned into a novel stem combined with an existing noun suffix. Two out of the three phonemes were changed so that the result remained phonotactically acceptable (Varlokosta, 2011). As far as consonants are concerned, changes were made to the place or manner of articulation so as to give a phonotactically acceptable result. With the vowels, changes were made along the height axis (e.g., the novel noun *πεφίας* was made from the real masculine noun *ταμίας* 'cashier', *βετέγα* from the real feminine noun *μητέρα* 'mother', *κηβάνι* from the real neuter noun *πεπόνι* 'rock melon'). The initial real words and the final list of the 45 non-words which were used in the experimental tasks can be found in Appendix A.

As was discussed in section 2.5 the task items correspond to all main noun declensions of MG, including almost all possible inflectional endings of Greek nouns in the nominative singular case (*-ος*, *-ας*, *-ης*, *-η*, *-α*, *-ι*, *-ο*).² However, due to several phonological overlaps between genders, not all of the noun suffixes provide a clear

² 'Nouns with suffixes *-es* *-us* *-u* were not included in the study as we had to keep down the size of test and the inclusion of these inflectional morphemes would not contribute any further results to our study, given that these inflectional morphemes are unambiguous' (Varlokosta, 2011, p. 332).

gender marking. The endings of the nonsense nouns are:

–ας, –ης indicating **masculine gender**

–α, –η indicating **feminine gender**

–ο, –ι indicating **neuter gender**

–ος **ambiguous suffix**

Taking into consideration the information that L2 speakers made more mistakes in gender agreement with the definite Greek article and fewer with the indefinite article in Τσιμπλή (2003) and that when ‘participants were free in how they named the objects, and most chose the pragmatically most felicitous option of using indefinite determiners in determiner–adjective–noun sequences’ (Hopp, 2013, p. 50), the written singular nominative form of the indefinite determiner *ένας – μια – ένα* was provided in some cases to the NNS participants.

5.5 Validity of the tasks

The validity of the tasks used in the research necessarily had to be ensured. The validation procedures indicate the effectiveness of the tasks in measuring and predicting the individual’s performance in attributing the grammatical gender of nouns in Greek. In other words, it is essential to ensure that the tasks measure what they were constructed to measure and they measure this behaviour well. The construct validation performed proved that the theoretical approach employed in the construction of the tasks was appropriate. In particular, the construct validation of the tasks included the following: construct validity of the first task, construct validity of the second task, construct validity of the first and the second task for nouns with ambiguous –ος ending, cross validation of the two tasks, concurrent validity and face validity of the survey.

5.5.1 Construct Validity of the first task

It was essential to establish the assumption of normality for the response time in the first task (Dancey & Reidy, 2002). This assumption was met. In particular, the Skewness and Kurtosis values ranged from 0.96 to 0.97.

The number of participants in the factor analysis was 105. The adequacy of the sample size is confirmed by both the Kaiser–Mayer–Olkin test of sampling adequacy and Bartlett’s test of sphericity. The first was 0.82, which is considered a satisfactory value (Kaiser, 1974), and the second was also statistically significant (χ^2 1/3 8150:77, df 1/3 103, $p < .05$). Loadings greater than 0.30 were considered to be significant.

In order to determine the efficiency of the task distributed to the participants, a series of factor analyses were performed. Three, four, five, six and seven factors were extracted. It appeared that the three factor solution was meaningful, as it coincided with the grammatical characteristics of the selected non-words and was also consistent with previous research (Koromvokis & Kalaitzidis, 2014), to extract the number of factors proposed by the theory. In this instance, the number of factors found was the same as in the assumptions for the experiment, that is, three factors. The scree test also showed the extraction of three factors (Cattell, 1966). In addition, a Principal Components Analysis was performed with oblique rotation using the Promax method as well as an orthogonal rotation with the Varimax method. The orthogonal rotation reached a simple structure. The three factors explained 29.04% of the total variance.

Factor 1 accounted for 9.53% of the common variance after rotation. It consists of 11 items. All of the items have significant loadings, which range from 0.69 to 0.49. All of the items belong to the subdivision of morphological information (noun ending). Thus, Factor 1 can be labelled morphological information.

Factor 2 accounted for 6.59% of the common variance after rotation. It is composed of 13 items. Ten items have significant loadings which range from 0.65 to 0.32 and all of these items belong to the subdivision of syntactical information (determiner + noun ending). Thus, Factor 2 may be called morphological + syntactic information.

Factor 3 accounted for 6.19% of the common variance after rotation. It contains 13 items. Twelve items have significant loadings, which range from 0.56 to 0.39 and all of these items belong to the subdivision of extensive syntactic information (determiner + adjective + noun ending). Thus, Factor 3 can be labelled morphological + extensive syntactic information.

Furthermore, in order to compare the factor structure of the first task a pilot study sample was used. A new principal components analysis was performed with orthogonal rotation using again the Varimax method. Three factors were extracted which explain 29.10% of the total variance. Factor 1 accounted for 10.81% of the common variance after rotation. It consists of 13 items. Ten items have significant loadings, which range from 0.75 to 0.34. All of these items belong to the dimension of morphological information, except three items which belong to the dimension of morphological + syntactic information. Thus, Factor 1 can be labelled morphology. Factor 2 accounted for 8.40% of the common variance after rotation. It is composed of 14 items. Thirteen

items have significant loadings which range from 0.68 to 0.31 and all of these items belong to the dimension of morphological + syntactic information, except two, which belong to morphological information. Factor 3 accounted for 6.59% of the common variance after rotation. It contains 12 items. Eleven items have significant loadings, which range from 0.61 to 0.38, and ten of these items belong to extensive syntactic information and one to morphological + syntactic information.

Further, in order to establish the construct validity of the task, a confirmatory factor analysis was performed using AMOS 3.6 (Arbuckle, 1997), investigating the three factor model of the constructed task. The estimation method used was that of maximum likelihood. The following indices were used to assess the fit of the model to the data: the ratio of discrepancy, χ^2 , divided by the degrees of freedom χ^2/df ; the goodness-of-fit index (GFI); the adjusted goodness-of-fit index (AGFI); the Tucker–Lewis index (TLI); the comparative fit index (CFI); the root-mean-square error of approximation (RMSEA); and the root-mean-square residual (RMR). It must be noted that there are no precise standards which indicate the values of the indices needed for a good fit. The analysis provided the following values for the aforementioned indices: $\chi^2/df = 3.43$, (GFI) $\chi^2/df = 0.81$, (AGFI) $\chi^2/df = 0.79$, (TLI) $\chi^2/df = 0.97$, (CFI) $\chi^2/df = 0.96$, (RMSEA) $\chi^2/df = 0.06$ and (RMR) $\chi^2/df = 0.07$. With regard to χ^2/df values fewer than three are considered favourable (Kline, 1998).

Furthermore, the χ^2 value was considered not as a formal statistic. Instead it was suggested to informally compare the magnitude of an observed χ^2 value to the degrees of freedom, and that a ‘small’ χ^2/df indicates a good fit and a large value indicates a ‘bad fit to the data’ (Mueller, 1996). Hu and Bentler (1999) reject the indices GFI and AGFI as acceptable tests of fit. They believe that the minimum criteria for fit using the relative fit TLI and CFI index is at least 0.95 or higher. The RMSEA indicates a good fit if it is smaller, $< .05$, and the RMR indicates a ‘good’ fit if its value is small, < 0.05 or below. Thus, we can conclude that the model seems to fit by all standards of fit, except the one index of RMSEA and the index of RMR. It also seems that the overall fit of the model of three factors is rather moderate (Marcoulides & Hershberger, 1997). In addition, in order to facilitate the replication of the findings of the present study, the means, standard deviations, discrimination indices and squared multiple correlations of each item of the tasks were computed.

5.5.2 Construct validity of the second task

It was essential to establish the assumption of normality for the response time in the second task (Dancey & Reidy, 2002). This assumption was met. In particular, the Skewness and Kurtosis values ranged from 0.91 to 0.95.

Exactly the same procedure as that followed for the first task was followed for the second in order to ensure the construct validity. This procedure also enabled comparison between the first and the second tasks.

The number of participants in the factor analysis was 105. The adequacy of the sample size is confirmed by both the Kaiser–Mayer–Olkin test of sampling adequacy and Bartlett’s test of sphericity. The first was 0.79, which is considered a satisfactory value (Kaiser, 1974), and the second was also statistically significant (χ^2 1/3 7956:66, df 1/3 103, $p < .05$). We considered loadings greater than 0.30 to be significant.

In order to determine the efficiency of the task that was distributed to the participants, a series of factor analyses were performed, that is, three, four, five, six and seven factors were extracted. It appeared that the three factor solution was meaningful, which coincided with the grammatical characteristics of the selected non-words and was also consistent with previous researches (Koromvokis & Kalaitzidis, 2014), to extract the number of factors proposed by the theory. In this instance the number of factors found was the same as in the assumptions for the experiment, that is, three factors. The scree test also showed the extraction of four factors (Cattell, 1966). In addition, a Principal Components Analysis was performed with oblique rotation using the Promax method as well as orthogonal rotation with the Varimax method. The orthogonal rotation reached a simple structure, less items loaded on one factor. The three factors explained 26.84% of the total variance.

Factor 1 accounted for 8.62% of the common variance after rotation. It consists of 11 items. All of the items have significant loadings which range from 0.71 to 0.44. All of the items belong to the subdivision of morphological information (noun ending). Thus, Factor 1 can be labelled morphological information.

Factor 2 accounted for 6.59% of the common variance after rotation. It is composed of 13 items. Twelve items have significant loadings which range from 0.62 to 0.36 and all of these items belong to the subdivision of syntactic information (definite article + adjective + noun ending). Thus, Factor 2 may be called morphological + syntactic information.

Factor 3 accounted for 6.23% of the common variance after rotation. It contains 13 items. Eleven items have significant loadings, which range from 0.58 to 0.33 and all of these items belong to the subdivision of extended syntactic information (definite article + adjective + noun ending). Thus, Factor 3 can be considered morphological + extensive syntactic information.

Furthermore, in order to compare the factor structure of the second task a pilot study sample was used. A new principal components analysis was performed with orthogonal rotation using again the Varimax method. Three factors were extracted which explained 30% of the total variance. Factor 1 accounted for 9.83% of the common variance after rotation. It consists of 13 items. Twelve items have significant loadings which range from 0.72 to 0.30. All of these items belong to the dimension of morphological information, except one, which belongs to morphological + syntactic information. Factor 2 accounted for 7.46% of the common variance after rotation. It is composed of 14 items. Thirteen items have significant loadings which range from 0.63 to 0.30 and all of these items belong to the dimension of morphological + syntactic information, except two, of which one belongs to morphological information, and the other belongs to morphological + extensive syntactic information. Factor 3 accounted for 6.59% of the common variance after rotation. It contains 12 items. Eleven items have significant loadings, which range from 0.65 to 0.31, and ten of these items belong to morphological + extensive syntactic information and one to morphological + syntactic information.

In order to establish the construct validity of the task, a confirmatory factor analysis was also performed using AMOS 3.6 (Arbuckle, 1997), investigating the three factor model of the constructed task. The estimation method used was that of maximum likelihood. The following indices were used to assess the fit of the model to the data: the ratio of discrepancy, χ^2 , divided by the degrees of freedom χ^2/df ; the goodness-of-fit index (GFI); the adjusted goodness-of-fit index (AGFI); the Tucker–Lewis index (TLI); the comparative fit index (CFI); the root-mean-square error of approximation (RMSEA); and the root-mean-square residual (RMR). It must be noted that there are no precise standards which indicate the values of the indices needed for a good fit. The analysis provided the following values for the aforementioned indices: χ^2/df 1/3 3:45, (GFI) 1/3 0.84, (AGFI) 1/3 0.82, (TLI) 1/3 0.96, (CFI) 1/3 0.95, (RMSEA) 1/3 0.06 and (RMR) 1/3 0.05. With regard to χ^2/df values, fewer than three are considered favourable (Kline, 1998). Furthermore, the χ^2 value was considered not as a formal

statistic. Instead it was suggested to informally compare the magnitude of an observed χ^2 value to the degrees of freedom, and that a 'small' $\chi^2 = df$ indicates a good fit and a large value indicates 'a bad fit to the data' (Mueller, 1996). Hu and Bentler (1999) reject the indices GFI and AGFI as acceptable tests of fit. They believe that the minimum criteria for fit using the relative fit TLI and CFI index is at least 0.95 or higher. The RMSEA indicates a good fit if it is smaller, $<.05$, and the RMR indicates a 'good' fit if its value is small, $<.05$ or below. Thus, we can conclude that the model seems to fit by all standards of fit, except surprisingly the one index of RMSEA. It seems that the overall fit of the model of three factors is rather strong (Marcoulides & Hershberger, 1997). In addition, in order to facilitate replication of the findings of the present study, the means, standard deviations, discrimination indices and squared multiple correlations of each item of the task were also computed.

5.5.3 Concurrent Validity

Validities were found by correlating the dimensions of the first task with the dimensions of the second. The correlation coefficients between the aforementioned tasks were 0.84 for morphological information, 0.81 for morphological + syntactic information, and 0.73 for morphological + extensive syntactic information, while all were statistically significant, $p < .05$.

The same analysis was performed for the first and the second task for nouns with ambiguous –ος ending. Validities were found by correlating the dimensions of the first task with the dimensions of the second. The correlation coefficients between the aforementioned tasks were 0.79 for the first factor, 0.83 for the second factor, and 0.77 for the third factor, while all were statistically significant, $p < .05$.

5.5.4 Cross validation of the first and second task

In terms of Cross Validation, it was essential for the tasks' validity to be computed on a different sample of people from the original research sample from which the questions (items) were selected. In other words it had to be computed the cross validation of the two tasks. It is logical that a high validity coefficient could result even when the task has no validity (Anastasi & Urbina, 1997; Dancey & Reidy, 2002). The computation of the validity coefficient on the same (the original research sample) would have capitalised on random sampling errors (Alexopoulos & Kalaitzidis, 2004). Therefore, a second sample, including native Greek speakers were recruited in order to allow cross validation in predicting the assumed criterion of the tests. The coefficients at the cross validation assessment were .81 and .89 respectively for the first and second tasks. The

second sample was small. Thus according to the theory (Anastasi & Urbina, 1997) it was therefore expected to capitalise on chance differences and thus exhibit greater validity shrinkage. In this analysis this was not the case because the items/questions were selected on the basis of previously formulated hypotheses, derived from grammar theories and from past experimental experiences. Therefore, the expected shrinkage in cross validation was minimised.

5.5.5 Principal Component Analysis for nouns with –ος ending in the first and second tasks

Construct validity in the first task for the questions containing nouns with –ος ending had to be established. Therefore, a Principal Component Analysis was performed. In the aforementioned questions, the only available information related to the grammatical gender of the nouns was the morphological information contained at the endings. There were three questions with these characteristics. It was therefore necessary to ensure that all three of them measured the same characteristics in order to allow further quantitative and qualitative analysis. The same procedure also had to be applied for both the dependent variables, the correctness of the answers and the processing time. The sample used in the Principal Component Analysis consisted of 105 participants. The size of the sample was considered satisfactory on the basis of the number of variables according to Dancey and Reidy (2002). Initially, the factorability of the three items was examined. Specific criteria for the factorability of a correlation were used. For the first task two independent factor analyses were performed, one for the dependent variable of answers' correctness and one for the processing time.

In terms of the dependent variable of correctness for the first test, the items correlated at least .30 with at least one other item. These results suggest reasonable factorability. The correlation matrix for all variables is presented in Table 20. The adequacy of the sample size was confirmed by both the Kaiser–Mayer–Olkin test of sampling adequacy and Bartlett's test of sphericity. The first was 0.79, which is considered a satisfactory value (Kaiser, 1974), and the second was also statistically significant (χ^2 1/3 7956:66, df 1/3 105, $p < .05$). Finally, the communalities were all above .30 (Table 21.), further confirming that each item shared some common variance with other items. Given these overall indicators, factor analysis was conducted.

		1Q	2Q	3Q
Correlation	1Q	1.000	.324	.243
	2Q	.324	1.000	.396
	3Q	.243	.396	1.000
Sig. (1-tailed)	1Q		.011	.006
	2Q	.011		.083
	3Q	.006	.083	

Table 20. Correlation matrix.

	Initial	Extraction
1Q	1.000	.561
2Q	1.000	.405
3Q	1.000	.440

Table 21. Communalities.

A Principal Component Analysis was performed in order to determine the efficiency of the questions on the basis of the correctness of answers. It appeared that the one factor solution was meaningful to extract the number of factors proposed by the theory, which coincided with the grammatical characteristics of the nouns and was also consistent with previous research (Koromvokis & Kalaitzidis, 2014). The scree test also showed the extraction of one factor (Cattell, 1966).

The initial eigenvalues showed that the one extracted factor explained 47% of the total variance. The exact results are presented in Table 22.

The extracted factor consists of all the three items. All of the items have significant loadings which are .749, .636 and .663 respectively for the first second and third item. All of the items belong to the category of morphological information. Thus, the factor can be labelled *–os* nouns with only morphological information. The factor loading matrix for the final solution is presented in Table 23. We considered loadings greater than 0.30 to be significant.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.405	46.837	46.837	1.405	46.837	46.837
2	.865	28.819	75.655			
3	.730	24.345	100.000			

Table 22. Total variance explained.

	Component
	1
1Q	.749
3Q	.663
2Q	.636

Table 23. Component matrix^a.

Finally, the solution of the Principal Components Analysis did not allow the rotation of the factor loading matrix either with Varimax or Promax rotations as there was only one extracted factor.

In terms of the dependent variable of processing time for the first task, the items correlated at least .3 with at least one other item. These results suggest reasonable factorability. The correlation matrix for all variables is presented in Table 24. The adequacy of the sample size was confirmed by both the Kaiser–Mayer–Olkin test of sampling adequacy and Bartlett’s test of sphericity. The first was 0.65, which is considered a satisfactory value (Kaiser, 1974), and the second was also statistically significant (χ^2 1/3 6587:64, df 1/3 105, $p < .05$). Finally, the communalities were all above .3 (see Table 25), further confirming that each item shared some common variance with other items. Given these overall indicators, factor analysis was conducted.

		1T	2T	3T
Correlation	1T	1.000	.219	.389
	2T	.219	1.000	.452
	3T	.389	.452	1.000
Sig. (1-tailed)	1T		.012	.000
	2T	.012		.000
	3T	.000	.000	

Table 24. Correlation matrix.

	Initial	Extraction
1T	1.000	.466
2T	1.000	.546
3T	1.000	.703

Table 25. Communalities.

A Principal Component Analysis was performed in order to determine the efficiency of the questions on the basis of processing time. It appeared that the one factor solution was meaningful to extract the number of factors proposed by the theory, which coincided with the grammatical characteristics of the nouns and was also consistent with previous research (Koromvokis & Kalaitzidis, 2014). The scree test also showed the extraction of one factor (Cattell, 1966).

The initial eigenvalues showed that the one extracted factor explained 57% of the total variance. The exact results are presented in Table 26.

The extracted factor consists of all the three items. All of the items have significant loadings which are .682, .739 and .838 respectively for the first second and third item. All of the items belong to the category of morphological information. Thus, the factor can be labelled –os nouns with only morphological information. The factor loading matrix for the final solution is presented in Table 27. We considered loadings greater than 0.30 to be significant.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.714	57.144	57.144	1.714	57.144	57.144
2	.785	26.151	83.295			
3	.501	16.705	100.000			

Table 26. Total variance explained.

	Component
	1
3T	.838
2T	.739
1T	.682

Table 27. Component matrix^a.

Finally, the solution of the Principal Components Analysis did not allow the rotation of the factor loading matrix either with Varimax or Promax rotations as there was only one extracted factor.

In terms of the dependent variable of correctness for the second task, the items correlated at least .3 with at least one other item. These results suggest reasonable factorability. The correlation matrix for all variables is presented in Table 28. The adequacy of the sample size was confirmed by the Kaiser–Mayer–Olkin test of sampling adequacy. The value was 0.71, which is considered a satisfactory value (Kaiser, 1974). Finally, the communalities were all above .3 (see Table 29), further confirming that each item shared some common variance with other items. Given these overall indicators, factor analysis was conducted.

		1Q	2Q	3Q
Correlation	1Q	1.000	.343	.303
	2Q	.343	1.000	.270
	3Q	.303	.270	1.000
Sig. (1-tailed)	1Q		.000	.001
	2Q	.000		.003
	3Q	.001	.003	

Table 28. Correlation matrix.

	Initial	Extraction
1Q	1.000	.578
2Q	1.000	.542
3Q	1.000	.492

Table 29. Communalities.

A Principal Component Analysis was performed in order to determine the efficiency of the questions on the basis of the answers' correctness. It appeared that the one factor solution was meaningful to extract the number of factors proposed by the theory, which coincided with the grammatical characteristics of the nouns and was also consistent with previous research (Koromvokis & Kalaitzidis, 2014). The scree test also showed the extraction of one factor (Cattell, 1966).

The initial eigenvalues showed that the one extracted factor explained 54% of the total variance. The exact results are presented in Table 30.

The extracted factor consists of all the three items. All of the items have significant loadings which are .760, .736 and .701 respectively for the first second and third item. All of the items belong to the category of morphological information. Thus, the factor can be labelled –*os* nouns with only morphological information. The factor loading matrix for the final solution is presented in Table 31. We considered loadings greater than 0.30 to be significant.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.612	53.731	53.731	1.612	53.731	53.731
2	.736	24.538	78.269			
3	.652	21.731	100.000			

Table 30. Total variance explained.

	Component
	1
1Q	.760
2Q	.736
3Q	.701

Table 31. Component matrix^a

Finally, the solution of the Principal Components Analysis did not allow the rotation of the factor loading matrix either with Varimax or Promax rotations as there was only one extracted factor.

In particular, in terms of the dependent variable of processing time for the second task, the items correlated at least .3 with at least one other item. These results suggest reasonable factorability. The correlation matrix for all variables is presented in Table 32. The adequacy of the sample size was confirmed by both the Kaiser–Mayer–Olkin test of sampling adequacy and Bartlett’s test of sphericity. The first was 0.70, which is considered a satisfactory value (Kaiser, 1974), and the second was also statistically significant (χ^2 1/3 7147:62, df 1/3 105, $p < .05$). Finally, the communalities were all above .3 (see Table 33), further confirming that each item shared some common variance with other items. Given these overall indicators, factor analysis was conducted.

		Bos1T	Bos2T	Bos3T
Correlation	1T	1.000	.517	.363
	2T	.517	1.000	.158
	3T	.363	.158	1.000
Sig. (1-tailed)	1T		.000	.000
	2T	.000		.054
	3T	.000	.054	

Table 32. Correlation matrix.

	Initial	Extraction
1T	1.000	.752
2T	1.000	.585
3T	1.000	.375

Table 33. Communalities.

A Principal Component Analysis was performed in order to determine the efficiency of the questions on the basis of the answers' correctness. It appeared that the one factor solution was meaningful to extract the number of factors proposed by the theory, which coincided with the grammatical characteristics of the nouns and was also consistent with previous research (Koromvokis & Kalaitzidis, 2014). The scree test also showed the extraction of one factor (Cattell, 1966).

The initial eigenvalues showed that the one extracted factor explained 57% of the total variance. The exact results are presented in Table 34

The extracted factor consists of all the three items. All of the items have significant loadings which are .867, .765 and .612 respectively for the first second and third item. All of the items belong to the category of morphological information. Thus, the factor can be labelled –os nouns with only morphological information. The factor loading matrix for the final solution is presented in Table 35. We considered loadings greater than 0.30 to be significant.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.712	57.073	57.073	1.712	57.073	57.073
2	.852	28.412	85.485			
3	.435	14.515	100.000			

Table 34. Total variance explained.

	Component
	1
1T	.867
2T	.765
3T	.612

Table 35. Component matrix^a.

Finally, the solution of the Principal Components Analysis did not allow the rotation of the factor loading matrix either with Varimax or Promax rotations as there was only one extracted factor.

5.5.6 Face validity

Assessment of the face validity of the two used tasks was considered essential even though face validity is considered a validity indication only in technical terms. Thus, it cannot be assumed that the face validity of the tests will automatically improve the objective validity, which was tested as well. Fundamentally, face validity pertains to whether the test ‘looks valid’ to the examinee/participant. It is itself a desirable feature of tasks, and functions effectively in practical situations (Alexopoulos et al., 2003). Regardless of the high objective validity of a test, if the test content appears irrelevant or inappropriate the outcome will be poor cooperation and it will have minimum usage value (Anastasi & Urbina, 1997; Dancey & Reidy, 2002). In terms of this research, face validity was carefully assessed with the use of an open question placed at the end of the survey. Each participant, at the end of the evaluation procedure, was asked if they could guess the purpose of the survey. The answers were qualitatively analysed by the researcher, an experienced secondary school teacher of MG and linguistics, as well as by a researcher experienced in methodology issues and psychometrics. Those who

completed the evaluation, reflected upon each answer, taking into consideration initially the existence within the answers of the words ‘gender’, ‘grammatical gender’ and ‘noun’. After completion of all the answers they classified each into two categories, tracked content and non-tracked content. The qualitative evaluation of the face validity of the tasks enabled the transformation of the answers into manageable results for quantitative analysis.

The majority of the participants included the words ‘gender’, ‘grammatical gender’ and ‘noun’ in their answers and thus were classified under the group of ‘tracked content’. In particular, 91% of the whole sample were able to link the survey with the grammatical gender of the nouns. Analytically, 71 participants reported that the survey assessed the grammatical gender of nouns and 24 participants evaluated the survey as an assessment tool for tracking their performance in terms of knowledge of Greek nouns, which was partly the purpose of the tasks. The answers of ten participants were not classified under the category of ‘tracked content’, while the rest of the sample did not manage to report anything about the questionnaires’ purpose.

The findings concerning the tasks’ face validity were further investigated by conducting analysis of variance (ANOVA) in order to explore any differences between men and women as well as any differences between beginners and advanced level learners. In particular, the analysis was a (2X2) factorial two-way mixed analysis of variances, the first factor had two levels (levels of Greek language knowledge: beginners and advanced), while the second factor also had two levels (female and male). The dependent variable was the number of participant’s answers on their evaluation upon the content of the tasks; the classification had two possibilities, ‘tracked content’ and ‘non tracked content’. The analysis of the results was done on the statistical program for social sciences (SPSS).

Because the factor of information had not more than two levels, there was no need to ensure that there was no violation of the assumption of normality, homogeneity of variance and sphericity. Therefore, the Mauchley test of sphericity was not interpreted (Dancey & Reidy, 2002). The ANOVA revealed that the main effects of the level of Greek language ($F(1,103)=16.407$ $MSe=8.008$ $p<.001$), were unlikely to have arisen due to sampling error. The main effect of the level of Greek language was that the advanced learners were better able to connect the tasks’ purpose to the Greek grammatical gender than the beginners (Means 3.1 and 2.6 respectively and partial Eta Squared=.2). Thus 20% of the overall variance was attributed to the influence of the

first factor; the level of Greek language knowledge. ANOVA also revealed that there was no significant main effect of the factor of gender ($F(1,103)=3.451$) and no significant interaction between the factors of gender and the level of Greek language knowledge ($F(1,103)=.473$).

These findings allow for the extraction of interpreted and valid conclusions. Thus, it can be stated that the two tasks have high face validity. According to the main principals of the ‘Classical Theory’ (Anastasi & Urbina, 1997; Dancey & Reidy, 2002), this outcome is compatible with the results of the construct validity of the tasks. The compatibility between face validity and construct validity allows for the consideration of the tasks as proper tools for assessing L2 Greek speakers in term of their capabilities in grammatical gender assignment and agreement.

5.6 Procedure of experimental tasks

The survey was administrated online using the application QUALTRICS. This application was chosen as it is provided by Macquarie University in order to cover the needs of researchers and students. The first section consisted of the participants’ information about the survey and the consent form. The participants’ consent was secured before they were able to proceed to the main part of the survey. The second section was a general task relating to the demographic characteristics of the sample. At this point, the participants were given specific instructions about the procedure of the first task.

In the first task pictures were presented to each of the participants individually. In the first slide the participants saw an imaginary being (Figure 5). At the same time the being’s name was presented in written form, including the grammatical gender information: (1) morphological information (noun suffix), (2) morphological and syntactic information (determiner + noun suffix), and (3) morphological and extensive syntactic information (determiner + adjective + noun suffix) (e.g., *ένας κόκκινος τανίκης*).



Figure 5. Imaginary being presented at the first slide for task 1.

In the second slide three coloured objects identical to the previous image, except for the colour, were presented to the participants. Only one of them was clearly marked in a square (Figure 6). After a time gap the participants were asked to fill in a written sentence: ‘*Μέσα στο τετράγωνο βρίσκεται ...*’ (‘Within the square there is ...’). The answers were evaluated upon the congruency of the gender of the noun (1st Dependent Variable). The individual participant’s time in reacting to the question was also recorded (2nd Dependent Variable).



Figure 6. Imaginary beings presented at the second slide for task 1.

At this point, the participants were given specific instructions about the procedure of the second task. In the second task they were asked to complete a gap filling exercise by choosing the appropriate English personal pronoun (he/she/it) according to the grammatical gender of the given Greek non-words.

e.g. *ένας μπλε κατάλης* _____ is blue

ένας κόκκινος τανίκης _____ is blue

At the end of the evaluation procedure each participant was asked to answer questions regarding the procedure and if they could guess the purpose of the tasks.

- 1 Can you guess what aspect of Greek grammar this experiment is examining?
- 2 Did you have any interruptions while completing the questionnaire (e.g., telephone calls)?
- 3 Please write your comments or concerns about the procedure, if you have any.

An example of the experimental procedure of task 1 and task 2 can be found in Appendix B.

5.7 Ethics approval — Consent form

Before collecting the data from the participants the present research had to comply with the National Health and Medical Research Council (NHMRC)'s Australian Code for the responsible Conduct of Research³ (2007), the National Statement on ethical conduct in Human Research⁴ and other relevant legislation and guidelines. A detailed application describing the purpose and methodology of the present study and experiment was submitted and monitored by the Faculty of Arts Human Research Ethics Committee of Macquarie University and University of NSW. The final ethics approval for the study was obtained in November 2013.

According to the relevant instructions each participant was provided with a consent form. The consent form included information about the title, purpose and procedure of the experimental tasks. The participants were asked to consent to being involved. Only those who answered in the affirmative were given the experimental tasks. Finally, contact details of the researchers and the Macquarie University Ethics Committee were made available on the form.

The consent form provided to the participants is located in Appendix C.

5.8 Pilot study

Before the administration of the main tasks of the study it was considered essential to perform a pilot study. A battery of the aforementioned tasks was administered to a sample of 20 participants. All of them met the selection criteria. Their answers were evaluated qualitatively prior to any statistical analysis. It was considered that their characteristics and the quality of their responses were sufficient for the researchers in order to track any problematic questions or tasks. Due to the small sample, non-parametric tests were applied. The analysis revealed problems with two questions. The problematic situation with these questions was attributed to the phonological properties of the referent words. Therefore, these non-words were appropriately replaced. No other issues emerged thereby allowing the design of the final experiment.

³ www.nhmrc.gov.au/guidelines-publications/r39.

⁴ www.nhmrc.gov.au/guidelines-publications/e72.

Chapter 6: Results

6.0 Chapter overview

This chapter presents the statistical analyses that were performed in order to answer the research questions. It has to be noted that for the analysis only data collected from 105 participants was used. Additionally, in order to secure the methodological appropriateness of the analysis each participant's answer was used in only one statistical analysis.

This chapter is divided into three main sections. These sections reflect the appropriate structure as directed by the design of the research: statistical analysis of the first task, statistical analysis of the second task, and statistical analysis for the ambiguous suffixes of the first and the second task.

6.1 Chi Square Analysis for nouns with *–ος* ending in the first and second tasks

The Chi Square Analysis was performed in order to analyse the non-words with ambiguous endings *–ος*. As was clarified in the methodology section these non-words could be correctly classified as masculine, feminine or neuter, as there was no other grammatical gender information apparent. Therefore, the responses consist of categorical data. On the basis of these characteristics, the experiment measured the probability of association (Robson, 2002) or the independence of facts (Dancey & Reidy, 2002). The analysis was aimed at the discrepancy between the observed results and some hypothetically expected results. This was applied to all of the six provided examples in both tasks. A Chi Square Analysis was considered as the only solution, because there is no other methodological approach for this type of categorical data (Anastasi & Urbina, 1997; Dancey & Reidy, 2002). The analysis was applied separately to the three non-words; '*δανύβος*', '*γεθάδος*' and '*γεχάθος*'. The same non-words were used for both tasks.

In order to analyse how participants attributed the grammatical gender in the example of '*δανύβος*' in the first task a χ^2 (Cramer's V) was performed. The pseudo-word contains the existing and grammatically correct ending *–ος* and thus can be masculine, feminine or neuter. The χ^2 analysis was therefore required as the participants' replies were categorical and we wanted to test the observed frequencies against the expected. The χ^2 value of 79.371, DF = 2 was found to have an associated probability value of $p < .001$. This means that if the null hypothesis was true, such a

value would rarely occur. Thus we can accept that there is a significant difference between the observed and expected frequencies, and can conclude that the assignment of masculine, feminine or neuter grammatical gender to the pseudo-word ‘δανύβος’ is not equally assigned on the basis of no other grammatical, syntactic or semantic information, except for the –ος ending. In fact, the masculine grammatical gender is by far the most commonly assigned to the pseudo-word. The Table 36 presents analytically the actual number of participants who assigned each grammatical gender to the targeted noun.

	Observed N	Expected N	Residual
1.00	78	35.0	43.0
2.00	12	35.0	-23.0
3.00	15	35.0	-20.0
Total	105		

Table 36. Observed, expected and residuals for the non-word ‘δανύβος’ in the first task.

In order to analyse how participants attributed the grammatical gender in the example of ‘γεθάδος’ in the first task a χ^2 (Cramer’s V) was performed. The aforementioned pseudo-word contains the existing and grammatically correct ending –ος and thus can be masculine, feminine or neuter. Therefore, the χ^2 analysis was necessary as the participants’ replies were categorical and we wanted to test the observed frequencies against the expected. The χ^2 value of 83.886, DF = 2 was found to have an associated probability value of $p < .001$. This means that if the null hypothesis was true, such a value would rarely occur. Thus we can accept that there is a significant difference between the observed and expected frequencies, and can conclude that the assignment of masculine, feminine or neuter grammatical gender to the pseudo-word ‘γεθάδος’ is not equally done on the basis of no other grammatical, syntactic or semantic information except for the –ος ending. In fact, the masculine grammatical gender is by far the most commonly assigned to the pseudo-word. Table 37 presents analytically the actual number of participants who assigned each grammatical gender to the targeted noun.

	Observed N	Expected N	Residual
1.00	79	35.0	44.0
2.00	9	35.0	-26.0
3.00	17	35.0	-18.0
Total	105		

Table 37. Observed, expected and residuals for the non-word ‘γεθάδος’ in the first task.

In order to analyse how participants attributed the grammatical gender in the example of ‘γεθάδος’ in the first task a χ^2 (Cramer’s V) was performed. The aforementioned pseudo-word contains the existing and grammatically correct ending *-ος*, and thus can be masculine, feminine or neuter. The χ^2 analysis was therefore necessary as the participants’ replies were categorical and we wanted to test the observed frequencies against the expected. The χ^2 value of 86.800, $DF = 2$ was found to have an associated probability value of $p < .001$. This means that if the null hypothesis was true, such a value would rarely occur. Thus we can accept that there is a significant difference between the observed and expected frequencies, and can conclude that the assignment of masculine, feminine or neuter grammatical gender to the pseudo-word ‘γεθάδος’ is not equally done on the basis of no other grammatical, syntactic or semantic information except for the *-ος* ending. Indeed, the masculine grammatical gender is by far the most commonly assigned to the pseudo-word. Table 38 presents analytically the actual number of participants who assigned each grammatical gender to the targeted noun.

	Observed N	Expected N	Residual
1.00	80	35.0	45.0
2.00	12	35.0	-23.0
3.00	13	35.0	-22.0
Total	105		

Table 38. Observed, expected and residuals for the non-word ‘γεθάδος’ in the first task.

In order to analyse how participants attributed the grammatical gender in the example of ‘δανύβος’ in the second task a χ^2 (Cramer’s V) was performed. The aforementioned

pseudo-word contains the existing and grammatically correct ending $-ος$, and thus can be masculine, feminine or neuter. The χ^2 analysis was therefore necessary as the participants' replies were categorical and we wanted to test the observed frequencies against the expected. The χ^2 value of 120.743, $DF = 2$ was found to have an associated probability value of $p < .001$. This means that if the null hypothesis was true, such a value would rarely occur. Thus we can accept that there is a significant difference between the observed and expected frequencies, and can conclude that the assignment of masculine, feminine or neuter grammatical gender to the pseudo-word ' $\deltaανύβος$ ' is not equally done on the basis of no other grammatical, syntactic or semantic information except for the $-ος$ ending. In fact, the masculine grammatical gender is by far the most commonly assigned to the pseudo-word. Table 39 presents analytically the actual number of participants who assigned each grammatical gender to the targeted noun.

	Observed N	Expected N	Residual
1.00	88	35.0	53.0
2.00	6	35.0	-29.0
3.00	11	35.0	-24.0
Total	105		

Table 39. Observed, expected and residuals for the non-word ' $\deltaανύβος$ ' in the second task.

In order to analyse how participants attributed the grammatical gender in the example of ' $\gammaεθάδος$ ' in the second task a χ^2 (Cramer's V) was performed. The aforementioned pseudo-word contains the existing and grammatically correct ending $-ος$, and thus can be masculine, feminine or neuter. The χ^2 analysis was therefore required as the participants' replies were categorical and we wanted to test the observed frequencies against the expected. The χ^2 value of 107.371, $DF = 2$ was found to have an associated probability value of $p < .001$. This means that if the null hypothesis was true, such a value would rarely occur. Thus we can accept that there is a significant difference between the observed and expected frequencies, and can conclude that the assignment of masculine, feminine or neuter grammatical gender to the pseudo-word ' $\gammaεθάδος$ ' is not equally done on the basis of no other grammatical, syntactic or semantical information except for the $-ος$ ending. In fact, the masculine grammatical gender is by far the most commonly assigned to the pseudo-word. Table 40 presents present

analytically the actual number of participants who assigned each grammatical gender to the targeted noun.

	Observed N	Expected N	Residual
1.00	85	35.0	50.0
2.00	12	35.0	-23.0
3.00	8	35.0	-27.0
Total	105		

Table 40. Observed, expected and residuals for the non-word 'γεθάδος' in the second task.

In order to analyse how participants attributed the grammatical gender in the example of 'γεχάθος' in the second task a χ^2 (Cramer's V) was performed. The aforementioned pseudo-word contains the existing and grammatically correct ending *-ος*, and thus can be masculine, feminine or neuter. The χ^2 analysis was therefore required as the participants' replies were categorical and we wanted to test the observed frequencies against the expected. The χ^2 value of 124.971, $DF = 2$ was found to have an associated probability value of $p < .001$. This means that if the null hypothesis was true, such a value would rarely occur. Thus we can accept that there is a significant difference between the observed and expected frequencies, and can conclude that the assignment of masculine, feminine or neuter grammatical gender to the pseudo-word 'γεχάθος' is not equally done on the basis of no other grammatical, syntactic or semantic information except for the *-ος* ending. In fact, the masculine grammatical gender is by far the most commonly assigned to the pseudo-word. Table 41 presents analytically the actual number of participants who assigned each grammatical gender to the targeted noun. The results for the χ^2 analyses on the nouns with *-ος* endings in the first and the second tasks are presented in Table 42.

	Observed N	Expected N	Residual
1.00	89	35.0	54.0
2.00	8	35.0	-27.0
3.00	8	35.0	-27.0
Total	105		

Table 41. Observed, expected and residuals for the non-word 'γεχάθος' in the second task.

	First task δανύθος	First task γεθάδος	First task γεχάθος	Second task δανύθος	Second task γεθάδος	Second task γεχάθος
Chi-Square	79.371 ^a	83.886 ^a	86.800 ^a	120.743 ^a	107.371 ^a	124.971 ^a
df	2	2	2	2	2	2
Asymp. Sig.	.000	.000	.000	.000	.000	.000

Table 42. χ^2 statistics for the nouns with *-ος* endings in the first and the second tasks.

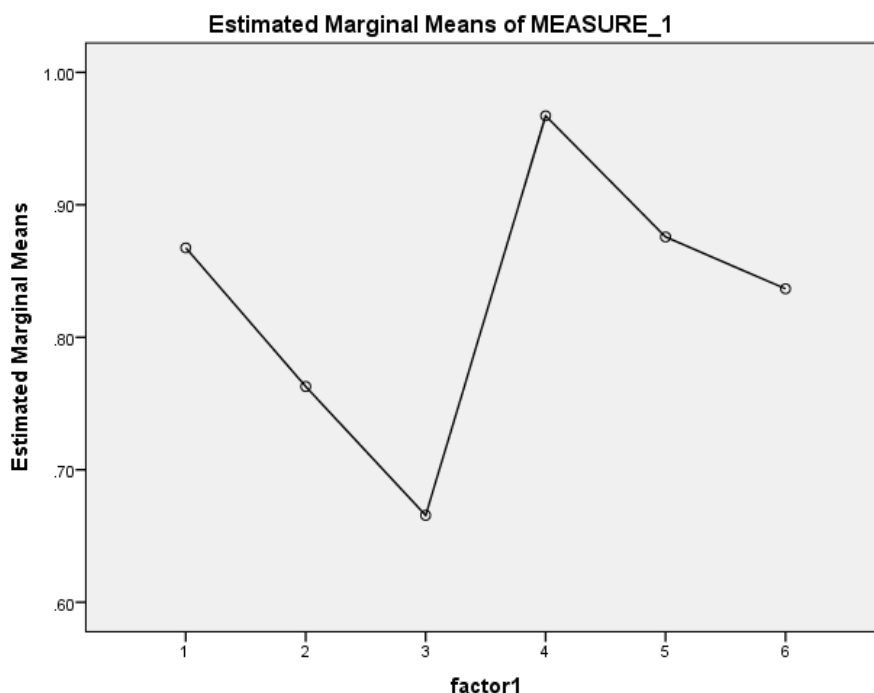
6.1.1 ANOVA for nouns with *-ος* ending at the first task and dependent variable grammatical gender accuracy

In Table 43 the descriptive statistics are presented for all of the participants' performance in the six conditions of the first task with as a dependent variable the accuracy of the participant's answers in terms of the noun's grammatical gender: masculine determiner + non-word with gender ending *-ος* (osmascartQA), feminine determiner + non-word with gender ending *-ος* (osfemartQA), neuter determiner + non-word with gender ending *-ος* (osneutartQA), masculine determiner + adjective with masculine ending *-ος* + non-word with ending *-ος* (osmascsyntQA), feminine determiner + adjective with feminine ending *-η* + non-word with ending *-ος* (osfemsyntQA) neuter determiner + adjective with neuter ending *-ο* + non-word with ending *-ος* (osneutsyntQA)

The descriptive statistics are also presented in Graph 1.

GR Language Competence		Mean	Std. Deviation	N
osmascartQA	Beginners	.8033	.40082	61
	Advanced	.9318	.25497	44
	Total	.8571	.35161	105
osfemartQA	Beginners	.6393	.48418	61
	Advanced	.8864	.32104	44
	Total	.7429	.43916	105
osneutartQA	Beginners	.6721	.47333	61
	Advanced	.6591	.47949	44
	Total	.6667	.47367	105
osmascsyntQA	Beginners	.9344	.24959	61
	Advanced	1.0000	.00000	44
	Total	.9619	.19234	105
osfemsyntQA	Beginners	.8197	.38765	61
	Advanced	.9318	.25497	44
	Total	.8667	.34157	105
osneutsyntQA	Beginners	.7869	.41291	61
	Advanced	.8864	.32104	44
	Total	.8286	.37869	105

Table 43. The descriptive statistics are presented for all of the participants' performance in the six conditions of the first task.



Graph 1. Mean performance for all of the participants in the six conditions of the first task.

As stated in the section of methodology, the experiment was a (2X2X3) factorial three-way mixed analysis of variances. The number of correct answers in terms of nouns with *-oς* endings in the first task was analysed with a split-plot ANOVA. The level of Greek language competence was the between participants factor. This factor had two levels (beginners and advanced). The type of information provided was the first within participants factor. This factor had two levels: (1) morphological and syntactic information (determiner + noun suffix), and (2) morphological and extensive syntactic information (determiner + adjective + noun suffix). The second within participants factor was the grammatical gender and had three levels: (1) masculine, (2) feminine and (3) neuter. The dependent variable was the accuracy of participants' answers on the grammatical gender of nouns with *-oς* endings. Therefore, each participant was examined in six conditions.

The results of the split-plot ANOVA are presented in Table 44 for the within subjects factor and in Table 45 for the between subjects factor.

Source	INFO	GenderMFN	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
INFO	Linear		2.507	1	2.507	20.174	.000	.164
INFO * LANG. COMP.	Linear		.031	1	.031	.250	.618	.002
Error(INFO)	Linear		12.801	103	.124			
GenderMFN	Linear		2.826	1	2.826	18.574	.000	.153
	Quadratic		.030	1	.030	.248	.620	.002
GenderMFN * LANG. COMP.	Linear		.074	1	.074	.487	.487	.005
	Quadratic		.408	1	.408	3.316	.071	.031
Error (GenderMFN)	Linear		15.674	103	.152			
	Quadratic		12.679	103	.123			
INFO * GenderMFN	Linear	Linear	.130	1	.130	1.312	.255	.013
		Quadratic	.017	1	.017	.144	.705	.001
INFO * GenderMFN * LANG. COMP.	Linear	Linear	.197	1	.197	1.984	.162	.019
		Quadratic	.217	1	.217	1.822	.180	.017
Error(INFO* GenderMFN)	Linear	Linear	10.217	103	.099			
		Quadratic	12.280	103	.119			

Table 44. Results of the split-plot ANOVA for the within subjects factor.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	421.883	1	421.883	2086.966	.000	.953
LANG. COMP.	1.743	1	1.743	8.625	.004	.077
Error	20.822	103	.202			

Table 45. Results of the split-plot ANOVA for the between subjects factor

The split-plot ANOVA analysis revealed for the between participants comparison that the main effect due to the level of Greek language competence factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality and homogeneity of variance were met. An F-value (1 – 103) of 8.625

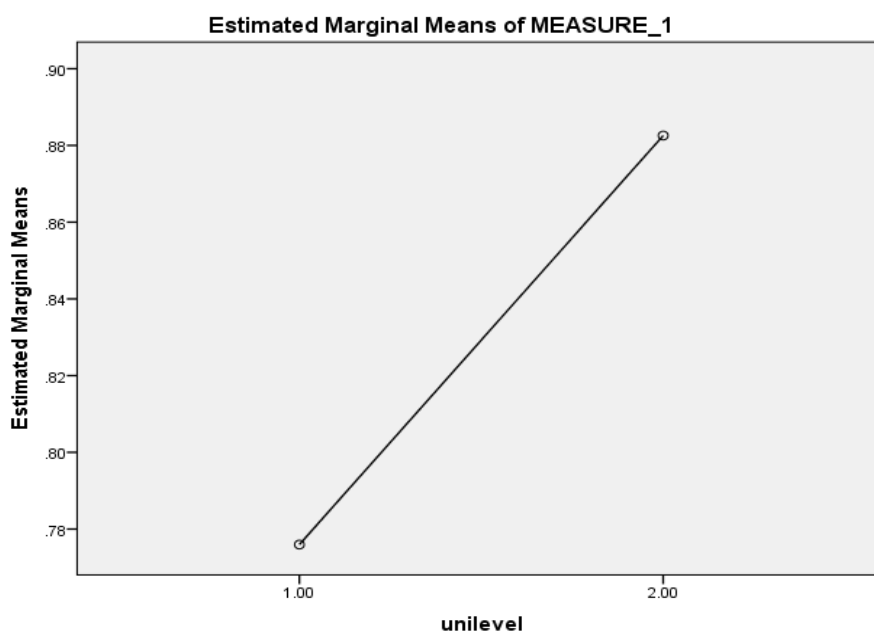
($p < 0.05$) represented an effect size (partial Eta squared) of .077, showing that nearly 8% of the variation in the number of correct answers in the nouns with $-o\varsigma$ endings in the first task can be accounted for by differing the level of Greek language competence. The results suggest that in the first task the advanced Greek language learners were more capable of correctly attributing the grammatical gender of nouns with $-o\varsigma$ endings than the beginners (means of .883 and .776 respectively).

The confidence interval showed that the population mean for the group of beginner Greek language learners is likely (95%) to be found between .729 and .823 and for the advanced learners between .828 and .937.

In Table 46 the descriptive statistics are presented for all of the participants' performance according to their level of Greek language competence. These means are also presented in Graph 2.

Language Competence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Beginners	.776	.024	.729	.823
Advanced	.883	.028	.828	.937

Table 46. Descriptive statistics for all of the participants' performance according to their level of Greek language competence in the first task



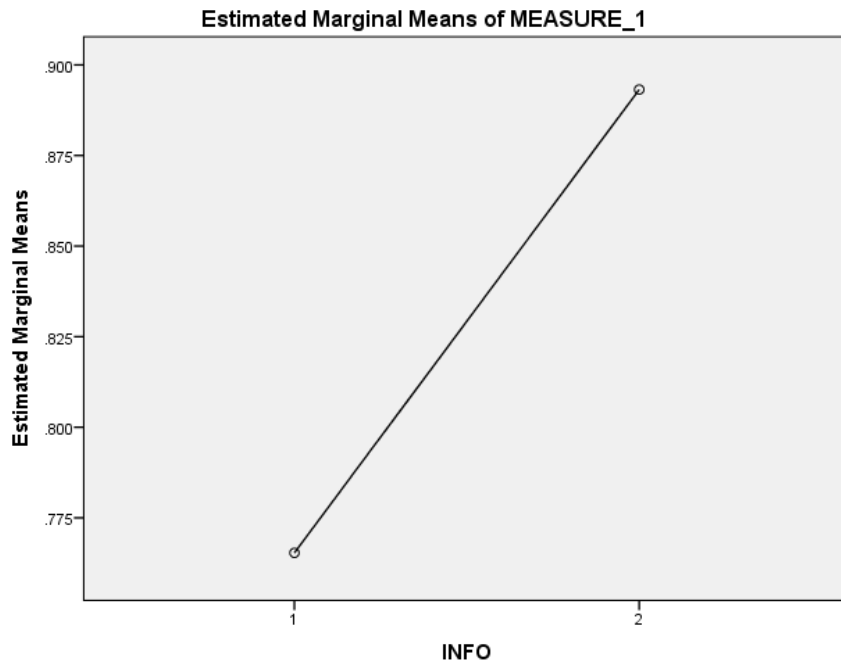
Graph 2. Mean performance for all of the participants according to their level of Greek language competence in the first task

The split-plot ANOVA analysis revealed for the within participants comparisons that the main effects due to the type of information provided factor and the grammatical gender factor were unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, homogeneity of variance and sphericity were met. In particular, the analysis for the main effect of the type of information provided revealed an F-value (1 – 103) of 20.174 ($p < 0.001$) and represented an effect size (partial Eta squared) of .164, showing that nearly 16% of the variation in the number of correct answers in the nouns with *-oç* endings in the first test can be accounted for by differing the type of information provided. Thus, the results suggest that there were more correct answers when morphological + extensive syntactic information was provided than when only morphological + syntactic information was provided (means of .893 and .765 respectively). The confidence interval showed that the population mean for the level of morphological + syntactic information is likely (95%) to be found between .713 and .817 and for the level of morphological + extensive syntactic information between .855 and .932.

In Table 47 the descriptive statistics are presented for all of the participants' performance according to the factor of the information provided. These means are also presented in Graph 3.

INFO	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Morphological + syntactic information	.765	.026	.713	.817
Morphological + extensive syntactic information	.893	.019	.855	.932

Table 47. Descriptive statistics for all of the participants' performance according to the factor of type of information provided in the first task.



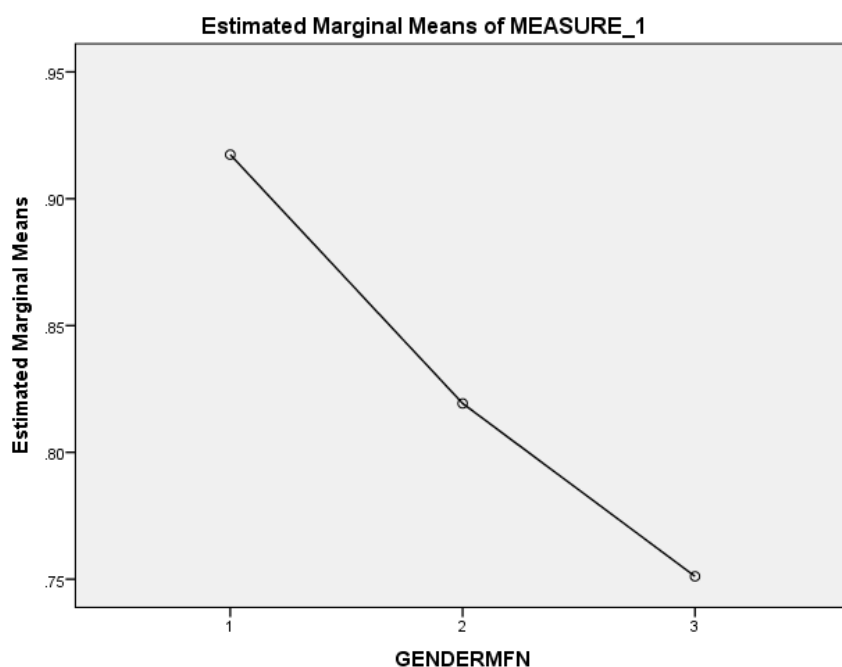
Graph 3. Mean performance for all of the participants according to the factor of type of information provided in the first task.

The analysis for the main effect of the factor of gender revealed an F-value (1 – 103) of 18.574 ($p < 0.001$) and represented an effect size (partial Eta squared) of .153, showing that nearly 15% of the variation in the number of correct answers in the nouns with *-oç* endings in the first task can be accounted for by differing the grammatical gender of the noun. The confidence interval showed that the population mean for the level of masculine grammatical gender is likely (95%) to be found between .876 and .959, for the level of feminine grammatical gender between .760 and .879, and for the level of neuter grammatical gender between .688 and .814. The factor of the grammatical gender of the nouns had three levels (masculine, feminine and neuter). Therefore, three pairwise comparisons were carried out, between the masculine and feminine levels, the masculine and neuter levels, and finally between the feminine and neuter levels. These comparisons allowed all the possible combinations to be analysed. The mean difference between the masculine and feminine levels was 0.098, between the masculine and neuter levels was 0.166, and between the feminine and neuter levels was 0.068. The Bonferroni test showed that the difference between the masculine and feminine levels was unlikely to have arisen by sampling error ($p < 0.05$). Therefore, it can be concluded that the participants performed better when they processed masculine nouns with *-oç* endings than when they processed feminine nouns with *-oç* endings. The confidence interval showed that the population mean difference is likely (95%) to be found between .009 and .187. The difference between the masculine and neuter levels was

unlikely to have arisen by sampling error ($p < 0.001$). Thus, it can be concluded that the participants performed better when they processed masculine nouns with $-o\varsigma$ endings than when they processed neuter nouns with $-o\varsigma$ endings. The confidence interval showed that the population mean difference is likely (95%) to be found between .072 and .260. The difference between the feminine and neuter levels was not significant ($p = 0.156$). Therefore, it can be concluded that the participants performed the same when they processed feminine nouns with $-o\varsigma$ endings as when they processed neuter nouns with $-o\varsigma$ endings. In Table 48 the descriptive statistics are presented for all of the participants' performance according to factor of grammatical gender (masculine, feminine and neuter). These means are also presented in Graph 4.

GenderMFN	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Masculine	.917	.021	.876	.959
Feminine	.819	.030	.760	.879
Neuter	.751	.032	.688	.814

Table 48. Descriptive statistics for all of the participants' performance according to the factor of grammatical gender in the first task.



Graph 4. Mean performance for all of the participants according to the factor of grammatical gender in the first task

		Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
(I) GenderMFN	(J) GenderMFN				Lower Bound	Upper Bound
Masculine	Feminine	.098*	.037	.026	.009	.187
	Neuter	.166*	.039	.000	.072	.260
Feminine	Masculine	-.098*	.037	.026	-.187	-.009
	Neuter	.068	.035	.156	-.016	.153
Neuter	Masculine	-.166*	.039	.000	-.260	-.072
	Feminine	-.068	.035	.156	-.153	.016

Table 49. Descriptive statistics for the pairwise comparisons for the factor of grammatical gender in the first task.

In Table 49 information is presented about the pairwise comparisons for the factor of grammatical gender (masculine, feminine and neuter). The split-plot ANOVA analysis revealed that the interaction between the level of Greek language competence and the type of information provided was not significant, F-value (1 – 103) of 0.25 ($p < 0.618$), indicating that the effect of the type of information provided was similar in the condition of the advanced and the beginner learners of Greek. Furthermore, the difference between the advanced and beginner learners of Greek was similar at all levels of information provided.

In addition, the interaction between the level of Greek language competence and the factor of grammatical gender was not significant, F-value (1 – 103) of 0.487 ($p = 0.487$), indicating that the effect of the factor of grammatical gender was similar in the condition of the advanced and the beginner learners of Greek. Furthermore, the effect of the factor of Greek language competence was similar in each level of the grammatical level factor: masculine, feminine or neuter nouns.

The interaction between the factors of the type of information provided and the grammatical gender was also not significant, F-value (1 – 103) of 1.312 ($p = 0.255$), indicating that the factor of grammatical gender (masculine, feminine and neuter nouns) behaves the same way at all levels of the factor of the information provided, morphological + syntactic information or morphological + extensive syntactic information. On the basis of this analysis there were no differences between the effect

of the factor of the information provided at all three levels of the grammatical gender factor: masculine, feminine or neuter nouns.

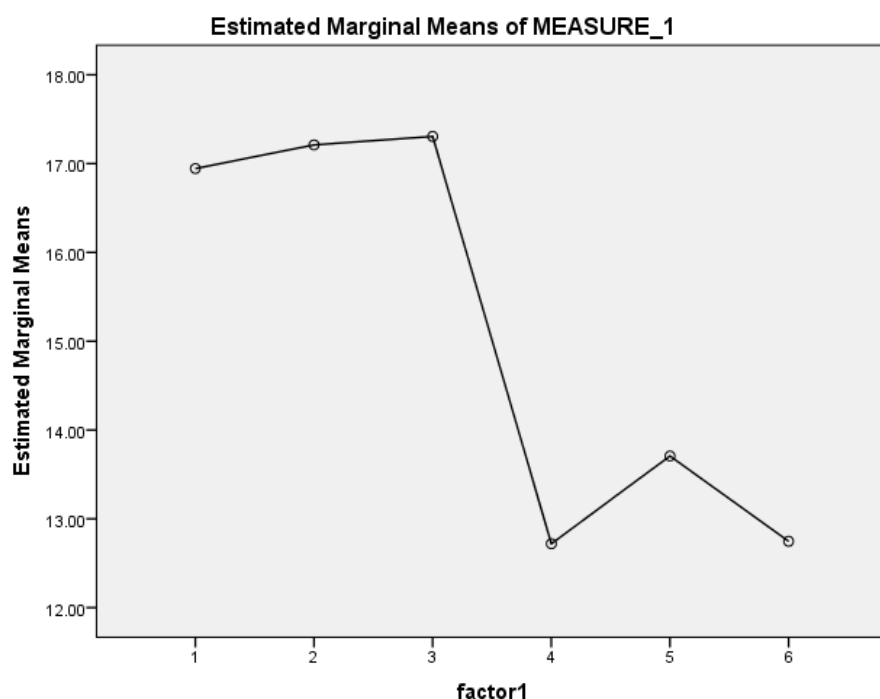
Finally, the interaction between all of the three factors — the level of Greek language competence, the type of information provided and the grammatical gender — was not significant, F-value (1 – 103) of 1.984 ($p = 0.162$), indicating that the effect of the type of information was similar in masculine, feminine and neuter nouns and this observation was confirmed for both the advanced and beginner learners of Greek. Furthermore, the effect of the grammatical gender factor was similar for all levels of information provided and this observation was confirmed for both the advanced and beginner learners of Greek. Finally, the factor of Greek language competence does not behave differently in each condition of two other variables: type of information provided and grammatical gender.

6.1.2 ANOVA for nouns with –ος ending in the first task and dependent variable reaction time

In Table 50 the descriptive statistics are presented for all of the participants' processing times in the six conditions in the first test with as a dependent variable the participants' processing time for their answers after the presentation of the stimulus. The stimuli are classified into six conditions on the basis of their grammatical gender and the level of information provided. Analytically, the conditions are masculine determiner + non-word with gender ending –ος (osmascarttimeA), feminine determiner + non-word with gender ending –ος (osfemarttimeA), neuter determiner + non-word with gender ending –ος (osneutarttimeA), masculine determiner + adjective with masculine ending –ος + non-word with ending –ος (osmascsynttimeA), feminine determiner + adjective with feminine ending –η + non-word with ending –ος (osfemsynttimeA) and neuter determiner + adjective with neuter ending –ο + non-word with ending –ος (osneutsynttimeA). The descriptive statistics are also presented in Graph 5.

GR Language Competence		Mean	Std. Deviation	N
osmascarttimeA	Beginners	16.6494	12.65203	61
	Advanced	17.2388	19.42646	44
	Total	16.8964	15.76296	105
osfemarttimeA	Beginners	19.2173	22.21364	61
	Advanced	15.2036	8.42930	44
	Total	17.5354	17.83304	105
osneutarttimeA	Beginners	19.2160	43.22372	61
	Advanced	15.3960	7.47996	44
	Total	17.6152	33.23521	105
osmascsynttimeA	Beginners	13.5391	7.61751	61
	Advanced	11.8992	9.62470	44
	Total	12.8519	8.51110	105
osfemsynttimeA	Beginners	15.9503	14.25264	61
	Advanced	11.4641	8.88384	44
	Total	14.0703	12.44078	105
osneutsynttimeA	Beginners	14.3310	11.27385	61
	Advanced	11.1620	7.48569	44
	Total	13.0030	9.94806	105

Table 50. The descriptive statistics are presented for all of the participants' reaction times in the six conditions in the first task.



Graph 5. Mean reaction time for all of the participants in the six conditions in the first task

As stated in the section of method, the experiment was a (2X2X3) factorial three-way mixed analysis of variances. The processing time for participants' answers in the nouns with *-oc* endings in the first task was analysed with a split-plot ANOVA. The level of Greek language competence was the between participants factor; this factor had two levels (beginner and advanced). The type of information provided was the first within participants factor. This factor had two levels: (1) morphological and syntactic information (determiner + noun suffix) and (2) morphological and extensive syntactic information (determiner + adjective + noun suffix). The second within participants factor was the grammatical gender and it had three levels: (1) masculine, (2) feminine and (3) neuter. The dependent variable was the participants' processing time for their answers on the grammatical gender of nouns with *-oc* endings. Therefore, each participant was examined in six conditions.

The results of the split-plot ANOVA are presented in Table 51 for the within subjects and in Table 52 for the between subjects.

Source	INFO	GenderMFN	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
INFO	Linear		2573.046	1	2573.046	12.590	.001	.109
INFO * LANG. COMP.	Linear		17.920	1	17.920	.088	.768	.001
Error(INFO)	Linear		21049.687	103	204.366			
GenderMFN	Linear		3.872	1	3.872	.013	.910	.000
	Quadratic		38.276	1	38.276	.106	.745	.001
GenderMFN * LANG. COMP.	Linear		225.373	1	225.373	.755	.387	.007
	Quadratic		171.014	1	171.014	.476	.492	.005
Error (GenderMFN)	Linear		30748.802	103	298.532			
	Quadratic		37036.421	103	359.577			
INFO * GenderMFN	Linear	Linear	2.860	1	2.860	.014	.908	.000
		Quadratic	26.934	1	26.934	.206	.651	.002
INFO * GenderMFN * LANG. COMP.	Linear	Linear	53.017	1	53.017	.251	.617	.002
		Quadratic	.854	1	.854	.007	.936	.000
Error(INFO* GenderMFN)	Linear	Linear	21742.099	103	211.088			
		Quadratic	13460.189	103	130.681			

Table 51. Results of the split-plot ANOVA for the within subjects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	139983.836	1	139983.836	175.742	.000	.630
LANG. COMP.	1165.430	1	1165.430	7.463	.029	.084
Error	82042.503	103	796.529			

Table 52. Results of the split-plot ANOVA for the between subjects.

The split-plot ANOVA analysis revealed that for the between participants comparison that the main effect due to the level of Greek language competence factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality and homogeneity of variance were met. An F-value (1 – 103) of 7.463 ($p < 0.05$) represented an effect size (partial Eta squared) of .084, showing that nearly 8% of the variation in the participants' processing time for their answers on the

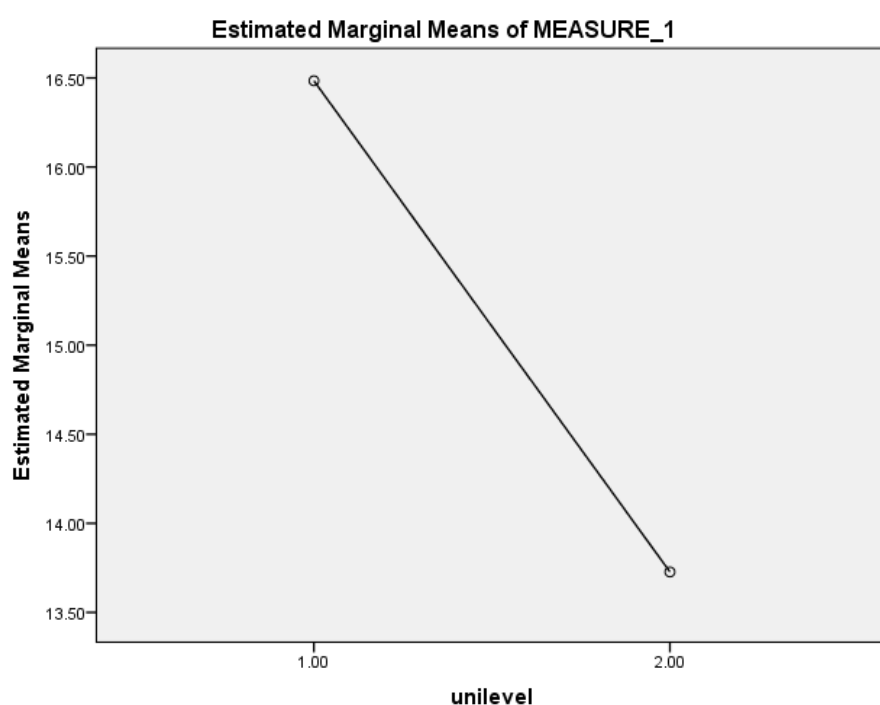
grammatical gender of nouns with $-o\varsigma$ endings in the first task can be accounted for by differing the level of Greek language competence. The results suggest that in the first task the advanced Greek language learners needed less processing time in attributing the grammatical gender of nouns with $-o\varsigma$ endings than the beginners (means of 13.727 and 16.484 respectively).

The confidence interval showed that the population mean for the group of beginners is likely (95%) to be found between 13.558 and 19.410 and for the advanced learners between 10.282 and 17.172.

In Table 53 the descriptive statistics are presented for all of the participants' processing time according to their level of Greek language competence. These means are also presented in Graph 6.

Language Competence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Beginners	16.484	1.475	13.558	19.410
Advanced	13.727	1.737	10.282	17.172

Table 53. Descriptive statistics for all of the participants' reaction times according to their level of Greek language competence in the first task.

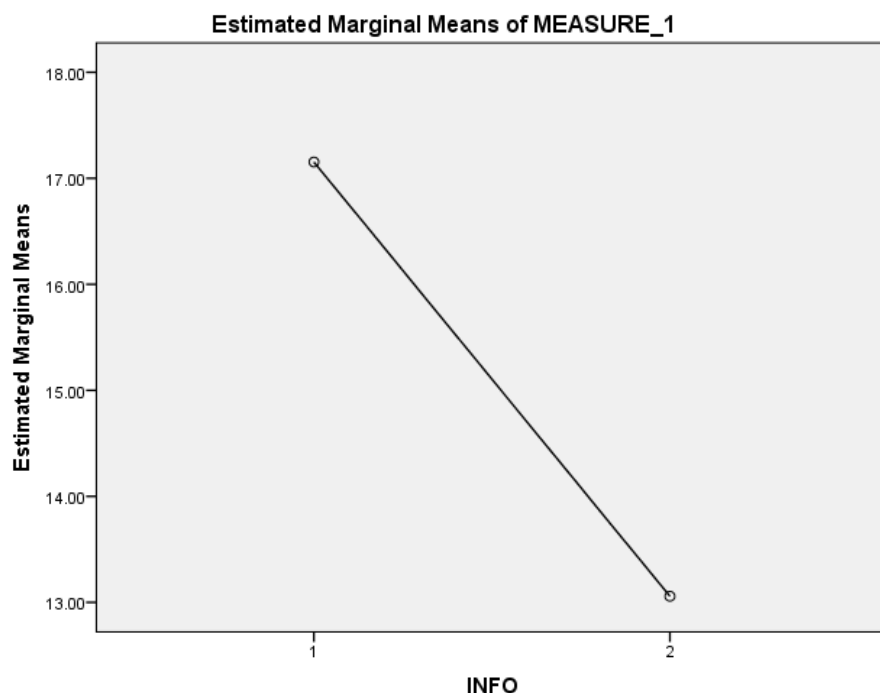


Graph 6. Mean reaction time for all of the participants according to their level of Greek language competence in the first task.

The split-plot ANOVA analysis revealed that for the within participants comparisons that the main effect due to the type of information provided factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, homogeneity of variance and sphericity were met. In particular, the analysis for the main effect of the type of information provided revealed an F-value (1 – 103) of 12.590 ($p < 0.001$) and represented an effect size (partial Eta squared) of .109, showing that nearly 11% of the variation in the participants' processing time for their answers on the grammatical gender of nouns with *-oç* endings in the first task can be accounted for by differing the type of information provided. Thus, the results suggest that the processing time was less when morphological + extensive syntactic information was provided rather than when only morphological + syntactic information was provided (means of 13.058 and 17.154 respectively). The confidence interval showed that the population mean for the level of morphological + syntactic information is likely (95%) to be found between 14.002 and 20.305 and for the level of morphological + extensive syntactic information between 11.354 and 14.762. In Table 54 the descriptive statistics are presented for all of the participants' processing time according to the factor of information provided (morphological + syntactic information and morphological + extensive syntactic information). These means are also presented in Graph 7.

INFO	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Morphological + syntactic information	17.154	1.589	14.002	20.305
Morphological + extensive syntactic information	13.058	.859	11.354	14.762

Table 54. Descriptive statistics for all of the participants' reaction times according to the factor of type of information provided in the first task.



Graph 7. Mean reaction time for all of the participants according to the factor of type of information provided in the first task.

The analysis for the main effect of the factor of gender was not significant revealing an F-value (1 – 103) of 0.13 ($p = .910$). These results indicate that the participants needed the same time in order to process masculine, feminine or neuter nouns with *-ος* endings in the first test.

The split-plot ANOVA analysis revealed that the interaction between the level of Greek language competence and the type of information provided was not significant, F-value (1 – 103) of 0.088 ($p = 0.768$), indicating that the effect of the factor of information provided was similar in the condition of the advanced and the beginner learner. Furthermore, the effect of the factor of Greek language competence was similar in each level of information provided.

In addition, the level of Greek language competence and the factor of grammatical gender was not significant, F-value (1 – 103) of 0.755 ($p = 0.387$), indicating that the effect of the factor of grammatical gender was similar in the condition of the advanced and the beginner learners. Furthermore, the effect of the factor of Greek language competence was similar in each level of the grammatical gender factor: masculine, feminine or neuter nouns.

The interaction between the factors of the type of information provided and the grammatical gender was also not significant, F-value (1 – 103) of 0.14 ($p = 0.908$),

indicating that the factor of grammatical gender (masculine, feminine and neuter nouns) behaves the same way at all levels of the factor of the information provided, (morphological + syntactic information or morphological + extensive syntactic information). On the basis of this analysis there were no difference between the effect of the factor of the information provided at all three levels of the grammatical gender factor: masculine, feminine or neuter nouns.

Finally, the interaction between all the three factors, the level of Greek language competence, the type of information provided and the grammatical gender, was not a significant F-value (1 – 103) of 0.251 ($p = 0.617$), indicating that the effect of the type of information was similar in masculine, feminine and neuter nouns and this observation was confirmed for both the beginners and the advanced learners of Greek. Furthermore, the effect of the grammatical gender factor was similar for all of the levels of information provided and this observation was confirmed for both advanced and beginner. Finally, the factor of Greek language competence does not behave differently in each condition of two other variables: type of information provided and grammatical gender.

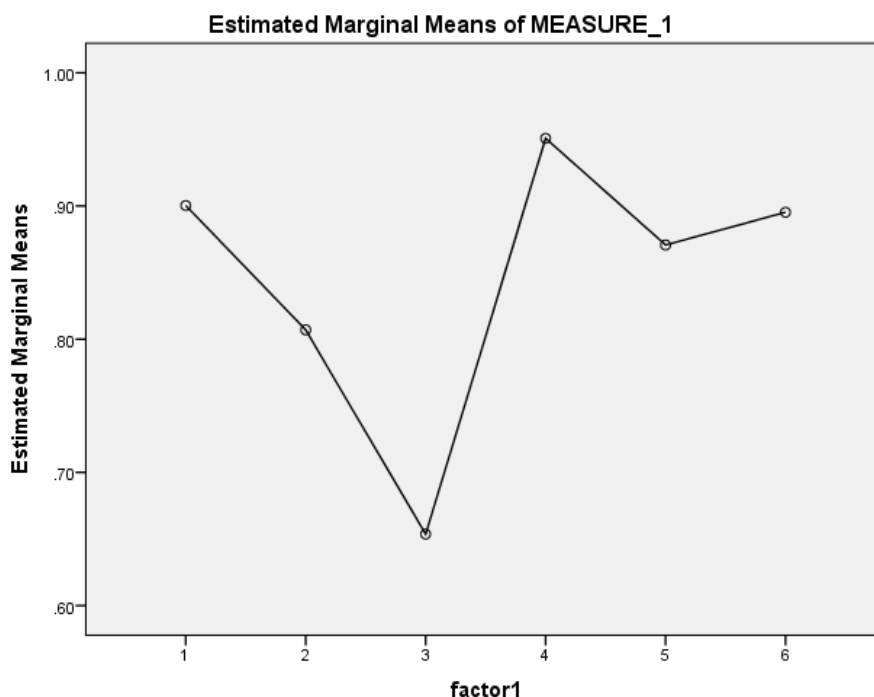
6.1.3 ANOVA for nouns with $-o\varsigma$ ending in the second task and dependent variable grammatical gender accuracy

In Table 55 the descriptive statistics are presented for all of the participants' performance in the six conditions in the second test with the dependent variable the correctness of participant's answer on the noun's grammatical gender: masculine determiner + non-word with gender ending $-o\varsigma$ (osmascartQA), feminine determiner + non-word with gender ending $-o\varsigma$ (osfemartQA), neuter determiner + non-word with gender ending $-o\varsigma$ (osneutartQA), masculine determiner + adjective with masculine ending $-os$ + non-word with ending $-o\varsigma$ (osmascsyntQA), feminine determiner + adjective with feminine ending $-\eta$ + non-word with ending $-o\varsigma$ (osfemsyntQA) and neuter determiner + adjective with neuter ending $-o$ + non-word with ending $-o\varsigma$ (osneutsyntQA).

The descriptive statistics are also presented in Graph 8.

GR Language Competence		Mean	Std. Deviation	N
osmascartQB	Beginners	.8689	.34036	61
	Advanced	.9318	.25497	44
	Total	.8952	.30772	105
osfemartQB	Beginners	.7049	.45986	61
	Advanced	.9091	.29080	44
	Total	.7905	.40892	105
osneutartQB	Beginners	.5574	.50082	61
	Advanced	.7500	.43802	44
	Total	.6381	.48286	105
osmascsyntQB	Beginners	.9016	.30027	61
	Advanced	1.0000	.00000	44
	Total	.9429	.23323	105
osfemsyntQB	Beginners	.7869	.41291	61
	Advanced	.9545	.21071	44
	Total	.8571	.35161	105
osneutsyntQB	Beginners	.8361	.37329	61
	Advanced	.9545	.21071	44
	Total	.8857	.31968	105

Table 55. The descriptive statistics for all of the participants' performance in the six conditions in the second task.



Graph 8. Mean performance for all of the participants in the six conditions in the second task.

As stated in the section on methodology, the experiment was a (2X2X3) factorial three-way mixed analysis of variances. The number of correct answers in the nouns with *-oc* endings in the second task was analysed with a split-plot ANOVA. The level of Greek language competence was the between participants factor, this factor had two levels (beginner and advanced). The type of information provided was the first within participants factor. This factor had two levels: (1) morphological and syntactic information (determiner + noun suffix) and (2) morphological and extensive syntactic information (determiner + adjective + noun suffix). The second within participants factor was the grammatical gender and it had three levels: (1) masculine, (2) feminine and (3) neuter. The dependent variable was the correctness of participants' answers on the grammatical gender of nouns with *-oc* endings. The correctness of the answer was based on the grammatical gender of the noun in Greek language and not its grammatical correctness in English. Therefore, each participant was examined in six conditions.

The results of the split-plot ANOVA are presented in Table 56 for the within subjects and in Table 57 for the between subjects.

Source	INFO	GenderMFN	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
INFO	Linear		2.157	1	2.157	24.644	.000	.193
INFO * LANG. COMP.	Linear		.024	1	.024	.276	.601	.003
Error(INFO)	Linear		9.017	103	.088			
GenderMFN	Linear		2.334	1	2.334	13.344	.000	.115
	Quadratic		.017	1	.017	.174	.677	.002
GenderMFN * LANG. COMP.	Linear		.143	1	.143	.820	.367	.008
	Quadratic		.157	1	.157	1.605	.208	.015
Error(GenderMFN)	Linear		18.014	103	.175			
	Quadratic		10.054	103	.098			
INFO * GenderMFN	Linear	Linear	.934	1	.934	11.154	.001	.098
		Quadratic	.231	1	.231	2.458	.120	.023
INFO * GenderMFN * LANG. COMP.	Linear	Linear	.077	1	.077	.916	.341	.009
		Quadratic	.003	1	.003	.027	.871	.000
Error(INFO * GenderMFN)	Linear	Linear	8.623	103	.084			
		Quadratic	9.685	103	.094			

Table 56. Results of the split-plot ANOVA for the within subjects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	439.405	1	439.405	2076.556	.000	.953
Language competence	3.037	1	3.037	14.351	.000	.122
Error	21.795	103	.212			

Table 57. Results of the split-plot ANOVA for the between subjects.

The split-plot ANOVA analysis revealed for the between participants comparison that the main effect due to the level of Greek language competence factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality and homogeneity of variance were met. An F-value (1 – 103) of 14.351 ($p < 0.001$) represented an effect size (partial Eta squared) of .122, showing that nearly

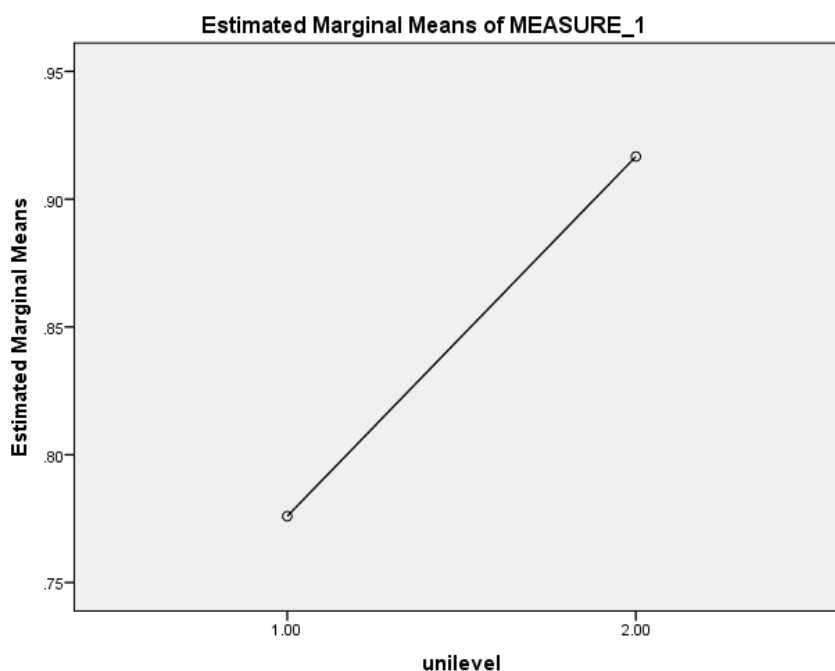
12% of the variation in the number of correct answers in the nouns with $-o\varsigma$ endings in the second task can be accounted for by differing the level of Greek language competence. The results suggest that in the second test the advanced Greek language learners were more capable of accurately attributing the grammatical gender of nouns with $-o\varsigma$ endings than the beginners (means of .917 and .776 respectively).

The confidence interval showed that the population mean for the group of beginners is likely (95%) to be found between .728 and .824 and for the advanced learners between .861 and .937.

In Table 58 the descriptive statistics are presented for all of the participants' performance according to their level of Greek language competence (beginner and advanced). These means are also presented in Graph 9.

GR Language Competence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Beginners	.776	.024	.728	.824
Advanced	.917	.028	.861	.973

Table 58. Descriptive statistics for all of the participants' performance according to their level of Greek language competence in the second task.



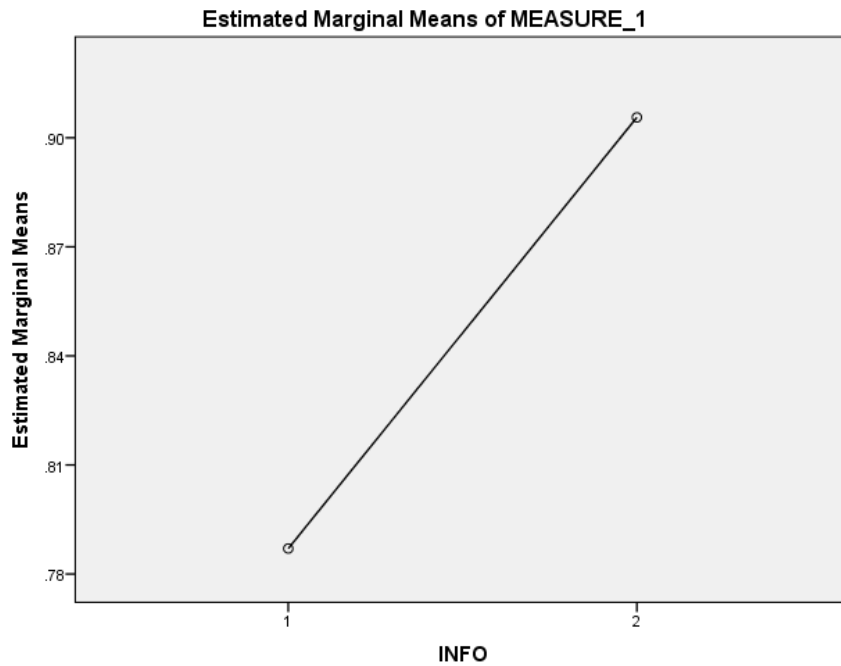
Graph 9. Mean performance for all of the participants according to their level of Greek language competence in the second task.

The split-plot ANOVA analysis revealed for the within participants comparisons that the main effects due to the type of information provided factor and the grammatical gender factor were unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, homogeneity of variance and sphericity were met. In particular, the analysis for the main effect of the type of information provided revealed an F-value (1 – 103) of 24.644 ($p < 0.001$) and represented an effect size (partial Eta squared) of .193, showing that nearly 19% of the variation in the number of accurate answers in the nouns with *-oç* endings in the second task can be accounted for by differing the type of information provided. Thus, the results suggest that there were more correct answers when morphological and extensive syntactic information (determiner + adjective + noun suffix) was provided rather than when only morphological and syntactic information (determiner + noun suffix) was provided (means of .906 and .787 respectively). The confidence interval showed that the population mean for the level of morphological and syntactic information (determiner + noun suffix) is likely (95%) to be found between .740 and .834 and for the level of morphological and extensive syntactic information (determiner + adjective + noun suffix) between .865 and .946.

In Table 59 the descriptive statistics are presented for all of the participants' performance according to the factor of the information provided. These means are also presented in Graph 10.

INFO	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Morphological + syntactic information	.787	.024	.740	.834
Morphological + extensive syntactic information	.906	.020	.865	.946

Table 59. Descriptive statistics for all of the participants' performance according to the factor of type of information provided in the second task.



Graph 10. Mean performance for all of the participants according to the factor of type of information provided in the second task.

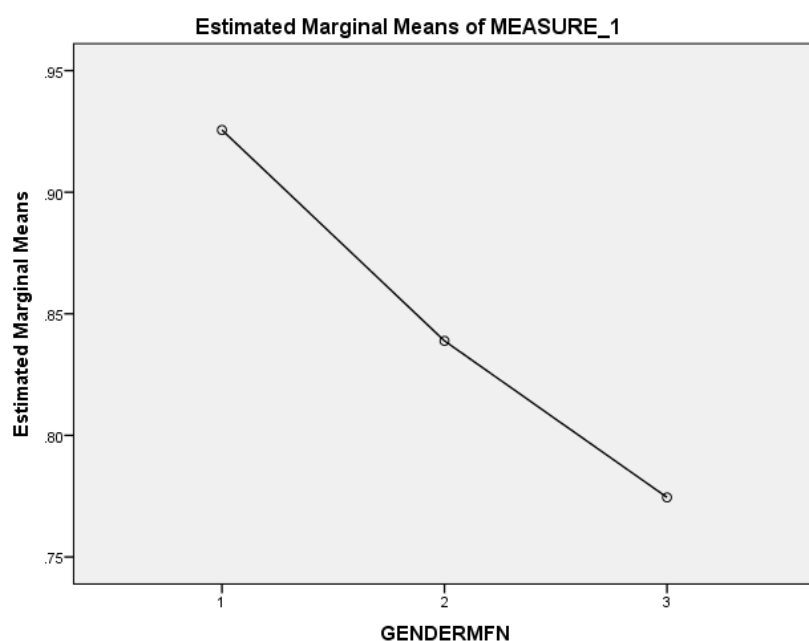
The analysis for the main effect of the factor of grammatical gender revealed an F-value (1 – 103) of 13.344 ($p < 0.001$) and represented an effect size (partial Eta squared) of .115, showing that nearly 12% of the variation in the number of correct answers in the nouns with $-o\varsigma$ endings in the second task can be accounted for by differing the grammatical gender of the noun. The confidence interval showed that the population mean for the level of masculine grammatical gender is likely (95%) to be found between .883 and .968, for the level of feminine grammatical gender between .779 and .899 and for the level of neuter grammatical gender between .712 and .837. The factor of the grammatical gender of the nouns had three levels (masculine, feminine and neuter). Therefore, three pairwise comparisons were carried out: between the masculine and feminine levels, the masculine and neuter levels, and finally between the feminine and neuter levels. These comparisons allowed all of the possible combinations to be analysed. The mean difference between the masculine and feminine levels was 0.087, between the masculine and neuter levels was 0.151 and between the feminine and neuter levels 0.064. The Bonferroni test showed that the difference between the masculine and feminine levels was unlikely to have arisen by sampling error ($p < 0.05$). Therefore, it can be concluded that the participants performed better when they processed masculine nouns with $-o\varsigma$ endings than when they processed feminine nouns with $-o\varsigma$ endings. The confidence interval showed that the population mean difference is likely (95%) to be found between .005 and .168. The difference between the

masculine and neuter levels was unlikely to have arisen by sampling error ($p < 0.001$). Thus, it can be concluded that the participants performed better when they processed masculine nouns with $-o\varsigma$ endings than when they processed neuter nouns with $-o\varsigma$ endings. The confidence interval showed that the population mean difference is likely (95%) to be found between .050 and .252. The difference between the feminine and neuter levels was not significant ($p = 0.188$). Therefore, it can be concluded that the participants performed the same when they either processed feminine nouns with $-o\varsigma$ endings or neuter nouns with $-o\varsigma$ endings.

In Table 60 the descriptive statistics are presented for all of the participants' performance according to factor of grammatical gender (masculine, feminine and neuter). These means are also presented in Graph 11.

GenderMFN	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Masculine	.926	.022	.883	.968
Feminine	.839	.030	.779	.899
Neuter	.774	.031	.712	.837

Table 60. Descriptive statistics for all of the participants' performance according to the factor of grammatical gender in the second task.



Graph 11. Mean performance for all of the participants according to the factor of grammatical gender in the second task.

(I) GenderMFN(J) GenderMFN		Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Masculine	Feminine	.087*	.033	.033	.005	.168
	Neuter	.151*	.041	.001	.050	.252
Feminine	Masculine	-.087*	.033	.033	-.168	-.005
	Neuter	.064	.034	.188	-.019	.148
Neuter	Masculine	-.151*	.041	.001	-.252	-.050
	Feminine	-.064	.034	.188	-.148	.019

Table 61. Pairwise comparisons for the factor of grammatical gender in the second task.

In Table 61 information is presented about the pairwise comparisons for the factor of grammatical gender (masculine, feminine and neuter). The split-plot ANOVA analysis revealed that the interaction between the factors of the type of information provided and the grammatical gender was significant, F-value (1 – 103) of 11.154 ($p < 0.001$). This interaction accounts for effect size almost 10% of the total variance (partial Eta squared 0.098). The simple main effects of this interaction were further investigated using t-tests. These analyses showed that the effect of grammatical gender on the condition of morphological and syntactic information (determiner + noun suffix) was such that it was unlikely to have arisen due to sampling error. In particular, for the comparison between the conditions of: masculine vs feminine ($t(104) = 2.153$ $p < 0.05$, $d = 0.29$), masculine vs neuter ($t(104) = 4.475$ $p < 0.001$, $d = 0.65$) and feminine vs neuter ($t(104) = 2.749$ $p < 0.05$, $d = 0.34$). The confidence interval showed that the population mean difference is likely (95%) to be found between .00828 and .20124 for the first comparison, .14319 and .37109 for the second comparison, and between .04244 and .26232 for the third comparison. These results indicate that in the condition of morphological and syntactic information (determiner + noun suffix) the participants performed better when they were processing nouns with masculine grammatical gender than when they were processing nouns with feminine or neuter grammatical gender. In addition, they also performed better when they were processing nouns with feminine grammatical gender than when they were processing nouns with neuter grammatical gender.

The t-tests indicate that the effect of grammatical gender on the condition of morphological and extensive syntactic information (determiner + adjective + noun suffix) was such that it was unlikely to have arisen due to sampling error only for the comparison between the conditions of masculine vs feminine ($t(104) = 2.375$ $p < 0.05$, $d = 0.29$). The confidence interval showed that the population mean difference is likely (95%) to be found between .01413 and .15730. There was no significant difference for the comparison between the conditions of masculine vs neuter ($t(104) = 1.421$ $p = 0.158$) and for the comparison between the conditions of feminine vs neuter ($t(104) = -.831$ $p = 0.408$). These results indicate that in the condition of morphological and extensive syntactic information (determiner + adjective + noun suffix) the participants performed better when they were processing nouns with masculine grammatical gender than when they were processing nouns with feminine grammatical gender. Furthermore, there was no simple main effect of grammatical gender when they were processing nouns with masculine or neuter grammatical gender. The same observation, no difference between feminine and neuter nouns, was also established by the t-test comparison.

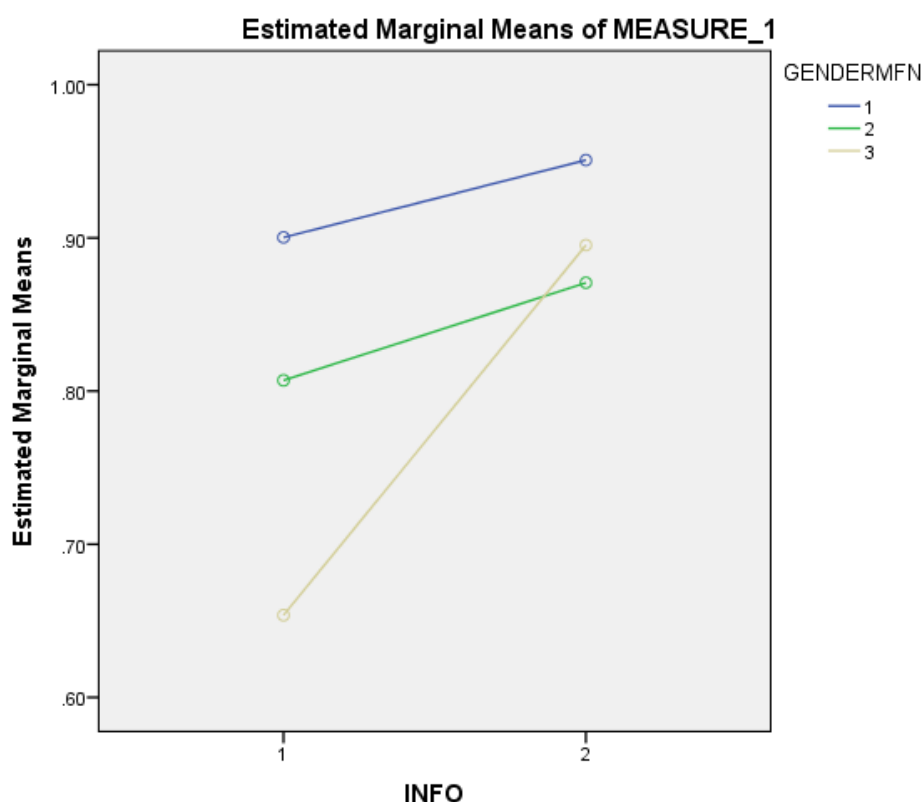
These t-test analyses showed that the effect of information provided (syntactical clue and extended syntactical clues) on the condition of nouns with neuter grammatical gender was such that it was unlikely to have arisen due to sampling error. In particular, for the comparison between the conditions of morphological and syntactic information (determiner + noun suffix) and morphological and extensive syntactic information (determiner + adjective + noun suffix) ($t(104) = -5.118$ $p < 0.001$, $d = 0.62$). The confidence interval showed that the population mean difference is likely (95%) to be found between $-.34356$ and $-.15168$. These results indicate that in the condition of nouns with neuter grammatical gender the participants performed better when they were provided with morphological and extensive syntactic information (determiner + adjective + noun suffix) than when they were provided with morphological and syntactic information (determiner + noun suffix).

There was no significant difference for the comparison between the type of information provided (morphological and syntactic information vs morphological and extensive syntactic information) on the condition of nouns with masculine grammatical gender ($t(104) = -1.517$ $p = 0.132$). Additionally, There was no significant difference for the comparison between the type of information provided (morphological and

syntactic information vs morphological and extensive syntactic information) on the condition of nouns with feminine grammatical gender ($t(104) = -1.517$ $p = 0.132$).

These results indicate that there was no simple main effect of information provided when participants had to process a noun with masculine grammatical gender. The same observation was true for nouns with feminine grammatical gender.

In Graph 12 the descriptive statistics are presented for all of the participants' performance according to the interaction of the factors of grammatical gender and the type of information provided. In Table 62 analytical information is presented about the nine t-test analyses after the results of ANOVA analysis regarding the interaction between the factors of the type of information provided and the grammatical gender. In Table 63 analytical information is presented about the Paired Samples Correlations after the nine t-test analyses regarding the interaction between the factors of the type of information provided and the grammatical gender.



Graph 12. Descriptive statistics for all of the participants' performance according to the interaction of the factors of grammatical gender and the type of information provided.

	Paired Differences					t	df	Sig. (2–tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 osmascartQB – osfemartQB	.10476	.49853	.04865	.00828	.20124	2.153	104	.034
Pair 2 osmascartQB – osneutartQB	.25714	.58882	.05746	.14319	.37109	4.475	104	.000
Pair 3 osfemartQB – osneutartQB	.15238	.56808	.05544	.04244	.26232	2.749	104	.007
Pair 4 osmascsyntQB – osfemsyntQB	.08571	.36988	.03610	.01413	.15730	2.375	104	.019
Pair 5 osmascsyntQB – osneutsyntQB	.05714	.41204	.04021	–.02260	.13688	1.421	104	.158
Pair 6 osfemsyntQB – osneutsyntQB	–.02857	.35239	.03439	–.09677	.03962	–.831	104	.408
Pair 7 osmascartQB – osmascsyntQB	–.04762	.32168	.03139	–.10987	.01463	–1.517	104	.132
Pair 8 osfemartQB – osfemsyntQB	–.06667	.42214	.04120	–.14836	.01503	–1.618	104	.109
Pair 9 osneutartQB – osneutsyntQB	–.24762	.49577	.04838	–.34356	–.15168	–5.118	104	.000

Table 62. t-test analyses regarding the interaction between the factors of the type of information provided and the grammatical gender.

		N	Correlation	Sig.
Pair 1	osmascartQB & osfemartQB	105	.053	.590
Pair 2	osmascartQB & osneutartQB	105	-.063	.520
Pair 3	osfemartQB & osneutartQB	105	.197	.044
Pair 4	osmascsyntQB & osfemsyntQB	105	.251	.010
Pair 5	osmascsyntQB & osneutsyntQB	105	-.088	.370
Pair 6	osfemsyntQB & osneutsyntQB	105	.452	.000
Pair 7	osmascartQB & osmascsyntQB	105	.318	.001
Pair 8	osfemartQB & osfemsyntQB	105	.392	.000
Pair 9	osneutartQB & osneutsyntQB	105	.290	.003

Table 63. Paired samples correlations after the nine t-test analyses regarding the interaction between the factors of the type of information provided and the grammatical gender.

Furthermore, the split-plot ANOVA analysis revealed that the interaction between the level of Greek language competence and the type of information provided was not significant, F-value (1 – 103) of 0.25 ($p = 0.618$), indicating that the effect of the factor of information provided was similar in the condition of both the advanced and the beginner learners. Furthermore, the effect of the factor of Greek language competence was similar in each level of information provided.

Also the level of Greek language competence and the factor of grammatical gender was not significant, F-value (1 – 103) of 0.487 ($p = 0.487$), indicating that the effect of the factor of grammatical gender was similar in the condition of both the advanced learners and the beginners.

Furthermore, the effect of the factor of Greek language competence was similar in each level of the grammatical level factor: masculine, feminine or neuter nouns.

The interaction between all the three factors, the level of Greek language competence, the type of information provided and the grammatical gender, was not significant F-value (1 – 103) of 1.984 ($p = 0.162$), indicating that the effect of the type of information provided was similar in masculine, feminine and neuter nouns and this

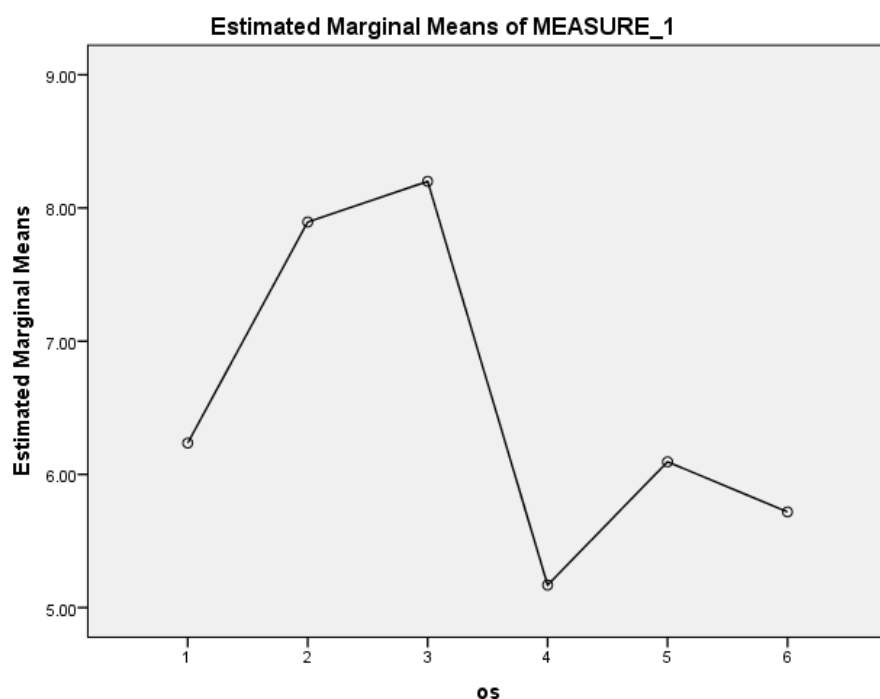
observation was confirmed for both the advanced and the beginner learners. The effect of the grammatical gender factor was also similar for all of the levels of information provided and this observation was confirmed for both the advanced and the beginner learners. Finally, the factor of Greek language competence did not behave differently in each condition of two other variables: type of information provided and grammatical gender.

6.1.4 ANOVA for nouns with $-o\varsigma$ ending in the second task and dependent variable reaction time

In Table 64 the descriptive statistics are presented for all of the participants' processing times in the six conditions in the second task with the dependent variable as the participants' processing times of their answers after the presentation of the stimulus. The stimuli are classified into six conditions on the basis of their grammatical gender and the level of information provided. Analytically, the conditions are: masculine determiner + non-word with gender ending $-o\varsigma$ (osmascarttimeA), feminine determiner + non-word with gender ending $-o\varsigma$ (osfemarttimeA), neuter determiner + non-word with gender ending $-o\varsigma$ (osneutarttimeA), masculine determiner + adjective with masculine ending $-os$ + non-word with ending $-o\varsigma$ (osmascsynttimeA), feminine determiner + adjective with feminine ending $-\eta$ + non-word with ending $-o\varsigma$ (osfemsynttimeA) and neuter determiner + adjective with neuter ending $-o$ + non-word with ending $-o\varsigma$ (osneutsynttimeA). The descriptive statistics are also presented in Graph 13.

GR Language Competence		Mean	Std. Deviation	N
osmascarttimeB	Beginners	7.4678	8.40250	61
	Advanced	5.0032	1.66845	44
	Total	6.4350	6.58603	105
osfemarttimeB	Beginners	8.6709	4.53012	61
	Advanced	7.1182	3.43222	44
	Total	8.0202	4.15967	105
osneutsarttimeB	Beginners	9.1947	6.53610	61
	Advanced	7.2049	3.13398	44
	Total	8.3609	5.44800	105
osmascsynttimeB	Beginners	6.7895	8.48574	61
	Advanced	3.5493	.98289	44
	Total	5.4317	6.67255	105
osfemsynttimeB	Beginners	7.4247	5.71893	61
	Advanced	4.7640	3.24977	44
	Total	6.3098	4.99755	105
osneutsynttimeB	Beginners	6.6668	5.30588	61
	Advanced	4.7701	2.46537	44
	Total	5.8720	4.43159	105

Table 64. The descriptive statistics are presented for all of the participants' reaction times in the six conditions in the second task.



Graph 13. Mean reaction time for all of the participants in the six conditions in the second task.

As stated in the section of methodology, the experiment for nouns with $-o\varsigma$ endings was a (2X2X3) factorial three-way mixed analysis of variances. The processing time for participants' answers in the nouns with $-o\varsigma$ endings in the second task was analysed with a split-plot ANOVA. The level of Greek language competence was the between participants factor, this factor had two levels (beginner and advanced). The type of information provided was the first within participants factor. This factor had two levels (morphological and syntactic information, morphological and extensive syntactic information) and the second within participants factor was the grammatical gender. It had three levels (masculine, feminine and neuter). The dependent variable was the participants' processing time for their answers on the grammatical gender of nouns with $-o\varsigma$ endings. Therefore, each participant was examined in six conditions. The results of the split-plot ANOVA are presented in Table 65 for the within subjects and in Table 66 for the between subjects.

Source	INFO	GenderMFN	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
INFO	Linear		487.335	1	487.335	12.240	.001	.106
INFO * LANG. COMP.	Linear		13.658	1	13.658	.343	.559	.003
Error(INFO)	Linear		4101.015	103	39.816			
GenderMFN		Linear	161.468	1	161.468	7.675	.007	.069
		Quadratic	60.048	1	60.048	3.132	.080	.030
GenderMFN * LANG. COMP.		Linear	21.125	1	21.125	1.004	.319	.010
		Quadratic	2.888	1	2.888	.151	.699	.001
Error (GenderMFN)		Linear	2167.067	103	21.039			
		Quadratic	1974.706	103	19.172			
INFO * GenderMFN	Linear	Linear	51.201	1	51.201	2.171	.144	.021
		Quadratic	.024	1	.024	.001	.972	.000
INFO * GenderMFN * LANG. COMP.	Linear	Linear	4.825	1	4.825	.205	.652	.002
		Quadratic	5.008	1	5.008	.255	.615	.002
Error(INFO* GenderMFN)	Linear	Linear	2429.182	103	23.584			
		Quadratic	2025.496	103	19.665			

Table 65. Results of the split-plot ANOVA for the within subjects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	26336.193	1	26336.193	530.764	.000	.837
LANG. COMP.	811.894	1	811.894	16.362	.000	.137
Error	5110.799	103	49.619			

Table 66. Results of the split-plot ANOVA for the between subjects.

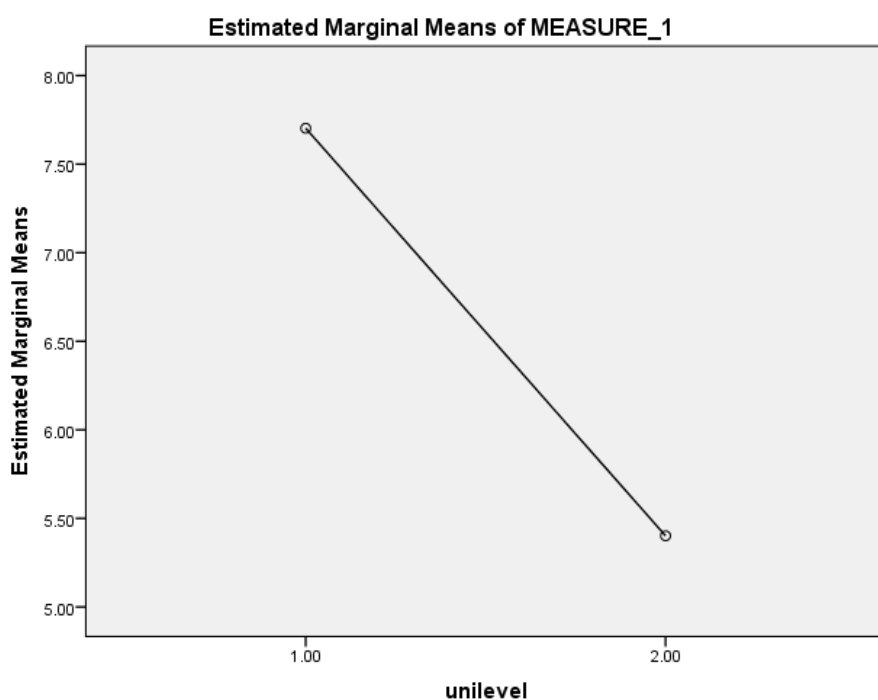
The split-plot ANOVA analysis revealed for the between participants comparison that the main effect due to the level of Greek language competence factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality and homogeneity of variance were met. An F-value (1 – 103) of 16.362 ($p < 0.001$) represented an effect size (partial Eta squared) of .137, showing that nearly 14% of the variation in the participants' processing time for their answers on the

grammatical gender of nouns with *-ος* endings in the second test can be accounted for by differing the level of Greek language competence. The results suggest that in the second task the advanced learners needed less processing time in attributing the grammatical gender of nouns with *-ος* endings than the beginners (means of 5.402 and 7.702 respectively).

The confidence interval showed that the population mean for the group of beginners is likely (95%) to be found between 6.972 and 8.433 and for the advanced learners between 4.542 and 6.261. In Table 67 the descriptive statistics are presented for all of the participants' processing time according to their level of Greek language competence. These means are also presented in Graph 14.

Language Competence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Beginners	7.702	.368	6.972	8.433
Advanced	5.402	.434	4.542	6.261

Table 67. Descriptive statistics for all of the participants' reaction times according to their level of Greek language competence in the second task.



Graph 14. Mean reaction time for all of the participants according to their level of Greek language competence in the second task.

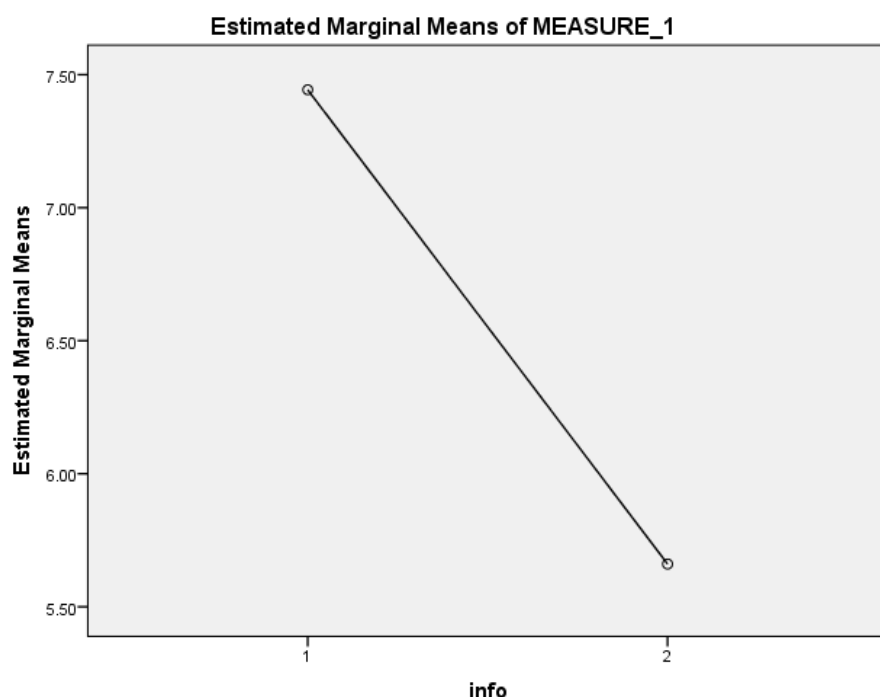
The split-plot ANOVA analysis revealed for the within participants comparisons that the main effects due to the type of information provided factor and the factor of grammatical gender were unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, homogeneity of variance and sphericity were met.

In particular, the analysis for the main effect of the type of information provided revealed an F-value (1 – 103) of 12.240 ($p < 0.001$) and represented an effect size (partial Eta squared) of .106, showing that nearly 11% of the variation in the participants' processing time for their answers on the grammatical gender of nouns with *-oç* endings in the second task can be accounted for by differing the type of information provided. Thus, the results suggest that the processing time was less when morphological and extensive syntactic information (determiner + adjective + noun suffix) was provided than when only morphological and syntactic information (determiner + noun suffix) was provided (means of 5.661 and 7.443 respectively). The confidence interval showed that the population mean for the level of morphological and syntactic information is likely (95%) to be found between 6.692 and 8.194, and for the level of morphological and extensive syntactic information between 4.897 and 6.424.

In Table 68 the descriptive statistics are presented for all of the participants' processing time according to the factor of information provided. These means are also presented in Graph 15.

INFO	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Morphological and syntactic information	7.443	.379	6.692	8.194
Morphological and extensive syntactic information	5.661	.385	4.897	6.424

Table 68. Descriptive statistics for all of the participants' reaction times according to the factor of type of information provided in the second task.



Graph 15. Mean reaction time for all of the participants according to the factor of type of information provided in the second task.

The analysis for the main effect of the factor of grammatical gender revealed an F-value (1 – 103) of 7.675 ($p < 0.05$) and represented an effect size (partial Eta squared) of .069, showing that nearly 7% of the variation in the participants' processing time for their answers on the grammatical gender of nouns with $-o\varsigma$ endings in the second task can be accounted for by differing the grammatical gender of the nouns.

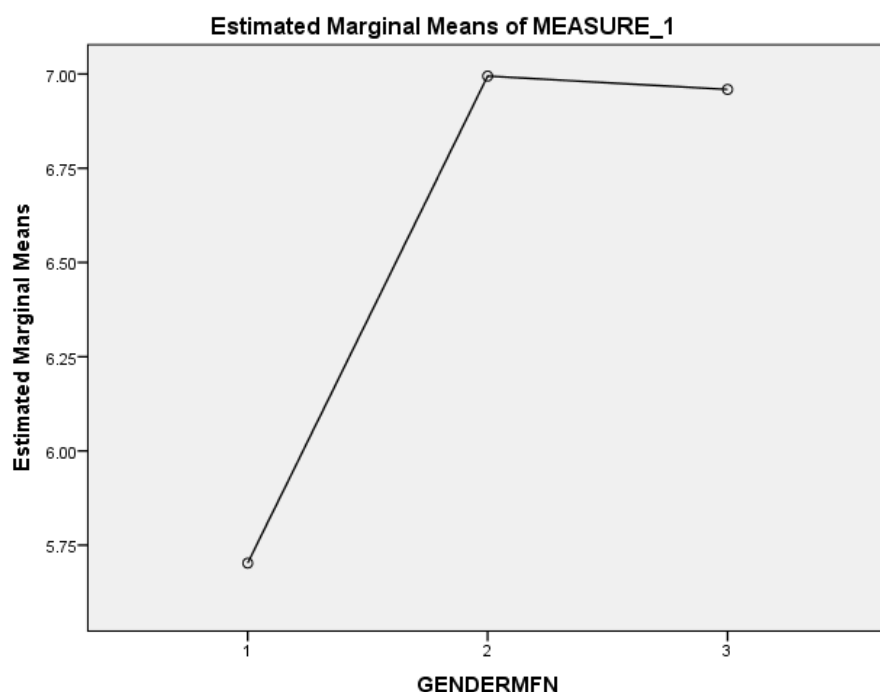
The confidence interval showed that the population mean for the level of masculine grammatical gender is likely (95%) to be found between 4.805 and 6.600, for the level of feminine grammatical gender between 6.286 and 7.703, and for the level of neuter grammatical gender between 6.311 and 7.607. The factor of the grammatical gender of the nouns had three levels (masculine, feminine and neuter). Therefore, three pairwise comparisons were carried out, between: the masculine and feminine levels, the masculine and neuter levels, and finally between the feminine and neuter levels. These comparisons allowed all the possible combinations to be analysed. The mean difference between the masculine and feminine levels was -1.292 , between the masculine and neuter levels was -1.257 , and between the feminine and neuter levels $.035$. The Bonferroni test showed that the difference between the masculine and feminine levels was unlikely to have arisen by sampling error ($p < 0.05$). Therefore, it can be concluded that the participants needed less processing time when they processed masculine nouns with $-o\varsigma$ endings than when they processed feminine nouns with $-o\varsigma$ endings. The

confidence interval showed that the population mean difference is likely (95%) to be found between -2.579 and $-.005$. The difference between the masculine and neuter levels was unlikely to have arisen by sampling error ($p < 0.05$). Thus, it can be concluded that the participants needed less processing time when they processed masculine nouns with $-o\varsigma$ endings than when they processed neuter nouns with $-o\varsigma$ endings. The confidence interval showed that the population mean difference is likely (95%) to be found between -2.361 and $-.153$. The difference between the feminine and neuter levels was not significant ($p = 1.00$). Therefore, it can be concluded that the participants needed the same processing time either when they processed feminine nouns with $-o\varsigma$ endings or when they processed neuter nouns with $-o\varsigma$ endings.

In Table 69 the descriptive statistics are presented for all of the participants' processing time according to the factor of grammatical gender (masculine, feminine and neuter). These means are also presented in Graph 16. In Table 70 information is presented about the pairwise comparisons for the factor of grammatical gender.

GenderMFN	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Masculine	5.702	.453	4.805	6.600
Feminine	6.994	.357	6.286	7.703
Neuter	6.959	.327	6.311	7.607

Table 69. Descriptive statistics for all of the participants' reaction times according to the factor of grammatical gender in the second task.



Graph 16. Mean reaction time for all of the participants according to the factor of grammatical gender in the second task.

(I) GenderMFN	(J) GenderMFN	Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Masculine	Feminine	-1.292*	.529	.049	-2.579	-.005
	Neuter	-1.257*	.454	.020	-2.361	-.153
Feminine	Masculine	1.292*	.529	.049	.005	2.579
	Neuter	.035	.324	1.000	-.752	.823
Neuter	Masculine	1.257*	.454	.020	.153	2.361
	Feminine	-.035	.324	1.000	-.823	.752

Table 70. Pairwise comparisons for the factor of grammatical gender in the second task.

The split-plot ANOVA analysis revealed that the interaction between the level of Greek language competence and the type of information provided was not significant, with F-value (1 – 103) of .343 ($p = 0.559$), indicating that the effect of the factor of information provided was similar in the condition of the advanced and the beginner learners. Furthermore, the effect of the factor of Greek language competence was similar in each level of information provided.

The level of Greek language competence and the factor of grammatical gender was not significant, F-value (1 – 103) of 1.004 ($p = 0.319$), indicating that the effect of the factor of grammatical gender was similar in the condition of the advanced and the beginner learners. Furthermore, the effect of the factor of Greek language competence was similar in each level of the grammatical level factor: masculine, feminine or neuter nouns.

The interaction between the factors of the type of information provided and the grammatical gender was also not significant, F-value (1 – 103) of 2.171 ($p = 0.144$), indicating that the factor of grammatical gender behaves the same way at all levels of the factor of information provided. On the basis of this analysis there was no difference between the effect of the factor of information provided at all three levels of the grammatical gender factor.

The interaction between all three factors, the level of Greek language competence, the type of information provided and the grammatical gender was not significant, F-value (1 – 103) of 0.205 ($p = 0.652$), indicating that the effect of the type of information was similar in masculine, feminine and neuter nouns and this observation was confirmed for both the advanced and beginner learners. Furthermore, the effect of the grammatical gender factor was similar for all of the levels of information provided and this observation was confirmed for both the advanced and the beginner learners. Finally, the factor of Greek language competence does not behave differently in each condition of two other variables: type of information provided and grammatical gender.

6.2 ANOVA for nouns in the first task and dependent variable grammatical gender accuracy

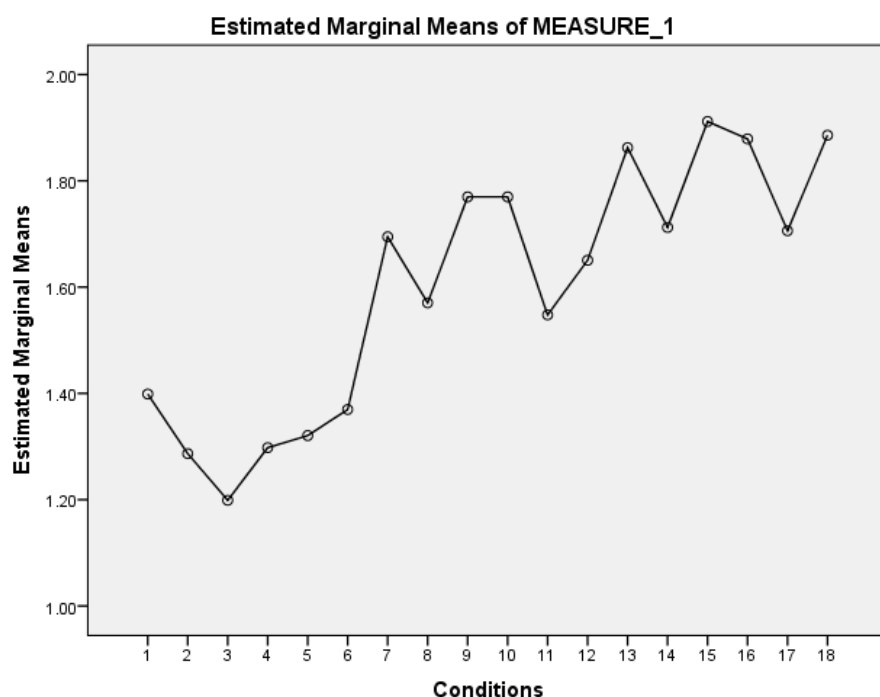
A statistical analysis on the first task was carried out in order to investigate any effects of the independent variables on the dependent variable. The independent variables were four. The first variable was information provided relating to the grammatical gender (morphological information, morphological + syntactic information and morphological + extensive syntactic information). The second variable was the nouns' grammatical gender (masculine, feminine and neuter). The third independent variable was the nouns' endings ($-\alpha\varsigma$, $-\eta\varsigma$, $-\alpha$, $-\eta$, $-ι$ and $-ο$). Finally, the last independent variable was the level of Greek language competence (beginner and advanced). Each participant was assessed in 18 conditions. In Table 71 the descriptive statistics are presented for all of the participants' performance in the 18 conditions in the first task with dependent variable the accuracy of participants' answers on the noun's grammatical gender: non-word with

gender ending $-\alpha\varsigma$ (AQmorphMas), non-word with gender ending $-\eta\varsigma$ (AQmorphMis), non-word with gender ending $-\alpha$ (AQmorphFa), non-word with gender ending $-\eta$ (AQmorphFi), non-word with gender ending $-\iota$ (AQmorphNi), non-word with gender ending $-o$ (AQmorphNo), masculine determiner + non-word with gender ending $-\alpha\varsigma$ (AQartMas), masculine determiner + non-word with gender ending $-\eta\varsigma$ (AQartMis), feminine determiner + non-word with gender ending $-\alpha$ (AQartFa), feminine determiner + non-word with gender ending $-\eta$ (AQartFi), neuter determiner + non-word with $-\iota$ (AQartNi), neuter determiner + non-word with $-o$ (AQartNo), masculine determiner + adjective with masculine ending $-os$ + non-word with ending $-\alpha\varsigma$ (AQsyntMas), masculine determiner + adjective with masculine ending $-os$ + non-word with ending $-\eta\varsigma$ (AQsyntMis), feminine determiner + adjective with feminine ending $-\eta$ + non-word with ending $-\alpha$ (AQsyntFa), feminine determiner + adjective with feminine ending $-\eta$ + non-word with ending $-\eta$ (AQsyntFi), neuter determiner + adjective with neuter ending $-o$ + non-word with ending $-\iota$ (AQsyntNi) and neuter determiner + adjective with neuter ending $-o$ + non-word with ending $-o$ (AQsyntNo). The descriptive statistics are also presented in Graph 17.

Language Competence		Mean	Std. Deviation	N
AQmorphMas	Beginners	1.2295	.69266	61
	Advanced	1.5682	.54550	44
	Total	1.3714	.65423	105
AQmorphMis	Beginners	1.1639	.68752	61
	Advanced	1.4091	.65833	44
	Total	1.2667	.68313	105
AQmorphFa	Beginners	1.1475	.62812	61
	Advanced	1.2500	.61474	44
	Total	1.1905	.62165	105
AQmorphFi	Beginners	1.1639	.63719	61
	Advanced	1.4318	.66114	44
	Total	1.2762	.65772	105
AQmorphNi	Beginners	1.1639	.73440	61
	Advanced	1.4773	.62835	44
	Total	1.2952	.70607	105
AQmorphNo	Beginners	1.2623	.70478	61
	Advanced	1.4773	.62835	44
	Total	1.3524	.67910	105
AQartMas	Beginners	1.6393	.54872	61

	Advanced	1.7500	.48823	44
	Total	1.6857	.52467	105
AQartMis	Beginners	1.4590	.59368	61
	Advanced	1.6818	.51817	44
	Total	1.5524	.57145	105
AQartFa	Beginners	1.7213	.55170	61
	Advanced	1.8182	.39015	44
	Total	1.7619	.49076	105
AQartFi	Beginners	1.7213	.48755	61
	Advanced	1.8182	.39015	44
	Total	1.7619	.44987	105
AQartNi	Beginners	1.4590	.53460	61
	Advanced	1.6364	.53226	44
	Total	1.5333	.53828	105
AQartNo	Beginners	1.5738	.53101	61
	Advanced	1.7273	.45051	44
	Total	1.6381	.50238	105
AQsyntMas	Beginners	1.7705	.46164	61
	Advanced	1.9545	.21071	44
	Total	1.8476	.38683	105
AQsyntMis	Beginners	1.6066	.55614	61
	Advanced	1.8182	.39015	44
	Total	1.6952	.50238	105
AQsyntFa	Beginners	1.8689	.38624	61
	Advanced	1.9545	.21071	44
	Total	1.9048	.32593	105
AQsyntFi	Beginners	1.8033	.44044	61
	Advanced	1.9545	.21071	44
	Total	1.8667	.36864	105
AQsyntNi	Beginners	1.6393	.54872	61
	Advanced	1.7727	.47562	44
	Total	1.6952	.52116	105
AQsyntNo	Beginners	1.8852	.32137	61
	Advanced	1.8864	.32104	44
	Total	1.8857	.31968	105

Table 71. The descriptive statistics are presented for all of the participants' performance in the 18 conditions in the first task.



Graph 17. Mean performance for all of the participants in the 18 conditions in the first task.

As stated in the section on methodology, the experiment was a (3X3X2X2) factorial four-way mixed analysis of variances. The number of accurate answers in terms of attribution of the grammatical gender of the presented non-words/nouns in the first task was analysed with a split-plot ANOVA. Therefore, in each condition the maximum mark that could be obtained was 2 and the minimum was 0. The level of Greek language competence was the between participants factor, this factor had two levels (beginner and advanced). The type of information provided was the first within participants factor. This factor had three levels (morphological information, morphological + syntactic information and morphological + extensive syntactic information). The second within participants factor was the grammatical gender and it had three levels (masculine, feminine and neuter). Finally, the third within participants factor was the ending of the nouns, two possible endings for each gender (for masculine: $-\alpha\varsigma$, $-\eta\varsigma$, for feminine: $-\alpha$, $-\eta$ and for neuter: $-\iota$ $-o$). The results of the split-plot ANOVA are presented in Table 72 for the within subjects and in Table 73 for the between subjects.

Source	INFO	GenderMFN	Endings	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
INFO	Linear			81.090	1	81.090	522.626	.000	.835
	Quadratic			3.927	1	3.927	35.114	.000	.254
INFO * LANG. COMP.	Linear			1.090	1	1.090	7.025	.009	.064
	Quadratic			.202	1	.202	1.807	.182	.017
Error(INFO)	Linear			15.981	103	.155			
	Quadratic			11.519	103	.112			
GenderMFN	Linear			.017	1	.017	.036	.851	.000
	Quadratic			1.192	1	1.192	3.709	.057	.035
GenderMFN * LANG. COMP.	Linear			.217	1	.217	.449	.504	.004
	Quadratic			.352	1	.352	1.097	.297	.011
Error (GenderMFN)	Linear			49.780	103	.483			
	Quadratic			33.088	103	.321			
Endings			Linear	.001	1	.001	.002	.960	.000
Endings * LANG. COMP.			Linear	.001	1	.001	.002	.960	.000
Error(Endings)			Linear	30.388	103	.295			
INFO * GenderMFN	Linear	Linear		.002	1	.002	.007	.932	.000
		Quadratic		2.706	1	2.706	12.717	.001	.110
	Quadratic	Linear		.103	1	.103	.396	.531	.004
		Quadratic		2.043	1	2.043	11.163	.001	.098
INFO * GenderMFN * LANG. COMP.	Linear	Linear		.135	1	.135	.552	.459	.005
		Quadratic		.106	1	.106	.497	.482	.005
	Quadratic	Linear		.103	1	.103	.396	.531	.004
		Quadratic		.006	1	.006	.031	.861	.000
Error(INFO* GenderMFN)	Linear	Linear		25.229	103	.245			
		Quadratic		21.916	103	.213			
	Quadratic	Linear		26.878	103	.261			
		Quadratic		18.847	103	.183			
	Linear		Linear	.013	1	.013	.044	.834	.000

INFO * Endings	Quadratic	Linear		.016	1	.016	.066	.797	.001
INFO * Endings *	Linear	Linear		.000	1	.000	.001	.973	.000
LANG. COMP.	Quadratic	Linear		.042	1	.042	.170	.681	.002
Error(INFO* Endings)	Linear	Linear		30.487	103	.296			
	Quadratic	Linear		25.210	103	.245			
GenderMFN * Endings	Linear	Linear		4.399	1	4.399	12.593	.001	.109
	Quadratic	Linear		.100	1	.100	.339	.562	.003
GenderMFN * Endings *	Linear	Linear		.193	1	.193	.551	.459	.005
LANG. COMP.	Quadratic	Linear		.319	1	.319	1.081	.301	.010
Error (GenderMFN* Endings)	Linear	Linear		35.979	103	.349			
	Quadratic	Linear		30.407	103	.295			
INFO * GenderMFN * Endings	Linear	Linear	Linear	.362	1	.362	1.190	.278	.011
	Quadratic	Linear	Linear	.542	1	.542	1.888	.172	.018
	Quadratic	Linear	Linear	.006	1	.006	.021	.884	.000
	Quadratic	Linear	Linear	.022	1	.022	.075	.785	.001
INFO * GenderMFN * Endings *	Linear	Linear	Linear	.077	1	.077	.252	.617	.002
LANG. COMP.	Quadratic	Linear	Linear	.088	1	.088	.306	.582	.003
	Quadratic	Linear	Linear	.012	1	.012	.044	.834	.000
	Quadratic	Linear	Linear	.310	1	.310	1.080	.301	.010
Error(INFO* GenderMFN* Endings)	Linear	Linear	Linear	31.368	103	.305			
	Quadratic	Linear	Linear	29.551	103	.287			
	Quadratic	Linear	Linear	28.609	103	.278			
	Quadratic	Linear	Linear	29.617	103	.288			

Table 72. Results of the split-plot ANOVA for the within subjects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	4722.219	1	4722.219	8510.784	.000	.988
LANG. COMP.	13.715	1	13.715	24.718	.000	.194
Error	57.150	103	.555			

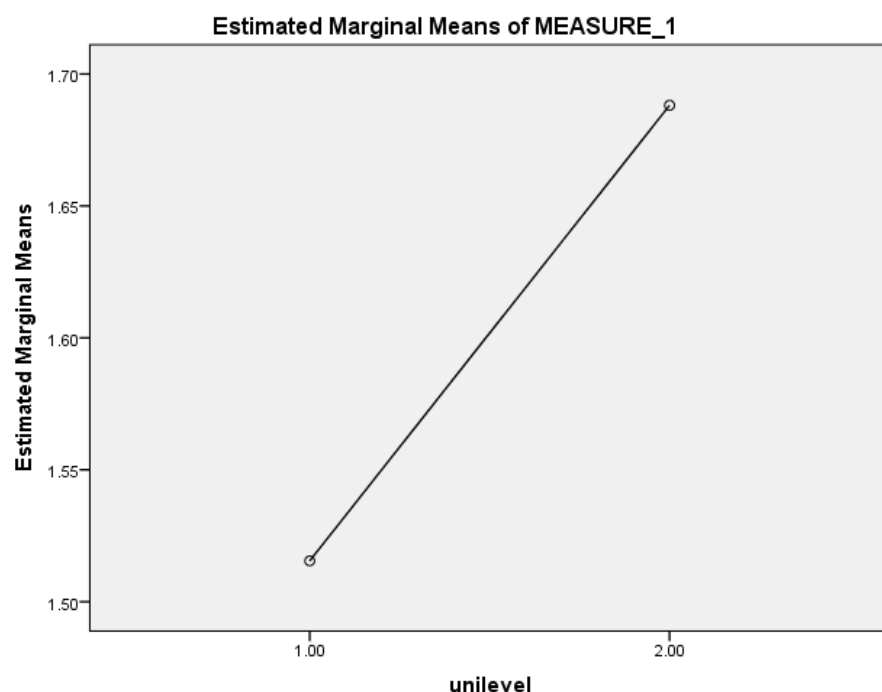
Table 73. Results of the split-plot ANOVA for the between subjects.

The split-plot ANOVA analysis revealed for the between participants comparison that the main effect due to the level of Greek language competence factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality and homogeneity of variance were met. An F-value (1 – 103) of 24.718 ($p < 0.001$) represented an effect size (partial Eta squared) of .194, showing that nearly 19% of the variation in the number of accurate answers in the grammatical gender of the presented nouns in the first task can be accounted for by differing the level of Greek language competence. The results suggest that in the first task the advanced learners were more capable of correctly attributing the grammatical gender of the presented non-words than the beginners (means of 1.688 and 1.515 respectively).

The confidence interval showed that the population mean for the group of beginners is likely (95%) to be found between 1.471 and 1.560 and for the advanced learners between 1.636 and 1.741. In Table 74 the descriptive statistics are presented for all of the participants' performance according to their level of Greek language competence. These means are also presented in Graph 18.

Language Competence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Beginners	1.515	.022	1.471	1.560
Advanced	1.688	.026	1.636	1.741

Table 74. Descriptive statistics for all of the participants' performance according to their level of Greek language competence in the first task.

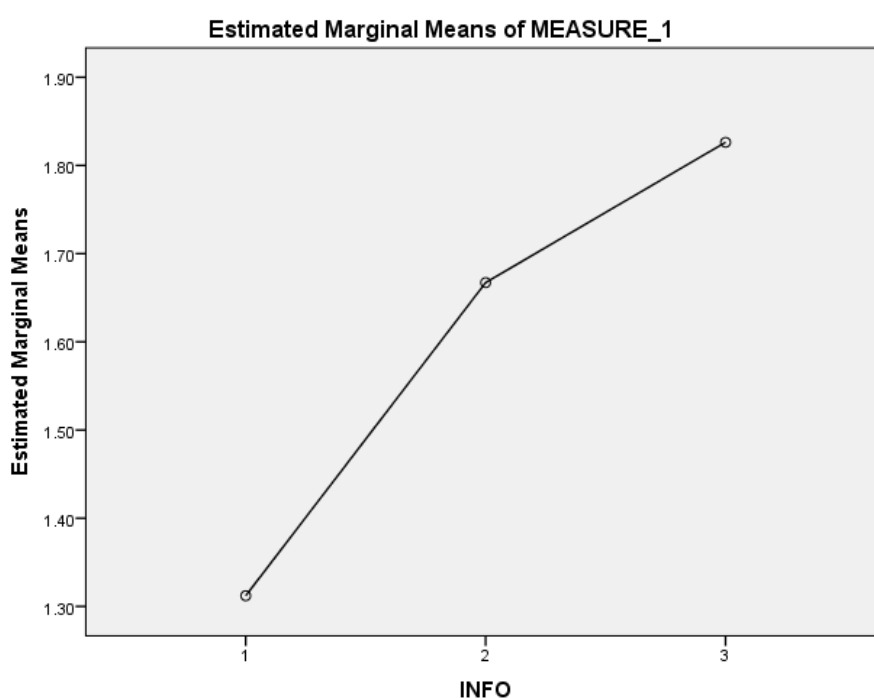


Graph 18. Mean performance for all of the participants according to their level of Greek language competence in the first task

The split-plot ANOVA analysis revealed for the within participants comparisons that the main effect due to the type of information provided factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, homogeneity of variance and sphericity were met. In particular, the analysis for the main effect of the type of information provided revealed an F-value (1 – 103) of 522.626 ($p < 0.001$) and represented a significantly large effect size (partial Eta squared) of .835, showing that nearly 84% of the variation in the number of correct answers in the grammatical gender of the presented non-words/nouns in the first test can be accounted for by differing the type of information provided. The confidence interval showed that the population mean for the level of morphological information was 1.312 and was likely (95%) to be found between 1.265 and 1.359. For the level of morphological + syntactic information the mean was 1.667 and was likely (95%) to be found between 1.627 and 1.708. Finally, for the level of morphological + extensive syntactic information the mean was 1.826 and was likely (95%) to be found between 1.789 and 1.864. In Table 75 the descriptive statistics are presented for all of the participants' performance according to the factor of information provided. These means are also presented in Graph 19.

INFO	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Morphological information	1.312	.024	1.265	1.359
Morphological + syntactic information	1.667	.020	1.627	1.708
Morphological + extensive syntactic information	1.826	.019	1.789	1.864

Table 75. Descriptive statistics for all of the participants' performance according to the factor of type of information provided in the first task.



Graph 19. Mean performance for all of the participants according to the factor of type of information provided in the first task.

The factor of information provided had three levels (morphological information, morphological + syntactic information and morphological + extensive syntactic information). Therefore, three pairwise comparisons were carried out. The first comparison was between the levels of morphological information and morphological + syntactic information. The second comparison was between the levels of morphological information and morphological + extensive syntactic information. And the third comparison was between the levels of morphological + syntactic information and morphological + extensive syntactic information. These comparisons allowed all the possible combinations to be analysed. In Table 76 information is presented for all of the

participants' performance relating to the pairwise comparisons for the factor of information provided.

(I) INFO	(J) INFO	Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Morphological information	morphological + syntactic information	-.355*	.023	.000	-.412	-.298
	morphological + extensive syntactic information	-.514*	.022	.000	-.569	-.459
Morphological + syntactic information	morphological information	.355*	.023	.000	.298	.412
	morphological + extensive syntactic information	-.159*	.016	.000	-.198	-.120
Morphological + extensive syntactic information	morphological information	.514*	.022	.000	.459	.569
	morphological + syntactic information	.159*	.016	.000	.120	.198

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Table 76. Pairwise comparisons for the factor of type of information provided in the first task.

The mean difference between the levels of morphological information and morphological + syntactic information was $-.355$, between the levels of morphological information and morphological + extensive syntactic information was $-.514$ and finally, between the levels of morphological + syntactic information and morphological + extensive syntactic information was $-.159$.

The Bonferroni test showed that the difference between the levels of morphological information and morphological + syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the participants' performance was more accurate in attributing the grammatical gender of the non-words/nouns when they were provided with morphological + syntactic information than when they were provided with morphological information only. The

confidence interval showed that the population mean difference is likely (95%) to be found between $-.412$ and $-.298$.

Similarly, the Bonferroni test showed that the difference between the levels of morphological information and morphological + extensive syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the participants' performance was more accurate in attributing the grammatical gender of the non-words/nouns when they were provided with morphological + extensive syntactic information than when they were provided with morphological information only. The confidence interval showed that the population mean difference is likely (95%) to be found between $-.569$ and $-.459$.

The same results were observed for the third comparison. In particular, the Bonferroni test showed that the difference between the levels of morphological + syntactic information and morphological + extensive syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the participants' performance was more accurate in attributing the grammatical gender of the non-words/nouns when they were provided with morphological + extensive syntactic information than when they were provided with morphological + syntactic information. The confidence interval showed that the population mean difference is likely (95%) to be found between $-.198$ and $-.120$.

The split-plot ANOVA analysis revealed that there was not a significant main effect of the factor of grammatical gender, F-value (1 – 103) of 0.036 ($p = 0.851$), indicating that the participants' accuracy in attributing the grammatical gender of non-words/nouns in the first task was not affected by any variation in terms of the grammatical gender of the provided non-word/noun. In other words, there was no significant difference in the participants' accuracy in attributing the grammatical gender of non-words/nouns in the first test when they processed masculine, feminine or neuter non-words/nouns.

The analysis on the factor of non-words/nouns' endings had no gravity on the interpretation of the results as an independent variable but only in relation to the factor of grammatical gender. This approach is explained by the design of the experiment. As stated in the methodology section, there are not two types of endings applied in all the three grammatical genders but rather two types of endings for each grammatical gender.

The split-plot ANOVA analysis revealed that the interaction between the factors of the type of information provided and the level of Greek language competence was

significant, F-value (1 – 103) of 7.025 ($p < 0.05$). This interaction accounts for an effect size almost 6% of the total variance (partial Eta squared 0.064). The simple main effects of this interaction were further investigated. In Table 77 the descriptive statistics are presented for all of the participants' performance according to the factor of information provided and the factor of Greek language competence.

Language Competence	INFO	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Beginners	morphological information	1.189	.031	1.127	1.250
	morphological + syntactic information	1.596	.026	1.543	1.648
	morphological + extensive syntactic information	1.762	.024	1.714	1.811
Advanced	morphological information	1.436	.036	1.364	1.508
	morphological + syntactic information	1.739	.031	1.677	1.800
	morphological + extensive syntactic information	1.890	.029	1.833	1.947

Table 77. Descriptive statistics for all of the participants' performance according to the factors of type of information provided and language competence in the first task.

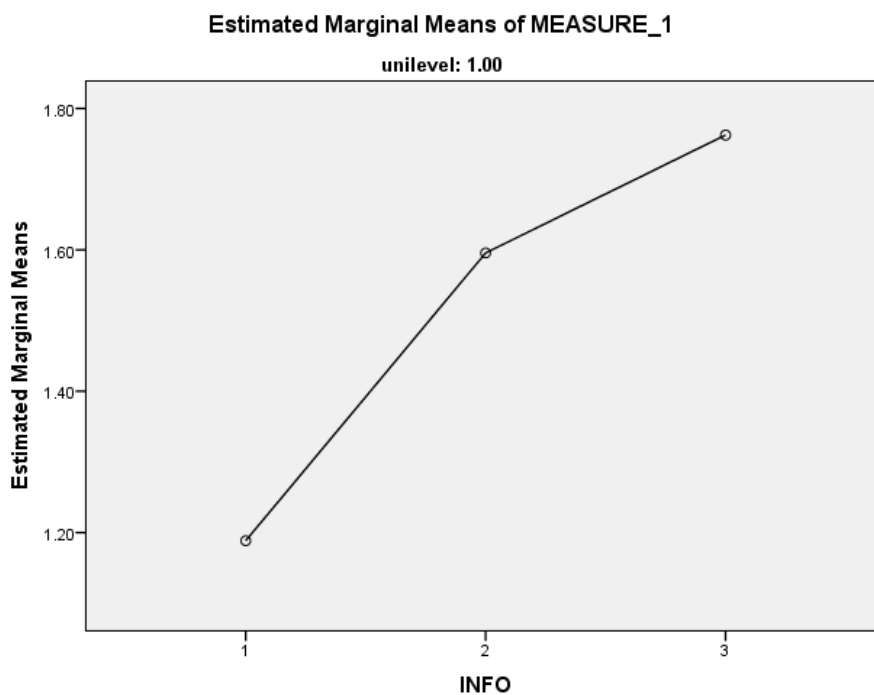
Due to the fact that one of the two variables was a between participants factor, the initial part of the analysis aimed to obtain descriptive statistics for each group of participants. Therefore, it was necessary to split the data file into two parts, one containing all the data for the beginners and one for the advanced learners (Dancey & Reidy, 2002). The aforementioned descriptive statistics are presented in Table 78 for the beginners and in Table 79 for the advanced learners. These results are also graphically represented in Graphs 20 and 21 respectively, as well as for all participants in Graph 22.

	N	Minimum	Maximum	Mean	Std. Deviation
AQmorphMas	61	.00	2.00	1.2295	.69266
AQmorphMis	61	.00	2.00	1.1639	.68752
AQmorphFa	61	.00	2.00	1.1475	.62812
AQmorphFi	61	.00	2.00	1.1639	.63719
AQmorphNi	61	.00	2.00	1.1639	.73440
AQmorphNo	61	.00	2.00	1.2623	.70478
AQartMas	61	.00	2.00	1.6393	.54872
AQartMis	61	.00	2.00	1.4590	.59368
AQartFa	61	.00	2.00	1.7213	.55170
AQartFi	61	.00	2.00	1.7213	.48755
AQartNi	61	.00	2.00	1.4590	.53460
AQartNo	61	.00	2.00	1.5738	.53101
AQsyntMas	61	.00	2.00	1.7705	.46164
AQsyntMis	61	.00	2.00	1.6066	.55614
AQsyntFa	61	.00	2.00	1.8689	.38624
AQsyntFi	61	.00	2.00	1.8033	.44044
AQsyntNi	61	.00	2.00	1.6393	.54872
AQsyntNo	61	1.00	2.00	1.8852	.32137
Valid N (listwise)	61				

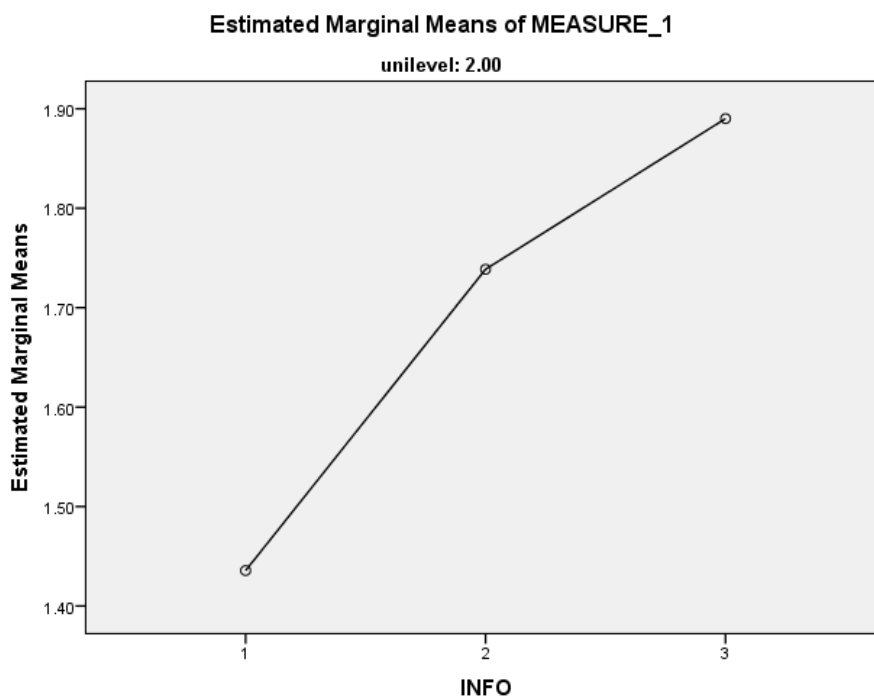
Table 78. Descriptive statistics for the beginners in each condition.

	N	Minimum	Maximum	Mean	Std. Deviation
AQmorphMas	44	.00	2.00	1.5682	.54550
AQmorphMis	44	.00	2.00	1.4091	.65833
AQmorphFa	44	.00	2.00	1.2500	.61474
AQmorphFi	44	.00	3.00	1.4318	.66114
AQmorphNi	44	.00	2.00	1.4773	.62835
AQmorphNo	44	.00	2.00	1.4773	.62835
AQartMas	44	.00	2.00	1.7500	.48823
AQartMis	44	.00	2.00	1.6818	.51817
AQartFa	44	1.00	2.00	1.8182	.39015
AQartFi	44	1.00	2.00	1.8182	.39015
AQartNi	44	.00	2.00	1.6364	.53226
AQartNo	44	1.00	2.00	1.7273	.45051
AQsyntMas	44	1.00	2.00	1.9545	.21071
AQsyntMis	44	1.00	2.00	1.8182	.39015
AQsyntFa	44	1.00	2.00	1.9545	.21071
AQsyntFi	44	1.00	2.00	1.9545	.21071
AQsyntNi	44	.00	2.00	1.7727	.47562
AQsyntNo	44	1.00	2.00	1.8864	.32104
Valid N (listwise)	44				

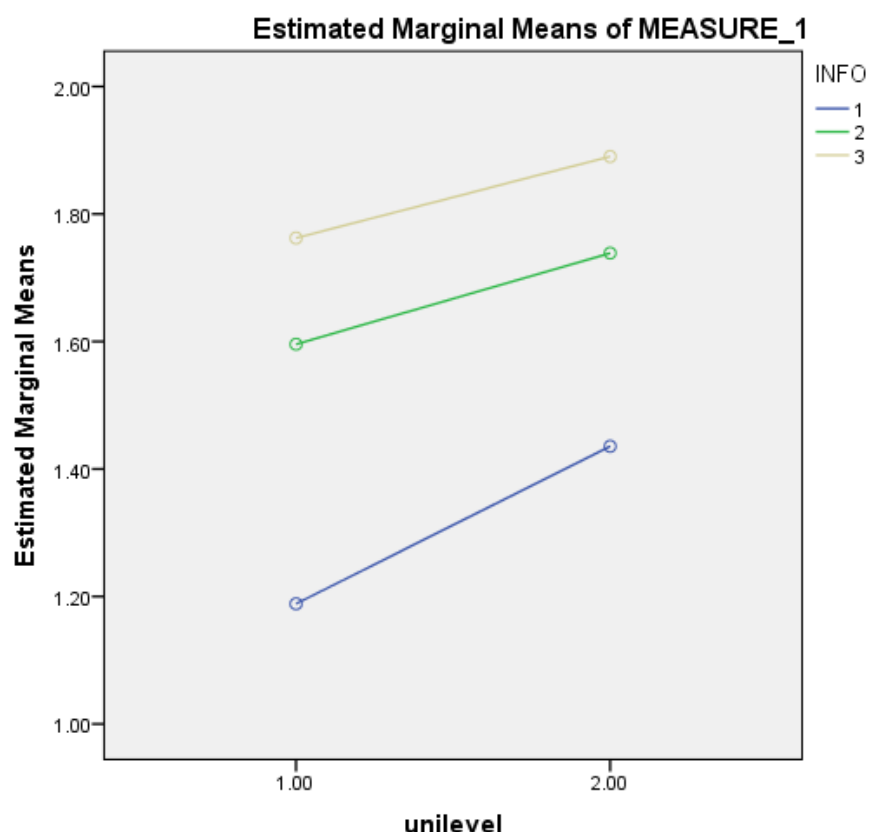
Table 79. Descriptive statistics for the advanced learners in each condition.



Graph 20. Mean performance for beginners in the three conditions of type of information provided in the first task.



Graph 21. Mean performance for advanced learners in the three conditions of type of information provided in the first task.



Graph 22. Mean performance for both beginners and advanced learners in the three conditions of type of information provided in the first task.

As required by the design of the experiment and because the SPSS cannot automatically conduct post hoc analyses, five ANOVAs were performed to examine the interaction between the factor of information provided and the factor of Greek language competence (Dancey & Reidy, 2002). This manipulation allowed the investigation of any possible meaningful interaction.

The split-plot ANOVA analysis for the group of beginners revealed for the within participants comparison that the main effect due to the type of information provided factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, homogeneity of variance and sphericity were met. In particular, the analysis for the main effect of the type of information provided revealed an F-value (1 – 60) of 390.611 ($p < 0.001$) and represented a significantly large effect size (partial Eta squared) of .867, showing that nearly 87% of the variation in the number of correct answers in the grammatical gender of the presented non-words/nouns in the first task for the beginners can be accounted for by differing the type of information provided. The confidence interval showed that the population mean for the level of morphological information was 1.189 and was likely (95%) to be found

between 1.127 and 1.250. For the level of morphological + syntactic information the mean was 1.596 and was likely (95%) to be found between 1.543 and 1.648. Finally, for the level of morphological + extensive syntactic information the mean was 1.762 and was likely (95%) to be found between 1.714 and 1.811. The results of the split-plot ANOVA for the beginner learners are presented in Table 80.

Source	INFO	GenderMFN	Endings	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
INFO	Linear			60.246	1	60.246	390.611	.000	.867
	Quadratic			3.526	1	3.526	28.102	.000	.319
Error (INFO)	Linear			9.254	60	.154			
	Quadratic			7.529	60	.125			

Table 80. ANOVA for the beginner learners.

The factor of information provided for the beginner learners had three levels. Therefore, three pairwise comparisons were carried out. The first comparison was between the levels of morphological information and morphological + syntactic information. The second comparison was between the levels of morphological information and morphological + extensive syntactic information. And the third comparison was between the levels of morphological + syntactic information and morphological + extensive syntactic information. These comparisons allowed all the possible combinations to be analysed. In Table 81 information is presented for the non-beginners' performance regarding the pairwise comparisons for the factor of information provided.

(I) INFO	(J) INFO	Mean Difference (I-J)	Std. Error	Sig. ^c	95% Confidence Interval for Difference ^c	
					Lower Bound	Upper Bound
Morphological information	morphological + syntactic information	-.407*	.031	.000	-.483	-.331
	morphological + extensive syntactic information	-.574*	.029	.000	-.645	-.502
Morphological + syntactic information	morphological information	.407*	.031	.000	.331	.483
	morphological + extensive syntactic information	-.167*	.022	.000	-.222	-.112
Morphological + extensive syntactic information	morphological information	.574*	.029	.000	.502	.645
	morphological + syntactic information	.167*	.022	.000	.112	.222

Based on estimated marginal means^a

*. The mean difference is significant at the .05 level.

a. unilevel = 1.00

c. Adjustment for multiple comparisons: Bonferroni.

Table 81. Pairwise comparisons for the factor of type of information provided in the first task in the condition of beginners.

The mean difference between the levels of morphological information and morphological + syntactic information was $-.407$, between the levels of morphological information and morphological + extensive syntactic information was $-.574$ and finally, between the levels of morphological + syntactic information and morphological + extensive syntactic information was $-.167$.

The Bonferroni test indicated that the difference between the levels of morphological information and morphological + syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the beginners' performance was more accurate in attributing the grammatical gender of the non-words/nouns when they were provided with morphological + syntactic information than when they were provided with morphological information only. The confidence

interval showed that the population mean difference is likely (95%) to be found between $-.483$ and $-.331$.

Similarly, the Bonferroni test showed that the difference between the levels of morphological information and morphological + extensive syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the beginners' performance was more accurate in attributing the grammatical gender of the non-words/nouns when they were provided with morphological + extensive syntactic information than when they were provided with morphological information only. The confidence interval showed that the population mean difference is likely (95%) to be found between $-.645$ and $-.502$.

The same results were observed for the third comparison. In particular, the Bonferroni test showed that the difference between the levels of morphological + syntactic information and morphological + extensive syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the beginners' performance was more accurate in attributing the grammatical gender of the non-words/nouns when they were provided with morphological + extensive syntactic information than when they were provided with morphological + syntactic information. The confidence interval showed that the population mean difference is likely (95%) to be found between $-.222$ and $-.112$.

The split-plot ANOVA analysis for the group of advanced learners revealed for the within participants comparison that the main effect due to the type of information provided factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, homogeneity of variance and sphericity were met. In particular, the analysis for the main effect of the type of information provided revealed an F-value (1 – 43) of 174.324 ($p < 0.001$) and represented a significantly large effect size (partial Eta squared) of .802, showing that nearly 80% of the variation in the number of correct answers in the grammatical gender of the presented non-words/nouns in the first test for the advanced learners can be accounted for by differing the type of information provided. The confidence interval showed that the population mean for the level of morphological information was 1.436 and was likely (95%) to be found between 1.364 and 1.508. For the level of morphological + syntactic information the mean was 1.739 and was likely (95%) to be found between 1.677 and 1.800. Finally, for the level of morphological information and morphological + extensive syntactic information the mean was 1.890 and was likely

(95%) to be found between 1.833 and 1.947. The results of the split-plot ANOVA for the advanced are presented in Table 82.

Source	INFO	GenderMFN	Endings	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
INFO	Linear			27.273	1	27.273	174.324	.000	.802
	Quadratic			1.010	1	1.010	10.886	.002	.202
Error(INFO)	Linear			6.727	43	.156			
	Quadratic			3.990	43	.093			

Table 82. ANOVA for the advanced learners in regard to the type of information provided.

The factor of information provided for the advanced learner had three levels. Therefore, three pairwise comparisons were carried out. The first comparison was between the levels of morphological information and morphological + syntactic information. The second comparison was between the levels of morphological information and morphological + extensive syntactic information. And the third comparison was between the levels of morphological + syntactic information and morphological + extensive syntactic information. In Table 83 information is presented for the advanced learners' performance relating to the pairwise comparisons for the factor of information provided.

(I) INFO	(J) INFO	Mean Difference (I-J)	Std. Error	Sig. ^c	95% Confidence Interval for Difference ^c	
					Lower Bound	Upper Bound
Morphological information	morphological + syntactic information	-.303*	.034	.000	-.389	-.217
	morphological + extensive syntactic information	-.455*	.034	.000	-.540	-.369
Morphological + syntactic information	morphological information	.303*	.034	.000	.217	.389
	morphological + extensive syntactic information	-.152*	.022	.000	-.205	-.098
Morphological + extensive syntactic information	morphological information	.455*	.034	.000	.369	.540
	morphological + syntactic information	.152*	.022	.000	.098	.205

Based on estimated marginal means^a

*. The mean difference is significant at the .05 level.

a. unilevel = 2.00

c. Adjustment for multiple comparisons: Bonferroni.

Table 83. Advanced pairwise comparisons for the factor of type of information provided in the first task.

The mean difference between the levels of morphological clue and syntactical + morphological clues was $-.303$, between the levels of morphological clue and extended syntactical + morphological clues was $-.455$ and finally, between the levels of syntactical + morphological clues and extended syntactical + morphological clues was $-.152$.

The Bonferroni test showed that the difference between the levels of morphological information and morphological + syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the advanced learners' performance was more accurate in attributing the grammatical gender of the non-words/nouns when they were provided with morphological + syntactic information than when they were provided with morphological information only. The confidence interval showed that the population mean difference is likely (95%) to be found between $-.389$ and $-.217$.

Similarly, the Bonferroni test showed that the difference between the levels of morphological information and morphological + extensive syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the advanced learners' performance was more accurate in attributing the grammatical gender of the non-words/nouns when they were provided with morphological + extensive syntactic information than when they were provided with morphological information only. The confidence interval showed that the population mean difference is likely (95%) to be found between $-.540$ and $-.369$.

The same results were observed for the third comparison. In particular, the Bonferroni test showed that the difference between the levels of morphological + syntactic information and morphological + extensive syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the advanced learners' performance was more accurate in attributing the grammatical gender of the non-words/nouns when they were provided with morphological + extensive syntactic information than when they were provided with morphological + syntactic information. The confidence interval showed that the population mean difference is likely (95%) to be found between $-.205$ and $-.098$.

Possible differences between the beginners and advanced learners at each level of the factor of information provided was investigated by three separate ANOVAs.

The split-plot ANOVA analysis revealed for the advanced and beginner learners comparison in the level of morphological information that the main effect due to the level of Greek language competence factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality and homogeneity of variance were met. The results of the split-plot ANOVA are presented in Table 84 for the between subjects. An F-value (1 – 103) of 26.866 ($p < 0.001$) represented an effect size (partial Eta squared) of .207, showing that nearly 21% of the variation in the number of correct answers in the grammatical gender of the presented nouns in the first test for the level of morphological information can be accounted for by differing the level of Greek language competence. The results suggest that in the first task the advanced learners were more capable of correctly attributing the grammatical gender of the presented non-words/nouns than the beginners (means of 1.436 and 1.189 respectively) when they were presented with morphological information.

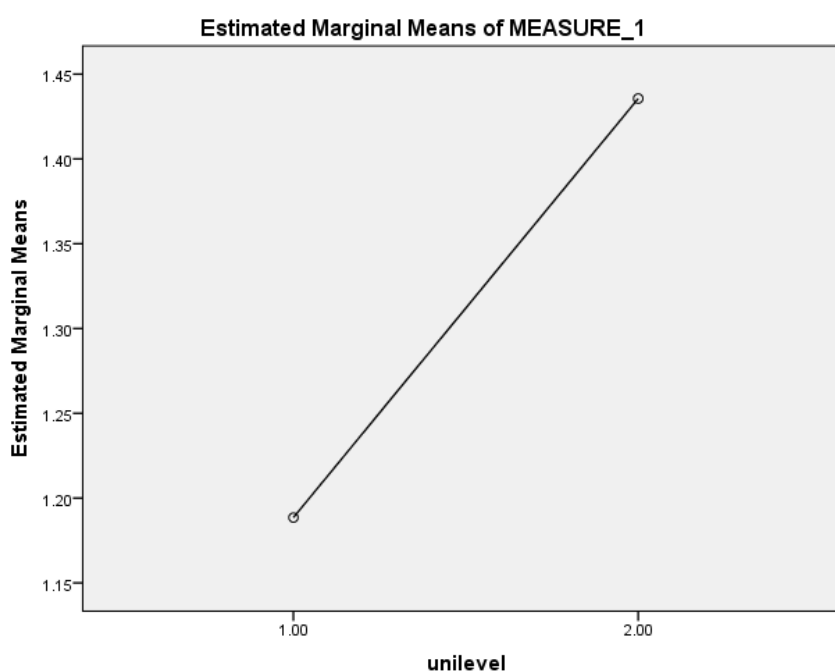
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	1056.125	1	1056.125	3030.353	.000	.967
LANG. COMP.	9.363	1	9.363	26.866	.000	.207
Error	35.897	103	.349			

Table 84. Split-plot ANOVA in the condition of morphological information.

The confidence interval showed that the population mean for the beginners is likely (95%) to be found between 1.127 and 1.250 and for the advanced learners between 1.364 and 1.508. In Table 85 the descriptive statistics are presented for all of the participants' performance at the level of morphological information according to their level of Greek language competence. These means are also presented in Graph 23.

Language Competence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Beginners	1.189	.031	1.127	1.250
Advanced	1.436	.036	1.364	1.508

Table 85. Descriptive statistics for all of the participants' performance at the level of morphological information according to their level of Greek language competence.



Graph 23. Mean for all of the participants' performance at the level of morphological information according to their level of Greek language competence.

The split-plot ANOVA analysis revealed for the advanced and beginners comparison in the level of morphological + syntactic information that the main effect due to the level of Greek language competence factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality and homogeneity of variance were met. The results of the split-plot ANOVA are presented in Table 86 for the between subjects. An F-value (1 – 103) of 12.291 ($p < 0.001$) represented an effect size (partial Eta squared) of .107, showing that nearly 11% of the variation in the number of correct answers in the grammatical gender of the presented nouns in the first task for the level of morphological + syntactic information can be accounted for by differing the level of Greek language competence. The results suggest that in the first task the advanced learners were more capable of correctly attributing the grammatical gender of the presented non-words/nouns than the beginners (means of 1.739 and 1.596 respectively) when they were presented with morphological + syntactic information.

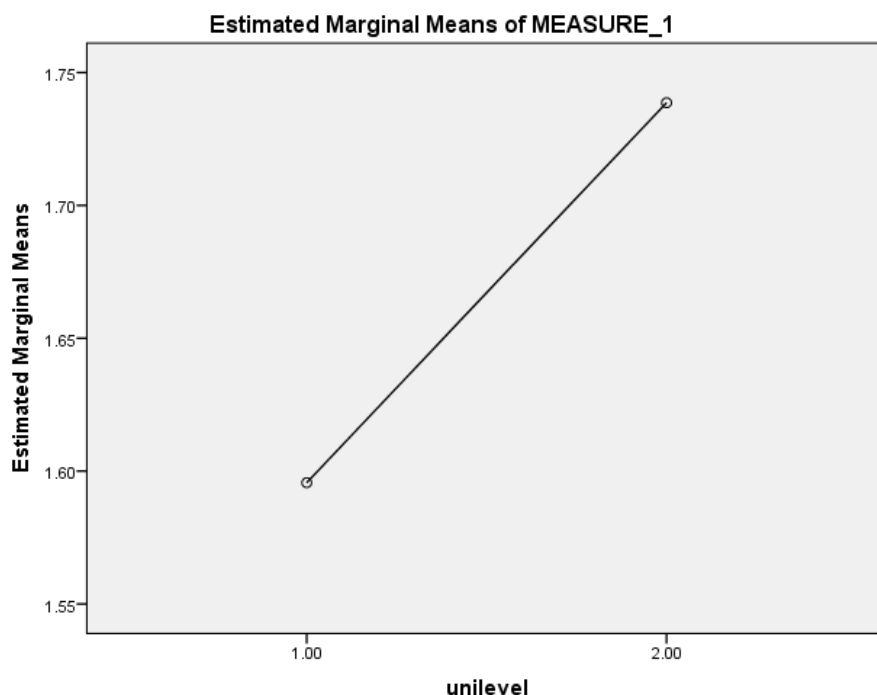
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	1705.079	1	1705.079	6681.351	.000	.985
LANG. COMP.	3.137	1	3.137	12.291	.001	.107
Error	26.286	103	.255			

Table 86. Split-plot ANOVA in the condition of morphological + syntactic information.

The confidence interval showed that the population mean for the group of beginners is likely (95%) to be found between 1.543 and 1.648 and for the advanced learners between 1.677 and 1.800. In Table 87 the descriptive statistics are presented for all of the participants' performance at the level of morphological + syntactic information according to their level of Greek language competence. These means are also presented in Graph 24.

Language Competence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Beginners	1.596	.026	1.543	1.648
Advanced	1.739	.031	1.677	1.800

Table 87. Descriptive statistics for all of the participants' performance at the level of morphological + syntactic information according to their level of Greek language competence.



Graph 24. Mean for all of the participants' performance at the level of morphological + syntactic information according to their level of Greek language competence.

The split-plot ANOVA analysis revealed for the advanced and beginner learners comparison in the level of morphological + extensive syntactic information that the main effect due to the level of Greek language competence factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality and homogeneity of variance were met. The results of the split-plot ANOVA are presented in Table 88 for the between subjects. An F-value (1 – 103) of 11.494 ($p < 0.001$) represented an effect size (partial Eta squared) of .100, showing that nearly 10% of the variation in the number of correct answers in the grammatical gender of the presented nouns in the first task for the level of morphological + extensive syntactic information can be accounted for by differing the level of Greek language competence. The results suggest that in the first task the advanced learners were more capable of correctly attributing the grammatical gender of the presented non-words/nouns than the beginners (means of 1.890 and 1.762 respectively).

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	2046.031	1	2046.031	9379.866	.000	.989
LANG. COMP.	2.507	1	2.507	11.494	.001	.100
Error	22.467	103	.218			

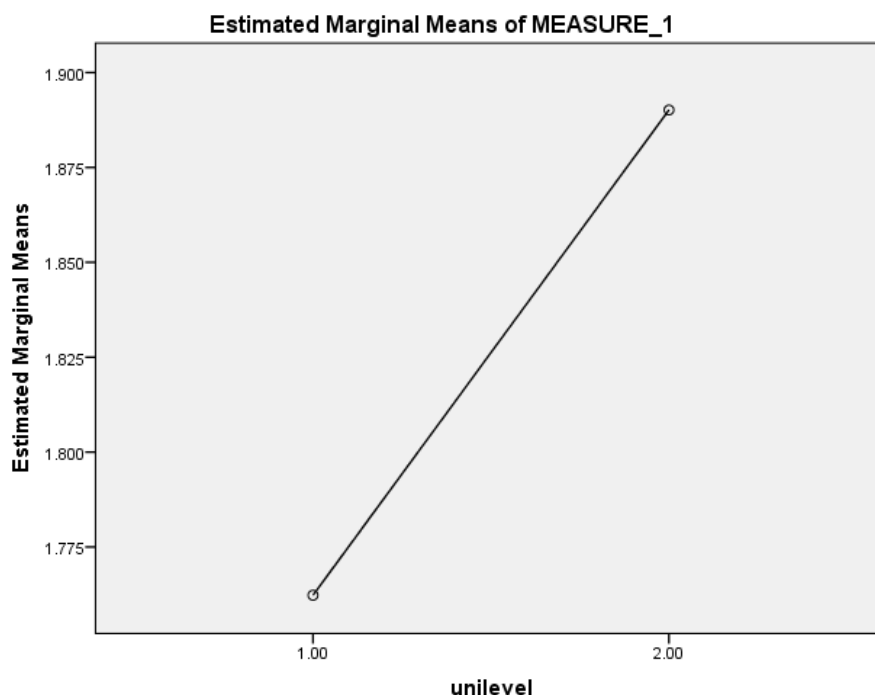
Table 88. Split-plot ANOVA in the condition of morphological + extensive syntactic information.

The confidence interval showed that the population mean for the group of beginners is likely (95%) to be found between 1.714 and 1.811 and for the advanced learners between 1.833 and 1.947.

In Table 89 the descriptive statistics are presented for all of the participants' performance at the level of morphological + extensive syntactic information according to their level of Greek language competence. These means are also presented in Graph 25.

Language Competence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Beginners	1.762	.024	1.714	1.811
Advanced	1.890	.029	1.833	1.947

Table 89. Descriptive statistics for all of the participants' performance at the level of morphological + extensive syntactic information according to their level of Greek language competence.



Graph 25. Mean for all of the participants' performance at the level of morphological + extensive syntactic information according to their level of Greek language competence

The split-plot ANOVA analysis revealed that the interaction between the factors of non-words/nouns' endings and the grammatical gender was significant, F-value (1 – 103) of 12.593 ($p < 0.001$). This interaction accounts for an effect size almost 11% of the total variance (partial Eta squared 0.109). The simple main effects of this interaction were therefore further investigated. In Table 90 the descriptive statistics are presented for all of the participants' performance according to the factor of non-words/nouns' endings and the factor of grammatical gender. The design of the experiment dictated the performance of three ANOVAs in order to investigate the interactions simple main effects. The first ANOVA investigated the difference between the two types of endings in the level of masculine grammatical gender, the second at the level of feminine grammatical gender and the third at the level of neuter grammatical gender. It was not meaningful to investigate any difference between the three levels of grammatical gender in type one and type two endings, as these endings were different for each type of grammatical gender.

GenderMFN	Endings	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Masculine	$-\alpha\zeta$	1.635	.036	1.564	1.706
	$-\eta\zeta$	1.505	.039	1.427	1.582
Feminine	$-\alpha$	1.627	.032	1.563	1.691
	$-\eta$	1.649	.033	1.584	1.713
Neuter	$-o$	1.508	.040	1.429	1.587
	$-l$	1.625	.034	1.558	1.693

Table 90. Descriptive statistics for all of the participants' performance according to the factor of grammatical gender and type of endings in the first task.

The ANOVA analysis revealed that the main effect due to the type of endings (type 1: $-\alpha\zeta$ and type 2: $-\eta\zeta$) in the level of masculine grammatical gender was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, sphericity and homogeneity of variance were met. The results of the split-plot ANOVA are presented in Table 91. An F-value (1 – 104) of 8.539 ($p < 0.05$) represented an effect size (partial Eta squared) of .076, showing that nearly 8% of the variation in the number of correct answers in the grammatical gender of the presented nouns in the first task for the level of masculine grammatical gender can be accounted for by differing the type of ending. The results suggest that in the first task the participants were more accurate in attributing the grammatical gender when they were dealing with non-words/nouns with $-\alpha\zeta$ ending than with $-\eta\zeta$ ending (means of 1.635 and 1.505 respectively).

Source	Info	ENDINGSasis	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
ENDINGSasis	Linear		2.668	1	2.668	8.539	.004	.076
Error(ENDINGSasis)	Linear		32.498	104	.312			

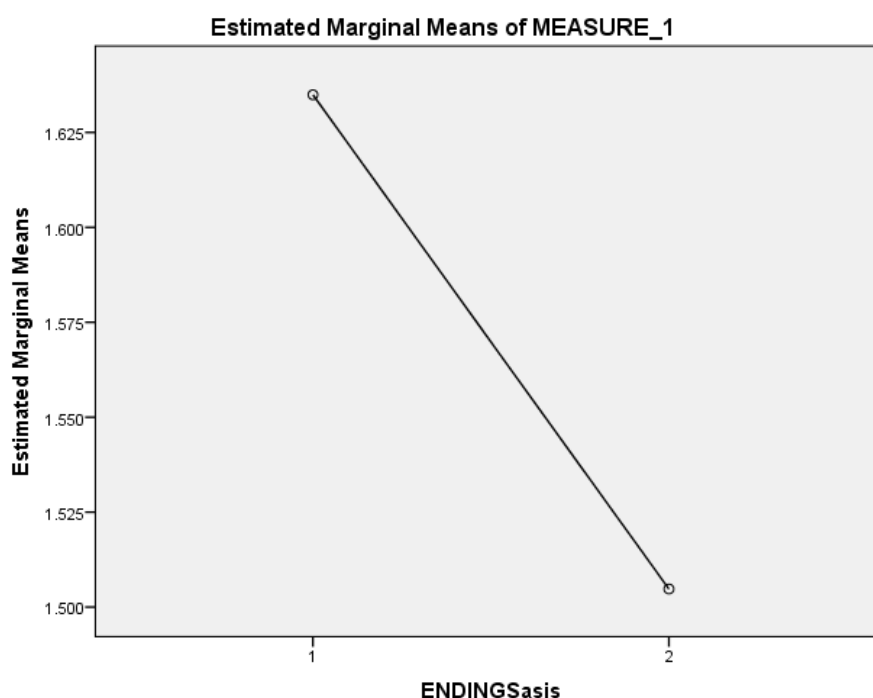
Table 91. Split-plot ANOVA for the condition of masculine type of endings.

The confidence interval showed that the mean for the participants' performance in non-words/nouns with $-\alpha\varsigma$ ending is likely (95%) to be found between 1.564 and 1.706 and for the $-\eta\varsigma$ ending between 1.427 and 1.582.

In Table 92 the descriptive statistics are presented for all of the participants' performance at the level of masculine gender according to the type of endings ($-\alpha\varsigma$ ending and $-\eta\varsigma$ ending). These means are also presented in Graph 26.

ENDINGS	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
$-\alpha\varsigma$	1.635	.036	1.564	1.706
$-\eta\varsigma$	1.505	.039	1.427	1.582

Table 92. Descriptive statistics for all of the participants' performance at the level of masculine gender according to the type of endings.



Graph 26. Means for all of the participants' performance at the level of masculine gender according to the type of endings.

The ANOVA analysis revealed that the main effect due to the type of endings (type 1: $-\iota$ and type 2: $-o$) in the level of neuter grammatical gender was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, sphericity and homogeneity of variance were met. The results of the split-plot ANOVA are presented in Table 93. An F-value (1 – 104) of 5.896 ($p < 0.05$) represented an

effect size (partial Eta squared) of .054, showing that nearly 5% of the variation in the number of correct answers in the grammatical gender of the presented nouns in the first task for the level of neuter grammatical gender can be accounted for by differences in the type of ending. The results suggest that in the first task the participants were more accurate in attributing the grammatical gender when they were dealing with non-words/nouns with *-o* endings than with *-i* endings (means of 1.508 and 1.625 respectively).

Source	Info	ENDINGS	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
ENDINGS		Linear	2.173	1	2.173	5.896	.017	.054
Error(ENDINGS)		Linear	38.327	104	.369			

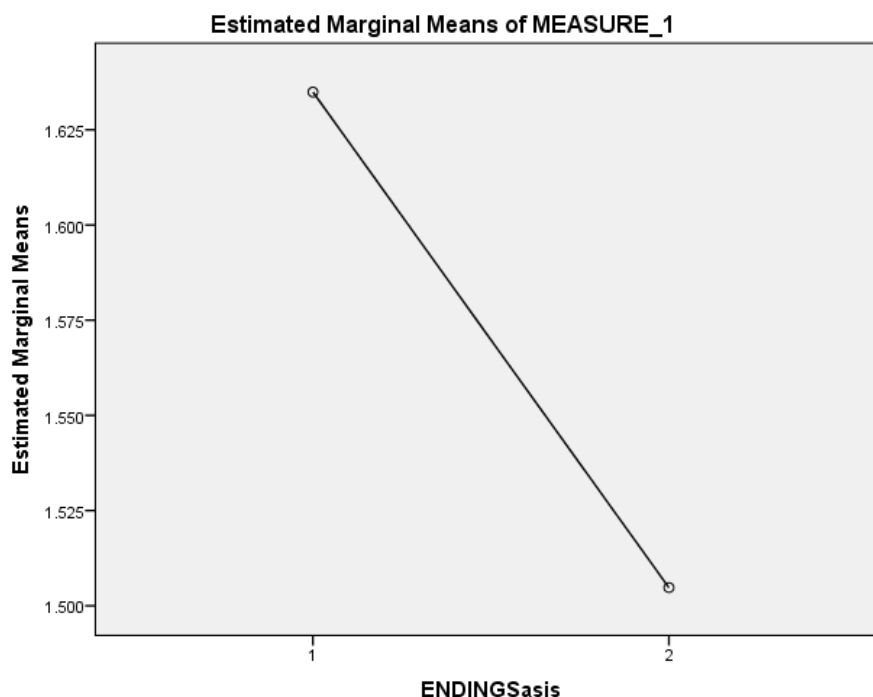
Table 93. Split-plot ANOVA for the condition of neuter type of endings.

The confidence interval showed that the mean for the participants' performance in non-words/nouns with *-o* ending is likely (95%) to be found between 1.558 and 1.693 and for the *-i* ending between 1.429 and 1.587.

In Table 94 the descriptive statistics are presented for all of the participants' performance at the level of neuter gender according to the type of endings (*-i* ending and *-o* ending). These means are also presented in Graph 27.

ENDINGS	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
-i	1.508	.040	1.429	1.587
-o	1.625	.034	1.558	1.693

Table 94. Descriptive statistics for all of the participants' performance at the level of neuter gender according to the type of endings.



Graph 27. Means for all of the participants' performance at the level of masculine gender according to the type of endings

The ANOVA analysis revealed that there was no significant main effect of the factor of endings (type 1: $-\alpha$ and type 2: $-\eta$) in the level of feminine grammatical gender, F-value (1 – 104) of 0.156 ($p = 0.694$), indicating that the participants' accuracy in attributing the grammatical gender of non-words/nouns in the first task is not affected by the type of endings (type 1: $-\alpha$ and type 2: $-\eta$). In other words, there is no significant difference in participants' accuracy in attributing the grammatical gender of non-words/nouns in the first task in terms of the level of feminine grammatical gender when they process nouns with $-\alpha$ endings or $-\eta$ endings.

The split-plot ANOVA analysis revealed that the interaction between the levels of Greek language competence and the grammatical gender of the provided non-words/nouns was not significant, F-value (1 – 103) of 0.449 ($p = 0.504$), indicating that the effect of the factor of grammatical gender was similar in the condition of both the advanced and beginner learners. Furthermore, the effect of the factor of Greek language competence was similar in each level of the grammatical level factor.

The interaction between the factors of the type of information provided and the grammatical gender was also not significant, F-value (1 – 103) of .007 ($p = 0.932$), indicating that the factor of grammatical gender behaves the same way at all levels of the factor of information provided. On the basis of this analysis there were no

differences between the effect of the factor of information provided at all three levels of the grammatical gender factor.

The interaction between the three factors (the levels of Greek language competence, the type of information provided and the grammatical gender) was not significant, F-value (1 – 103) of 0.552 ($p = 0.459$), indicating that the effect of the type of information provided was similar in masculine, feminine and neuter nouns. This observation was confirmed for both the advanced and beginner learners. Furthermore, the effect of the grammatical gender factor was similar for all of the levels of information provided and this observation was confirmed for both the advanced and beginner learners. Finally, the factor of Greek language competence did not behave differently in each condition of two other variables: type of information provided and grammatical gender.

The split-plot ANOVA analysis revealed that the interaction between the levels of Greek language competence, the grammatical gender and the type of endings of the provided non-words/nouns was not significant, F-value (1 – 103) of 0.551 ($p = 0.459$), indicating that the observed differences between the endings of the nouns were the same for both levels of Greek language competence.

The split-plot ANOVA analysis revealed that the interaction between the levels of information provided, the grammatical gender and the type of endings of the provided non-words/nouns was not significant, F-value (1 – 103) of 1.190 ($p = 0.278$), indicating that the observed differences between the endings of the nouns in each grammatical gender were the same for all levels of the factor of information provided.

The split-plot ANOVA analysis revealed that the interaction between the levels of information provided, the grammatical gender, the levels of Greek language competence and the type of endings of the provided non-words/nouns was not significant, F-value (1 – 103) of 0.252 ($p = 0.617$), indicating that the observed differences between the endings of the nouns in each grammatical gender were the same for all levels of the factor of information provided. This observation was confirmed for both the advanced and beginner learners.

6.3 ANOVA for nouns in the first task and dependent variable reaction time

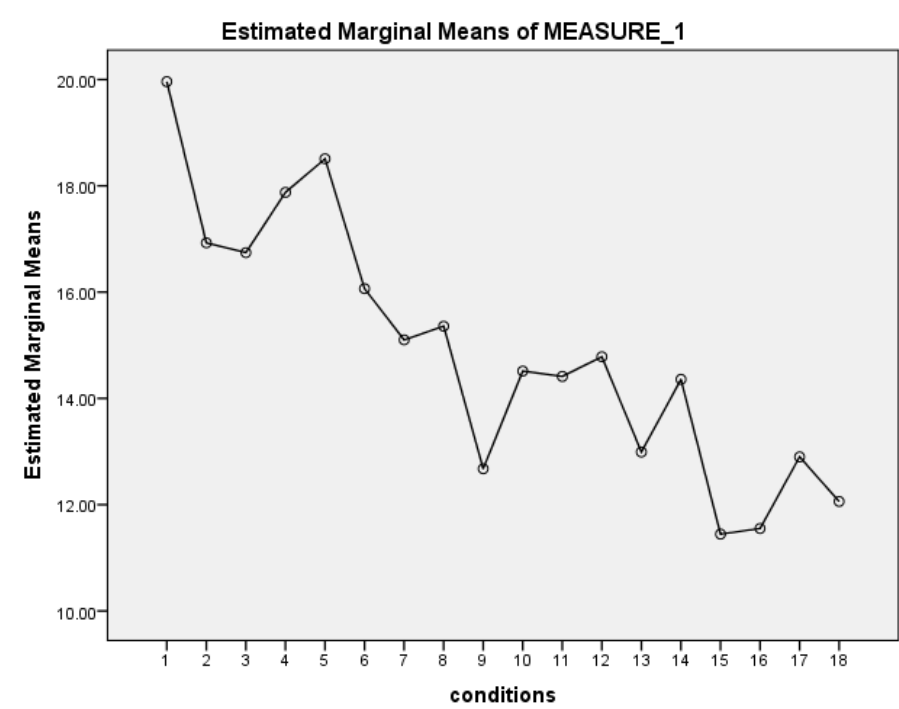
A statistical analysis on the first task was carried out in order to investigate any effects of the independent variables on the dependent variable. The independent variables were

four. The first variable was information provided relating to the grammatical gender. The second variable was the nouns' grammatical gender. The third independent variable was the nouns' endings. Finally, the last independent variable was the level of Greek language competence. Therefore, each participant was assessed in 18 conditions. In Table 95 the descriptive statistics are presented for all of the participants' performance in the 18 conditions in the first task with dependent variable the reaction time of participants' answers: non-word with gender ending $-\alpha\varsigma$ (ATmorphMas), non-word with gender ending $-\eta\varsigma$ (ATmorphMis), non-word with gender ending $-\alpha$ (ATmorphFa), non-word with gender ending $-\eta$ (ATmorphFi), non-word with gender ending $-\iota$ (ATmorphNi), non-word with gender ending $-o$ (ATmorphNo), masculine determiner + non-word with gender ending $-\alpha\varsigma$ (ATartMas), masculine determiner + non-word with gender ending $-\eta\varsigma$ (ATartMis), feminine determiner + non-word with gender ending $-\alpha$ (ATartFa), feminine determiner + non-word with gender ending $-\eta$ (ATartFi), neuter determiner + non-word with $-\iota$ (AQartNi), neuter determiner + non-word with $-o$ (ATartNo), masculine determiner + adjective with masculine ending $-\text{os}$ + non-word with ending $-\alpha\varsigma$ (ATsyntMas), masculine determiner + adjective with masculine ending $-\text{os}$ + non-word with ending $-\eta\varsigma$ (ATsyntMis), feminine determiner + adjective with feminine ending $-\eta$ + non-word with ending $-\alpha$ (ATsyntFa), feminine determiner + adjective with feminine ending $-\eta$ + non-word with ending $-\eta$ (ATsyntFi), neuter determiner + adjective with neuter ending $-\text{o}$ + non-word with ending $-\iota$ (ATsyntNi) and neuter determiner + adjective with neuter ending $-\text{o}$ + non-word with ending $-o$ (ATsyntNo). The descriptive statistics are also presented in Graph 28.

Language Competence		Mean	Std. Deviation	N
ATmorphMas	Beginners	22.8363	38.34348	61
	Advanced	15.9748	9.59008	44
	Total	19.9610	29.96336	105
ATmorphMis	Beginners	18.2550	10.87994	61
	Advanced	15.0844	7.34821	44
	Total	16.9264	9.64823	105
ATmorphFa	Beginners	18.4653	10.06614	61
	Advanced	14.3559	7.56420	44
	Total	16.7433	9.28794	105
ATmorphFi	Beginners	19.9494	21.42554	61
	Advanced	15.0047	7.86247	44
	Total	17.8773	17.21650	105
ATmorphNi	Beginners	21.1294	20.33429	61
	Advanced	14.8767	7.10838	44
	Total	18.5092	16.40272	105
ATmorphNo	Beginners	16.8677	8.63107	61
	Advanced	14.9516	8.06947	44
	Total	16.0648	8.41448	105
ATartMas	Beginners	14.9386	6.07336	61
	Advanced	15.3262	14.65425	44
	Total	15.1010	10.49318	105
ATartMis	Beginners	17.2101	20.42296	61
	Advanced	12.7933	7.58792	44
	Total	15.3592	16.40834	105
ATartFa	Beginners	13.0920	6.28732	61
	Advanced	12.0990	7.88363	44
	Total	12.6759	6.98181	105

ATartFi	Beginners	16.0589	17.76353	61
	Advanced	12.3739	5.84862	44
	Total	14.5147	14.12532	105
ATartNi	Beginners	16.0623	8.23059	61
	Advanced	12.1253	5.92173	44
	Total	14.4125	7.57568	105
ATartNo	Beginners	14.8353	10.92065	61
	Advanced	14.7115	13.42847	44
	Total	14.7834	11.97351	105
ATsyntMas	Beginners	14.2955	12.87072	61
	Advanced	11.1831	8.63371	44
	Total	12.9913	11.34774	105
ATsyntMis	Beginners	13.7324	8.46327	61
	Advanced	15.2262	28.84980	44
	Total	14.3584	19.64689	105
ATsyntFa	Beginners	12.5903	7.24257	61
	Advanced	9.8591	5.68012	44
	Total	11.4458	6.74060	105
ATsyntFi	Beginners	12.5409	7.78651	61
	Advanced	10.1805	7.91119	44
	Total	11.5518	7.88831	105
ATsyntNi	Beginners	14.8755	14.21328	61
	Advanced	10.1590	6.21764	44
	Total	12.8991	11.74735	105
ATsyntNo	Beginners	13.6497	9.07515	61
	Advanced	9.8570	4.69395	44
	Total	12.0604	7.75627	105

Table 95. Descriptive statistics for all of the participants' reaction times in the 18 conditions in the first task.



Graph 28. Mean reaction time for all of the participants in the 18 conditions in the first task.

As stated in the section of methodology, the experiment was a (3X3X2X2) factorial four-way mixed analysis of variances. The reaction time of participants’ answers on the presented non-words/nouns in the first task was analysed with a split-plot ANOVA. The level of Greek language competence was the between participants factor, this factor had two levels. The type of information provided was the first within participants factor. This factor had three levels. The second within participants factor was the grammatical gender and it had three levels. Finally, the third within participants factor was the ending of the nouns, two possible endings for each gender. The results of the split-plot ANOVA are presented in Table 96 for the within subjects and in Table 97 for the between subjects.

Source	INFO	GenderMFN Endings	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
INFO	Linear		7567.192	1	7567.192	36.840	.000	.263	36.840	1.000
	Quadratic		113.585	1	113.585	1.706	.194	.016	1.706	.253
INFO * LANG. COMP.	Linear		308.568	1	308.568	1.502	.223	.014	1.502	.229
	Quadratic		203.714	1	203.714	3.061	.083	.029	3.061	.410
Error(INFO)	Linear		21157.046	103	205.408					
	Quadratic		6855.926	103	66.562					
GenderMFN	Linear		346.546	1	346.546	1.939	.167	.018	1.939	.281
	Quadratic		549.430	1	549.430	11.622	.001	.101	11.622	.922
GenderMFN * LANG. COMP.	Linear		54.520	1	54.520	.305	.582	.003	.305	.085
	Quadratic		1.072	1	1.072	.023	.881	.000	.023	.053
Error (GenderMFN)	Linear		18404.358	103	178.683					
	Quadratic		4869.136	103	47.273					
Endings		Linear	1.314	1	1.314	.019	.892	.000	.019	.052
Endings * LANG. COMP.		Linear	125.740	1	125.740	1.785	.185	.017	1.785	.263
Error(Endings)		Linear	7256.267	103	70.449					
INFO * GenderMFN	Linear	Linear	7.884	1	7.884	.049	.824	.000	.049	.056
		Quadratic	71.814	1	71.814	1.604	.208	.015	1.604	.241
	Quadratic	Linear	28.290	1	28.290	.143	.706	.001	.143	.066
		Quadratic	7.023	1	7.023	.114	.737	.001	.114	.063
INFO * GenderMFN * LANG. COMP.	Linear	Linear	244.853	1	244.853	1.536	.218	.015	1.536	.233
		Quadratic	.023	1	.023	.001	.982	.000	.001	.050
	Quadratic	Linear	26.246	1	26.246	.133	.716	.001	.133	.065
		Quadratic	2.342	1	2.342	.038	.846	.000	.038	.054
Error(INFO * GenderMFN)	Linear	Linear	16422.939	103	159.446					
		Quadratic	4612.490	103	44.781					
	Quadratic	Linear	20374.998	103	197.816					
		Quadratic	6361.985	103	61.767					
INFO * Endings	Linear	Linear	202.482	1	202.482	2.129	.148	.020	2.129	.304
	Quadratic	Linear	138.787	1	138.787	.936	.335	.009	.936	.160
INFO * Endings * LANG. COMP.	Linear	Linear	3.552	1	3.552	.037	.847	.000	.037	.054
	Quadratic	Linear	297.227	1	297.227	2.006	.160	.019	2.006	.289
	Linear	Linear	9793.810	103	95.086					

CHAPTER 6: RESULTS

Error(INFO* Endings)	Quadratic	Linear		15264.786	103	148.202					
GenderMFN * Endings	Linear	Linear		9.414	1	9.414	.053	.819	.001	.053	.056
	Quadratic	Linear		227.559	1	227.559	1.713	.194	.016	1.713	.254
GenderMFN * Endings * LANG. COMP.	Linear	Linear		66.350	1	66.350	.370	.544	.004	.370	.093
	Quadratic	Linear		253.088	1	253.088	1.905	.170	.018	1.905	.277
Error (GenderMFN* Endings)	Linear	Linear		18455.122	103	179.176					
	Quadratic	Linear		13682.494	103	132.840					
INFO * GenderMFN * Endings	Linear	Linear	Linear	126.530	1	126.530	1.208	.274	.012	1.208	.193
	Quadratic	Linear		250.384	1	250.384	2.230	.138	.021	2.230	.316
	Quadratic	Linear	Linear	51.654	1	51.654	.684	.410	.007	.684	.130
	Quadratic	Linear		1.080	1	1.080	.032	.858	.000	.032	.054
INFO * GenderMFN * Endings * LANG. COMP.	Linear	Linear	Linear	59.853	1	59.853	.572	.451	.006	.572	.116
	Quadratic	Linear		25.672	1	25.672	.229	.634	.002	.229	.076
	Quadratic	Linear	Linear	437.691	1	437.691	5.793	.018	.053	5.793	.664
	Quadratic	Linear		11.538	1	11.538	.345	.558	.003	.345	.090
Error(INFO* GenderMFN* Endings)	Linear	Linear	Linear	10785.451	103	104.713					
	Quadratic	Linear		11565.194	103	112.283					
	Quadratic	Linear	Linear	7782.503	103	75.558					
	Quadratic	Linear		3443.742	103	33.434					

Table 96. Results of the split-plot ANOVA for the within subjects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
Intercept	395193.361	1	395193.361	278.528	.000	.730	278.528	1.000
LANG. COMP.	4333.788	1	4333.788	3.054	.029	.083	3.054	.410
Error	146143.094	103	1418.865					

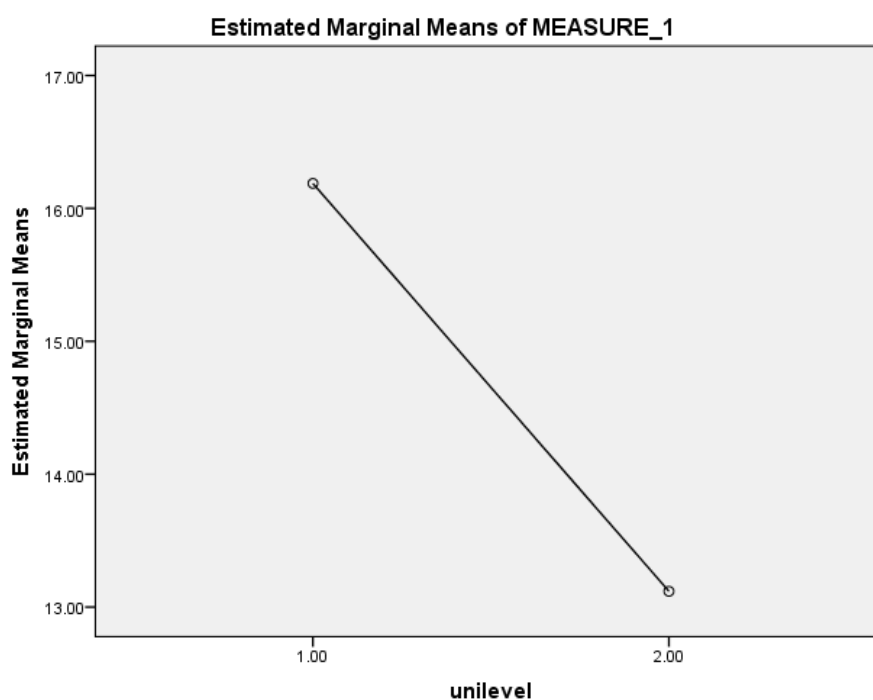
Table 97. Results of the split-plot ANOVA for the between subjects.

The split-plot ANOVA analysis revealed for the between participants comparison that the main effect due to the level of Greek language competence factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality and homogeneity of variance were met. An F-value (1 – 103) of 3.054 ($p < 0.05$) represented an effect size (partial Eta squared) of .083, showing that nearly

8% of the variation in the participants' reaction times for their answers in the first task can be accounted for by differing the level of Greek language competence. The results suggest that in the first task the advanced learners needed less time to react in regard to attributing the grammatical gender of the presented non-words/nouns than the beginners (means of 13.119 sec and 16.188 sec respectively). The confidence interval showed that the population mean for the group of beginners is likely (95%) to be found between 13.934 and 18.443 and for the advanced learners between 10.464 and 15.774. In Table 98 the descriptive statistics are presented for all of the participants' performance according to their level of Greek language competence. These means are also presented in Graph 29.

Language Competence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Beginners	16.188	1.137	13.934	18.443
Advanced	13.119	1.338	10.464	15.774

Table 98. Descriptive statistics for all of the participants' reaction times according to the level of Greek language competence in the first task.

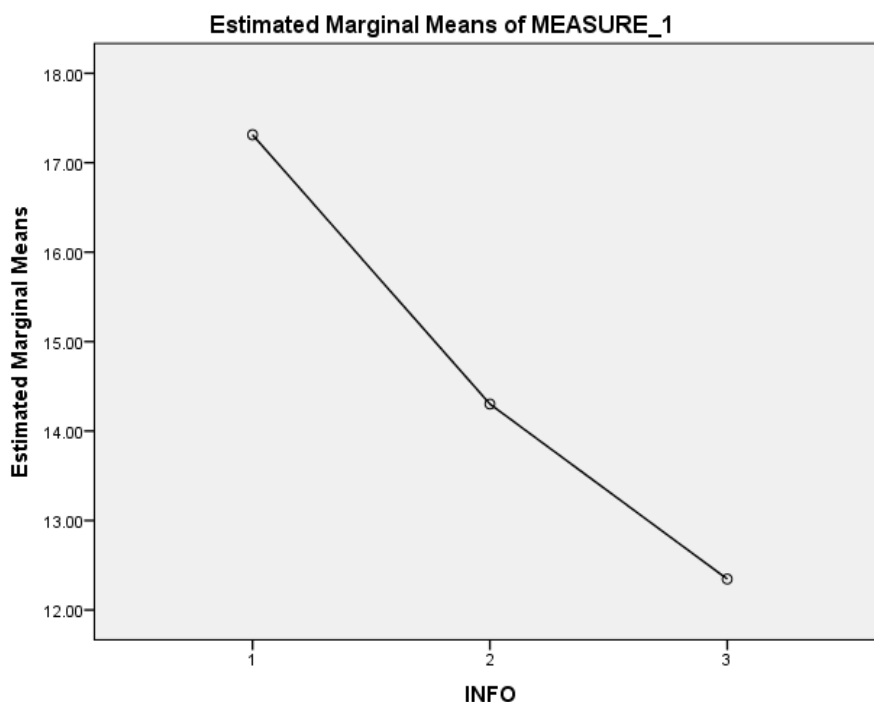


Graph 29. Mean reaction time for all of the participants according to their level of Greek language competence in the first task

The split-plot ANOVA analysis revealed for the within participants comparisons that the main effect due to the type of information provided factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, homogeneity of variance and sphericity were met. In particular, the analysis for the main effect of the type of information provided revealed an F-value (1 – 103) of 36.840 ($p < 0.001$) and represented a significantly large effect size (partial Eta squared) of .263, showing that nearly 26% of the variation in the participants' reaction times for their answers in the first test can be accounted for by differing the type of information provided. The confidence interval showed that the population mean for the level of morphological information was 17.313 and was likely (95%) to be found between 15.016 and 19.609. For the level of morphological + syntactic information the mean was 14.302 and was likely (95%) to be found between 12.689 and 15.916. Finally, for the level of morphological + extensive syntactic information the mean was 12.346 and was likely (95%) to be found between 10.624 and 14.067. In Table 99 the descriptive statistics are presented for all of the participants' reaction times according to the factor of information provided. These means are also presented in Graph 30.

INFO	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Morphological information	17.313	1.158	15.016	19.609
Morphological + syntactic information	14.302	.814	12.689	15.916
Morphological + extensive syntactic information	12.346	.868	10.624	14.067

Table 99. Descriptive statistics for all of the participants' reaction times according to the factor of type of information provided in the first task.



Graph 30. Mean reaction time for all of the participants according to the factor of type of information provided in the first task.

The factor of information provided had three levels. Therefore, three pairwise comparisons were carried out. The first comparison was between the levels of morphological information and morphological + syntactic information. The second comparison was between the levels of morphological information and morphological + extensive syntactic information. And the third comparison was between the levels of morphological + syntactic information and morphological + extensive syntactic information. These comparisons allowed all the possible combinations to be analysed. In Table 100 information is presented for all of the participants' reaction times relating to the pairwise comparisons for the factor of information provided.

(I) INFO	(J) INFO	Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Morphological information	morphological + syntactic information	3.010*	.670	.000	1.682	4.338
	morphological + extensive syntactic information	4.967*	.818	.000	3.344	6.590
Morphological + syntactic information	morphological information	-3.010*	.670	.000	-4.338	-1.682
	morphological + extensive syntactic information	1.956*	.460	.000	1.043	2.869
Morphological + extensive syntactic information	morphological information	-4.967*	.818	.000	-6.590	-3.344
	morphological + syntactic information	-1.956*	.460	.000	-2.869	-1.043

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Table 100. Pairwise comparisons for the factor of type of information in the first task.

The mean difference between the levels of morphological information and morphological + syntactic information was 3.010, between the levels of morphological information and morphological + extensive syntactic information was 4.967 and finally, between the levels of morphological + syntactic information and morphological + extensive syntactic information was 1.956.

The Bonferroni test showed that the difference between the levels of morphological information and morphological + syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the participants reacted in significantly less time when they were provided with morphological + syntactic information than when they were provided with morphological information only. The confidence interval showed that the population mean difference is likely (95%) to be found between 1.682 and 4.338.

Similarly, the Bonferroni test showed that the difference between the levels of morphological information and morphological + extensive syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded

that the participants reacted in significantly less time when they were provided with morphological + extensive syntactic information than when they were provided with morphological information only. The confidence interval showed that the population mean difference is likely (95%) to be found between 3.344 and 6.590.

The same results were observed for the third comparison. In particular, the Bonferroni test showed that the difference between the levels of morphological + syntactic information and morphological + extensive syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the participants reacted in significantly less time when they were provided with morphological + extensive syntactic information than when they were provided with morphological + syntactic information only. The confidence interval showed that the population mean difference is likely (95%) to be found between 1.043 and 2.869.

The split-plot ANOVA analysis revealed that there was not a significant main effect of the factor of grammatical gender, F-value (1 – 103) of 0.036 ($p = 0.851$), indicating that the participants' reaction time when attributing the grammatical gender of non-words/nouns in the first task was not affected by any variation in terms of the grammatical gender of the provided non-word/noun. In other words, there was no significant difference in participants' reaction time when attributing the grammatical gender of non-words/nouns in the first task when they processed masculine, feminine or neuter non-words/nouns.

The analysis on the factor of non-words/nouns' endings had no gravity on the interpretation of the results as an independent variable but only in relation to the factor of grammatical gender. This approach is explained by the design of the experiment. As stated in the methodology section, there are not the same two types of endings applied in all of the three grammatical genders but rather two types of endings for each grammatical gender. Absence of significant interpretation can be assumed for the interaction between the factors of endings of the nouns and Greek language competence. The same conclusions can be drawn for the interaction between the factor of endings of the nouns and the type of information provided as well as for the interaction between three factors: the type of information provided, the endings of the nouns and the level of Greek language competence. Finally, there is no need to investigate the interaction between all four independent variables as this contains the factor of the endings, which is investigated in the analysis of the interaction between the factor of endings and the factor of the grammatical gender. The interaction between the

other variables and the grammatical gender is investigated separately. This interpretation is valid for the interaction between the three factors; the factor of endings of the nouns, the factor of the grammatical gender and the type of information provided, as well as for the interaction between the endings of the nouns, the grammatical gender and Greek language competence.

The split-plot ANOVA analysis revealed that the interaction between the factors of the type of information provided and the level of Greek language competence was not significant, F-value (1 – 103) of 1.502 ($p = 0.223$). The non-significant interaction between those two variables indicates that the observed differences between the three levels of the factor of information provided are not different in beginners or advanced learners. Furthermore, the observed differences between the advanced and beginner learners are not significantly different at any level of the factor of information provided. In other words, the advanced learners processed the grammatical gender in less time than the beginners and this is observed at all levels of the type of information provided. Also, the participants' shorter time in processing grammatical gender in the order of morphological + extensive syntactic information, morphological + syntactic information and morphological information was observed in both advanced learners and beginners.

The interaction between the factors of grammatical gender and Greek language competence was not significant, F-value (1 – 103) of 0.305 ($p = 0.582$), indicating that the observed difference between the advanced learners and beginners was the same at all levels of the factor of grammatical gender. Additionally, the non-significant differences in processing time between nouns with masculine, feminine or neuter grammatical gender marked cues was observed in both advanced and beginner learners.

The split-plot ANOVA analysis revealed that the interaction between the factors of non-words/nouns' endings and the grammatical gender was not significant, F-value (1 – 103) of 0.530 ($p = 0.819$). This non-significant interaction in relation to the non-significant difference between the levels of endings, indicates that the participants processed the different endings in the masculine, feminine and neuter nouns in the same time.

The interaction between the factors of the type of information provided and the grammatical gender was also not significant, F-value (1 – 103) of 0.049 ($p = 0.824$), indicating that the factor of grammatical gender behaves the same way at all levels of the factor of information provided. On the basis of this analysis there was no difference

between the effect of the factor of information provided at all three levels of the grammatical gender factor.

The interaction between the three factors, the levels of Greek language competence, the type of information provided and the grammatical gender, was not significant, F-value (1 – 103) of 1.536 ($p = 0.218$), indicating that the effect of the type of information was similar in masculine, feminine and neuter nouns. This observation was confirmed for both the advanced and beginner learners. Furthermore, the effect of the grammatical gender factor was similar for all of the levels of information provided and this observation was confirmed for both the advanced and beginner learners. Finally, the factor of Greek language competence did not behave differently in each condition of two other variables: type of information provided and grammatical gender.

6.4 ANOVA for nouns in the second task and dependent variable grammatical gender accuracy

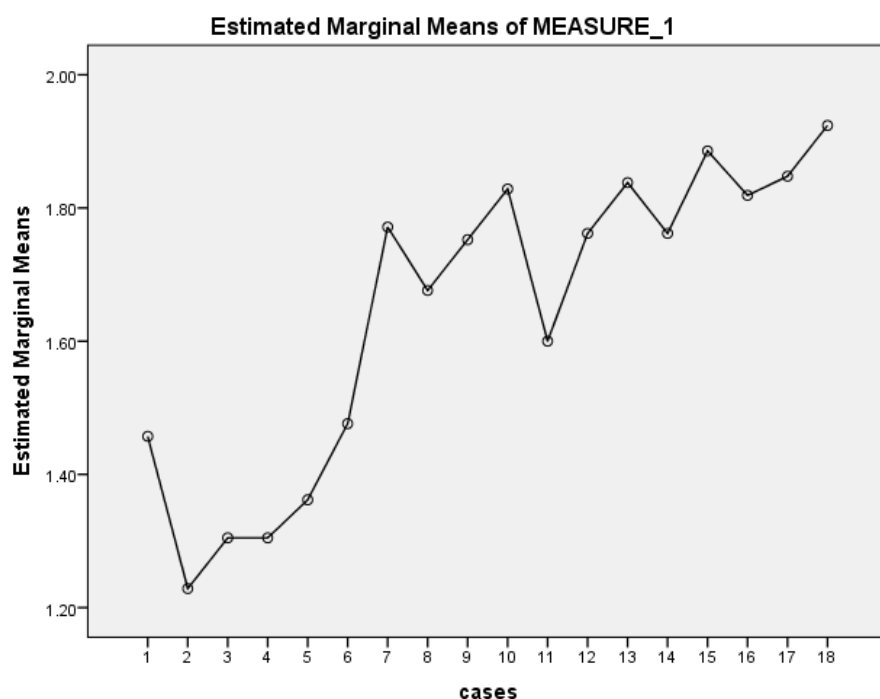
A statistical analysis on the second task was carried out in order to investigate any effects of the independent variables on the dependent variable. The independent variables were four. The first variable was information provided relating to the grammatical gender (morphological information, morphological + syntactic information and morphological + extensive syntactic information). The second variable was the nouns' grammatical gender (masculine, feminine and neuter). The third independent variable was the nouns' endings ($-\alpha\varsigma$, $-\eta\varsigma$, $-\alpha$, $-\eta$, $-\iota$ and $-o$). Finally, the last independent variable was the level of Greek language competence (advanced and beginner). Therefore, each participant was assessed in 18 conditions. In Table 101 the descriptive statistics are presented for all of the participants' performance in the 18 conditions in the second task with dependent variable the correctness of participant's answers regarding the noun's grammatical gender: non-word with gender ending $-\alpha\varsigma$ (BQmorphMas), non-word with gender ending $-\eta\varsigma$ (BQmorphMis), non-word with gender ending $-\alpha$ (BQmorphFa), non-word with gender ending $-\eta$ (BQmorphFi), non-word with gender ending $-\iota$ (BQmorphNi), non-word with gender ending $-o$ (BQmorphNo), masculine determiner + non-word with gender ending $-\alpha\varsigma$ (BQartMas), masculine determiner + non-word with gender ending $-\eta\varsigma$ (BQartMis), feminine determiner + non-word with gender ending $-\alpha$ (BQartFa), feminine determiner + non-word with gender ending $-\eta$ (BQartFi), neuter determiner + non-word with $-\iota$ (BQartNi), neuter determiner + non-word with $-o$ (BQartNo), masculine determiner + adjective with masculine ending $-os$ + non-word with ending $-\alpha\varsigma$ (BQsyntMas),

masculine determiner + adjective with masculine ending *-os* + non-word with ending $-\eta\varsigma$ (BQsyntMis), feminine determiner + adjective with feminine ending $-\eta$ + non-word with ending $-\alpha$ (BQsyntFa), feminine determiner + adjective with feminine ending $-\eta$ + non-word with ending $-\eta$ (BQsyntFi), neuter determiner + adjective with neuter ending $-o$ + non-word with ending $-\iota$ (BQsyntNi) and neuter determiner + adjective with neuter ending $-o$ + non-word with ending $-o$ (BQsyntNo). The descriptive statistics are also presented in Graph 31.

Language Competence		Mean	Std. Deviation	N
BQmorphMas	Beginners	1.3934	.73663	61
	Advanced	1.5455	.58883	44
	Total	1.4571	.67977	105
BQmorphMis	Beginners	1.1475	.72655	61
	Advanced	1.3409	.71343	44
	Total	1.2286	.72400	105
BQmorphFa	Beginners	1.2131	.68592	61
	Advanced	1.4318	.62497	44
	Total	1.3048	.66685	105
BQmorphFi	Beginners	1.2787	.71019	61
	Advanced	1.3409	.68005	44
	Total	1.3048	.69509	105
BQmorphNi	Beginners	1.2951	.76036	61
	Advanced	1.4545	.58883	44
	Total	1.3619	.69509	105
BQmorphNo	Beginners	1.4590	.64740	61
	Advanced	1.5000	.59062	44
	Total	1.4762	.62165	105
BQartMas	Beginners	1.7213	.55170	61
	Advanced	1.8409	.36999	44
	Total	1.7714	.48550	105
BQartMis	Beginners	1.5902	.61582	61
	Advanced	1.7955	.40803	44
	Total	1.6762	.54588	105

MQartFa	Beginners	1.6721	.59781	61
	Advanced	1.8636	.40868	44
	Total	1.7524	.53315	105
BQartFi	Beginners	1.7541	.56733	61
	Advanced	1.9318	.25497	44
	Total	1.8286	.46939	105
BQartNi	Beginners	1.5410	.53460	61
	Advanced	1.6818	.47116	44
	Total	1.6000	.51141	105
BQartNo	Beginners	1.7049	.49478	61
	Advanced	1.8409	.36999	44
	Total	1.7619	.44987	105
BQsyntMas	Beginners	1.7869	.52009	61
	Advanced	1.9091	.29080	44
	Total	1.8381	.44124	105
BQsyntMis	Beginners	1.6557	.60236	61
	Advanced	1.9091	.29080	44
	Total	1.7619	.50997	105
BQsyntFa	Beginners	1.8525	.47736	61
	Advanced	1.9318	.33395	44
	Total	1.8857	.42323	105
BQsyntFi	Beginners	1.7705	.52894	61
	Advanced	1.8864	.38675	44
	Total	1.8190	.47598	105
BQsyntNi	Beginners	1.7705	.42401	61
	Advanced	1.9545	.21071	44
	Total	1.8476	.36111	105
BQsyntNo	Beginners	1.9344	.24959	61
	Advanced	1.9091	.29080	44
	Total	1.9238	.26658	105

Table 101. The descriptive statistics are presented for all of the participants' performance in the 18 conditions in the second task.



Graph 31. Mean performance for all of the participants in the 18 conditions in the second task.

As stated in the section of method, the experiment was a (3X3X2X) factorial four-way mixed analysis of variances. The number of correct answers in attributing the grammatical gender of the presented non-words/nouns in the second task was analysed with a split-plot ANOVA. Therefore, in each condition the maximum mark that could be obtained was 2 and the minimum was 0. The level of Greek language competence was the between participants factor, and had two levels (beginner and advanced). The type of information provided was the first within participants factor. This factor had three levels (morphological information, morphological + syntactic information and morphological + extensive syntactic information). The second within participants factor was the grammatical gender and it had three levels (masculine, feminine and neuter). Finally, the third within participants factor was the ending of the nouns, two possible endings for each gender (for masculine: $-\alpha\varsigma$, $-\eta\varsigma$, for feminine: $-\alpha$, $-\eta$ and for neuter: $-\iota$ $-ο$). The results of the split-plot ANOVA are presented in Table 102 for the within subjects and in Table 103 for the between subjects.

Source	INFO	GenderMFN	Endings	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
INFO	Linear			73.398	1	73.398	355.185	.000	.775
	Quadratic			7.295	1	7.295	74.741	.000	.421
INFO * LANG. COMP.	Linear			.020	1	.020	.097	.756	.001
	Quadratic			.106	1	.106	1.082	.301	.010
Error(INFO)	Linear			21.285	103	.207			
	Quadratic			10.053	103	.098			
GenderMFN	Linear			.358	1	.358	.703	.404	.007
	Quadratic			.021	1	.021	.055	.815	.001
GenderMFN * LANG. COMP.	Linear			.358	1	.358	.703	.404	.007
	Quadratic			5.677E-5	1	5.677E-5	.000	.990	.000
Error (GenderMFN)	Linear			52.396	103	.509			
	Quadratic			39.840	103	.387			
Endings			Linear	.017	1	.017	.054	.816	.001
Endings * LANG. COMP.			Linear	.062	1	.062	.195	.660	.002
Error (Endings)			Linear	32.597	103	.316			
INFO * GenderMFN	Linear	Linear		.002	1	.002	.012	.914	.000
		Quadratic		.464	1	.464	3.057	.083	.029
	Quadratic	Linear		.956	1	.956	5.517	.021	.051
		Quadratic		1.431	1	1.431	9.968	.002	.088
INFO * GenderMFN * lang. Comp.	Linear	Linear		.017	1	.017	.087	.768	.001
		Quadratic		.027	1	.027	.179	.673	.002
	Quadratic	Linear		.075	1	.075	.434	.512	.004
		Quadratic		.057	1	.057	.398	.529	.004
Error(INFO* GenderMFN)	Linear	Linear		19.479	103	.189			
		Quadratic		15.625	103	.152			
	Quadratic	Linear		17.852	103	.173			

Quadratic				14.789	103	.144			
INFO * Endings	Linear	Linear		.034	1	.034	.075	.785	.001
	Quadratic	Linear		.710	1	.710	2.829	.096	.027
INFO * Endings * LANG. COMP.	Linear	Linear		.078	1	.078	.173	.678	.002
	Quadratic	Linear		.119	1	.119	.475	.492	.005
Error(INFO* Endings)	Linear	Linear		46.652	103	.453			
	Quadratic	Linear		25.829	103	.251			
GenderMFN * Endings	Linear	Linear		4.230	1	4.230	15.811	.000	.133
	Quadratic	Linear		.007	1	.007	.037	.848	.000
GenderMFN * Endings * LANG. COMP.	Linear	Linear		.744	1	.744	2.780	.098	.026
	Quadratic	Linear		.026	1	.026	.132	.718	.001
Error (GenderMFN* Endings)	Linear	Linear		27.553	103	.268			
	Quadratic	Linear		20.711	103	.201			
INFO * GenderMFN * Endings	Linear	Linear	Linear	.538	1	.538	1.633	.204	.016
		Quadratic	Linear	.199	1	.199	.974	.326	.009
	Quadratic	Linear	Linear	.009	1	.009	.032	.859	.000
		Quadratic	Linear	.046	1	.046	.263	.609	.003
INFO * GenderMFN * Endings * LANG. COMP.	Linear	Linear	Linear	.104	1	.104	.317	.575	.003
		Quadratic	Linear	.160	1	.160	.780	.379	.008
	Quadratic	Linear	Linear	.109	1	.109	.401	.528	.004
		Quadratic	Linear	.006	1	.006	.036	.851	.000
Error(INFO* GenderMFN* Endings)	Linear	Linear	Linear	33.919	103	.329			
		Quadratic	Linear	21.072	103	.205			
	Quadratic	Linear	Linear	27.890	103	.271			
		Quadratic	Linear	17.941	103	.174			

Table 102. Results of the split-plot ANOVA for the within subjects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
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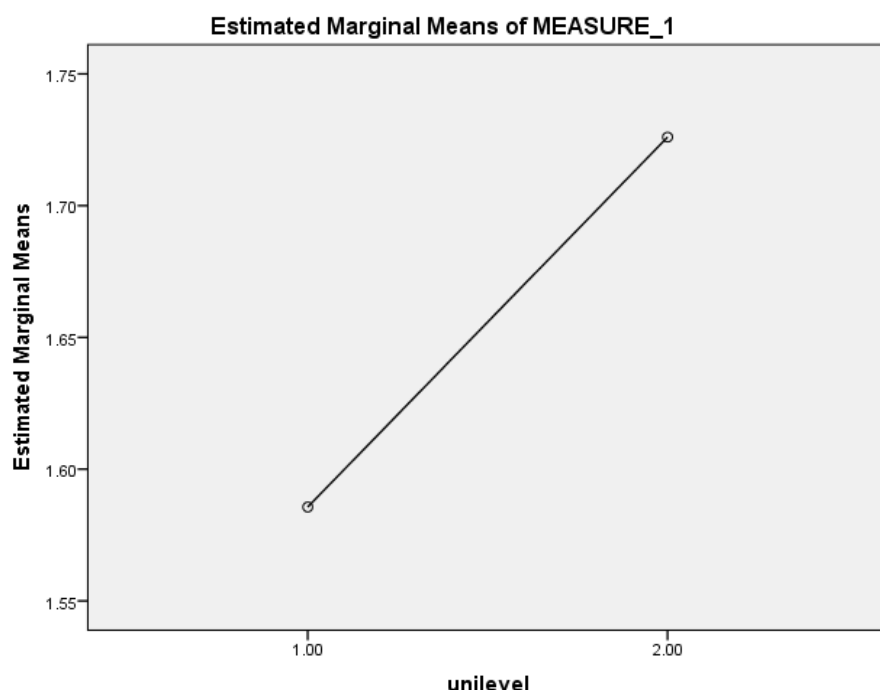
Intercept	5045.995	1	5045.995	5220.743	.000	.981
LANG. COMP.	9.070	1	9.070	9.384	.003	.083
Error	99.552	103	.967			

Table 103. Results of the split-plot ANOVA for the between subjects.

The split-plot ANOVA analysis revealed for the between participants comparison that the main effect due to the level of Greek language competence factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality and homogeneity of variance were met. An F-value (1 – 103) of 9.384 ($p < 0.05$) represented an effect size (partial Eta squared) of .083, showing that nearly 8% of the variation in the number of correct answers in relation to the grammatical gender of the presented nouns in the second test can be accounted for by differing the level of Greek language competence. The results suggest that in the first task the advanced learners were more capable of correctly attributing the grammatical gender of the presented non-words/nouns than the beginners (means of 1.726 and 1.586 respectively). The confidence interval showed that the population mean for the group of beginners is likely (95%) to be found between 1.527 and 1.644 and for the advanced learners between 1.657 and 1.795. In Table 104 the descriptive statistics are presented for all of the participants' performance according to their level of Greek language competence. These means are also presented in Graph 32.

Language Competence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Beginners	1.586	.030	1.527	1.644
Advanced	1.726	.035	1.657	1.795

Table 104. Descriptive statistics for all of the participants' performance according to their level of Greek language competence in the second task.

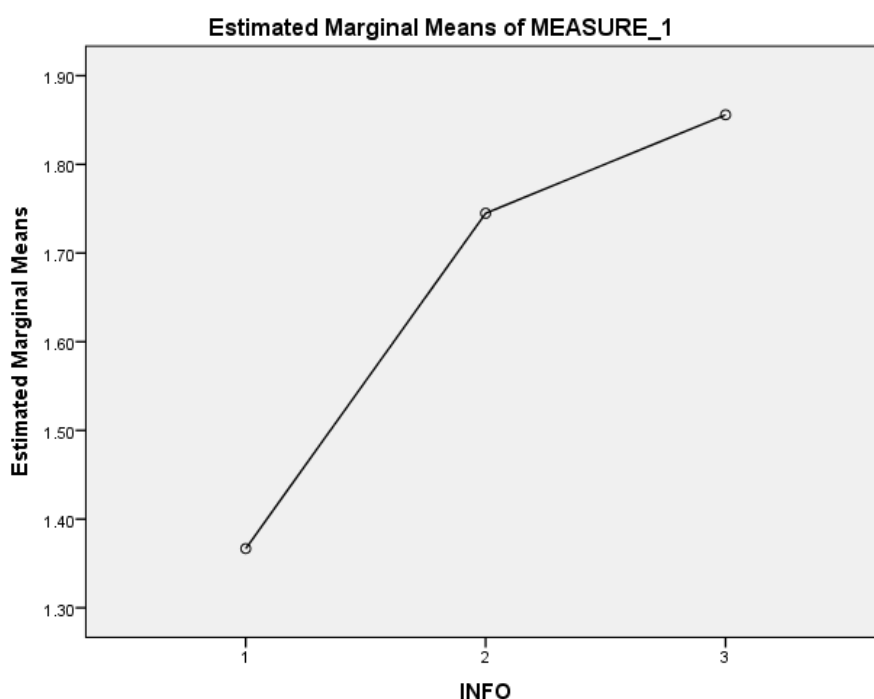


Graph 32. Mean performance for all of the participants according to their level of Greek language competence in the second task.

The split-plot ANOVA analysis revealed for the within participants comparisons that the main effect due to the type of information provided factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, homogeneity of variance and sphericity were met. In particular, the analysis for the main effect of the type of information provided revealed an F-value (1 – 103) of 355.185 ($p < 0.001$) and represented a significantly large effect size (partial Eta squared) of .775, showing that nearly 78% of the variation in the number of correct answers in the grammatical gender of the presented non-words/nouns in the second task can be accounted for by differing the type of information provided. The confidence interval showed that the population mean for the level of morphological information was 1.367 and was likely (95%) to be found between 1.307 and 1.426. For the level of morphological + syntactic information the mean was 1.745 and was likely (95%) to be found between 1.697 and 1.793. Finally, for the level of morphological + extensive syntactic information the mean was 1.856 and was likely (95%) to be found between 1.807 and 1.904. In Table 105 the descriptive statistics are presented for all of the participants' performance according to the factor of information provided. These means are also presented in Graph 33.

INFO	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Morphological information	1.367	.030	1.307	1.426
Morphological + syntactic information	1.745	.024	1.697	1.793
Morphological + extensive syntactic information	1.856	.025	1.807	1.904

Table 105. Descriptive statistics for all of the participants' performance according to the factor of type of information provided in the second task.



Graph 33. Mean performance for all of the participants according to the factor of type of information provided in the second task.

The factor of information provided had three levels. Therefore, three pairwise comparisons were carried out. The first comparison was between the levels of morphological information and morphological + syntactic information. The second comparison was between the levels of morphological information and morphological + extensive syntactic information. And the third comparison was between the levels of morphological + syntactic information and morphological + extensive syntactic information. These comparisons allowed all the possible combinations to be analysed. In Table 106 information is presented for all of the participants' performance with regard to the pairwise comparisons for the factor of information provided.

(I) INFO	(J) INFO	Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Morphological information	morphological + syntactic information	-.378*	.023	.000	-.423	-.333
	morphological + extensive syntactic information	-.489*	.026	.000	-.541	-.438
Morphological + syntactic information	morphological information	.378*	.023	.000	.333	.423
	morphological + extensive syntactic information	-.111*	.017	.000	-.146	-.076
Morphological + extensive syntactic information	morphological information	.489*	.026	.000	.438	.541
	morphological + syntactic information	.111*	.017	.000	.076	.146

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Table 106. Pairwise comparisons for the factor of type of information in the second task.

The mean difference between the levels of morphological information and morphological + syntactic information was $-.378$, between the levels of morphological information and morphological + extensive syntactic information was $-.489$ and finally, between the levels morphological + syntactic information and morphological + extensive syntactic information was $-.111$.

The Bonferroni test showed that the difference between the levels of morphological information and morphological + syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the participants' performance was more accurate in attributing the grammatical gender of the non-words/nouns when they were provided with morphological + syntactic information than when they were provided with morphological information only. The confidence interval showed that the population mean difference is likely (95%) to be found between $-.423$ and $-.333$.

Similarly, the Bonferroni test showed that the difference between the levels of morphological information and morphological + extensive syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the participants' performance was more accurate in terms of attributing the grammatical gender of the non-words/nouns when they were provided with morphological + extensive syntactic information than when they were provided with morphological information only. The confidence interval showed that the population mean difference is likely (95%) to be found between $-.541$ and $-.438$.

The same results were observed for the third comparison. In particular, the Bonferroni test showed that the difference between the levels of morphological + syntactic information and morphological + extensive syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the participants' performance was more accurate in terms of attributing the grammatical gender of the non-words/nouns when they were provided with morphological + extensive syntactic information than when they were provided with morphological + syntactic information only. The confidence interval showed that the population mean difference is likely (95%) to be found between $-.146$ and $-.076$.

The split-plot ANOVA analysis revealed that there was not a significant main effect of the factor of grammatical gender, F-value (1 – 103) of 0.703 ($p = 0.404$), indicating that the participants' accuracy in terms of attributing the grammatical gender of non-words/nouns in the second task was not affected by variation of the grammatical gender of the provided non-word/noun. In other words, there was no significant difference in participants' accuracy in attributing the grammatical gender of non-words/nouns in the second task when they processed masculine, feminine or neuter non-words/nouns.

The analysis on the factor of non-words/nouns' endings had no gravity on the interpretation of the results as an independent variable but only in relation to the factor of grammatical gender. This approach is explained by the design of the experiment. As stated in the methodology section, there are not two types of endings applied in all the three grammatical genders but rather two types of endings for each grammatical gender.

The split-plot ANOVA analysis revealed that the interaction between the factors of non-words/nouns' endings and the grammatical gender was significant, F-value (1 – 103) of 15.811 ($p < 0.001$). This interaction accounts for an effect size almost 13% of the total variance (partial Eta squared 0.133). The simple main effects of this interaction

were further investigated. In Table 107 the descriptive statistics are presented for all of the participants' performance according to the factor of non-words/nouns' endings and the factor of grammatical gender. The design of the experiment dictated the performance of three ANOVAs in order to investigate the interactions' simple main effects. Therefore, the first ANOVA investigated the difference between the two types of endings in terms of the level of masculine grammatical gender, the second in terms of feminine grammatical gender and the third in terms of neuter grammatical gender. It was not meaningful to investigate any difference between the three levels of grammatical gender in type 1 and type 2 endings, as these endings were different for each type of grammatical gender.

GenderMFN	Endings	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Masculine	$-\alpha\varsigma$	1.689	.038	1.613	1.765
	$-\eta\varsigma$	1.556	.044	1.469	1.643
Feminine	$-\alpha$	1.648	.041	1.566	1.730
	$-\eta$	1.651	.040	1.571	1.731
Neuter	$-o$	1.603	.034	1.536	1.670
	$-l$	1.721	.027	1.667	1.775

Table 107. Descriptive statistics for all of the participants' performance according to the factor of grammatical gender and type of endings in the second task.

The ANOVA analysis revealed that the main effect due to the type of endings (type 1: $-\alpha\varsigma$ and type 2: $-\eta\varsigma$) in the level of masculine grammatical gender was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, sphericity and homogeneity of variance were met. The results of the split-plot ANOVA are presented in Table 108. An F-value (1 – 104) of 10.450 ($p < 0.05$) represented an effect size (partial Eta squared) of .091, showing that nearly 9% of the variation in the number of correct answers in terms of the grammatical gender of the presented nouns in the second task for the level of masculine grammatical gender can be accounted for by differing the type of ending. The results suggest that in the second test the participants were more accurate in attributing the grammatical gender when they were dealing with non-words/nouns with $-\alpha\varsigma$ endings than with $-\eta\varsigma$ endings (means of 1.689 and 1.556 respectively).

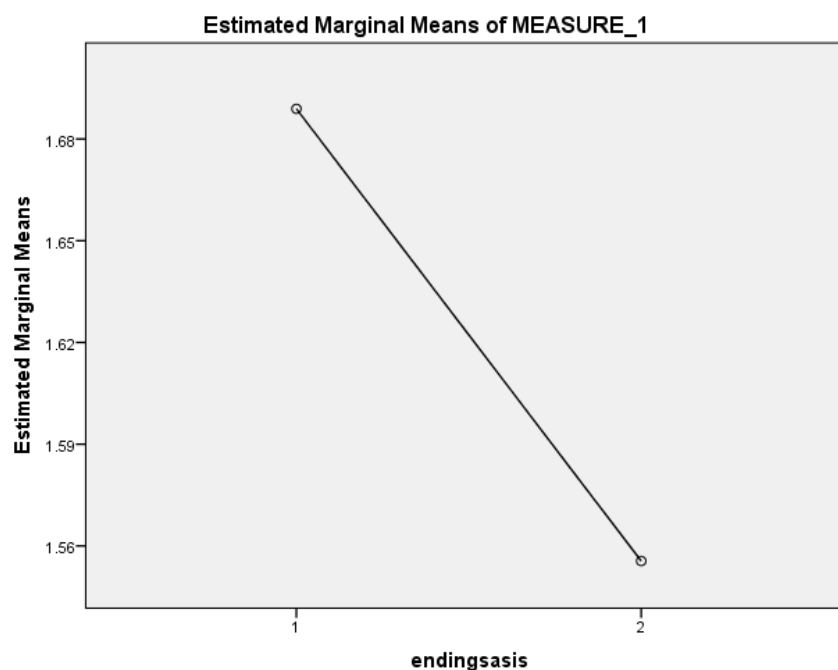
Source	Info	ENDINGSasis	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
ENDINGSasis	Linear		2.800	1	2.800	10.450	.002	.091
Error (ENDINGSasis)	Linear		27.867	104	.268			

Table 108. Split-plot ANOVA for the condition of masculine type of endings.

The confidence interval showed that the mean for the participants' performance in terms of non-words/nouns with $-\alpha\zeta$ endings is likely (95%) to be found between 1.613 and 1.765 and for the $-\eta\zeta$ endings between 1.469 and 1.643. In Table 109 the descriptive statistics are presented for all of the participants' performance at the level of masculine gender according to the type of endings ($-\alpha\zeta$ ending and $-\eta\zeta$ ending). These means are also presented in Graph 34.

ENDINGSasis	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
$-\alpha\zeta$	1.689	.038	1.613	1.765
$-\eta\zeta$	1.556	.044	1.469	1.643

Table 109. Descriptive statistics for all of the participants' performance at the level of masculine gender according to the type of endings.



Graph 34. Means for all of the participants' performance at the level of masculine gender according to the type of endings.

The ANOVA analysis revealed that the main effect due to the type of endings (type 1: $-l$ and type 2: $-o$) in terms of the level of neuter grammatical gender was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, sphericity and homogeneity of variance were met. The results of the split-plot ANOVA are presented in Table 110. An F-value (1 – 104) of 8.270 ($p < 0.05$) represented an effect size (partial Eta squared) of .074, showing that nearly 7% of the variation in the number of correct answers in terms of the grammatical gender of the presented nouns in the second task for the level of neuter grammatical gender can be accounted for by differing the type of ending. The results suggest that in the second task the participants were more accurate in attributing the grammatical gender when they were dealing with non-words/nouns with $-o$ endings than with $-l$ endings (means of 1.603 and 1.721 respectively).

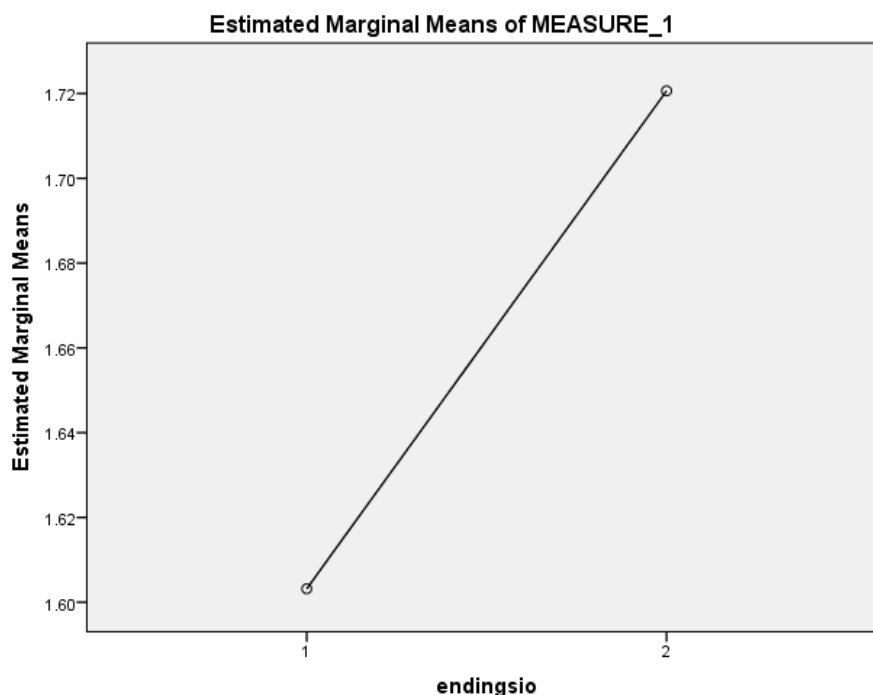
Source	Info	ENDINGS	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
ENDINGS		Linear	2.173	1	2.173	8.270	.005	.074
Error(ENDINGS)		Linear	27.327	104	.263			

Table 110. Split-plot ANOVA for the condition of neuter type of endings.

The confidence interval showed that the mean for the participants' performance in non-words/nouns with $-o$ ending is likely (95%) to be found between 1.667 and 1.775 and for the $-l$ ending between 1.536 and 1.670. In Table 111 the descriptive statistics are presented for all of the participants' performance at the level of neuter gender according to the type of endings ($-l$ ending and $-o$ ending). These means are also presented in Graph 35.

ENDINGSio	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
$-l$	1.603	.034	1.536	1.670
$-o$	1.721	.027	1.667	1.775

Table 111. Descriptive statistics for all of the participants' performance at the level of neuter gender according to the type of endings.



Graph 35. Means for all of the participants' performance at the level of masculine gender according to the type of endings.

The ANOVA analysis revealed that there was not a significant main effect of the factor of endings (type1: $-\alpha$ and type2: $-\eta$) in the level of feminine grammatical gender, F-value (1 – 104) of 0.006 ($p = 0.937$), indicating that the participants' accuracy in attributing the grammatical gender of non-words/nouns in the second task was not affected by the type of endings (type 1: $-\alpha$ and type 2: $-\eta$). In other words, there was no significant difference in the participants' accuracy in attributing the grammatical gender of non-words/nouns in the second task in the level of feminine grammatical gender when they processed nouns with $-\alpha$ ending or $-\eta$ ending.

The split-plot ANOVA analysis revealed that the interaction between the levels of Greek language competence and the grammatical gender of the non-words/nouns was not significant, F-value (1 – 103) of 0.703 ($p = 0.404$), indicating that the effect of the factor of grammatical gender was similar in both the condition of the beginners and advanced learners. Furthermore, the effect of the factor of Greek language competence was similar in each level of the grammatical level factor.

The interaction between the factors of the type of information provided and the grammatical gender was also not significant, F-value (1 – 103) of .012 ($p = 0.914$), indicating that the factor of grammatical gender behaves the same way at all levels of the factor of information provided. On the basis of this analysis there were no

differences between the effect of the factor of information provided at all three levels of the grammatical gender factor.

The interaction between the three factors (the levels of Greek language competence, the type of information provided and the grammatical gender) was not significant F-value (1 – 103) of 0.087 ($p = 0.768$), indicating that the effect of the type of information was similar in masculine, feminine and neuter nouns. This observation was confirmed for both the beginners and advanced learners. Furthermore, the effect of the grammatical gender factor was similar for all of the levels of information provided and this observation was confirmed for both the beginners and advanced learners. Finally, the factor of Greek language competence did not behave differently in each condition of two other variables: type of information provided and grammatical gender.

The split-plot ANOVA analysis revealed that the interaction between the levels of Greek language competence, the grammatical gender and the type of endings of the provided non-words/nouns was not significant, F-value (1 – 103) of 2.780 ($p = 0.098$), indicating that the observed differences between the endings of the nouns were the same for both levels of Greek language competence.

The split-plot ANOVA analysis revealed that the interaction between the levels of information provided, the grammatical gender and the type of endings of the provided non-words/nouns was not significant, F-value (1 – 103) of 1.633 ($p = 0.204$), indicating that the observed differences between the endings of the nouns in each grammatical gender were the same for all levels of the factor of information provided.

The split-plot ANOVA analysis revealed that the interaction between the levels of information provided, the grammatical gender, the levels of Greek language competence and the type of endings of the provided non-words/nouns was not significant, F-value (1 – 103) of 0.317 ($p = 0.575$), indicating that the observed differences between the endings of the nouns in each grammatical gender were the same for all levels of the factor of information provided. This observation was confirmed for both the beginners and advanced learners.

The split-plot ANOVA analysis revealed that the interaction between the factors of the type of information provided and the level of Greek language competence was not significant, F-value (1 – 103) of 7.097 ($p = 0.756$), indicating that in the second task the effect of the factor of information provided was similar in the condition of both the beginners and advanced learners. Furthermore, the effect of the factor of Greek language competence was similar in each level of the factor of information provided.

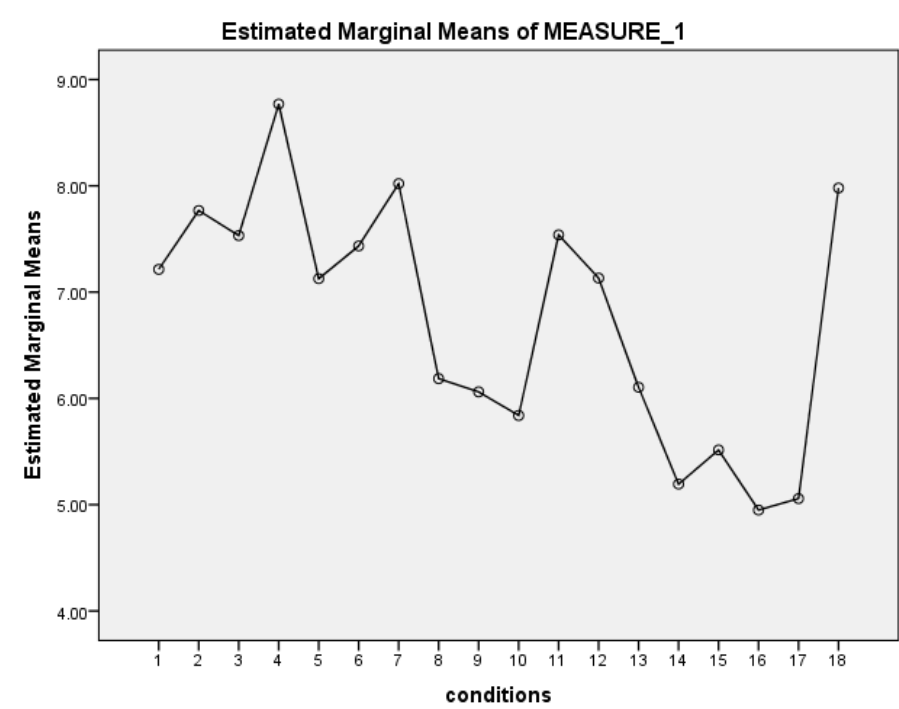
6.5 ANOVA for nouns in the second task and dependent variable reaction time

A statistical analysis on the second task was carried out in order to investigate any effects of the independent variables on the dependent variable. The independent variables were four. The first variable was information provided relating to the grammatical gender (morphological information, morphological + syntactic information and morphological + extensive syntactic information). The second variable was the nouns' grammatical gender (masculine, feminine and neuter). The third independent variable was the nouns' endings ($-\alpha\varsigma$, $-\eta\varsigma$, $-\alpha$, $-\eta$, $-\iota$ and $-o$). Finally, the last independent variable was the level of Greek language competence (beginner and advanced). Therefore, each participant was assessed in 18 conditions. In Table 112 the descriptive statistics are presented for all of the participants' performance in the 18 conditions in the second task with dependent variable the reaction time of participants' answers: non-word with gender ending $-\alpha\varsigma$ (BTmorphMas), non-word with gender ending $-\eta\varsigma$ (BTmorphMis), non-word with gender ending $-\alpha$ (BTmorphFa), non-word with gender ending $-\eta$ (BTmorphFi), non-word with gender ending $-\iota$ (BTmorphNi), non-word with gender ending $-o$ (BTmorphNo), masculine determiner + non-word with gender ending $-\alpha\varsigma$ (BTartMas), masculine determiner + non-word with gender ending $-\eta\varsigma$ (BTartMis), feminine determiner + non-word with gender ending $-\alpha$ (BTartFa), feminine determiner + non-word with gender ending $-\eta$ (BTartFi), neuter determiner + non-word with $-\iota$ (BTartNi), neuter determiner + non-word with $-o$ (BTartNo), masculine determiner + adjective with masculine ending $-os$ + non-word with ending $-\alpha\varsigma$ (BTsyntMas), masculine determiner + adjective with masculine ending $-os$ + non-word with ending $-\eta\varsigma$ (BTsyntMis), feminine determiner + adjective with feminine ending $-\eta$ + non-word with ending $-\alpha$ (BTsyntFa), feminine determiner + adjective with feminine ending $-\eta$ + non-word with ending $-\eta$ (BTsyntFi), neuter determiner + adjective with neuter ending $-o$ + non-word with ending $-\iota$ (BTsyntNi) and neuter determiner + adjective with neuter ending $-o$ + non-word with ending $-o$ (BTsyntNo). The descriptive statistics are also presented in Graph 36.

Language Competence		Mean	Std. Deviation	N
BTmorphMas	Beginners	7.8352	5.43110	61
	Advanced	6.3541	2.58148	44
	Total	7.2146	4.50687	105
BTmorphMis	Beginners	8.3736	5.05718	61
	Advanced	6.9283	4.18397	44
	Total	7.7679	4.74407	105
BTmorphFa	Beginners	8.0764	5.05362	61
	Advanced	6.7775	3.31491	44
	Total	7.5321	4.43758	105
BTmorphFi	Beginners	10.5616	17.71623	61
	Advanced	6.2846	2.72214	44
	Total	8.7693	13.73446	105
BTmorphNi	Beginners	7.7967	4.41502	61
	Advanced	6.1977	2.65131	44
	Total	7.1266	3.84453	105
BTmorphNo	Beginners	8.2155	7.70991	61
	Advanced	6.3514	3.05657	44
	Total	7.4344	6.24586	105
BTartMas	Beginners	10.2340	22.78938	61
	Advanced	4.9524	1.65937	44
	Total	8.0208	17.53920	105
BTartMis	Beginners	6.5070	4.05902	61
	Advanced	5.7406	3.75438	44
	Total	6.1858	3.93414	105
MTartFa	Beginners	6.3879	3.12862	61
	Advanced	5.6081	2.78796	44
	Total	6.0611	3.00171	105

BTartFi	Beginners	6.1044	3.03232	61
	Advanced	5.4716	3.33553	44
	Total	5.8392	3.16280	105
BTartNi	Beginners	8.6784	10.34615	61
	Advanced	5.9585	5.38655	44
	Total	7.5386	8.69312	105
BTartNo	Beginners	8.4816	12.27097	61
	Advanced	5.2598	1.80055	44
	Total	7.1315	9.52696	105
BTsyntMas	Beginners	7.2448	8.58723	61
	Advanced	4.5237	2.55144	44
	Total	6.1045	6.85960	105
BTsyntMis	Beginners	5.9905	6.40515	61
	Advanced	4.0881	1.55262	44
	Total	5.1933	5.05520	105
BTsyntFa	Beginners	5.6952	4.43837	61
	Advanced	5.2650	5.77185	44
	Total	5.5149	5.01842	105
BTsyntFi	Beginners	4.9606	3.00107	61
	Advanced	4.9331	7.24457	44
	Total	4.9491	5.18616	105
BTsyntNi	Beginners	5.8670	5.31567	61
	Advanced	3.9356	1.08155	44
	Total	5.0576	4.20740	105
BTsyntNo	Beginners	10.9021	28.21217	61
	Advanced	3.9286	1.47293	44
	Total	7.9799	21.72644	105

Table 112. Descriptive statistics for all of the participants' reaction times in the 18 conditions in the second task.



Graph 36. Mean reaction time for all of the participants in the 18 conditions in the second task.

As stated in the section on methodology, the experiment was a (3X3X2X) factorial four-way mixed analysis of variances. The reaction time of participants’ answers in terms of the presented non-words/nouns in the second task was analysed with a split-plot ANOVA. The level of Greek language competence was the between participants factor, this factor had two levels. The type of information provided was the first within participants factor. This factor had three levels. The second within participants factor was the grammatical gender and it had three levels. Finally, the third within participants factor was the ending of the nouns, two possible endings for each gender. The results of the split-plot ANOVA are presented in Table 113 for the within subjects and in Table 114 for the between subjects.

Source	INFO	GenderMFN	ENDINGS	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
INFO	Linear			1070.590	1	1070.590	12.727	.001	.110	12.727	.942
	Quadratic			2.008	1	2.008	.025	.874	.000	.025	.053
INFO * unilevel	Linear			8.701	1	8.701	.103	.748	.001	.103	.062
	Quadratic			.517	1	.517	.006	.936	.000	.006	.051
Error(INFO)	Linear			8664.348	103	84.120					
	Quadratic			8218.176	103	79.788					
GenderMFN	Linear			16.706	1	16.706	.194	.661	.002	.194	.072
	Quadratic			46.508	1	46.508	.690	.408	.007	.690	.130
GenderMFN * unilevel	Linear			47.290	1	47.290	.549	.461	.005	.549	.114
	Quadratic			205.577	1	205.577	3.049	.084	.029	3.049	.409
Error (GenderMFN)	Linear			8876.396	103	86.179					
	Quadratic			6945.527	103	67.432					
ENDINGS			Linear	4.080	1	4.080	.061	.805	.001	.061	.057
ENDINGS * unilevel			Linear	11.679	1	11.679	.175	.677	.002	.175	.070
Error (ENDINGS)			Linear	6892.023	103	66.913					
INFO * GenderMFN	Linear	Linear		44.124	1	44.124	.771	.382	.007	.771	.140
		Quadratic		109.078	1	109.078	1.703	.195	.016	1.703	.253
	Quadratic	Linear		.001	1	.001	.000	.997	.000	.000	.050
		Quadratic		113.906	1	113.906	2.009	.159	.019	2.009	.290
INFO * GenderMFN * unilevel	Linear	Linear		44.807	1	44.807	.783	.378	.008	.783	.142
		Quadratic		321.550	1	321.550	5.019	.027	.046	5.019	.602
	Quadratic	Linear		26.955	1	26.955	.273	.602	.003	.273	.081
		Quadratic		38.982	1	38.982	.687	.409	.007	.687	.130
Error(INFO* GenderMFN)	Linear	Linear		5893.372	103	57.217					
		Quadratic		6598.209	103	64.060					
	Quadratic	Linear		10153.19 ₄	103	98.575					
		Quadratic		5841.298	103	56.712					
INFO * ENDINGS	Linear		Linear	4.209	1	4.209	.076	.783	.001	.076	.059
	Quadratic		Linear	148.417	1	148.417	2.440	.121	.023	2.440	.340
INFO * ENDINGS * unilevel	Linear		Linear	.801	1	.801	.015	.904	.000	.015	.052
	Quadratic		Linear	167.274	1	167.274	2.750	.100	.026	2.750	.376

CHAPTER 6: RESULTS

Error(INFO* ENDINGS)	Linear	Linear	5688.399	103	55.227					
	Quadratic	Linear	6264.312	103	60.819					
GenderMFN * ENDINGS	Linear	Linear	143.986	1	143.986	1.734	.191	.017	1.734	.257
	Quadratic	Linear	.022	1	.022	.000	.983	.000	.000	.050
GenderMFN * ENDINGS * unilevel	Linear	Linear	266.205	1	266.205	3.206	.076	.030	3.206	.426
	Quadratic	Linear	13.853	1	13.853	.286	.594	.003	.286	.083
Error (GenderMFN* ENDINGS)	Linear	Linear	8553.341	103	83.042					
	Quadratic	Linear	4983.666	103	48.385					
INFO * GenderMFN * ENDINGS	Linear	Linear	168.325	1	168.325	2.184	.142	.021	2.184	.310
	Quadratic	Linear	64.313	1	64.313	1.058	.306	.010	1.058	.175
	Quadratic	Linear	4.658	1	4.658	.041	.839	.000	.041	.055
	Quadratic	Linear	29.789	1	29.789	.623	.432	.006	.623	.122
INFO * GenderMFN * ENDINGS * unilevel	Linear	Linear	98.780	1	98.780	1.282	.260	.012	1.282	.202
	Quadratic	Linear	123.213	1	123.213	2.027	.158	.019	2.027	.292
	Quadratic	Linear	15.975	1	15.975	.142	.707	.001	.142	.066
	Quadratic	Linear	16.133	1	16.133	.337	.563	.003	.337	.089
Error(INFO* GenderMFN* ENDINGS)	Linear	Linear	7937.019	103	77.058					
	Quadratic	Linear	6261.465	103	60.791					
	Quadratic	Linear	11586.34 3	103	112.489					
	Quadratic	Linear	4926.316	103	47.828					

a. Computed using alpha = .05

Table 113. Results of the split-plot ANOVA for the within subjects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
Intercept	79410.195	1	79410.195	397.018	.000	.794	397.018	1.000
LANG. COMP.	2199.378	1	2199.378	10.996	.001	.096	10.996	.907
Error	20601.693	103	200.016					

Table 114. Results of the split-plot ANOVA for the between subjects.

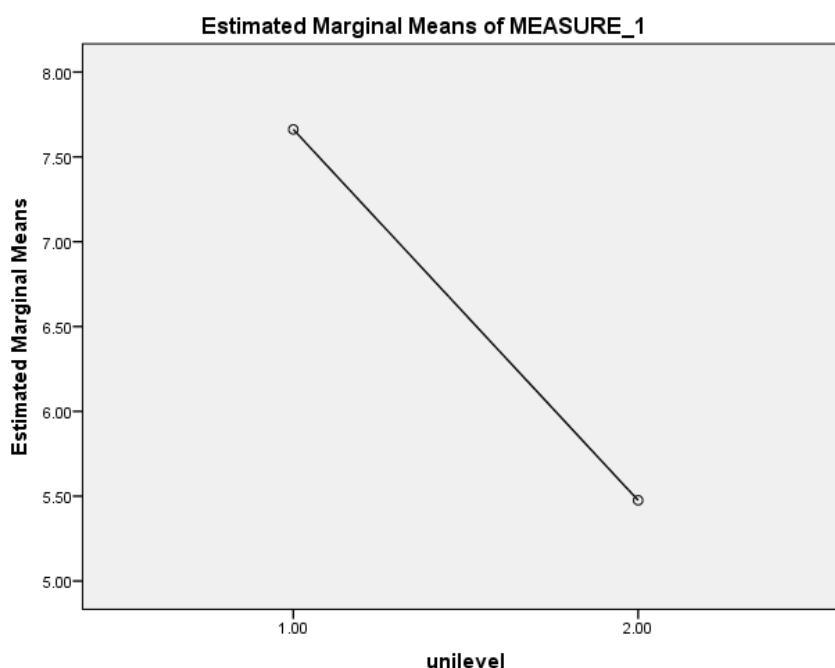
The split-plot ANOVA analysis revealed for the between participants comparison that the main effect due to the level of Greek language competence factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of

normality and homogeneity of variance were met. An F-value (1 – 103) of 10.996 ($p < 0.001$) represented an effect size (partial Eta squared) of .096, showing that nearly 10% of the variation in the participants' reaction time for their answers in the second test can be accounted for by differing the level of Greek language competence. The results suggest that in the second task the advanced learners needed less time to react in regard to attributing the grammatical gender of the presented non-words/nouns than the beginners (means of 5.475 sec and 7.662 sec respectively).

The confidence interval showed that the population mean for the beginners is likely (95%) to be found between 6.815 and 8.508 and for the advanced between 4.479 and 6.472 . In Table 115 the descriptive statistics are presented for all of the participants performance according to their level of Greek language competence. These means are also presented in Graph 37.

Language Competence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Beginners	7.662	.427	6.815	8.508
Advanced	5.475	.503	4.479	6.472

Table 115. Descriptive statistics for all of the participants' reaction times according to the level of Greek language competence in the second task.

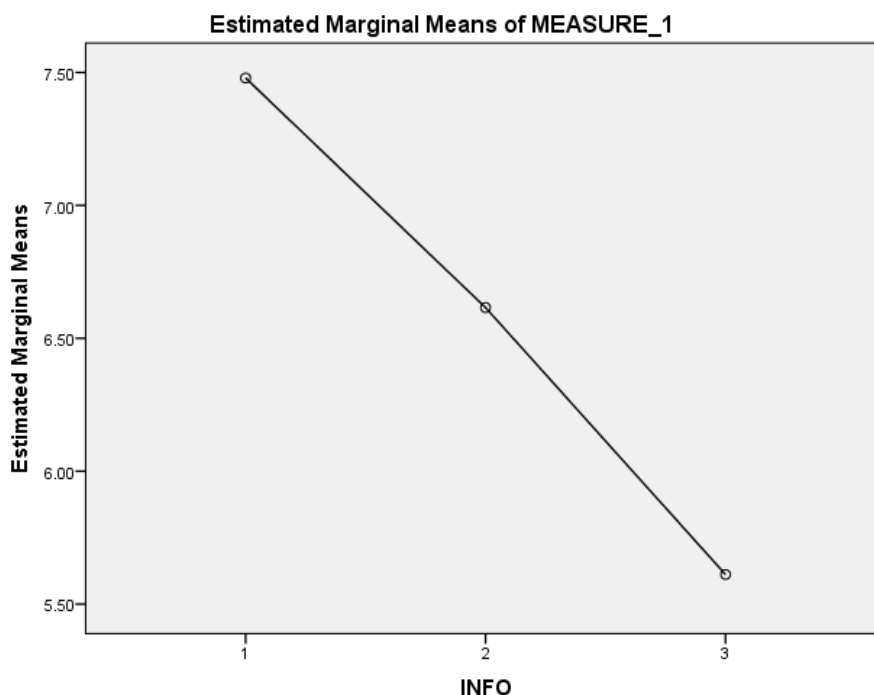


Graph 37. Mean reaction time for all of the participants according to their level of Greek language competence in the second task.

The split-plot ANOVA analysis revealed for the within participants comparisons that the main effect due to the type of information provided factor was unlikely to have arisen by sampling error, assuming the null hypothesis to be true. Assumptions of normality, homogeneity of variance and sphericity were met. In particular, the analysis for the main effect of the type of information provided revealed an F-value (1 – 103) of 12.727 ($p < 0.001$) and represented a significantly large effect size (partial Eta squared) of .110, showing that nearly 11% of the variation in the participants' reaction times for their answers in the second task can be accounted for by differing the type of information provided. The confidence interval showed that the population mean for the level of morphological information was 7.479 and was likely (95%) to be found between 6.677 and 8.282. For the level of morphological + syntactic information the mean was 6.615 and was likely (95%) to be found between 5.691 and 7.540. Finally, for the level of morphological + extended syntactic information-the mean was 5.611 and was likely (95%) to be found between 4.698 and 6.525. In Table 116 the descriptive statistics are presented for all of the participants' reaction times according to the factor of information provided. These means are also presented in Graph 38.

INFO	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Morphological information	7.479	.404	6.677	8.282
Morphological + syntactic information	6.615	.466	5.691	7.540
Morphological + extensive syntactic information	5.611	.461	4.698	6.525

Table 116. Descriptive statistics for all of the participants' reaction times according to the factor of type of information in the second task.



Graph 38. Mean reaction time for all of the participants according to the factor of type of information in the second task.

The factor of information provided had three levels. Therefore, three pairwise comparisons were carried out. The first comparison was between the levels of morphological information and morphological + syntactic information. The second comparison was between the levels of morphological information and morphological + extensive syntactic information. And the third comparison was between the levels of morphological + syntactic information and morphological + extensive syntactic information. These comparisons allowed all of the possible combinations to be analysed. In Table 117 information is presented for all of the participants' reaction times relating to the pairwise comparisons for the factor of information provided.

(I) Info	(J) Info	Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Morphological information	morphological+ syntactic information	.864	.466	.037	-.061	1.789
	morphological+ extensive syntactic information	1.868*	.524	.001	.830	2.907
Morphological + syntactic information	morphological information	-.864	.466	.037	-1.789	.061
	morphological + extensive syntactic information	1.004	.557	.074	-.100	2.108
Morphological + extensive syntactic information	morphological information	-1.868*	.524	.001	-2.907	-.830
	morphological + syntactic information	-1.004	.557	.074	-2.108	.100

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Table 117. Pairwise comparisons for the factor of type of information provided in the second task.

The mean difference between the levels of morphological information and morphological + syntactic information was .864, between the levels of morphological information and morphological + extensive syntactic information was 1.868* and finally, between the levels of morphological + syntactic information and morphological + extensive syntactic information was 1.004.

The Bonferroni test showed that the difference between the levels of morphological information and morphological + syntactic information was unlikely to have arisen by sampling error ($p < 0.05$). Therefore, it can be concluded that the participants reacted in significantly less time when they were provided with morphological + syntactic information than when they were provided with morphological information only. The confidence interval showed that the population mean difference is likely (95%) to be found between -.061 and 1.789.

Similarly, the Bonferroni test showed that the difference between the levels of morphological information and morphological + extensive syntactic information was unlikely to have arisen by sampling error ($p < 0.001$). Therefore, it can be concluded that the participants reacted in significantly less time when they were provided with morphological + extensive syntactic information than when they were provided with morphological clues only. The confidence interval showed that the population mean difference is likely (95%) to be found between $-.100$ and 2.108 .

In contrast, the analysis revealed for the third comparison that there was no significant difference between reaction times in terms of the levels of morphological + syntactic information and morphological + extended syntactic information. Therefore, it was likely for any difference to have arisen by sampling error ($p = 0.074$). It can be concluded that the participants reacted in similar times when they were provided with morphological + extensive syntactic information and when they were provided with morphological + syntactic information.

The split-plot ANOVA analysis revealed that there was not a significant main effect of the factor of grammatical gender, F-value (1 – 103) of 0.194 ($p = 0.661$), indicating that the participants' reaction time when attributing the grammatical gender of non-words/nouns in the second task was not affected by any variation in terms of the grammatical gender of the provided non-word/noun. In other words, there was no significant difference in the participants' reaction time when attributing the grammatical gender of non-words/nouns in the second task when they processed non-words/nouns with masculine, feminine or neuter gender-marked cues.

The analysis on the factor of non-words/nouns' endings had no gravity on the interpretation of the results as an independent variable but only in relation to the factor of grammatical gender. This approach is explained by the design of the experiment. As stated in the methodology section, there are not two types of endings applied in all the three grammatical genders but rather two types of endings for each grammatical gender. Absence of significant interpretation can be assumed for the interaction between the factors of endings of the nouns and Greek language competence. The same conclusions could be drawn for the interaction between the factor of endings of the nouns and the type of information provided as well as for the interaction between three factors; the type of information provided, the endings of the nouns and the level of Greek language competence. Finally, there is no need to investigate the interaction between all four independent variables as this contains the factor of the endings. This aforementioned

interpretation is valid for the interaction between the three factors (the factor of endings of the nouns, the factor of the grammatical gender and the type of information provided) as well as for the interaction between the endings of the nouns, the grammatical gender and Greek language competence.

The split-plot ANOVA analysis revealed that the interaction between the factors of the type of information provided and the level of Greek language competence was not significant, F-value (1 – 103) of 0.103 ($p = 0.748$). The non-significant interaction between those two variables indicates that the observed differences between the three levels of the factor of information provided are not different in beginners and advanced learners. Furthermore, the observed differences between the beginners and the advanced learners are not significantly different at any level of the factor of information provided. In other words, the advanced learners processed in less time the grammatical gender than the beginners and this was observed in terms of the provision of morphological information, morphological + syntactic information and morphological + extensive syntactic information. Also, the participants' less time in processing grammatical gender in the order of morphological + extensive syntactic information, morphological + syntactic information and morphological information is observed in beginners and the advanced.

The interaction between the factors of grammatical gender and Greek language competence was not significant, F-value (1 – 103) of 0.549 ($p = 0.461$), indicating that the observed differences between beginners and advanced learners is the same at all levels of the factor of grammatical gender. In other words the advanced learners correctly attributed grammatical gender in less time than the beginners when they processed non-words nouns with masculine, feminine or neuter grammatical gender-marked cues. Additionally, the non-significant differences in processing time between nouns with masculine, feminine or neuter grammatical gender was observed in both beginners and advanced learners.

The split-plot ANOVA analysis revealed that the interaction between the factors of non-words/nouns' endings and grammatical gender was not significant, F-value (1 – 103) of 1.734 ($p = 0.191$). This non-significant interaction in relation to the non-significant difference between the levels of endings, indicates that the participants processed in the same time the different endings for the masculine, feminine and neuter nouns.

The interaction between the factors of the type of information provided and the grammatical gender was also not significant, F-value (1 – 103) of 0.771 ($p = 0.382$), indicating that the factor of grammatical gender behaves the same way at all levels of the factor of information provided. On the basis of this analysis there was no difference between the effect of the factor of information provided at all three levels of the grammatical gender factor. In other words the participants requirements of less time in processing grammatical gender in the order of morphological + extensive syntactic information, morphological + syntactic information and morphological information was observed in terms of masculine, feminine and neuter nouns. Also, the non-significant differences in processing time between nouns with masculine, feminine or neuter grammatical gender was observed in all three levels of information provided.

The interaction between the three factors (the levels of Greek language competence, the type of information provided and the grammatical gender) was not significant, F-value (1 – 103) of 0.783 ($p = 0.378$), indicating that the effect of the type of information was similar in terms of masculine, feminine and neuter nouns. This observation was confirmed for both the beginners and the advanced learners. Furthermore, the effect of the grammatical gender factor was similar for all of the levels of information provided and this observation was confirmed for both the beginners and the advanced learners. Finally, the factor of Greek language competence did not behave differently in each condition relating to two other variables; type of information provided and grammatical gender.

Chapter 7: Discussion

7.0 Chapter overview

In the first section (7.1) of this chapter we summarise the findings of the present study. We offer an analysis of the results regarding accuracy and reaction times of participants according to quantity and quality of gender-marked cues (noun suffix, determiner, adjective) in the processing of novel nouns with unambiguous endings ($-\alpha\varsigma$, $-\eta\varsigma$, $-\alpha$, $-\eta$, $-o$, $-i$) and ambiguous endings ($-o\varsigma$). In section 7.2 we connect these results with models and theories of language processing; the model of Levelt et al. (1999), the model of Caramazza (1997), the Competition Model (MacWhinney 2005; 2008) and, finally, with the different theoretical accounts relating to processing grammatical gender in L2 (FFFH and MSIH). The aim of section 7.3 is to highlight the significant role of syntax in the processing of transparent nouns (7.3.1), in gender processing (7.3.2), and in learning input and production (7.3.3). The variable level of Greek language competence will be discussed with regard to all results. In the final section (7.4) we comment on the potential limitations of the present study and offer possible directions for further research.

7.1 Summary of findings

Below is a summary of the results of the two experimental tasks relating to accuracy and reaction times in the processing of novel nouns with unambiguous endings ($-\alpha\varsigma$, $-\eta\varsigma$, $-\alpha$, $-\eta$, $-o$, $-i$) and ambiguous endings ($-o\varsigma$) according to quantity and quality of gender-marked cues (noun suffix, determiner, adjective).

7.1.1 Experimental task 1: Accuracy and reaction times for processing unambiguous endings

The findings of the first task reveal for both dependent variables (accuracy and reaction time) significant main effects of the factors of Greek language competence and type of information provided. The factor of grammatical gender, as was assumed and confirmed, does not have any significant effect.

In particular, advanced Greek language learners are more capable of correctly processing the grammatical gender of the presented non-words than beginners (means of 1.688 and 1.515 respectively). Regarding the factor of type of information provided there is a significant main effect with a significantly large effect size (partial Eta squared) of .835, showing that nearly 84% of the variation in the number of correct answers in the grammatical gender of the presented non-words in the first task can be

accounted for by differing the type of information provided. Analytically, the results indicate that L2 Greek learners' performance is more accurate in terms of processing the grammatical gender of novel words when they are provided with morphological + syntactic information (determiner + noun suffix) than when they are only provided with morphological gender cues via the noun suffix. In addition, the L2 Greek learners' performance is more accurate when they are provided with morphological + extensive syntactic information (determiner + adjective + noun suffix) than when they are only provided with morphological gender cues via the noun suffix. Finally, the L2 Greek learners' performance is more accurate when they are provided with morphological + extensive syntactic information (determiner + adjective + noun suffix) than when they are provided with morphological + syntactic information (determiner + noun suffix).

Regarding the factor of grammatical gender the analysis reveals that there is no significant difference in L2 Greek learners' accuracy in processing the grammatical gender of non-words in the first test when they process masculine, feminine or neuter non-words.

The type of the endings was not analysed regarding a main effect, as was explained in the results section of this thesis, because this analysis is irrelevant (masculine, feminine and neuter non-words have different endings). However, a significant interaction between the factors of type of endings and the grammatical gender is nevertheless observed. Further exploration reveals that in terms of the first test L2 Greek learners are more accurate in processing the grammatical gender when they are dealing with masculine non-words with $-\alpha\varsigma$ endings than with $-\eta\varsigma$ endings (means of 1.635 and 1.505 respectively). This may be attributed to the fact that the phoneme $/-a/$ is present in the masculine nominative ($-\alpha\varsigma$) and accusative ($-\alpha$), feminine nominative and accusative ($-\alpha$) and in the neuter nominative and accusative endings ($-\mu\alpha$). In addition, the L2 Greek learners are more accurate in processing the grammatical gender when they were dealing with non-words with $-o$ endings than with $-i$ endings (means of 1.508 and 1.625 respectively). This may be attributed to the fact that the phoneme $/-o/$ is present in masculine nominative ($-o\varsigma$) and accusative ($-o$) and in the neuter nominative and accusative endings ($-o$).

All other interactions are not significant, indicating the importance of the type of information provided and the level of Greek language competence.

Analysis of the second dependent variable, that of time reaction, in the first task reveals similar results to the first dependent variable, that of accuracy. Advanced Greek

language learners need less time to process the grammatical gender of the presented non-words than beginner learners (means of 13.119 sec and 16.188 sec respectively). Also, analysis of the main effect of the type of information provided reveals a significant main effect with a medium effect size (partial Eta squared) of .263, showing that nearly 26% of the variation in the L2 learners' reaction times for their answers in the first test can be accounted for by differing the type of information provided. The L2 Greek learners react in less time when they are provided with morphological + syntactic information (determiner + noun suffix) than when they are provided only with morphological information via the noun suffix. They react in less time when they are provided with morphological + extensive syntactic information (determiner + adjective + noun suffix) than when they are provided only with morphological gender cues via the noun suffix. Finally, they also react in less time when they are provided with morphological + extensive syntactic information (determiner + adjective + noun suffix) than when they are provided with morphological + syntactic information (determiner + noun suffix).

The factor of grammatical gender does not have any significant effect indicating that there is no significant difference in L2 Greek learners' reaction times when processing the grammatical gender of non-words in the first task, when they process masculine, feminine or neuter non-words.

No interaction is significant as it indicates the importance of the type of information provided and the level of Greek language competence.

7.1.2 Experimental task 2: Accuracy and reaction times for processing unambiguous endings

The analysis of the second task reveals identical results to those found in the first task. Advanced Greek language learners are thus more capable of correctly processing the grammatical gender of the presented non-words than beginners (means of 1.726 and 1.586 respectively). Regarding the factor of type of information provided there is a significant main effect with a significantly large effect size (partial Eta squared) of .775, showing that nearly 78% of the variation can be accounted for by differing the type of information provided. Analytically, the results indicate that L2 Greek learners' performance is more accurate in processing the grammatical gender of non-words when they are provided with morphological + syntactic information (determiner + noun suffix) than when they are provided only with morphological gender cues via the noun suffix. The L2 Greek learners' performance is also more accurate when they are

provided with morphological + extensive syntactic information (determiner + adjective + noun suffix) than when they are only provided with morphological gender cues via the noun suffix. Finally, the L2 Greek learners' performance is more accurate when they are provided with morphological + extensive syntactic information (determiner + adjective + noun suffix) than when they are provided with morphological + syntactic information (determiner + noun suffix).

Regarding the factor of grammatical gender the analysis reveals that there is no significant difference in L2 Greek learners' accuracy in terms of processing the grammatical gender of non-words in the second task when they process masculine, feminine or neuter non-words.

The type of the endings was not analysed regarding a main effect, as was explained in the results section of this thesis, because this analysis is irrelevant (masculine, feminine and neuter non-words have different endings). Analysis of the second task does reveal, however, a significant interaction between the factors of type of endings and the grammatical gender. Further exploration reveals that in the second task the L2 Greek learners are more accurate in processing the grammatical gender when they are dealing with masculine non-words with $-\alpha\varsigma$ endings rather than with $-\eta\varsigma$ endings. Also, they are more accurate in processing the grammatical gender when they are dealing with neuter non-words with $-o$ endings than with $-ι$ endings.

All other interactions are not significant, indicating the importance of the type of information and the level of Greek language competence.

Analysis of the second dependent variable (time reaction) in the second task reveals identical results to the first task. In particular, advanced Greek L2 learners need less time to react in regard to processing of the grammatical gender of the presented non-words than the beginner learners. Also, the L2 Greek language learners react in less time when they are provided with morphological + syntactic information (determiner + noun suffix) than when they are only provided with morphological gender cues via the noun suffix. They also react in less time when they are provided with morphological + extensive syntactic information (determiner + adjective + noun suffix) than when they are only provided with morphological gender cues via the noun suffix. Finally, they react in less time when they are provided with morphological + extensive syntactic information (determiner + adjective + noun suffix) than when they are provided with morphological + syntactic information (determiner + noun suffix).

The factor of grammatical gender does not have any significant effect indicating that there is no significant difference in the L2 Greek learners' reaction times when processing the gender of novel words in the second task regardless of whether they process masculine, feminine or neuter non-words.

No interaction is significant, indicating the importance of the type of information and the level of Greek language competence.

7.1.3 Experimental tasks 1 and 2: Accuracy and reaction time for processing ambiguous endings with only morphological information provided

As mentioned in the methodology chapter the experiment consisted of non-words with various endings. One special category of stimuli consisted of non-words with *-ος* endings (morphological information) with no other type of information provided (e.g., syntactic information via the gender-marked determiner and/or adjective).

According to Greek grammars and linguistic scholarship, non-words ending in *-ος* can be correctly classified as masculine, feminine or neuter (Τριανταφυλλίδης, 1996; 2002; Ralli, 2002; 2003; Χριστοφίδου, 2003; Αναστασιάδη-Συμεωνίδη & Χειλά-Μαρκοπούλου, 2003; Holton et al., 2004). Therefore, the design of the experiment requires that the responses to these stimuli consist of categorical data, dictating that the only appropriate statistical analysis is measurement of the probability of association (Robson, 2002) or the independence of facts (Dancey & Reidy, 2002). The characteristics of the aforementioned type of analysis indicates three separate statistical analyses (one for each non-word; *‘δανύβος’*, *‘γεθάδος’* and *‘γεχάθος’*) for the first task and three for the second task. The analysis reveal the same tendency for the three stimuli of the first task. There is a significant difference between the observed and expected frequencies. This leads us to the conclusion that the assignment/processing of pseudo-words as masculine, feminine or neuter is not equal — except the morphological ending is *-ος* — when no other syntactic (determiner and/or adjective) or semantic information is provided. The participants in this study therefore processed the non-words with *-ος* endings as masculine nouns. The same findings are replicated for the second task.

7.1.4 Experimental task 1: Accuracy and reaction times for processing ambiguous endings with morphological and syntactic information provided

An ANOVA was carried out for non-words with *-ος* endings which were implemented in stimuli containing additional gender-marking information (gender-marked determiners and adjectives). For the first task the analysis reveals significant main

effects for the factors of grammatical gender, type of the information provided and the level of Greek language competence.

The results suggest that in the first test the advanced Greek L2 learners are more capable of correctly processing the grammatical gender of nouns with *-oς* endings than the beginners (means of .883 and .776 respectively). There are more correct answers when morphological + extensive syntactic information (determiner + adjective + noun ending) is provided than when only morphological + syntactic information (determiner + noun ending) is provided (means of .893 and .765 respectively). The significant main effect of the grammatical gender factor indicates that L2 Greek learners perform better when they process masculine nouns with *-oς* endings than when they process feminine nouns with *-oς* endings. Additionally, they perform better when they process masculine nouns with *-oς* endings than when they process neuter nouns with *-oς* endings. Finally, the difference between the feminine and neuter levels is not significant, indicating that only the masculine grammatical gender has an effect on the learners' performance. The analysis for any interaction reveals that the gender effect is present in all conditions; for beginners and advanced learners, as well as in both conditions of syntactic information and extended syntactic information. Furthermore, advanced learners perform better in all experimental conditions. Finally, the advantage of the type of information provided was present in all conditions.

The gender effect can be easily interpreted if we consider our analysis on the condition of non-words with *-oς* endings with no other type of information provided (gender-marked determiner and/or adjective). The participants processed nouns with *-oς* endings as masculine and this effect is present even in stimuli with clearly indicated grammatical gender. This tendency is attributed to the effect of frequency. However, the significant effect of the type of information provided indicates that any additional gender-marked information (determiner and/or adjective) is used effectively by the L2 learners. They use this information in order to overcome the existed ambiguity of the *-oς* ending. The frequency effect is also evident in both advanced and beginners L2 learners, indicating that they make use of this information very early on. However, the advanced learners' advantage does have a measurable effect due to their greater exposure to the Greek language.

Analysis of the second dependent variable, reaction time, reveals similar findings. Advanced L2 Greek learners need less time in processing the grammatical gender of nouns with *-oς* endings than beginners (means of 13.727 and 16.484 respectively). The

processing time is less when morphological and extensive syntactic information (determiner + adjective + noun suffix) is provided than when only morphological and syntactic information (determiner + noun suffix) is provided (means of 13.058 and 17.154 respectively). However, the effect of grammatical gender is not significant, indicating that L2 learners need the same time in order to process masculine, feminine or neuter nouns with *-ος* endings. They do not rely on morphological information in regard to the processing time. The participants seem to decide upon the grammatical gender of the provided noun faster as the informative cues are increased. The frequency effect of the *-ος* ending (Χριστοφίδου, 2003; Αναστασιάδη-Συμεωνίδη, 2012) seems to be eliminated in regard to second thoughts. L2 learners appear come up with a decision and turnovers are not observed. The explanation of the second thoughts could interpret the contradictions between this finding and the results of the first dependent variable analysis. The analysis for interactions is not significant, indicating that the tendency of the main effects is not affected by other factors. Advanced learners are faster in all conditions and the effect of the type of information provided is significant under any condition. Thus, it can be concluded that the availability of a factor/cue enables L2 learners to overcome any disturbance caused by the ambiguity of the ending. Thus they rely more on syntactic than on morphological information.

7.1.5 Experimental task 2: Accuracy and reaction times for processing ambiguous endings with morphological and syntactic information provided

The results for the second experimental task are identical to the first task with regard to the first dependent variable, revealing a significant main effect of the type of information, the grammatical gender and the level of Greek language competence. However, a significant interaction between the factor of grammatical gender and the factor of type of information is also observed.

In particular, in the experimental condition of morphological and syntactic information (determiner + noun suffix) the L2 learners perform better when they are processing nouns with masculine grammatical gender than when they are processing nouns with feminine or neuter grammatical gender. Also, they perform better when they are processing nouns with feminine grammatical gender than when they are processing nouns with neuter grammatical gender. In the experimental condition of morphological and extensive syntactic information (determiner + adjective + noun suffix) the L2 learners perform better when they are processing nouns with masculine grammatical gender than when they are processing nouns with feminine grammatical gender.

Furthermore, there is no simple main effect of grammatical gender when they are processing nouns with masculine or neuter grammatical gender. The same observation, no difference between feminine and neuter nouns, is established by the t-tests comparison. These findings indicate that the frequency effect of the ambiguous *-ος* ending is diminished when additional gender-marked information is provided (e.g., determiner and adjective). This explains why there is no difference between masculine and neuter nouns in the condition of extensive syntactic information. The difference between masculine and feminine nouns can be explained on the basis of similar use in nouns describing professions (*ο/η γιατρός* ‘doctor’).

The findings of the analysis for the second dependent variable (reaction time) have important but interpreted differences. In particular, as in first task the advanced L2 Greek learners need less processing time in attributing the grammatical gender of nouns with *-ος* endings than the beginners (means of 5.402 and 7.702 respectively). The processing time is less when morphological and extensive syntactic information (determiner + adjective + noun suffix) is provided than when only morphological and syntactic information is provided (determiner + noun suffix) (means of 5.661 and 7.443 respectively). However, in contrast to the first task the factor of grammatical gender has a significant main effect on the dependent variable of reaction time. Even though the effect size (partial Eta squared) is relatively small an interpretation can easily be extracted. In detail, L2 learners need less processing time when they processed masculine nouns with *-ος* endings than when they process feminine nouns with *-ος* endings. They also need less processing time when they process masculine nouns with *-ος* endings than when they process neuter nouns with *-ος* endings. Finally, they appear to need the same processing time either when they process feminine nouns with *-ος* endings or when they process neuter nouns with *-ος* endings. This tendency is observed mainly because of the experimental nature of the second task. The experiment required switching between two languages. This process allows a second evaluation further to the processing during stimulus presentation. This time and procedural gap allows for the emergence of the grammatical gender effect. However, the dominant effect of the type of information on reaction time and gender accuracy indicates that extended gender informative cues play the most significant role in processing nouns with grammatical gender ambiguous endings.

7.2 Connection of the present results with models and theories of language processing

7.2.1 The model of Levelt et al. and the model of Caramazza

Levelt et al. (1999) and Caramazza (1997) claim that grammatical gender is an inherent property of the noun lemma. The selection of a specific lemma and consequently the assignment of a noun to a specific gender node is directed and eventually connected to specific properties. The information provided during the stimulus presentation indicates and directs the connection with a specific gender node. In other words, when the stimulus contains additional syntactic information (gender-marked determiner + adjective), the process of selecting the appropriate lemma and assigning/processing the specific noun to a gender node is directed and facilitated by the available information. The more information provided and the nature of the gender transparency cues, the more accurate and faster the selection of the appropriate gender node. When the presented non-word contains a gender-marked ending which is syntactically linked with a specific gender-marked determiner and an adjective, the probability of assignment to the appropriate gender node is greater than when only the noun ending is provided. This explains the advantage of the provided morphological and extensive syntactic information (determiner + adjective + noun ending) against the other two conditions (noun ending or determiner + noun ending).

Additionally, according to the theory, all nouns of the same grammatical gender are linked to the same gender node, and the gender node of the target noun is linked to all agreement targets of the same gender. Therefore, in the case of the provided morphological and extensive syntactic information (determiner + adjective + noun ending) in the present experiment, the relevant gender node is activated for the noun, the determiner and the adjective at the same time. In contrast, during the experimental condition when only the noun ending gender is provided as the stimulus, the activation of the targeted gender node is limited. As in the conceptual stratum of Levelt et al.'s (1999) model, the selection of the appropriate lemma is performed on purely syntactic properties, the selection of the appropriate gender node is facilitated by this information and process, and, analogically is performed on relevant principals. Furthermore, the model indicates that not all the lexical-syntactic properties of the lemma are selected every time the corresponding lemma is selected but rather the most necessary properties. Levelt and his colleagues state that 'the gender of a selected lemma only becomes selected when actually needed in the local syntactic environment of the noun'

(Schriefers & Jescheniak, 1999, p. 578). Stimuli containing extensive gender-marked syntactic cues (e.g., determiners and/or adjectives) expose consideration of the grammatical gender as an essential factor and, therefore, dictate the use of all of the relevant information.

In relation to the second task it has to be noted that since the task does not allow the use of any semantic information, the lemma of the presented noun is created using only information in Greek. The answer is required to be given in English. Therefore, according to the structure of gender in English, the lemma will determine the use of the appropriate pronoun. In other words, the answer in English reflects the assignment of gender based only on information in Greek.

In relation to the architectural layout of the model proposed by Caramazza (1997) there are no significant differences to the model of Levelt et al. (1999). However, the retrieval processes and, especially, the ordering of stages are different in relation to the function of the lemma and the word form stage. According to this perspective, the advantage of the morphological and extensive syntactic cues (determiner + adjective + noun ending) can be explained as a standard procedure of processing the available syntactic information in parallel to the lemma. As this model does not contain a feed forward principle, the processing of syntactic information is not limited but rather a standard procedure. Taking into consideration the extent of the gender related syntactic information, we can easily explain the positive effect of the process on gender assignment accuracy and reaction time.

7.2.2 The Competition Model

Levelt et al. (1999) and Caramazza (1997) claim that grammatical gender is an inherent property of the noun lemma. According to this theory, NS do not rely on extended gender cues and gender assignment is correctly attributed using the minimum of available gender-marked information. However, in children and, especially, in L2 learners a greater availability of cues has been shown to be highly important (Carroll, 1999).

MacWhinney (2005; 2008) proposes a unified model of linguistic and cognitive systems shared in L1 and L2. This is a logical decomposition of ‘the general problem of language learning into a series of smaller, but interrelated components’ (MacWhinney, 2005, p. 70). The model is based on the idea of a system, which activates cues according to their reliability and availability. The key concept, competition, is viewed as a reasoning procedure as well as cue summation (MacWhinney, 2005). This

perspective supports the findings of the present study. As the L2 learners do not fully master Greek language, they need the maximum amount of available gender-marked information. Therefore, they rely heavily on the availability of extended gender-marked cues.

In relation to the findings of the present study, interpretation of the results can be based on the idea of activation of cues according to their reliability and strength. The more reliable and available the gender-marked cues (noun suffix, determiners, adjectives) are, the higher the probability of activation. Studies in bilinguals and L2 learners (Kilborn & Ito, 1989; Carroll, 1999) reveal that they differ from monolinguals in regard to the use of gender cues. Bilinguals and L2 learners are sensitive to gender cues ‘when cues are used by parsers to facilitate and speed up parsing’ (Carroll, 1999, p. 43). The experimental condition of morphological and extensive syntactic cues (determiner + adjective + noun ending) provides more opportunity to activate and select the appropriate gender node than the other two experimental conditions (noun ending and determiner + noun ending). L2 learners extract grammatical information from the morphological properties of the noun but the processing and, therefore, the production, is highly improved by related gender information located in the determiner and the morphology of the adjective. The additional information not only confirms the possible evaluation based on the noun but also facilitates the whole process. In other words L2 learners will process gender by relying on the noun but will make full use of the additional information. This tendency is not observed in NS, as the gender information in the noun suffix is a reliable factor for gender attribution. The additional information does not provide essential confirmation for their evaluation. It must be noted here that L2 learners make use of the available morphological information (noun suffix). This is obvious in the extraction of relevant information from the noun’s suffix but also from the adjective’s suffix. However, the crucial factor is the quantity of the information.

Furthermore, analysis reveals that there is no significant interaction between the factor of the Greek language competence and the factor of type of information provided. As previous literature has indicated, L2 learners never fully master grammatical gender. It was thus expected and confirmed that there would be no significant interaction between the two aforementioned variables. Although advanced L2 learners do have higher capacities than beginner learners, they will never fully master grammatical gender. Advanced learners, therefore, still rely on the availability of grammatical gender cues. In other words, they show the same tendencies as beginners. Nevertheless, the

analysis also reveals that the main effect of the type of information provided is not the same in beginners and advanced learners. Advanced learners use morphological gender-marked cues within the noun more effectively than beginners and they rely less on extended gender-marked cues. However, in conditions of learning a new word these cues remain a significant facilitative factor.

In relation to reaction times the same interpretations as those made in terms of accuracy can be applied. However, a clarification is necessary for the observed high requirement processing time in the experimental condition of morphological information (noun suffix). L2 learners need more time to process nouns when the only available information is the noun suffix not because they cannot process grammatical gender information but rather because the non-transparent gender information forces them to evaluate and readjust their decisions regarding the grammatical gender of the noun. According to the Competition Model, the availability and reliability of the gender related information allows them to come up with a reliable decision on the gender of the noun in less time than when more gender information is provided via gender-marked determiners and adjectives.

In summary, the key concept of the model is based on the idea of a strategic plan achieved mainly on resonance. Therefore, the incorporation of extensive syntactic cues (determiner + adjective + noun ending) is an ideal environment for accurately processing and assigning grammatical gender. This tendency is not observed in NS, as the reliability of the extracted information from the noun morphology is sufficient to minimise the processing time and accurately assign grammatical gender.

7.2.3 Theoretical approaches with regard to processing grammatical gender in L2 (deficit – accessibility account): The problem of morphology

The present findings will be connected with the different theoretical approaches of L2 gender processing (reviewed in section 4.1) which argue that L2 learners' difficulty with gender processing may reflect impaired syntactic representations or problems in morphological realisation due to performance problems.

Our findings do not indicate lack of, or impairment in, underlying morphosyntactic competence in UG, such as proposed by deficit theories like the RDH (Hawkins, 2009) and FFFH (Hawkins & Chan, 1997; Hawkins, 1998; Hawkins & Franceschina, 2004) (see also Smith & Tsimpli, 1995; Tsimpli & Roussou, 1991 for similar proposals). According to the RDH, FFFH and the results of several observational studies, after the critical period adult L2 learners are no longer able to

acquire abstract grammatical features such as gender, when it is not available in their L1 (Carroll, 1989; Hawkins & Chan, 1997; Hawkins & Franceschina, 2004; 2005). For example, Franceschina (2001; 2005) and Hawkins & Franceschina (2004) suggest that L1 English speakers do not exhibit a facilitate effect of gender-marked determiners as their L1 lacks uninterpretable gender features (Chomsky, 2000; 2001; 2002; Carstens, 2000) on determiners and adjectives. They can only learn the genders of nouns to the extent that a noun's form provides cues to its gender. Carroll (1989) also argues that the conceptual and lexical knowledge of adult L1 English L2 learners of French 'overrides' the phonological status of determiners and other gender-marked clitics due to their linguistic and cognitive maturity.

The participants of the present study are adult L2 learners of Greek whose L1 is English, a language which is unmarked in lexical nouns, determiners and adjectives, but still marked in pronouns. However, the accuracy rates and the RTs of the present study indicate that L2 learners of Greek are able to use the uninterpretable gender feature (*ugender*)¹ of determiners and/or adjectives in order to process accurately and quickly the interpretable gender of the presented novel nouns. Although gender is not marked on nouns, determiners and adjectives in their L1, they process accurately the morphological and extensive syntactic information (determiner + adjective + noun suffix) or the morphological and syntactic information (determiner + noun suffix) or even merely the morphological information provided. These findings are in contrast with all the aforementioned theoretical accounts and studies, and indicate that English L1 learners of gendered languages are able to accurately use the uninterpretable gender features of the agreeing elements which are encoded in the determiners and adjectives of a L2 in order to process the gender of new novel nouns.

This can be firstly explained by the Competition Model according to which L2 learners, like children, benefit from the presence of more than cues. Secondly, most of the FFFH studies used familiar nouns. As a result the L1 English learners of L2 gender in these studies were able to accurately process the interpretable gender feature of nouns by relying mostly on their endings, most probably due to familiarity and not the uninterpretable gender features of the agreeing elements such as determiners. Thus, the

¹ In section 2.1.2 we explain that gender represents an interpretable feature of nouns [\pm feminine], while it is an uninterpretable (e.g., *ugender*) (formal) feature in determiners and adjectives, which must be checked through agreement (Chomsky, 1995; Carstens, 2000). In minimalistic terms, gender agreement relies on checking or matching gender relations between the noun's interpretable gender class and uninterpretable gender features on determiners and adjectives, deleting the latter (e.g., Bernstein, 1993; Carstens, 2000).

use of familiar nouns is less reliable than the use of novel nouns in a study such as this because they do not reveal the participants' underlying system. Hence, this is why we use novel nouns in the present study. Our results indicate that L2 learners perform better when they are presented a novel noun accompanied by morphological and extensive syntactic information (determiner + adjective + noun suffix). This leads us to the conclusion that L1 English learners are able to activate more accurately the gender node of a novel noun (lexical knowledge) when gender-marked cues such as determiners, via gender agreement, and adjectives are provided.

However, the present results do seem to be in line with the MSIH (Haznedar & Schwartz, 1997; Prévost & White, 1999; 2000; Lardiere, 2000) which attributes L2 morphological errors to problems with mapping from abstract features to their surface morphological manifestation rather than impaired underlying syntactic representations. The studies which support MSIH, especially the L2 Greek studies, (Τσιμπλή, 2003; Tsimpli et al., 2005; Dimitrakopoulou et al., 2006; Agathopoulou & Papadopoulou, 2011; Agathopoulou et al., 2008; Montrul et al., 2008; Alarcón, 2011) have mainly examined L2 oral production which is always affected by the pressure of real-time processing. Thus, it 'remains unclear whether persistent difficulty with grammatical gender in production is really a production-specific problem, or whether it might be a result of difficulty with the retrieval of gender information in real-time language use' (Grüter et al., 2012, p. 195).

In this study both of the experimental tasks were written in such a way as to limit the pressure from real-time processing. Despite this methodological characteristic, the present findings do nevertheless demonstrate low-accuracy rates and high RTs when L2 learners are provided with only morphological information, that is, the noun suffix (*είναι μπεζ δανύβος*). In contrast, when they are provided with additional cues/information such as gender-marked determiners and/or adjectives they perform better (*ένας κόκκινος δανύβος*). These results complement the MSIH by indicating that morphology not only represents a mapping problem (Lardiere, 2000) but also does not represent such a valid cue in the processing of gender in L2 as gender-marked determiners and adjectives. Although in all of the previous L2 Greek gender processing studies (Τσιμπλή, 2003; Tsimpli et al., 2005; Dimitrakopoulou et al., 2006; Agathopoulou & Papadopoulou, 2011; Agathopoulou et al., 2008) the participants were NS of gendered languages and mastered adjective–noun agreement gradually, any

difficulties that they face are in fact due to insufficient knowledge of their L2 required morphology.

Therefore, in line with MSIH, our findings suggest that any representational ‘deficits’ lie in morphology, rather than syntax. The morphological information provided via noun suffix of the presented novel words did not improve processing in production (task 1) and classification of the noun in terms of the appropriate gender class (task 2) as much as the gender-marked information provided via the gender agreement of determiner + adjective + noun suffix. Furthermore, the quantity of gender-marked cues seems to play a crucial role in production. Increasing the available gender-marked cues has a positive effect on the appropriate processing of the gender of novel nouns. Thus, while the reported problems found with the aforementioned theories (FFFH and MSIH) might still exist, their effects seem to be reduced or even overcome when additional reliable gender information is incorporated. However, it must be noted that the measuring technique followed and the methodology used in these studies could easily overlook significant factors, especially during gender processing of novel nouns.

Overall, in our experimental tasks the participants, as NS of a language where nouns are not gender-marked, are able to classify a noun to a specific gender node by being provided only with the noun ending. However, their performance is improved when syntactic information is added to the stimulus via gender-marked determiners and adjectives. Making even stronger our argument for the importance of syntactic information in L2 gender processing, especially for learners whose L1 does have grammatical gender, we highlight Alarcón’s (2009) argument that learners whose L1 does not have grammatical gender do not rely on morphology while ‘morphology is a more reliable cue for native speakers of inflectionally rich languages like Spanish’ (Alarcón I., 2009, p. 822). This conclusion is consistent with Sabourin et al.’s (2006) argument, stating that the morphological similarity of gender marking in the L1 and L2 affects L2 gender processing more than the presence of the abstract gender feature in L1.

Moreover, the present findings are consistent with the FT/FA model which suggests that adult L2 learners have ‘Full Access’ to underlying UG and that new grammatical features, not instantiated in L1, can be acquired, regardless of the age of acquisition. Schwartz and Sprouse (1996) underline the significant role of: the initial state, the type of input, the apparatus of UG and the learnability considerations in the trajectory of L2 morphological development. This is why L2 studies whose findings support the ‘Full Access’ model (Keating, 2009; Gillon Dowens et al., 2010; 2011)

indicate that features which are not present in the L1 can be acquired at higher stages of proficiency due to the fact that ‘automaticity of processing some language features requires more time and L2 exposure’ (Gillon Dowens et al., 2011, p. 165).

Regarding the role of input, the present study examines the processing of gender information of L2 Greek novel nouns. We argue that the results achieved are in line with the ‘Full Access’ model emphasising the role of input, and will be analysed in the following sections (see 7.3.3).

7.3 The processing effect of syntax

7.3.1 The role of syntactic information in processing transparent nouns

As was reviewed in Chapter 3, gender frequency and ambiguity affect gender processing by children and adults who are NS of Greek. Ambiguous suffixes demonstrate low predictability when compared to unambiguous ones, especially in written tasks (Mastropavlou, 2006). Morphological transparency also plays a very important role in L2 gender processing. Intermediate to highly-advanced L2 learners whose L1 is English are more accurate in processing transparently-marked nouns than non-transparently-marked nouns in production and comprehension tasks (Tsimpli et al., 2005; Bordag et al., 2006; Montrul et al., 2008; 2012; 2014; Alarcón, 2010; 2011; Foote, 2014; 2015; Bobb et al., 2015). Both Oliphant (1998) and Taraban and Kempe (1999) underline the role of syntactical cues when L2 learners process ambiguous nouns.

Regarding our study, as was discussed in Chapter 2, the inflectional morpheme *-ος* predominantly characterises masculine nouns due to frequency (Χριστοφίδου, 2003; Αναστασιάδη-Συμεωνίδη, 2012). The fact that the participants in this study processed the majority of the non-words ending in *-ος* as masculine when they were presented with only morphological information reveals the effect of frequency. The effect of frequency is also obvious in Greek NS who assign gender to nouns with the most frequent gender value of each suffix (Mastropavlou, 2006; Mastropavlou & Tsimpli, 2011) (see sections 3.3 and 3.4). In addition, when the participants in this study were provided with the additional gender-marked information of determiners and adjectives, they were more accurate and faster when processing masculine nouns ending in *-ος* than feminine or neuter nouns ending in *-ος*. Thus, the effect of frequency is also underpinned by the fact that these observations were also present when syntactic information (gender-marked determiners and/or adjectives) were added in the stimulus.

However, the significant effect of the type of the information provided indicates that any additional gender-marked information (determiner and/or adjective) is used effectively by the L2 learners. They use this information in order to overcome the existing ambiguity of the *-ος* ending. These findings confirm Ralli (2002; 2003) and Alexiadou (2004) who highlight the role of syntactic agreement not only in the ambiguous but also in persisting gender underspecification cases. As was described in Chapter 2, the novel words in the present experimental tasks belong to the cases of persisting underspecification,² which cannot be resolved through semantic or morphological information but rather at the phrasal level. The participants decide upon the grammatical gender of the provided noun faster as the informative cues are increased in phrasal level by the addition of determiners and adjectives. The frequency effect is therefore used by both beginners and advanced L2 learners indicating that this information is useful in the early stages of L2 acquisition. However, the advantage for advanced learners' has a measurable effect due to their greater exposure to Greek language.

The model of MacWhinney (2005; 2008) and, especially, the concept of cue strength and competition can also be used in order to explain the findings indicating that L2 Greek learners have a tendency to classify non-words with *-ος* endings as masculine. Generally, cue strength is a property of the connection between units. The strength of the noun ending *-ος* as an indication of a masculine noun can be viewed as the weight of the connection between noun ending and the classification of the noun lemma as masculine. This kind of mechanism eliminates the distinction between probabilistic tendencies and deterministic rules (Bates & MacWhinney, 1987). Therefore, in regard to cue validity, the availability of the cue is based on the frequency of the cue. The data indicates that this mechanism is present even in beginner L2 learners. However, the strength of the availability of the cues as observed in non-ambiguous noun endings is present in ambiguous *-ος* endings as well.

In the results of this study there are more correct answers given when extended syntactic information (determiner + gender marked adjective + noun ending) is provided than when only syntactic information (determiner + noun ending) is provided. Furthermore, the significant main effect of the grammatical gender factor in nouns with

² Ralli (2002; 2003) notes that Greek nouns denoting a human profession that have the same morphological form for two different gender values (masculine and feminine) are cases of persisting underspecification, which cannot be resolved through the co-occurrence but rather at the phrasal level, that is, through agreement with an item marked for a specific gender value (e.g., determiner — *ο/η* *γιατρος* [MSC/FEM] 'doctor').

–ος endings indicates that the cue availability as an effective process is still present. This can be confirmed by the finding that the difference between feminine and neuter levels was not significant, and thus only the masculine grammatical gender has an effect on the participants' performance. In other words, L2 learners rely on syntax to classify a noun with –ος ending, but masculine gender-marked cues provide more additional grounds for accurate assignment than feminine or neuter. The competition between cue frequency and gender agreement is in favour of agreement. However, this does depend on the quantity of the cues. More cues minimise the effect of frequency. L2 learners rely more on the reliability and availability of cues in syntax than in frequency, but only when these cues are significant in quantity. Relevant tendencies are also observed for the second dependent variable, reaction time. For this variable, interpretation can be based on the same principles as in the case of the first dependent variable, accuracy. Finally, this interpretation is based on the findings of both tasks, thereby increasing the validity of the assumptions and analysis.

In terms of considering another theoretical perspective, Levelt et al.'s (1999) model indicates each lemma node is connected to specific nodes that map the syntactic properties of the target lemma/word. The syntactic properties might be the syntactic, number, case and/or the grammatical category. The aforementioned connection is facilitated or not by referred information. For example, gender ambiguous endings can be regarded as significant obstacles to the gender assignment process. This is overcome by the use of information related to frequency. Thus we observe that the majority of the nouns with –ος ending are attributed to the masculine gender. However, the presence of extended gender-marked cues (determiner + adjective + noun ending) provides additional information and allows more accurate and faster activation and selection of the appropriate gender node.

7.3.2 The role of syntactic information in gender processing

In the present study, L1 English L2 Greek learners' performance is more accurate and faster when the available gender cues are more than one. This is in line with a majority of studies which suggest that L1 English L2 learners of gendered languages rely more on syntactic (determiners and adjectives) than on morphological information in L2 Italian (Oliphant, 1998), L2 Spanish (Cain et al., 1987; Franceschina, 2005) and L2 Russian (Taraban & Kempe, 1999). Specifically, in Oliphant's (1998) study the rate of gender accuracy increases as the number of gender elements increases while

Franceschina (2005) points out that that syntax is a stronger clue than morphology and semantics.

Moreover, as reviewed in Chapter 4, a few studies have recently examined the potential priming effect of syntactical gender-marked cues (determiners and/or adjectives) on lexical access in fully grammatical sentences in L2 processing³ (Guillelmon & Grosjean, 2001; Scherag et al., 2004; Lew-Williams & Fernald, 2010; Grüter et al., 2012; Dussias et al., 2013; Bobb et al., 2015; Hopp, 2016; Morales et al., 2016). In the discussion below we will focus on the studies which had participants with the same profile as the ones in the present study — NS of English who are learners of gendered languages.

Some research indicates that advanced L1 English L2 learners of gendered languages evidence no differences in naming speeds according to the preceding gender-marking on determiners (L2 French: Guillelmon & Grosjean, 2001; L2 German: Scherag et al., 2004; Bobb et al., 2015) or even adjectives (Scherag et al., 2004). Thus, L2 learners do not appear to benefit from agreement relations between determiner and noun during the processing of the noun phrase. However, later and more accurate studies indicate that even highly-proficient L1 English L2 learners of gendered languages (Spanish and German) rely on the gender-marked articles as predictive cues in the processing of novel nouns although only when these nouns co-occur with the articles in the learning trials of the studies (Lew-Williams & Fernald, 2010; Grüter et al., 2012; Dussias et al., 2013; Hopp, 2016).

Although in this study we do not examine the predictive effect of determiners and adjectives but rather the processing effect, the present results complement the aforementioned studies in many ways. Firstly, in this study L2 learners use the provided morphological and extensive syntactic information (determiner + adjective + noun suffix) not to predict the upcoming novel nouns but rather to accurately process the grammatical gender of the presented novel nouns. In this study we use the term process in order to refer to the realisation of a noun's gender class. In other words this study reveals the importance of gender-marked determiners and adjectives in the realisation of the gender class of a novel noun. Secondly, some of these studies only examine the role of determiners after a training phase where the participants encounter them with the nouns. But what happens when adjectives are also provided in the training phase? The

³ As reviewed in Chapter 4 (4.2.4) most of studies examining gender processing in L2 use ungrammatical sentences.

present study fills this gap by also examining the processing role of gender marking on adjectives in L2.

Thirdly, Hopp (2013) suggests that an overall mastery of lexical gender assignment of a specific lemma/word results from an accurate use of the syntactic determiner + noun gender agreement in predictive processing. However, this proposal leaves unanswered the crucial stage of building a specific lemma and more importantly the connection to the appropriate gender node. The lemma is crucial for the appropriate use of adjectives and determiners (gender agreement) but gender agreement is a special facilitative factor in the gender node link. Our experiment, especially, the second part answers this question. According to the assumptions of task 2, the participants rely on lexical knowledge (gender assignment) in order to provide a response to the task. The lexical knowledge in L1 is based on the stimulus in L2. The participants make a connection with the referent lemma to the appropriate gender node although this connection is based on the available gender-marked cues (noun ending, determiners, adjectives). Additionally, this process is facilitated by the quantity of cues; the more cues, the more accurate and faster the gender assignment. Therefore, the present findings indicate that lexical knowledge is the main ground for gender assignment but is highly facilitated by gender agreement. These findings, especially in task 2, question the facilitative effect of lexical knowledge on gender agreement. This question has an additional importance as the nature of the tasks in this study allow us to track the effect of gender-marked information on lemma processing.

7.3.3 The role of syntax in the learning input and in gender production — beginners vs. advanced L2 learners

In the present study we examine the role of morphology (via noun suffix) and syntactic information (via gender agreement of determiners (+ adjectives) + noun) in gender processing by presenting novel words to the participants. Thus, our L2 learners have to realise, process and integrate gender-marked cues (noun suffix, determiner, adjective) in order to produce accurate gender agreement phrases in Greek language (task 1) and to assign accurately and quickly the novel nouns (task 2). We exclude the effects of familiarity or previous experience by using novel words. The present study examines the role of gender information provided; in other words, the role of input. In this case, the term input refers to the learning conditions of grammatical gender.

As reviewed in Chapter 4, different learning conditions have an impact on L2 learners' ability to associate a noun with its gender class and, consequently, process it in

real time (Agathopoulou et al., 2008; Arnon & Ramscar, 2009; Lew-Williams & Fernald, 2010; Grüter et al., 2012; Montrul et al., 2012; Hopp, 2016). There are studies (Franceschina, 2005; Tsimpli et al., 2005; Dimitrakopoulou et al., 2006; Tanner, 2008; Agathopoulou & Papadopoulou, 2011; Grüter et al., 2012; Hopp, 2013; Montrul et al., 2012; 2014; Bobb et al., 2015) which conclude that L2 learners produce more assignment errors than gender agreement errors showing that ‘persistent difficulty with grammatical gender experienced by highly proficient L2 learners primarily affects lexical, rather than syntactic aspects of gender’ (Grüter et al., 2012, p. 208). These findings further support the MSIH (Haznedar & Schwartz, 1997; Prévost & White, 1999; 2000; Lardiere, 2000) and attribute the high percentage of gender errors by L2 learners to difficulty with the retrieval of gender information in real-time language use. The studies suggest that this condition lies in the fact that, in contrast with the L1 lexicon where the lexical representation of grammatical gender is shaped by early distributional learning resulting in tight associations between determiners and nouns, in the L2 lexicon ‘the associations between nouns and gender class information are unlikely to attain the same strength in L2 as in L1 lexicons, as a result of L2 learners’ reliance on cues other than co-occurrence relations during word learning’ (Grüter et al., 2012, p. 210). Lew-Williams & Fernald (2010) argue that the difference between the nature of L1 and L2 learning environments, as well as the different characteristics of children and adults, like age and previous language experience, can be significant factors which result in the differences between L1 and L2 learners of Spanish in terms of real-time processing of determiner–noun phrases. Thus, Grüter et al. (2012), based on the results of Arnon and Ramscar’s (2009) training study and on the fact that L2 learners have prior metalinguistic knowledge about nouns and determiners, they provide the possibility of a lexical gender learning hypothesis.⁴ This hypothesis suggests that grammatical gender has to be taught in a non-segmented way with determiners–adjectives–nouns sequences (like children) in order for L2 learners to establish strong lexical gender representations.

Along the same lines, Montrul et al. (2012, p. 111) argue that ‘input modality affects language representation and processing’. Specifically, L2 learners are primarily exposed to both visual and aural input in classroom settings. This results in different patterns of agreement errors between NS and NNS of Spanish, due to the nature of the links between nouns and their corresponding gender nodes in the NS versus the L2

⁴ The lexical gender learning hypothesis was analysed in section 4.1.3.

learner lexicon (Foote, 2015, p. 368). Regarding Greek language, Agathopoulou et al. (2008) suggest that the type of instruction plays a very important role. They argue that the use of structured-input activities where ‘nouns and their modifying adjectives are coupled with typographical enhancement of agreement suffixes’ (Agathopoulou et al., 2008, p. 15) help L2 learners of Greek to acquire the required morphology and, thus, the lexical knowledge of Greek nouns.

This study does not test the production but rather the processing of gender-marked cues. However, we can extract reliable predictions for performance in production. Both beginners and advanced learners are more accurate and faster when they are presented with an input including morphological and extensive syntactic information (determiner + adjective + noun) in Greek unsegmented gender agreement phrases (*ο κόκκινος δανύβος*). The processing effect of syntactic information is also obvious with phrases including non-transparent endings (*ο κόκκινος πιφάρης*). Thus, when L2 learners, in line with lexical gender learning hypothesis, are provided with gender-marked cues, like children in a non-segmented way (e.g., determiners–adjectives–nouns sequences), they are able to establish strong lexical gender representations and accurately connect each novel noun to its gender class. This has also an effect on gender agreement production; most of the Greek L2 studies suggest that L2 learners are less target-like in terms of the type of agreement between determiner + noun than adjective + noun (Tsimpli et al., 2005; Dimitrakopoulou et al., 2006; Agathopoulou & Papadopoulou, 2011).

Therefore, we can predict that difficulties in gender production are derived from the low availability of reliable gender-marked cues. The findings of the present study indicate that if we increase the availability of the cues, we could increase accuracy in production similar to Oliphant’s (1998) results. These findings are in line with the lexical gender learning hypothesis (Grüter et al., 2012) but also with the notion of Competition Model (Bates & MacWhinney, 1987; MacWhinney, 2005; 2008). Not only does the unsegmented input help the participants but also the availability of gender-marked cues.

The processing effect of gender-marked determiners and adjectives is obvious in both beginners and advanced L2 Greek learners. This leads us to two important conclusions. Firstly, the level of competence in L2 Greek does affect gender processing in regard to the level of accuracy and RT rates. However, the analysis reveal that there is no significant interaction between the variables of Greek language competence and the type of information provided. This leads us to the conclusion that beginners and

advanced learners differ in regard to accuracy but not in relation to the processing strategies that they employ. The advanced learners, like the beginners, continue to use the maximum information available when they process grammatical gender. An advanced level merely means more L2 oral and written experience, plus more cumulative frequency of hearing and reading gender-marked determiners and adjectives. Both of the experimental tasks in the present study prove that advanced learners of Greek are also affected by the reliability and availability of gender cues in the input. The present results are in contrast with previous studies, which argue that at least in the first learning levels the phonological forms have to be activated in order for L2 learners to compute and then to accurately complete gender processing (Bordag et al., 2006) or that late learners may be able to employ explicit knowledge of gender during those stages, while they cannot do so at earlier stages (Foote, 2014).

Finally, we have to emphasise here that the measurement and observance of processing effect of gender-marked determiners and adjectives is achieved due to the methodology of the present study. In other words, in task 1 the participants were examined in the lexical knowledge of the novel words in a natural way and not by asking them directly for the gender of the nouns. In task 2, any potential difficulties or errors in gender agreement production were excluded allowing only the observation of processes and performance in gender assignment. Thus, if we had used, for example, ungrammatical sentences the effect of syntax may not have been revealed.

7.4 Limitations — Further research

A possible limitation of the present study is that we didn't use a proficiency test in order to standardise the level of Greek language competence as other L2 studies have done (e.g., a language questionnaire: Lew-Williams & Fernald, 2010; a written test: Grüter et al., 2012; a lexical and grammar test: Alarcón, 2011; a written proficiency test: Foote, 2015), apart from the biographical question that each participant had to answer before commencing the tasks. However, adding another element to the present study would have necessarily increased the required time for the completion of the experiment. Although the number of experimental tasks and materials increased the validity of the present results, we can assume that it also increased the required time needed to complete both of the tasks. This could have resulted in tiredness, which may have affected the performance of the L2 learners. While the statistical analysis did not reveal such an effect, this possibility cannot be easily excluded. Moreover, the fact that we did

not conduct an error analysis could have allowed for the extraction of other factors that could affect the processing of grammatical gender.

In consequence, future research should examine L2 Greek gender processing including inanimate novel nouns, oral production, other cases — apart from the nominative— and, last but not least, the effect of training (e.g., determiner + adjective + noun) in classroom settings on the learning of grammatical gender for Greek new nouns.

What will occur with inanimate novel words? There is no competition between English and Greek grammar in regard to animated nouns. In English, all animated nouns can be masculine, feminine or neuter. The same tendency is followed in Greek grammar. Therefore, the systematic relations between cues (MacWhinney, 2005; 2008) and, more specifically the cue validity, divided on availability and reliability, in Greek and English are not significantly different. In other words, the validity of the referent cues in Greek is not significantly different to the validity of the cues in English. It would have been extremely interesting and useful to test if the observed tendency of this study (the advantage of extensive syntactic cues: determiner + adjective + noun ending) could be replicated if the nouns were not animate but rather inanimate. Under this condition there would be competition between the validity in English and Greek, because in English all inanimate nouns are neuter while this is not exclusively the case in Greek. It could be predicted that the same tendency would be observed again. This prediction is based on the findings of the second task in this study. It is predicted that L2 learners of Greek would rely again on extended gender-marked cues in order to overcome the obstacle of mismatching between the languages. However, it is reasonable to predict that the main effects should not have the same size effect. In any case, such a hypothesis remains to be tested.

In addition it is important for future research to examine the role of morphological (noun suffix) and syntactic information (gender-marked determiners and adjectives) in L2 Greek gender processing by using oral production and comprehension tasks. Taking into consideration the MSIH we could hypothesise that L2 learners would be less accurate and slower in oral experimental tasks than they were in the present written tasks.

In the first experimental task the participants were asked to provide the nominative form of the determiner, adjective and novel noun. What would L2 learners do if they had to process the gender of novel words in other cases? This question is very

important, especially for language like Greek, which has four cases. It could be predicted that the same tendency will be observed again. Once L2 learners of gender languages have acquired gender agreement (e.g., the ‘agreement chains’ between determiners + adjectives + nouns) they should be able to apply these ‘agreement chains’ to all the other cases. Any errors would therefore be attributed to morphological realisation of the syntactic related constituents and not to syntactic deficits. The latter finding is indicated by the present findings for the nominative case (see section 7.2.3).

Finally, any future research should investigate the extent of the effect of training with regard to determiner + adjective + noun in classroom settings on learning the grammatical gender of Greek novel nouns. The present research proves the importance of syntactic information via gender agreement of determiners, adjectives and nouns on gender processing and, more specifically, on the realisation of the gender class of novel nouns. As discussed in section 7.3.3, this reveals the effect of ‘linguistic input’ in the processing strategies of L2 learners. Will gender-marked determiners and even adjectives in the ‘teaching input’ help L2 learners to form stable gender representations, which may lead to gender assignment and gender agreement being partially erroneous? In any case, we believe that the present study underlines the need for further research into teaching L2 Greek gender by taking into consideration the factor of syntax.

Appendix A

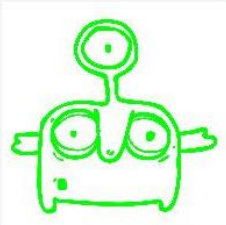
Real words	Non-words
Msc	
θόρυβος	δανύβος
κλητήρας	κνητήζας
σακάτης	δοκάθης
συνθέτης	συντάδης
φυγάδας	μυχόδας
δάσκαλος	γοστέλος
κανόνας	καζάγας
αγώνας	εζάνας
προδότης	προνάζης
μανάβης	βονάπης
φάκελος	βαπίλος
πατέρας	παδάβας
σωλήνας	ζαγάνας
πελάτης	πεγόπης
ροδίτης	μαδίθης
Fem	
κάθοδος	γεθάδος
γαρίδα	κορίθα
ταμπέλα	κομπέδα
θυμέλη	θυβόνη
σκύταλη	στυκέλη
άνοδος	εμάδος
σελίδα	θαλίγα
φιάλη	θιάνη
λεκάνη	νητόνη
ταβέρνα	κεφάρνα
μέθοδος	βηθόγος
πατάτα	πακόθα
μητέρα	βετέγα
αγάπη	αχόδη
δαπάνη	θεκόνη
Neut	
μέγεθος	γεχάθος
τασάκι	ποσάπι
αχλάδι	εκλάγι

στιφάδο	στιπόγο
μοτίβο	γαθίβο
έδαφος	ατέφος
πεπόνι	κηβάνι
ποτήρι	ποκένι
πιάτο	πιέπο
στιλέτο	στιγάπο
πέλαγος	βανόγος
λιμάνι	ζιθένι
παγάκι	παλέχι
πακέτο	παχάκο
τσιγάρο	σιβέρο

NOTE: Each non-word on the right column was derived from each referent real word on the left column.

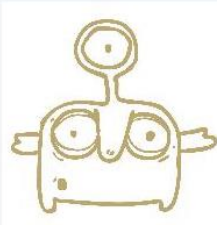
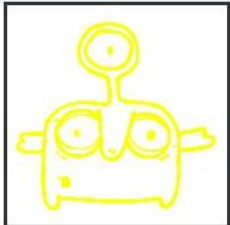
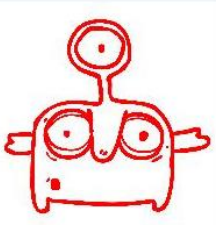
Appendix B

TASK 1



Ένα πράσινο παλέχι

Slide 1

Μέσα στο τετράγωνο βρίσκεται

Slide 2

TASK 2

ένα πράσινο παλέχι

Slide 1

☐ he

☐ she

☐ it

---- is green

Slide 2

Appendix C



Department of International Studies
Faculty of Arts

Phone:
Fax:
Email:

Chief's Investigator's / Supervisor's Name: Elizabeth Kefallinos

Chief's Investigator's / Supervisor's Title: Doctor

Participant Information and Consent Form

Name of Project

The role of intralinguistic factors in the acquisition of Greek grammatical gender for adult L2 learners – Implications for practice.

You are invited to participate in a study of Greek grammatical gender. The purpose of this study is to clearly identify the linguistic factors which are elaborated in the acquisition of the Greek grammatical gender of new words in adult second language acquisition.

Researcher's Details:

The study is being conducted to meet the requirements of PhD under the supervision of Dr Elizabeth Kefallinos (phone: [02] 9850 7031, email: Elizabeth.kefallinos@mq.edu.au) of the Department of International Studies.

Explanation of the study

About 60 learners of Greek language will participate in this study. L1 (first language) English L2 (second language) learners of Greek will be provided with words accompanied by specially designed pictures. After they will be asked to use them appropriately by providing additionally an agreeing adjective. The participants' answers will be evaluated upon the correctness of the answers. Furthermore, reaction time to the question that will be placed, will be recorded. Each participant will be provided with 45 words. Additionally, participants will be asked to fill in a questionnaire about the whole process. The procedure will take about 30 minutes.

In order the results of the experiment to be accurate, you have to answer first a questionnaire about background and language experience, so as the researcher to be sure that all participants are in the same knowledge level and have the same language background as regards the Greek language. You will not be paid for participating in this study.

Participant Information and Consent Form
[Version no.] [1-10-13]

Page 1 of 2

Confidentiality

Any information or personal details gathered in the course of the study are confidential, except as required by law. No individual will be identified in any publication of the results. The data will be stored on a computer, and only the Chief Investigator and the researcher will have access to it. A summary of the results of the data can be made available to you on line.

Your participation

Participation in this study is entirely voluntary: you are not obligated to participate and if you decide to participate, you are free to withdraw at any time without having to give a reason and without consequence.

I have read and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

Participant's Research Code: _____
(Block letters)

Date: _____

Investigator's Name: _____
(Block letters)

Investigator's Signature: _____ Date: _____

The ethical aspects of this study have been approved by Macquarie University Human Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics (telephone [02] 9850 7854, email: ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

INVESTIGATOR'S [OR PARTICIPANT'S] COPY

Participant Information and Consent Form
[Version no.] [1-10-13]

Page 1 of 2

Appendix D

7/6/2017

Mail – patricia.koromvokis@mq.edu.au

Fwd: Final Approval with Condition - 5201300779(R)

PATRICIA KOROMVOKIS <patricia.koromvokis@students.mq.edu.au>

Mon 06/02/2017 11:54

To: Patricia Koromvokis <patricia.koromvokis@mq.edu.au>;

----- Forwarded message -----

From: Faculty of Arts Research Office <artsro@mq.edu.au>

Date: Mon, Nov 18, 2013 at 9:17 AM

Subject: Final Approval with Condition - 5201300779(R)

To: Dr Elizabeth Kefallinos <elizabeth.kefallinos@mq.edu.au>

Cc: Faculty of Arts Research Office <artsro@mq.edu.au>, Prof Martina Mollering <martina.mollering@mq.edu.au>, Mrs Patricia Panagiota Koromvokis <patricia.koromvokis@students.mq.edu.au>

Dear Dr Kefallinos

Re: 'The role of intralinguistic factors in the acquisition of Greek grammatical gender for adults L2 learners- implications for teaching'

The above application was reviewed by the Faculty of Arts Human Research Ethics Committee. Approval of the above application is granted, effective (18/11/2013) with the following condition. This email constitutes ethical approval only.

Condition of approval:

The Information and Consent form to be updated to include contact details and the Explanation of the Study to be rewritten for clarity and sent to ArtsRO@mq.edu.au for inclusion in your application file.

The following personnel are authorised to conduct this research:

Dr Elizabeth Kefallinos
Mrs Patricia Panagiota Koromvokis
Prof Martina Mollering

Please note the following standard requirements of approval:

1. The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).
2. Approval will be for a period of five (5) years subject to the provision of annual reports.

Progress Report 1 Due: 18th November 2014
Progress Report 2 Due: 18th November 2015
Progress Report 3 Due: 18th November 2016
Progress Report 4 Due: 18th November 2017
Final Report Due: 18th November 2018

NB. If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report for the project.

Progress reports and Final Reports are available at the following website:
http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_appr

<https://outlook.office.com/owa/?realm=mq.edu.au&path=/mail/inbox/rp&exsvurl=1&ll-cc=1033&modurl=0>

1/2

7/6/2017

Mail – patricia.koromvokis@mq.edu.au

oval/human_research_ethics/forms

3. If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).

4. All amendments to the project must be reviewed and approved by the Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

5. Please notify the Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.

6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at the following websites:

<http://www.mq.edu.au/policy/>

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/policy

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have approval for your project and funds will not be released until the Research Grants Management Assistant has received a copy of this email.

If you need to provide a hard copy letter of approval to an external organisation as evidence that you have approval, please do not hesitate to contact the Faculty of Arts Research Office at ArtsRO@mq.edu.au

Please retain a copy of this email as this is your official notification of ethics approval.

Yours sincerely

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References

- Agathopoulou, E. & Papadopoulou, D. (2011). Probing the adult initial state: of non-native Greek: A case study. *19th International Symposium on Theoretical and Applied Linguistics*. Thessaloniki.
- Agathopoulou, E., Papadopoulou, D. & Zmijanac, K. (2008). Noun–Adjective agreement in L2 Greek and the effect of input-based instruction. *Journal of Applied Linguistics*, 24, 9–33.
- Alarcón, I. (2009). The Processing of Gender Agreement in L1 and L2 Spanish: Evidence from Reaction Time Data. *Hispania*, 92 (4), 814–828.
- Alarcón, I. V. (2010). Gender Assignment and Agreement in L2 Spanish: The Effects of Morphological Marking, Animacy, and Gender. *Studies in Hispanic and Lusophone Linguistics*, 3 (2), 267–299.
- Alarcón, I. V. (2011). Spanish gender agreement under complete and incomplete acquisition: Early and late bilinguals' linguistic behavior within the noun phrase. *Bilingualism: Language and Cognition*, 14 (3), 332–350.
- Alexiadou, A. (2004). Inflection class, gender and DP internal structure. In G. Müller, L. Gunkel & G. Zifonoun (Eds.), *Explorations in nominal inflection* (pp. 21–49). Berlin: Mouton de Gruyter.
- Alexiadou, A. & Stavrou, M. (2000). Adjective–clitic combinations in Greek DP. In B. Gelarch & J. Grijzenhout, *Clitics in Phonology, Morphology and Syntax* (pp. 63–84). Amsterdam: John Benjamins.
- Alexopoulos, D. & Kalaitzidis, I. (2004). Reliability and Validity of Eysenck's Personality Questionnaire Revised (EPQ-R) Short Scale in Greece. *Personality and Individual Differences*, 10, 1205–1220.
- Alexopoulos, D., Sifaki, A., Filipatou, D., Polychroni, B., Sakellari, M., Manesis, N., et al. (2003). Construction of a vocabulary test for E' level elementary school. *9th Pan-Hellenic Conference of Psychological Assessment*. Rhodes.
- Anagnostopoulou, E. (2003). *The Syntax of Ditransitives: Evidence from Clitics*. Berlin & New York: Mouton de Gruyter.
- Anastasi, A. & Urbina, S. (1997). *Psychological testing*. New Jersey: Prentice-Hall.

- Andersen, R. (1984). What's gender good for anyway? In R. Andersen (Ed.), *Second languages: a cross-linguistic perspective* (pp. 77–99). Rowley, MA: Newbury House.
- Arbuckle, J. L. (1997). *AMOS 3.6 user's guide*. Chicago, IL: SPSS.
- Arnon, I. & Ramscar, M. (2009). Granularity and the acquisition of grammatical gender: How order-of-acquisition affects what gets learned. In N. Taatgen & H. Rijn (Ed.), *31st Annual Conference of the Cognitive Science Society* (pp. 2112–2117). Austin, TX: Cognitive Science Society.
- Arnon, I. & Ramscar, M. (2012). Granularity and the acquisition of grammatical gender: How order-of-acquisition affects what gets learned. *Cognition*, 122, 292–305.
- Audring, J. (2014). Gender as a complex feature. *Language Sciences*, 43, 5–17.
- Baddeley, A. (2000). The episodic buffer: a new component of working memory? *Trends in Cognitive Sciences*, 4, 417–423.
- Baddeley, A. (2003). Working Memory: looking back and looking forward. *Nature reviews neuroscience*, 4, 417–423.
- Baddeley, A. (2007). *Working Memory, Thought, and Action*. Oxford: Oxford University Press.
- Badecker, W., Miozzo, M. & Zanuttini, R. (1995). The two-stage model of lexical retrieval: Evidence from a case of anomia with selective preservation of grammatical gender. *Cognition*, 57, 193–216.
- Barber, H. & Carreiras, M. (2005). Grammatical gender and number in Spanish: An ERP comparison. *Journal of Cognitive Neuroscience*, 17, 137–153.
- Bartning, I. (2000). Gender agreement in L2 French: Pre- advanced vs. advanced learners. *Studia Linguistica*, 54, 225–237.
- Bates, E. & MacWhinney, B. (1987). Competition, variation, and language learning. In B. MacWhinney, *Mechanisms of language acquisition*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Bates, E., Devescovi, A., Pizzamiglio, L., D'Amico, S. & Hernandez, A. (1995). Gender and lexical access in Italian. *Perception & Psychophysics*, 57, 847–862.

REFERENCES

- Berkum, J. A. (1997). Syntactic processes in speech production: the retrieval of grammatical gender. *Cognition*, 64, 115–152.
- Bobb, S. C., Kroll, J. F. & Jackson, C. N. (2015). Lexical constraints in second language learning: Evidence on grammatical gender in German. *Bilingualism: Language and Cognition*, 18 (3), 502–523.
- Bock, K. & Levelt, W. (1994). Language production: Grammatical encoding. In M. A. Gernsbacher (Ed.), *Handbook of Psycholinguistics* (pp. 945–983). San Diego: Academic Press.
- Bohme, K. & Levelt, W. J. M. (1979). Children's use and awareness of natural and syntactic gender in possessive pronouns. *Paper presented to the conference on Linguistics Awareness and Learning to Read*, Victoria, British Columbia.
- Bordag, D. (2004). Interaction of L1 and L2 systems at the level of grammatical encoding. *EUROSLA Yearbook*, 4, 203–230.
- Bordag, D., Opitz, A. & Pechmann, T. (2006). Gender Processing in First and Second Languages: The Role of Noun Termination. *Journal of Experimental Psychology*, 32 (5), 1090–1101.
- Brien, C. & Sabourin, L. L. (2012). Second language effects on ambiguity resolution in the first language. *EUROSLA Yearbook*, 12, 191–217.
- Bruhn de Garavito, J. & White, L. (2002). The second language acquisition of Spanish DPs: The status of grammatical features. In T. Pérez-Leroux & J. M. Liceras (Eds.), *The acquisition of Spanish morphosyntax: The L1/L2 connection* (pp. 153–178). Dordrecht: Kluwer.
- Cain, J., Weber-Olsen, M. & Smith, R. (1987). Acquisition strategies in first and second language: Are they the same? *Journal of Child Language*, 14, 333–352.
- Caramazza, A. (1997). How many levels of processing are there in lexical access? *Cognitive Neuropsychology*, 14, 177–208.
- Caramazza, A. & Costa, A. (2000). The semantic interference effect in the picture–word interference paradigm: Does the response set matter?. *Cognition*, 75, B51–B64.
- Caramazza, A., Miozzo, M., Costa, A., Schiller, N. & Alario, F. X. (2001). A cross-linguistic investigation of determiner production. In E. Dupoux, *Language*,

- brain and cognitive development: Essays in honour of Jacques Mehler* (pp. 209–226). Cambridge: MA: MIT Press.
- Carroll, S. (1999). Input and SLA: Adults' Sensitivity to Different Sorts of Cues to French Gender. *Language Learning*, 49 (1), 37–92.
- Carroll, S. (1989). Second-language acquisition and the computational paradigm. *Language Learning*, 39, 535–594.
- Carroll, S. E. (1999). Input and SLA: Adults' Sensitivity to Different Sorts of Cues to French Gender. *Language Learning*, 49 (1), 37–92.
- Carstens, V. (2000). Concord in Minimalist Theory. *Linguistic Inquiry*, 31, 319–355.
- Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research*, 1, 245–276.
- Chomsky, N. (2000). Minimalist inquiries: the framework. In R. Martin, D. Michaels & J. Uriagereka (Eds.), *Step by Dtep: Essays on Minimalist Syntax in Honor of Howard Lasnik* (pp. 89–155). Cambridge, MA: MIT Press.
- Chomsky, N. (2002). *On Nature and Language*. Cambridge: Cambridge University Press.
- Chomsky, N. (1995). *The Minimalist Program*. Cambridge, MA: MIT Press.
- Chomsky, N. (2001). Derivation by phase. In M. Kenstowicz (Ed.), *Ken Hale: A Life in Language* (pp. 1–52). Cambridge, MA: MIT Press.
- Clahsen, H. & Felser, C. (2006). Grammatical processing in language learners. *Applied Psycholinguistics*, 27, 3–42.
- Corbett, G. (2011). Sex-based and non-sex-based gender systems. In M. Dryer & M. Haspelmath, *The World Atlas of Language Structures Online*. Munich: Max Planck Digital Library.
- Corbett, G. (1991). *Gender*. New York: Cambridge University Press.
- Corbett, G. G. & Fraser, N. (1993). Network morphology: A DATR account of Russian nominal inflection. *Journal of Linguistics*, 29, 113–142.
- Corbett, G.G., (2006). *Agreement*. Cambridge: Cambridge University Press.
- Costa, A., Kovacić, D., Fedorenko, E. & Caramazza, A. (2003). The gender congruency effect and the selection of freestanding and bound morphemes: Evidence from Croatian. *Journal of Experimental Psychology*, 29, 1270–1282.

REFERENCES

- Dahan, D., Magnuson, J. C. & Tanenhaus, M. K. (2000). Time course of frequency effects in spoken-word recognition: Evidence from eye movements. *Cognitive Psychology*, 42, 317–367.
- Dahl, Ö. (2004). *The Growth and Maintenance of Linguistic Complexity*. Amsterdam/Philadelphia: Benjamins.
- Dancey, P. & Reidy, J. (2002). *Statistics Without Maths for Psychology*. Edinburgh: Prentice Hall.
- De Bot, K. (1992). A bilingual production model: Levelt's speaking model adapted. *Applied Linguistics*, 13, 1–24.
- Delisle, H. H. (1985). The acquisition of gender by American students of German. *The Modern language Journal*, 69, 55–63.
- Dell, G. S. (1986). A spreading-activation model of retrieval in sentence production. *Psychological Review*, 93, 231–241.
- Dewaele, J. M. & Véronique, D. (2001). Gender assignment and gender agreement in advanced French interlanguage: A cross-sectional study. *Bilingualism: Language and Cognition*, 32 (1), 275–296.
- Dimitrakopoulou, M., Fotiadou, G., Roussou, A. & Tsimpli, I.-M. (2006). Features and agree relations in L2 Greek. In A. Belletti, E. Bennati, C. Chesi, E. Di Domenico & I. Ferrari (Eds.), *Language Acquisition and Development Proceedings of GALA2005* (pp. 161–166). Newcastle: Cambridge Scholars Press.
- Dussias, P., Valdés Kroff, J., Guzzardo Tamargo, R. & Gerfen, C. (2013). When gender and looking go hand by hand: Grammatical Gender Processing In L2 Spanish. *Studies in Second Language Acquisition*, 35, 353–387.
- Eubank, L. (1993). On the transfer of parametric values in L2 development. *Language Acquisition*, 3, 183–208.
- Fernández-García, M. (1999). Patterns of gender agreement in the speech of second language learners. In J. Gutiérrez- Rexach & F. Martínez-Gil (Eds.), *Advances in Hispanic linguistics: Papers from the 2nd Hispanic Linguistics Symposium* (pp. 3–15). Somerville, MA: Cascadilla Press.
- Finneman, M. D. (1992). Learning agreement in the noun phrase: The strategies of three first-year Spanish students. *IRAL*, 30 (2), 121–136.

- Foote, R. (2014). Age of Acquisition and Sensitivity to Gender in Spanish Word Recognition. *Language Acquisition*, 21 (4), 365–385.
- Foote, R. (2015). The production of gender agreement in native and L2 Spanish: The role of morphophonological form. *Second Language Research*, 31 (3), 343–373.
- 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.
- 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.
- Franceschina, F. (2001). Morphological or syntactic deficits in near-native speakers? An assessment of some current proposals. *Second Language Research*, 17 (3), 213–247.
- Franceschina, F. (2002). Case and phi-feature agreement in advanced L2 Spanish grammars. In S. H. Foster-Cohen, T. Ruthenberg & M. L. Poschen, *EUROSLA Yearbook* (Vol. 2, pp. 71–86). Amsterdam: John Benjamins.
- Franceschina, F. (2005). Fossilized second language grammars. The acquisition of grammatical gender. Amsterdam: John Benjamins.
- Franck, J., Vigliocco, G., Antón-Méndez, I., Collina, S. & Frauenfelder, U. H. (2008). The interplay of syntax and form in sentence production: A cross-linguistic study of form effects on agreement. *Language and Cognitive Processes*, 23, 329–374.
- Frenck-Mestre, C., Foucart, A., Carrasco, H. & Herschensohn, J. (2009). *Processing of grammatical gender in French as a first and second language: Evidence from ERPs*. EUROSLA yearbook (pp. 76–106).
- Gabriele, A., Fiorentino, R. & Alemán Bañón, J. (2013). Examining second language development using event-related potentials A cross-sectional study on the processing of gender and number agreement. *Linguistic Approaches to Bilingualism*, 3 (2), 213–232.

REFERENCES

- Gaskell, M. G. & Marslen-Wilson, W. D. (1997). "Integrating form and meaning: A distributed model of speech perception". *Language and Cognitive Processes*, 12, 613–656.
- Gathercole, S. E., Willis, C. & Baddeley, A. D. (1991). Differentiating phonological memory and awareness of rhyme: Reading and vocabulary development in children. *British Journal of Psychology*, 82, 387–406.
- Gillon Dowens, M., 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, 1651–1659.
- Gillon Dowens, M., Vergara, M., Barber, H. & Carreiras, M. (2010). Morphosyntactic Processing in Late Second-Language Learners. *Journal of Cognitive Neuroscience*, 22 (8), 1870–1887.
- Gollan, T. H. & Frost, R. (2001). Two Routes to Grammatical Gender: Evidence from Hebrew. *Journal of Psycholinguistic Research*, 30 (6), 627–651.
- Grandfelt, J. (2000). The acquisition of the determiner phrase in bilingual and second language French. *Bilingualism: Language and Cognition*, 3 (3), 263–280.
- Grosjean, F., Dommergues, F. Y., Cornu, E., Guillelmon, D. & Besson, C. (1998). The gender marking effect in spoken word recognition. *Perception & Psychophysics*, 56, 590–598.
- Grüter, T., Lew-Williams, C. & Fernald, A. (2012). Grammatical gender in L2: A production or a real-time processing problem?. *Second Language Research*, 28, 191–215.
- Guillelmon, D. & Grosjean, F. (2001). The gender marking effect in spoken recognition: The case of bilinguals. *Memory & Cognition*, 29 (3), 503–511.
- Gunter, T. C., Friederici, A. D. & Schriefers, H. (2000). Syntactic gender and semantic expectancy: ERPs reveal early autonomy and late interaction. *Journal of Cognitive Neuroscience*, 12, 556–568.
- Hagoort, P. & Brown, C. M. (1999). Gender electrified: ERP evidence on the syntactic nature of gender processing. *Journal of Psycholinguistic Research*, 28, 715–728.

- Halle, M. & Marantz, A. (1993). Distributed Morphology and the pieces of inflection. In K. Hale & S. Keyser, *The view from building 20: Essays in linguistics in honor of Sylvain Bromberger* (pp. 111–176). Cambridge, MA: MIT Press.
- Hardison, D. M. (1992). Acquisition of grammatical gender in French: L2 learner accuracy and strategies. *The Canadian Modern Language Review*, 48, 292–306.
- Hawkins, R. & Chan, C. Y. (1997). The partial availability of Universal Grammar in second language acquisition: the ‘failed functional features hypothesis’. *Second Language Research*, 13 (3), 187–226.
- Hawkins, R. (1998). Explaining the difficulty of French gender attribution for speakers of English. Paper presented at the EUROSLA conference, Paris.
- Hawkins, R. (2009). Statistical learning and innate knowledge in the development of second language proficiency: Evidence from the acquisition of gender concord. In A. G. Benati (Ed.), *Issues in Second Language Proficiency* (pp. 63–78). London: Continuum.
- Hawkins, R. & Franceschina, F. (2004). Explaining the acquisition and non-acquisition of determiner-noun gender concord in French and Spanish. In P. Prévost & J. Paradis, *The Acquisition of French in Different Contexts* (pp. 175–206). Amsterdam: John Benjamins.
- Haznedar, B. & Schwartz, B. (1997). Are there optional infinitives in child L2 acquisition? In E. Hughes, M. Hughes & A. Greenhill, *Proceedings of the 21st Annual Boston University Conference on Language Development* (pp. 257–268). Somerville, MA: Cascadilla Press.
- Henzl, V. M. (1975). Acquisition of grammatical gender in Czech. *Papers and Reports on Child Language Development*, 10, 188–198.
- Hockett, C. F. (1958). *A Course in Modern Linguistics*. New York: Macmillan.
- Holmes, V. M. & Dejean de la Bâtie, B. (1999). Assignment of grammatical gender by native speakers and foreign learners of French. *Applied Psycholinguistics*, 20, 479–506.
- Holton, D., Mackridge, P. & Φιλίππáκη-Warburton, E. (2004). *Βασική Γραμματική της Σύγχρονης Ελληνικής Γλώσσας*. Αθήνα: Πατάκης.

REFERENCES

- Hopp, H. (2013). Grammatical gender in adult L2 acquisition: Relations between lexical and syntactic variability. *Second language research*, 29, 33–56.
- Hopp, H. (2016). Learning (not) to predict: Grammatical gender processing in second language acquisition. *Second Language Research*, 32 (2), 277–307.
- Hu, L. & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling*, 6 (1), 1–55.
- Jackendoff, R. (2003). Précis of foundations of language: Brain, meaning, grammar, evolution. *Behavioral and Brain Sciences*, 26, 651–707.
- Jeong, H., Sugiura, M., Sassa, Y., Haji, T., Usui, N. & Taira, M. (2007). Effect of syntactic similarity on cortical activation during second language processing: A comparison of English and Japanese among native Korean trilinguals. *Human Brain Mapping*, 28 (3), 194–204.
- Joseph, B. & Philippaki-Warbuton, I. (1987). *Modern Greek*. London: Croom Helm.
- Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, 39, 31–36.
- Karmiloff-Smith, A. (1979). A functional approach to child language. A study of determiners and reference. Cambridge: Cambridge University Press.
- Keating, G. D. (2009). Sensitivity to Violations of Gender Agreement in Native and Nonnative Spanish: An Eye-Movement Investigation. *Language Learning*, 59 (3), 503–535.
- Kempe, V. & Brooks, P. J. (2001). The role of diminutives in the acquisition of Russian gender: Can elements of child-directed speech aid in learning morphology? *Language Learning*, 51, 221–256.
- Kilborn, K. & Ito, T. (1989). Sentence processing strategies in adult bilinguals. In B. MacWhinney & E. Bates, *The crosslinguistic study of sentence processing* (pp. 257–291). Cambridge: Cambridge University Press.
- Kline, R. B. (1998). Principle and practice of structural equation modeling. New York: The Guildford Press.
- Köpcke, K. M. & Zubin, D. (1984). Sechs Prinzipien für die Genuszuweisung im Deutschen: Ein Beitrag zur natürlichen Klassifikation [Six principles of German gender assignment: A contribution to natural classification theory]. *Linguistische Berichte*, 93, 26–50.

- Koromvokis, P. and Kalaitzidis, I. (2014). The acquisition of grammatical gender in Greek language. *A Journal for Greek Letters*, 16–17 B, 307–323. [L]
[SEP]
- Lardiere, D. (2000). Mapping features to forms in second language acquisition. In J. Archibald, *Second language acquisition and linguistic theory* (pp. 102–129). Oxford: Blackwell.
- Lardiere, D. (1998). Dissociating syntax from morphology in a divergent end-state grammar. *Second Language Research*, 14, 359–375.
- Larigauderie, P., Michaud, A. & Vicente, S. (2011). The role of semantic memory in short-term recall: Effect of strategic retrieval ability in an elderly population. *Aging, Neuropsychology, and Cognition*, 18, 147–179.
- Lehman, C. (1988). On the function of agreement. In M. Barlow & C. Ferguson, *Agreement in Natural Languages — Approaches, Theories, Descriptions* (pp. 55–65). Stanford: Center for the Study of Language and Information.
- Lemhöfer, K., Dijkstra, T., Schriefers, H., Baayen, R. H., Grainger, J. & Zwitserlood, P. (2008). Native language influences on word recognition in a second language: A mega-study. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 34 (1), 12–31.
- Lemhöfer, K., Schriefers, H. & Hanique, I. (2010). Native language effects in learning second-language grammatical gender: A training study. *Acta Psychologica*, 135, 150–158.
- Levelt, W. J. M. (1989). *Speaking: from intention to articulation*. Cambridge, MA: MIT Press.
- Levelt, W. M., Roelofs, A. & Meyer, A. S. (1999). A theory of lexical access in speech production. *Behavioral and Brain Sciences*, 22, 1–75.
- Levy, Y. (1980). *The non-interaction of linguistic and cognitive notions of gender in the language of young children*. Ms., The Hebrew University, Jerusalem.
- Levy, Y. (1983a). It's frogs all the way down. *Cognition*, 15, 75–93.
- Levy, Y. (1983b). The acquisition of Hebrew plurals: the case of the missing gender category. *Journal of Child Language*, 10, 107–121.

REFERENCES

- Levy, Y. (1988). On the early learning of formal grammatical systems: evidence from studies of the acquisition of gender and countability. *Journal of Child Language*, 15, 179–187.
- Lew-Williams, C. & Fernald, A. (2007). Young children learning Spanish make rapid use of grammatical gender in spoken word recognition. *Psychological Science*, 18, 193–198.
- Lew-Williams, C. & Fernald, A. (2010). Real-time processing of gender-marked articles by native and non-native Spanish speakers. *Journal of Memory and Language*, 63, 447–464.
- Lieber, R. (1992). *Deconstructing Morphology*. Chicago: University of Chicago Press.
- Lopez, F. (1988). Adquisición y desarrollo de la identidad y de género. In J. Fernandez (ed.) *Nuevas perspectivas en el desarrollo del sexo y el género*. Madrid: Piramide.
- Lyons, J. (1968) *Introduction to theoretical linguistics*. Cambridge: Cambridge University Press.
- MacWhinney, B. (2005). Extending the Competition Model. *International Journal of Bilingualism*, 9 (1), 69–84.
- MacWhinney, B. (2008). A unified model. In N. Ellis & P. Robinson, *Handbook of cognitive linguistics and second language acquisition* (pp. 341–371). New York: Routledge.
- Maratsos, M. P. & Chalkley, M. A. (1980). The internal language of children's syntax: the ontogenesis and representation of syntactic categories. In K. E. Nelson (ed.), *Children's language*. Vol. 2. New York: Gardner Press.
- Marcoulides, G. A. & Hershberger, S. L. (1997). *Multivariate statistical methods: A first course*. Mahwah, NJ: Erlbaum.
- Maridaki-Kassotaki, K. (2002). The relation between phonological memory skills and reading ability in Greek-speaking children: Can training of phonological memory contribute to reading development? *European Journal of Psychology of Education*, 17 (1), 63–73.
- Marinis, T. (2010). Using on-line processing methods in language acquisition research. *Language Learning and Language Teaching*, 27, 139–162.

- Marslen-Wilson, W. D. (1984). Function and process in spoken word-recognition. In H. Bouma & D. G. Bouwhuis, *Attention and Performance X: Control of Language Processes* (pp. 125–150). Hillsdale, NJ: LEA.
- Mastropavlou, M. (2006). *The Role of Phonological Salience and Feature Interoretability in the Grammar of Typically Developing and Language Impaired Children*. PhD Dissertation. Aristotle University of Thessaloniki.
- Mastropavlou, M. & Tsimpli, I. M. (2011). The Role of Suffixes in Grammatical Gender Assignment in Modern Greek: A Psycholinguistic Study. *Journal of Greek Linguistics*, 11, 27–55.
- McCarthy, C. (2008). Morphological variability in the comprehension of agreement: an argument for representation over computation. *Second Language Research*, 24 (4), 459–486.
- Mills, A. E. (1985). The acquisition of German. In D. I. Slobin (ed.), *The crosslinguistic study of language acquisition*. Vol. 1. The data. Hillsdale, NJ: Erlbaum.
- Mills, A. E. (1986). Acquisition of the natural-gender rule in English and German. *Linguistics*, 24, 31–45.
- Montrul, S., Davidson, J., de la Fuente, I. & Foote, R. (2014). Early language experience facilitates the processing of gender agreement in Spanish heritage speakers. *Bilingualism: Language and Cognition*, 17 (1), 118–138.
- Montrul, S., de la Fuente, I., Davidson, J. & Foote, R. (2012). The role of experience in the acquisition and production of diminutives and gender in Spanish: Evidence from L2 learners and heritage speakers. *Second Language Research*, 29 (1), 87–118.
- Montrul, S., Foote, R. & Perpiñán, S. (2008). Gender Agreement in Adult Second Language Learners and Spanish Heritage Speakers: The Effects of Age and Context of Acquisition. *Language Learning*, 58 (3), 503–533.
- Morales, L., Paolieri, D., Dussias, P. E., Valdes Kroff, J. R., Gerfen, C. & Bajo, M. T. (2016). The gender congruency effect during bilingual spoken-word recognition. *Bilingualism: Language and Cognition*, 19 (2), 294–310.
- Mueller, R. O. (1996). *Basic principles of structural equation modeling*. Germany: Springer.

REFERENCES

- Mulford, R. (1983). Semantic and formal factors in the comprehension of Icelandic pronoun gender. *Papers and reports on Child Language Development*, 12, 83–91.
- Mulford, R. (1985). Comprehension of Icelandic pronoun gender: semantic versus formal factors. *Journal of Child Language*, 12, 443–453.
- Navarrete, E., Mahon, B. Z. & Caramazza, A. (2010). The cumulative semantic cost does not reflect lexical selection by competition. *Acta Psychologica*, 134, 279–289.
- Oliphant, K. (1998). Acquisition of grammatical gender in Italian as foreign language. *Canadian Modern Language Review*, 54 (2), 239–262.
- Paolieri, D., Cubelli, R., Macizo, P., Bajo, T., Lotto, L. & Job, R. (2010). Grammatical gender processing in Italian and Spanish bilinguals. *The Quarterly Journal of Experimental Psychology*, 63, 1631–1645.
- Paraskevopoulos I. (1985). *Exeliktiki Psychologia*. Athina: Ekdoseis Panepistimiou Athinon.
- Paris, G. & Weber, A. (2004). The role of gender information in spoken-word recognition in a non-native language. *AMLaP (10th annual conference on architecture and mechanisms of language processing)*. Aix en Provence France.
- Pérez-Pereira, M. (1991). The acquisition of gender: What Spanish children tell us. *Journal of Child Language*, 18, 571–590.
- Pinker, S. (1982). A theory of the acquisition of lexical-interpretive grammars. In J. Bresnan (Ed.), *The mental representation of grammatical relations* (pp. 655–726). Cambridge, MA: M.I.T.
- Plemmenou, E., Bard, E. G. & Branigan, H. P. (2002). Grammatical gender in the production of single words: some evidence from Greek. *Brain and Language*, 81, 236–241.
- Poirier, M. & Saint-Aubin, J. (1995). Memory for related and unrelated words: Further evidence on the influence of semantic factors in immediate serial recall. *Quarterly Journal of Experimental Psychology*, 48A, 384–404.

- Poirier, M., Saint-Aubin, J., Mair, A., Tehan, G. & Tolan, A. (2015). Order recall in verbal short-term memory: The role of semantic networks. *Memory and Cognition*, 43, 489–499.
- Popova, M. I. (1973). Grammatical elements of language in the speech of preschool children. In C. A. Ferguson and D. I. Slobin (Eds.), *Studies of child language development* (pp. 269–280). New York: Holt, Rinehart & Winston.
- Prévost, P. & White, L. (1999). Accounting for morphological variation in second language acquisition: truncation or missing inflection? In M.-A. Friedemann & L. Rizzi, *The acquisition of syntax* (pp. 202–235). London: Longman.
- 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.
- Protopapas, A. (2006). On the use and usefulness of stress diacritics in reading Greek. *Reading and Writing: An Interdisciplinary Journal*, 19 (2), 171–198.
- Ralli, A. (1994). Feature representations and feature-passing operations in Greek nominal inflection. *Proceedings of the 8th Symposium on English and Greek Linguistics* (pp. 19–46). Thessaloniki: Department of English, Aristotle University of Thessaloniki.
- Ralli, A. (2002). The role of morphology in gender determination: evidence from Modern Greek. *Linguistics*, 40 (3), 519–551.
- Ramscar, M., Yarlett, D., Dye, M., Denny, K. & Thorpe, K. (2010). The effects of Feature–Label–Order and their implications for symbolic learning. *Cognitive Science*, 34 (6), 909–957.
- Robson, C. (2002). *Real world research*. Oxford: Blackwell Publishing.
- Sabourin, L. & Haverkort, M. (2003). Neural substrates of representation and processing of a second language. In R. van Hout, A. Hulk & F. Kuiken (Eds.), *The lexicon–syntax interface in second language acquisition* (pp. 175–195). Amsterdam: John Benjamins.
- Sabourin, L. & Stowe, L. (2008). Second language processing: when are first and second languages processed similarly? *Second Language Research*, 24 (3), 397–430.

REFERENCES

- Sabourin, L., Stowe, L. & de Hann, G. (2006). Transfer effects in learning a second language grammatical gender system. *Second Language Research*, 22 (1), 1–29.
- Sagarra, N. & Herschensohn, J. (2010). The role of proficiency and working memory in gender and number agreement processing in L1 and L2 Spanish. *Lingua*, 120, 2022–2039.
- Saint-Aubin, J. & Poirier, M. (1999). The Influence of Long-term Memory Factors on Immediate Serial Recall: An Item and Order Analysis. *International Journal of Psychology*, 34 (516), 347–352.
- Salamoura, A. (2007). Grammatical Gender in the Bilingual Lexicon: A Psycholinguistic Approach. In I. Kecskes & L. Albertazzi, *Cognitive Aspects of Bilingualism* (pp. 99–151). New York: Springer.
- Salamoura, A. & Williams, J. N. (2007). The representation of grammatical gender in the bilingual lexicon: Evidence from Greek and German. *Bilingualism: Language and Cognition*, 10 (3), 257–275.
- Scherag, A., Demuth, L., Rosler, F., Neville, H. & Roder, B. (2004). The effects of late acquisition of L2 and the consequences of immigration on L1 for semantic and morpho-syntactic language aspects. *Cognition*, 93, B97–B108.
- Schriefers, H. & Jescheniak, J. D. (1999). Representation and Processing of Grammatical Gender in Language Production: A Review. *Journal of Psycholinguistic Research*, 28, 575–600.
- Schwartz, B. D. & Sprouse, R. A. (1996). L2 cognitive states and the Full Transfer/Full Access model. *Second Language Research*, 12, 40–72.
- Selkirk, E. (1982). *The Syntax of Words*. Cambridge, MA: MIT Press.
- Slobin, D. I. (1989). Thinking for speaking. In W. J. Levelt, A. Roelofs & A. S. Meyer, *A theory of lexical access in speech production* (Vol. 22, pp. 1–75). Behavioral and Brain Sciences.
- Smith, N. & Tsimpli, I. M. (1995). *The mind of a savant: language learning and modularity*. Oxford: Blackwell.
- Soares, C. & Grosjean, F. (1984). Bilinguals in a monolingual and a bilingual speech mode: The effect on lexical access. *Memory & Cognition*, 12, 380–386.

- Stephany, U. (1997). The acquisition of Greek. In D.I. Slobin (Eds.), *The crosslinguistic study of language acquisition*, Vol. 4, (pp. 183–333). Hillsdale, NJ: Erlbaum.
- Stump, G. (2001). *Inflectional Morphology – A Theory of Paradigm Structure*. Cambridge: Cambridge University Press.
- Taft, M. & Meunier, F. (1998). Lexical representation of gender: A quasiregular domain. *Journal of Psycholinguistic Research*, 27, 23–45.
- Tanner, D. (2008). Agreeing That Agreement Isn't the Problem. In M. Bowles, R. Foote, S. Perpiñán & R. Bhatt (Ed.), *Selected Proceedings of the 2007 Second Language Research Forum* (pp. 22–34). Somerville, MA: Cascadilla Proceedings Project.
- Taraban, R. & Kempe, V. (1999). Gender processing in native and nonnative Russian speakers. *Applied Psycholinguistics*, 20, 119–148.
- Taraban, R. & Roark, B. (1996). Competition in learning language-based categories. *Applied Psycholinguistics*, 17, 125–148.
- Tokowicz, N. & MacWhinney, B. (2005). Implicit and explicit measures of sensitivity to violations in second language grammar — An event-related potential investigation. *Studies in Second Language Acquisition*, 27 (2), 173–204.
- 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. & Mastropavlou, M. (2007). Feature Interpretability in L2 Acquisition and SLI: Greek Clitics and Determiners. In J. M. Liceras, H. Zobl & H. Goodluck (Eds.), *The Role of Formal Features in Second Language Acquisition* (pp. 142–183). Mahwah, NJ: Lawrence Erlbaum.
- Tsimpli, I. M. (1997). Variation in the L2 speaker. In K. Brown (Ed.), *Encyclopaedia of language and linguistics* (Ed. 2, Vol. 13, pp. 387–394). Oxford: Elsevier.
- Tsimpli, I., Roussou, A., Fotiadou, G. & Dimitrakopoulou, M. (2005). The syntax/morphology interface: Agree relations in L1 Slavic/L2 Greek. *Proceedings of the 7th International Conference on Greek Linguistics*, (pp. 1–15).
- Tsimpli, I. M. & Roussou, A. (1991). Parameter-resetting in L2? *UCL Working Papers in Linguistics*, 3, 149–170.

REFERENCES

- Tsimpili, I. M. & Smith, N. V. (1991). Second language learning: evidence from a polyglot savant. *UCL Working Papers in Linguistics*, 3, 171–184.
- Tucker, G. R., Lambert, W. E. & Rigault, A. (1977). *The French speaker's skill with grammatical gender: an example of rule-governed behaviour*. The Hague: Mouton.
- Ullman, M. T. (2001). The declarative/procedural model of lexicon and grammar. *Journal of Psycholinguistic Research*, 30, 37–69.
- Vainikka, A. & Young-Scholten, M. (1996). Gradual development of L2 phrase structure. *Second Language Research*, 12, 7–39.
- van Heugten, M. & Shi, R. (2009). French-learning toddlers use gender information on determiners during word recognition. *Developmental Science*, 12, 419–425.
- Varlokosta, S. (2011). The role of morphology in grammatical gender assignment. In A. Galani, G. Hicks & G. Tsoulas, *Morphology and its Interfaces* (pp. 321–349). Amsterdam: John Benjamins.
- White, L. (1989). *Universal grammar and second language acquisition*. Amsterdam: John Benjamins.
- White, L. (2003). *Second language acquisition and universal grammar*. Cambridge: Cambridge University Press.
- White, L., Valenzuela, E., Kozłowska-Macgregor, M. & Leung, Y.-K. (2004). Gender agreement in nonnative Spanish: Evidence against failed features. *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, 1272–1288.
- Zekhnini, A. & Hulstijn, J. H. (1995). An experimental study on the learning of arbitrary and non-arbitrary gender of pseudo Dutch nouns by non-native and native speakers of Dutch. *Applied Linguistics*, 53, 121–136.
- Αλεξόπουλος, Δ. Σ. (1998). *Ψυχομετρία: Κατασκευή τεστ [Psychometrics: construction of tests]*. Αθήνα: Ελληνικά Γράμματα.
- Αναστασιάδη-Συμεωνίδη, Α. (2012). Το νεοελληνικό κλιτικό σύστημα των ουσιαστικών και οι τάσεις τους [Modern Greek conjugation system of nouns

- and their trends]. In Ζ. Γαβριηλίδου, Α. Ευθυμίου, Ε. Θωμαδάκη & Π. Καμπάκη-Βουγιουκλή (Eds.), *10th ICGL* (pp. 23–40). Κομοτηνή: Δημοκρίτειο Πανεπιστήμιο Θράκης.
- Αναστασιάδη-Συμεωνίδη, Α. & Χειλά-Μαρκοπούλου, Δ. (2003). Συγχρονικές και διαχρονικές τάσεις στο γένος της ελληνικής: Μια θεωρητική πρόταση [Synchronic and diachronic trends in the Greek gender: A theoretical proposal]. In Α.-Σ. Άννα, Α. Ράλλη & Δ. Χειλά-Μαρκοπούλου (Eds.), *Το Γένος [The Gender]* (pp. 13–56). Αθήνα: Πατάκης.
- Γαβριηλίδου, Ζ. & Ευθυμίου, Α. (2003). Η κατάκτηση του γένους της ελληνικής από παιδιά προσχολικής ηλικίας (Πιλοτική Μελέτη) [The acquisition of gender by Greek infants (pilot study)]. In Ι. Μ. Αναστασιάδη-Συμεωνίδη, Α. Ράλλη & Δ. Χειλά-Μαρκοπούλου (Eds.), *Το Γένος [The Gender]* (pp. 190–207). Αθήνα: Πατάκης.
- Θεοφανοπούλου-Κοντού, Δ. (2002). *Γενετική σύνταξη το πρότυπο της κυβέρνησης και αναφορικής δέσμευσης [Genetic syntax the prototype of command and referential commitment]*. Αθήνα: Καρδαμίτσα.
- Κλαίρης, Χ. & Μπαμπινιώτης, Γ. (1998). *Γραμματική της Νέας Ελληνικής: Δομολειτουργική — Επικοινωνιακή (Τόμος. 1) [Modern Greek Grammar: Structural/functional — Communicative (Vol. 1)]*. Αθήνα: Ελληνικά Γράμματα.
- Ράλλη, Α. (2003). Ο καθορισμός του γραμματικού γένους στα ουσιαστικά της νέας ελληνικής [The role of grammatical gender in nouns of modern Greek]. In Α. Αναστασιάδη-Συμεωνίδη, Α. Ράλλη & Δ. Χειλά-Μαρκοπούλου (Eds.), *Το Γένος [The Gender]* (pp. 57–99). Αθήνα: Πατάκης.
- Ράλλη, Α. (2005). *Μορφολογία [Morphology]*. Αθήνα: Πατάκης.
- Τριανταφυλλίδης, Μ. (1996). *Νεοελληνική Γραμματική της Δημοτικής. Ανατύπωση της έκδοσης του ΟΕΣΒ (1941) [Traditional Modern Greek Grammar. Republishing of OESV (1941)]*. Θεσσαλονίκη: Ινστιτούτο Νεοελληνικών Σπουδών.
- Τριανταφυλλίδης, Μ. (2002). *Νεοελληνική Γραμματική [Modern Greek Grammar]*. Αθήνα: ΟΕΔΒ.
- Τσιμπλή, Ι.-Μ. (2003). Η κατάκτηση του γένους στην ελληνική ως δεύτερη γλώσσα [The acquisition of gender in Greek as a second language]. In Α.

REFERENCES

- Αναστασιάδη-Συμεωνίδη, Α. Ράλλη & Δ. Χειλά-Μαρκοπούλου (Eds.), *Το Γένος [The Gender]* (pp. 168–189). Αθήνα: Πατάκης.
- Χειλά-Μαρκοπούλου, Δ. (2003). *Γένος και συμφωνία στη νέα ελληνική [Gender and agreement in Modern Greek]*. In Α. Αναστασιάδη-Συμεωνίδη, Α. Ράλλη & Δ. Χειλά-Μαρκοπούλου (Eds.), *Το Γένος [The Gender]* (pp. 132–167). Αθήνα: Πατάκης.
- Χριστοφίδου, Α. (2003). *Γένος και συμφωνία στην νέα ελληνική. Μια φυσική προσέγγιση [Gender and agreement in Modern Greek. A natural approach]*. In Α. Αναστασιάδη-Συμεωνίδη, Α. Ράλλη & Δ. Χειλά-Μαρκοπούλου (Eds.), *Το Γένος [The Gender]* (pp. 100–131). Αθήνα: Πατάκης.