Sublexical and Lexico-Syntactic Factors in Gender Access in Spanish

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Abstract The influence of sublexical and lexico-syntactic factors during the grammatical gender assignment process in Spanish was studied in two experiments using the gender decision task. In Experiment 1, the regularity of the ending of gender-marked nouns (masculine nouns ended in $-o$ and feminine nouns ended in $-a$) and of nouns with gender-correlated but unmarked word-endings (e.g., $-ad$) was manipulated. The results showed that regularity affected reaction times and error rates only in the case of gender-marked nouns, suggesting that the mere statistical distribution of a word-ending across genders is not responsible for the regularity effect. In Experiment 2, gender-marked nouns and gender-unmarked nouns were preceded by a masked prime which could be a definite article (which provides information about the gender of the noun) or a possessive pronoun (which does not contain gender information). The presentation of the definite article led to shorter reaction times and less errors only when the word-ending was different from $-o$ or $-a$. Taken together, these results indicate that gender assignment in Spanish is carried out through different processes depending on the noun ending: gender decisions for gender-marked nouns are based on the gender-to-ending distribution. Meanwhile, gender decisions for unmarked nouns seem to require the retrieval of the corresponding definite grammatical article, regardless of the statistical distribution of the noun ending across genders.

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Introduction

Grammatical gender is a linguistic category morphologically developed in many of the world's languages. For instance, in Spanish all the nouns are masculine or feminine, and gender categorization may be necessary in order to correctly place a word in a sentence. Even though sometimes it denotes biological value, grammatical gender is typically non-conceptual in nature, and cannot be derived from the meaning of the noun (e.g., in Spanish, *cesta* is feminine and *cesto* is masculine, both words meaning different kind of *basket*). Despite the fact that Spanish nouns ending in −*o* are usually masculine and those ending in −*a* tend to be feminine, this is far from being a rule for accessing grammatical gender. Not only there are many nouns reversing this pattern (such as *mano –hand–*, which is feminine, or *mapa –map–*, which is masculine), but also there are plentiful nouns with an ending different from −*o* and −*a* (e.g., *mujer*, *woman*). Given the arbitrariness of the grammatical gender of most Spanish nouns, it is unclear how this is assigned[1] during the comprehension and production processes. The present study addresses what kind of information is used when deciding the gender of a Spanish noun during comprehension, specially in the context of a gender decision task.

Two sources of information have been proposed as relevant during the gender assignment process: sublexical and lexico-syntactic information. It has been argued that gender could be assigned exclusively based on superficial *sublexical* information, and specifically by attending to the gender-to-ending distribution (Taft and Meunier 1998; Gollan and Frost 2002; Bates et al. 1995). This information may be specially useful in some languages such as Spanish, in which there are several word-endings that are more frequent in one specific gender. Nouns including this sort of ending are known as phonologically transparent, because gender can be correctly recovered from the surface form with only a few exceptions. Words with an ending non-biased towards one specific gender are called phonologically opaque. For example, and according to statistical analyses carried out by Teschner and Russell (1984), the orthographic/phonological marker −*ad* is considerably more frequent in Spanish feminine nouns (99.7 %) than in masculine nouns (0.3 %). Thus, the feminine noun *ciudad* (*city*) is a transparent noun. Differently, the feminine word *crisis* (*crisis*) is an opaque noun because the ending −*s* is approximately equally distributed across feminine (42.68 %) and masculine nouns (57.32 %). There is ample evidence suggesting that the gender-to-ending distribution plays a critical role in extracting grammatical gender. Tucker et al. (1968) observed that in French, the gender given to a non-word correlates with the proportion of words in masculine or feminine with its ending. The authors interpreted this result as proof of the existence of a set of rules linking word-endings and grammatical gender. Moreover, it seems that phonological transparency affects reaction times when assigning gender to real words. Slower gender decisions for opaque than for transparent words have been repeatedly observed (Bates et al. 1995, 1996; Hernandez et al. 2004), suggesting that the word-ending is relevant during gender access.

Regularity effects have also been reported when deciding the grammatical gender of single words (Taft and Meunier 1998; Holmes and Dejean de la Bâtie 1999; Gollan and Frost 2002;

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[1] In the present manuscript, the terms *gender decision*, *gender assignment* and *gender attribution* are used interchangeably. They are referred to the set of processes involved in the selection of the grammatical gender of a visually presented word.

De Martino et al. 2010). Irregular gender refers to the situation in which the grammatical gender of a noun is unexpected given its ending. For example, the masculine Spanish word *abad* (*abbot*) is irregular because its ending is typical of feminine words. It is worth noting that only transparent nouns can be categorized into regular and irregular, since opaque nouns are equally distributed across genders. The studies addressing regularity effects have usually reported longer reaction times and more errors when deciding the gender of irregular than regular words (Gollan and Frost 2002; Cacciari and Padovani 2002; Padovani 2002; Padovani and Cacciari 2003). This evidence seems to confirm that the word-ending is used to decide the word's grammatical gender.

At least two different mechanisms may account for transparency and regularity effects. On the one hand, grammatical gender could be assigned depending on the strength of the association between a word-ending and a particular gender. If so, differences in reaction time between transparent and opaque words (*casa* vs. *crisis*) and between regular and irregular words (*casa* vs. *prisma*) would be due to mere differences in the statistical distribution of their endings across both genders (Rumelhart and McClelland 1986). Thus, transparency and regularity effects should be obtained with any gender-correlated word-ending, such as −*ad*. However, studies addressing this issue in Spanish have only used the above-mentioned gender markers −*o* and −*a* as transparent endings. If gender is accessed by taking into account the statistical distribution of an ending across genders, then irregular nouns like *abad* should yield an irregularity effect as well.

On the other hand, it could be argued that transparency and regularity effects observed in Spanish might be exclusively linked to the gender markers −*o* and −*a*. Since these markers are not just correlated to a particular grammatical gender, but also gender suffixes that can be attached to some modifiers (e.g., adjectives) that qualify nouns (e.g., *bonita casa −nice*_fem *house−*, *bonito pueblo −nice*_masc *village−*), they can play an especially relevant role in gender access (Gollan and Frost 2002). Crucially, they are also gender markers in some personal pronouns (*ella*, *ellos*, *ellas*; *she*, *they*_masc, *they*_fem, respectively), demonstratives (*estos*, *esos*, *estas*, *esas*; *these*_masc, *those*_masc, *these*_fem, *those*_fem) and object pronouns (*lo*, *la*). This fact may have led to some sort of "grammaticalization" of −*o* and −*a*. They are also considerably more common than other endings. For example, the percentage of words ending in −*a* and −*o* is quite high (32.69 and 29.21 %, respectively), whereas other endings are relatively infrequent (e.g., only a 3.62 % out of the Spanish words end in −*ión*). Moreover, the markers −*o* and −*a* convey information about the biological/semantic gender of some nouns. In nouns like *chico*, *chica* (*boy*, *girl*) −*o* is added to the root when referring to males and −*a* is added when referring to females. Therefore, it is possible that only the endings −*o* and −*a* are relevant for a gender decision. From this point of view, the presence of a mere gender-correlated word-ending would not to have an effect on gender decisions. Instead, only "grammaticalized" endings (i.e, −*o* and −*a*) would be used as indicators of the gender of the word. Since the studies addressing the gender assignment process in Spanish have almost exclusively used the endings −*o* and −*a* to generate transparent stimuli (Álvarez et al. 2011; Hernandez et al. 2004; Urrutia et al. 2009), these two accounts cannot be separated on the grounds of previous evidence.

Apart from sublexical information, another type of information that has been proposed to influence access to grammatical gender is *lexico-syntactic* information (Taft and Meunier 1998; Holmes and Segui 2004; Bates et al. 1996; Wicha et al. 2004). Several studies have indicated that the gender of a word can be extracted on the basis of the gender of other words that systematically co-occur with the target word. The words most frequently accompanying nouns are undoubtedly articles (in Spanish, *el*, *la*, *un*, *una*). It is thought that these words could play a critical role in the gender assignment process. This is because, since they are

gender-marked in several languages, they are excellent predictors of the grammatical gender of the associated noun (in Spanish, *el*, *un* are the masculine forms, and *la*, *una* are the feminine forms).

In French, the definite article only provides gender information when followed by a noun which begins with a consonant (e.g., *la femme –the woman–*, *le roi –the king–*). However, the definite article is reduced to *l′* when the noun begins with a vowel (e.g., *l'homme*, *–the man–*). This form is common to both masculine and feminine forms, so it does not provide gender information. This characteristic of French has been used to address the relevance of lexico-syntactic information when performing a gender decision task. Taft and Meunier (1998) observed that French speakers had difficulties in making gender decisions over country names when they began with a vowel. A similar pattern of results has been reported by other authors (Desrochers and Paivio 1990; Desrochers et al. 1989). Moreover, Taft and Meunier observed in their study that participants assigned the gender faster when they were presented with the categorical labels *un/une* as an aid (which represent the masculine and the feminine form of the indefinite article, respectively) than when they were presented with the categories *masculine/feminine*. These results indicate that articles might be used to some extent to determine the gender of a noun.

Some studies have attempted to establish the relative contributions of lexical and sublexical factors to the gender assignment process. The results suggest that both kinds of information play a role when deciding the grammatical gender of a word, and that the influence of each factor varies depending on the nature of the task (Holmes and Segui 2004; Bates et al. 1995; Desrochers et al. 1989). Of special interest for the present work are those studies that have used the gender decision task. The evidence obtained in French indicates that sublexical information is only consulted when the lexical information is impoverished. Taft and Meunier (1998) observed that their participants had difficulties in making gender decisions to words beginning with a vowel even when they had highly informative endings. They proposed that the most reliable cue in each language (e.g., in French the gender marked article) plays the central role in accessing the grammatical gender.

In Spanish, only a few studies have investigated the relative contribution of sublexical and lexico-syntactic cues to the gender assignment process. In a functional MRI (fMRI) study, Hernandez et al. (2004) scanned participants while they performed a gender decision task on transparent and opaque words. The results revealed increased activity in BA 44/6 and BA 44/45 (among other areas) for opaque words compared to transparent words (namely, $-o/-a$ words). BA 44/45 has appeared in several studies linked to syntactic tasks, and in gender decisions to single nouns compared to semantic decision tasks (Miceli et al. 2002). BA44/6 has been associated with phonological retrieval (Burton et al. 2000; Zatorre et al. 1996) and with the actual generation of the determiner (Heim et al. 2002). Hernandez and colleagues interpreted these findings as evidence that opaque items require additional morphological processing relative to transparent items. Moreover, they suggested that, at least in Spanish, gender attribution for an opaque noun could require the retrieval of the determiner associated with it. This means that for the masculine word *arroz* (*rice*), the gender is decided by (silently) generating the determiner that usually accompanies it (*el*).

The present study is aimed at establishing the extent to which both sublexical and lexical information are used in order to perform a gender decision task on nouns ending with gender-marked suffixes ($-o/-a$) and nouns with other word-endings. In Experiment 1 we assessed whether gender decision is performed relying on the information provided by the Spanish gender-to-ending distribution. Specifically, we examined whether or not there is any difference in the size of the regularity effect between gender-marked nouns and unmarked nouns with gender-correlated word-endings (e.g., $-ad$). In Experiment 2, we used the masked

priming paradigm to establish whether or not the retrieval of a determiner is used by Spanish speakers in order to decide the gender of a noun.

Experiment 1

In this experiment we aimed to test whether other gender-correlated word-endings are relevant in performing a gender decision task to the same extent as the gender markers $-o/-a$ do. To this end, we manipulated the regularity of nouns ending in $-o/-a$ and the regularity of other gender-correlated endings (for example, $-\acute{o}n$ is more frequent in masculine words and $-ad$ in feminine words). If participants perform the gender decision task depending on the main gender-to-ending distribution, then regularity should equally affect nouns ended in $-o/-a$ and nouns with other gender-correlated endings. However, if only the gender markers $-o/-a$ are used to access gender information, then regularity should affect exclusively those nouns ending in $-o/-a$.

Method

Participants

Twenty eight students from introductory courses of the University of La Laguna participated in this experiment to fulfill a course credit requirement. All of them were native Spanish speakers, right-handed and with no known motor or perceptive disorders.

Materials

We selected 64 experimental nouns from the Spanish LEXESP database: in one half of the stimuli the noun ending was $-o/-a$, and in the other half the nouns had other endings. In both cases endings statistically biased towards one specific gender were used. For the items ending in $-o/-a$, 16 nouns ending in $-o$ and 16 nouns ending in $-a$ were selected, and for the items with other endings we chose 16 nouns with a typically feminine ending and 16 nouns with a typically masculine ending. The statistical distribution in Spanish of the endings used in this experiment as a function of the grammatical gender is given in Table 1, adapted from Teschner and Russell (1984). We considered the distribution across genders of the rhyme, rather than considering only the last letter of the word. We chose this procedure because some endings are strongly biased towards one gender only when a larger segment is taken into account. For example, although the majority of words ended in $-\acute{o}n$ are masculine (94.2 %), the ending $-i\acute{o}n$ is feminine in more than the 98 % of the Spanish nouns (see Table 1). Thus, in the present study we consider $-i\acute{o}n$ a typical feminine ending, and $-\acute{o}n$ preceded by other letters was included as a typical masculine ending. For each condition, one half of the words were feminine and the other half were masculine, so one half of the stimuli were regular and the other half were irregular. The experimental conditions did not differ in mean lexical frequency, word length, syllabic length or orthographic neighborhood (all ts < 1). The values for these measures were provided by B-PAL software (Davis and Perea 2005).

Table 1 Statistical distribution in Spanish for each gender of the endings used in Experiment 1 and Experiment 2

Grammatical gender	Masculine (%)	Feminine (%)
−a	3.70	96.30
−o	97.85	0.13
−ad	0.30	99.70
−ón	94.20	5.80
−ud	5	95
−iz	26.30	73.70
−ión	1.64	98.36
−i	92.70	7.30
−ú	99.9	0.1
−e	85.60	14.40

Procedure

The experiment was conducted individually in a sound-proof cabin, and it was run on a PC connected to a CRT monitor. Stimuli presentation and data recording were controlled by DMDX software (Forster and Forster 2003). A trial began with a centered 500-ms fixation point (+) that was immediately replaced by the uppercase target word, which remained in the screen for a maximum of 2,000 ms or until a response was produced. The participants were instructed to make a gender decision on the target word by pressing one of the response keys labeled M (masculine) and F (feminine) as quickly and accurately as possible. Half of the participants had to respond with the right hand to the masculine words and with the left hand to the feminine words, and the opposite was true for the other half. They were trained with a 9-trial practice block. The presentation of the stimuli was randomized across participants. The whole experimental session lasted around 20 min.

Results

Only correct responses were included in the analysis of reaction times. Latencies above and below 2 standard deviations from the mean by participant were excluded from the analysis (11.48 %). Table 2 shows the mean response latencies, error rates and standard deviations for each condition. We carried out two separate ANOVAs, one on the reaction times and one on the error rates. Type of ending and regularity were both within-subject variables in the analysis by participants (F_1) and between-subjects variables in the analysis by items (F_2).

For the reaction times, the main effect of regularity was significant in the analysis by participants (14 ms), $F_1(1,26) = 7.11$, $MSE = 5,018.86$, $p < .05$, but not by items ($F_2 < 1$). Reaction times were faster when the ending of the noun was regular. More importantly, the interaction between type of ending and regularity was significant in both analyses, $F_1(1,26) = 11.93$, $MSE = 5,992.63$, $p < .05$; $F_2(1,55) = 4.18$, $MSE = 11,301.01$, $p < .05$. Planned comparisons showed that regularity affected reaction times in the case of nouns ended in −o/−a (88 ms), $F_1(1,26) = 15.63$, $MSE = 6,658.76$, $p < .01$; $F_2(1,25) = 4.59$,

Table 2 Mean response latencies (in ms) and percentage of error rates (in brackets) in Experiment 1

	Gender-marked	Gender-unmarked
Regular	894 (6.25 %)	950 (10.90 %)
Irregular	982 (18.50 %)	935 (10.30 %)

$MSE = 12,376.95$, $p < .05$, but not in the case of nouns with other endings ($F < 1$). The variable type of ending did not reach significance (all Fs < 1).

In the case of errors, the main effect of regularity was significant, $F_1(1,26) = 11.34$, $MSE = 1.06$, $p < .05$; $F_2(1,55) = 7.94$, $MSE = 5.76$, $p < .01$. Participants made more errors in irregular than in regular items. The interaction between type of ending and regularity was also significant, $F_1(1,26) = 14.64$, $MSE = 1.71$, $p < .01$; $F_2(1,55) = 9.136$, $MSE = 5.76$, $p < .05$. Planned comparisons showed that regularity affected errors when responding to gender-marked nouns, $F_1(1,26) = 20.65$, $MSE = 1.73$, $p < .01$; $F_2(1,27) = 17.16$, $MSE = 5,76$, $p < .05$, but not when responding to gender-unmarked nouns, ($F < 1$). Type of ending was not significant (all Fs < 1).

It is worth noting that the error rate in Experiment 1 is quite high (11.48 %). It can be seen in Table 2 that this is mainly due to the large number of errors in the irregular gender-marked condition (18 %). Consistently with this idea, the error rate in the regular gender-marked condition is as high as might be expected (6.25 %). More importantly, the significant interaction obtained in the error analysis supports this claim.

Discussion

Experiment 1 revealed that regularity affected only those nouns ended in $-o$ and $-a$. This pattern of results suggests that these gender-marked suffixes heavily influence the gender decision process. Participants seem to directly assign masculine gender to nouns ended in $-o$ and feminine gender to nouns ended in $-a$. Thus, when gender was irregular, reaction times and error rates increased significantly. However, when the word-ending was different from $-o/-a$, participants were not affected by the gender-to-ending distribution. This evidence rules out the existence of a general mechanism of gender assignment based on the probability associated to a particular word-ending as representing one gender or another. Rather, it seems that only the gender-markers influence the gender decision process.

However, a question that remains unsolved is what information is used to decide the gender of those Spanish nouns which are not gender-marked. As mentioned above, some authors have suggested that gender assignment for opaque nouns could require the retrieval of the gender-marked determiner associated with it (Hernandez et al. 2004; Taft and Meunier 1998; Gollan and Frost 2002). In Experiment 2, we aimed to test whether or not gender assignment for gender-unmarked nouns is actually based on the retrieval of the gender-marked definite article. For this purpose, we used the masked priming paradigm. In this gender decision experiment we compared the priming effect produced by the brief masked presentation of a definite article on gender-marked nouns versus gender unmarked nouns.

Experiment 2

In Experiment 2 gender-marked nouns and gender-unmarked nouns were preceded by the appropriate definite article *el* or *la* (the masculine and the feminine form of 'the', respectively), or by a possessive pronoun *mi* or *tu* ('my' or 'your', respectively), which do not provide gender information. If the gender of a gender-unmarked noun is accessed by retrieving the determiner associated with it, then a priming effect produced by the definite article is expected for this type of nouns. We do not expect this effect for gender-marked nouns because gender decision in these cases would mainly rely on the gender-marker.

Method

Participants

Forty students from introductory courses of the University of La Laguna participated in this experiment to fulfill a course credit requirement. All of them were native Spanish speakers, right-handed and with no known motor or perceptive disorders. None of them took part in Experiment 1.

Materials

We selected 60 nouns as targets, 30 masculine and 30 feminine, all of them containing a regular ending. Half of them ended in $-o/-a$ (they ended in $-o$ in the case of masculine nouns and in $-a$ in the case of feminine nouns) and the other half had other biased endings which are not gender markers (for example, $-ón$ for masculine nouns and $-ad$ for feminine nouns). Both groups of nouns were matched in word length, word frequency and orthographic neighborhood. No statistical differences were found between conditions in these variables (all $ts < 1$). Both singular forms of the definite article (*la* and *el*) and two singular forms of possessive pronoun (*mi* and *tu*) were selected as prime words. Ten additional words were selected as practice items.

Design

A 2×2 experimental design was used. The variable type of ending had two levels (gender-marked, gender-unmarked) as had the variable Type of prime (definite article, possessive pronoun). Each target word appeared preceded by both primes, but two different lists were created so that a participant only saw each target word once. Therefore, each participant saw 60 prime-target pairs.

Procedure

The participants carried out the experiment individually in a sound-proof cabin. The experiment was run using DMDX software (Forster and Forster 2003). Each trial started with a 50-ms fixation point (+) in the center of the screen followed by the presentation of a row of hash marks (##) for 11 ms. This was immediately replaced by a centered lowercase prime during 33 ms, which was in turn replaced by the 11-ms row of hash marks. After this mask, the target word appeared in uppercase letters during 2,000 ms, or until a response was given. The participants were instructed to make a gender decision on the target word as quickly and accurately as possible. They had to press one of the response keys labeled on the keyboard

Table 3 Mean response latencies (in ms) and percentage of error rates (in brackets) in Experiment 2

	Gender-marked	Gender-unmarked
Determiner	802 (3.65 %)	806 (3.50 %)
Possessive pronoun	796 (3.75 %)	836 (3.90 %)

(M for masculine nouns and F for feminine nouns). Half of the participants had to respond with the right hand to the masculine words and with the left hand to the feminine words, and the opposite was true for the other half. They were trained with a 10-trial practice block. The presentation of the stimuli was randomized across participants. The whole experimental session lasted around 30 minutes.

Results

Only correct responses were included in the analysis over reaction times. Latencies above and below 2 standard deviations from the mean by participant were excluded from the analysis (3,7 %). Table 3 shows the mean response latencies and error rates for each condition.

ANOVAs were carried out on the response latencies and on the error rates. Type of ending and type of prime were within-subject variables in the analysis by participants (F_1). In the analysis by items (F_2), Type of ending was a between-subjects variable and type of prime was a within-subjects variable.

In the reaction times analysis, the effect of type of ending was significant in the analysis by participants, $F_1(1,39) = 10.95$, $MSE = 19,450.33$, $p < .01$, but not in the analysis by items $F_2 < 1$. Response latencies were faster for gender-marked nouns than for gender-unmarked nouns (22 ms). The effect of type of prime was marginally significant in both analysis, by participants, $F_1(1,39) = 3.39$, $MSE = 5,826.97$, $p = .073$, and by items, $F_2(1,58) = 2.83$, $MSE = 6,809.15$, $p = .098$. Gender decisions were faster when the prime was a definite article than when it was a possessive pronoun (24 ms). Critically, the interaction between type of ending and type of prime was significant in the analysis by participants, $F_1(1,39) = 10.02$, $MSE = 13,825.67$, $p < .01$, and in the analysis by items, $F_2(1,58) = 4.06$, $MSE = 9,786.03$, $p < .05$. Planned comparisons revealed that effect of type of prime was only significant for gender-unmarked nouns (30 ms), $F_1(1,39) = 11.67$, $MSE = 18,801.95$, $p < .01$, $F_2(1,29) = 5.43$, $MSE = 16,460.59$, $p < .05$, but not for gender-marked nouns ($F < 1$), where there was in fact a tendency in the opposite direction (−6 ms). In the error analysis, there were no significant differences (all Fs < 1).

Discussion

In Experiment 2 we observed faster gender decisions for nouns ended in −o/−a than for other nouns. It seems that gender decisions benefited from the gender-marking. More interestingly, the results suggest that the gender information provided by the definite article was only relevant for accessing the gender of unmarked nouns. This pattern of results is in line with the proposal of Hernandez et al. (2004). It seems that, at least in Spanish, the determiner may be generated in order to extract the grammatical gender of nouns only if they do not end in −o or −a.

General Discussion

The main question addressed in the present study was whether or not the gender decision process relies on the same mechanisms when the nouns are gender-marked and when they are not. Based on the whole set of results of Experiments 1 and 2, the answer is straightforward: the gender attribution process is different depending on the word-ending. Experiment 1 replicated previous findings of shorter reaction times for regular than for irregular nouns in the gender decision task (Bates et al. 1996; Hernandez et al. 2004). More importantly, our results revealed that regularity only affected reaction times in the case of gender-marked nouns, suggesting that only the markers −o and −a are used as cues for accessing grammatical gender. It is worth noting than in this experiment the gender-unmarked condition was made up of nouns with a gender-correlated word-ending. Thus, these nouns are not opaque. This fact allows us to conclude that the gender decision process is not exclusively based on the statistical distribution of the endings across feminine and masculine nouns. Instead, it seems that −a/−o are the only endings used for extracting information about grammatical gender. It could be argued that −o and −a are just more frequent in Spanish that the other endings used here, so our results might just reveal quantitative rather than qualitative differences between gender-marked and gender-unmarked nouns. If this was the case, a reduced (but still reliable) regularity effect for gender-unmarked nouns in Experiment 1 would be expected. However, there was in fact a tendency in the opposite direction (−15 ms).

In Experiment 2, we observed that unmarked nouns were faster in the gender decision task when a definite article was used as a prime than when the prime was a possessive pronoun, while gender-marked nouns were not affected by the type of prime. This pattern of results suggests that those nouns which do not end in −o or −a would be gender assigned by retrieving the determiner. Again, gender-marked nouns were slightly (not significantly) slower when preceded by the determiner than when preceded by the possessive pronoun.

Taken together, these results indicate that the gender-markers −o/−a are crucial when performing a grammatical gender decision task in Spanish. However, if the target noun contains a different ending, then the retrieval of the determiner would be the preferred strategy in order to establish the grammatical gender of the noun. This pattern of results is in line with those reported by Hernandez et al. (2004). They proposed that in the case of deciding the gender of an opaque noun in Spanish, it is more likely that a small syntactic phrase (determiner + noun) is generated to access the morphological information, than in the case of a transparent noun. This strategy would permit a faster decision with a very low percentage of error. Since these authors used only nouns ended in −o/−a to create the transparent condition, we consider that the determiner could also be the preferred source of information to decide the gender of other gender-correlated nouns different from −o/−a, such as −ad or −ón. This idea is supported by the results obtained in our Experiment 2.

Thus, we consider that our results indicate that both lexico-syntactic and sublexical factors play a role during the gender decision process, as has been claimed in previous studies (Holmes and Segui 2004; Bates et al. 1996, 1995; Desrochers et al. 1989; Taft and Meunier 1998). However, some differences can be highlighted between our findings and some of the evidence coming from the studies conducted in French. Namely, Taft and Meunier (1998) concluded that the retrieval of the determiner is the most influential source of information in accessing the gender of a noun, since the gender of the definite article is the most reliable gender cue in French. In contrast, we observed that in Spanish the determiner is relevant only in those cases in which the nouns do not end in −o or −a. Our results suggest that the most reliable cue in accessing the gender in Spanish is the gender-marking. This explanation would

be in line with the so called *reliable cue hypothesis* (Gollan and Frost 2002) proposed by Taft and Meunier, which claims that the most reliable cue to gender in each language adopts a central role in representing grammatical gender. As commented above, gender markers are used to generate the feminine and masculine form of some modifiers that qualify nouns (e.g., adjectives). Moreover, −o/−a can denote the real (semantic) gender of some biological entities (*loc-o/loc-a*). For these reasons, elementary school teachers usually resort to this type of nouns in order to exemplify differences in grammatical gender. These characteristics of Spanish could contribute to the special status of the endings −o /−a when deciding the grammatical gender of a noun (see Gollan and Frost 2002, for a similar reasoning for Hebrew). Further studies are clearly necessary in order to establish the differences and similarities among languages concerning the gender decision process.

Appendix A

Gender-marked			Gender-unmarked	
Regular	Irregular		Regular	Irregular
Masculine	*Masculine*		*Masculine*	*Masculine*
Abuso	Clima		Aguacate	Abad
Dorso	Cromosoma		Alambre	Alud
Gráfico	Dilema		Bambú	Avión
Lóbulo	Diploma		Disfraz	Bastión
Monólogo	Dogma		Límite	Camión
Mozo	Emblema		Maquillaje	Embrión
Periodo	Prisma		Penalti	Guión
Trecho	Tranvía		Taxi	Sarampión
Feminine	*Feminine*		*Feminine*	*Feminine*
Errata	Bonoloto		Ecuación	Cumbre
Fiesta	Dinamo		Entidad	Efigie
Franja	Foto		Fusión	Elipse
Galaxia	Libido		Gestión	Faz
Granja	Moto		Latitud	Gripe
Grieta	Radio		Legión	Higiene
Paella	Ratio		Longitud	Mili
Plantilla	Soprano		Pensión	Tribu

Appendix B

Gender-marked	Gender-unmarked
Masculine	*Masculine*
Apetito	Balón
Beso	Botón
Boniato	Champú
Caldo	Corazón
Ciclo	Iglú
Curso	Maní
Diablo	Millón
Dígito	Ratón
Dinero	Salón
Foco	Sillón
Hábito	Tacón
Libro	Tapón
Madroño	Taxi
Miedo	Tazón
Pulso	Turrón
Feminine	*Feminine*
Bombona	Acción
Época	Actriz
Errata	Ciudad
Esfera	Edad
Hebra	Emoción
Hora	Función
Lógica	Maldad
Loncha	Mitad
Marca	Nación
Mona	Pasión
Ninfa	Piedad
Nobleza	Raíz
Obra	Salud
Pluma	Unión
Sombra	Verdad

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