Gender Doublets as a Mark of Gender Inclusive Language: An Experimental Study on Language Processing

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Abstract

Over the last decades, gender inclusive language has become a debated issue in which two opposing positions hardly reach a meeting point: those who believe that the masculine plural form for groups of people can be interpreted as neutral, unmarked and inclusive of both biological sexes compared to those who claim that the generic masculine is a sexist use of language, while the gender doublet forms (*los pol íticos y pol íticas*) are alternatives that offer greater visibility to women. The purpose of our study is to contribute to this debate by means of objective data obtained out of experimental linguistics. In this context, an eyetracking experiment was carried out with 88 native speakers of Spanish at the National University of Colombia, with the aim of testing whether one of the first alternatives proposed as an inclusive language strategy, that is gender doublet, affects the cognitive efforts required to process written sentences. The results show that gender desinences significantly affect the cognitive effort required by readers during the information retrieval phase.

Keywords: Inclusive language, Eyetracking, Information processing

1. Introduction: A Lively Debate

The issue of inclusive language is currently the subject of an important debate between two opposing positions that are unlikely to reach an agreement (Escandell, 2020; Guerrero Salazar, 2021). On the one hand, stands the position advocated by the Royal Spanish Academy (RAE)

and its supporters, which is based mainly on three points: the masculine plural is interpreted in Spanish as generic or unmarked, sexism is not inherent to the language, but is a social attitude, and the linguistic norm is established on the basis of the use that speakers make of the language; still, the alternatives proposed as gender inclusive marks do not seem to be part of everyday use in Spanish (Bosque, 2012; RAE, 2020). On the other hand, there are those who advocate the social need to make language a more inclusive means of communication and suggest, in opposition to academics, the use of alternatives (either based on morphemic solutions of the Spanish system or other spellings) to overcome the abusive use of the generic masculine and to enable women and other social groups to be more visible (Escandell, 2020, p. 2).

Within the Spanish linguistic system, gender is a grammatical property of some words. In the case of nouns and some pronouns, it is an inherent property, since nouns are necessarily assigned to a male (*el sol*; 'the sun') or female (*la luna*; 'the moon') gender; in the case of adjectives, determiners, quantifiers or participles, gender is a dependent property, since they are gender marked in order to agree grammatically with the nominal unit they occur with (*la luna llena*; 'the full moon') (Roca, 2005; Escandell, 2018). The attribution of a grammatical gender in the case of nouns is arbitrary, which is clearly proved whenever in other languages nouns present an opposite gender: in German, the word "moon" is masculine, while "sun" is feminine, likewise in Spanish we say "la sal" (female definite article), whilst in Italian it is "il sale" (male definite article).

In Spanish, the opposition between male and female genders is considered asymmetrical, that is, while the masculine is the neutral or unmarked gender that responds to the trait [-f], the feminine is the trait marked as [+f] (Escandell, 2020). This is the same opposition that is established between *día* ('day') and *noche* ('night'), while *día* is used as the unmarked term (24-hour unit including day and night) (1), the noun *noche* constitutes the marked term (2).

(1) *Estuvimos cinco días en Colonia.*
'We stayed five days in Cologne.'

(2) *Pagamos cinco noches de hotel en Colonia.*
'We paid a five-night hotel stay in Cologne.'

This very asymmetry is furthermore proved by the way in which a male and female noun agree in a sentence (Mendívil Giró, 2020).

(3) *Tanto el problema como la solución son complejos.*

(4) **Tanto el problema como la solución son complejas.*

(3) (4) 'Both the problem and the solution are complex.'

However, being this unacceptable, when the grammatical gender is attached to words which refer to people with biological sex, it is argued that the masculine may not be interpreted in a generic and inclusive way and, therefore, makes women invisible. One of the first proposals aimed at overcoming this situation is to perform a systematic disjunction of nouns that refer to people, that is, to use gender doublets (*los alumnos y las alumnas;* 'the students') (Medina,

2014; Llamas, 2015; Cuenca, 2020). However, this solution is considered to cause a higher cognitive effort during the information processing (Escandell, 2020).

Considering these contrasting ideas, this paper provides objective data from experimental pragmatics that show the effects of one of these inclusive alternatives, such as the use of the slash forms for gender doublets (*los/as niños/as;* 'the children') in the reading process of sentences by native Spanish speakers from Colombia (Note 1).

2. The Grammatical Gender in Spanish

The problems arise when it comes to nouns in which the grammatical gender must be aligned with biological sex; it is the case of so-called dimorphic nouns, those that exist in masculine or feminine form (Escandell, 2018). These nouns can acquire their dual form by means of three procedures: the use of inflectional morphemes (*el alumno / la alumna*; 'the student'), the use of other derivational morphemes (*actor / actriz*; 'the actor') or the change of the lexical root (*varón / mujer*; 'man / woman'). These nouns are followed by others which do not vary according to the person to whom they refer and in which the grammatical gender is marked by the co-occurrence of articles or adjectives: *el / la modelo* ('the model')*, el / la artista* ('the artist'). Yet, it is worth underlining that in all words in which grammatical gender depends on biological sex, two types of information coexist: conceptual information, which includes information about the biological sex (*nuera* 'daughter-in-law' would contain the semantic feature [+ woman] among others) and grammatical information, which refers to the grammatical gender inherent in the noun (*nuera*, marked gender [+f]) (Roca, 2005). Finally, we add to this set of nouns the so-called epicene nouns, those that reflect a complete lack of connection between the conceptual and grammatical information, since the grammatical gender does not vary according to the biological sex of the person to whom they refer, such as nouns like *el vástago* ('the stem') or *la víctima* ('the victim').

Given these possibilities within the system, language changes according to the society in which it is used and adapts itself to the needs of its users (cf. Pons, 2022). However, this does not prevent linguistic changes from occurring in accordance with the possibilities available within the system (Bosque, 2012). Lexical forms such as *el juez / la jueza* ('the judge'), *el médico / la médica* ('the doctor') or *el modisto / la modista* ('the dressmaker') are regarded as completely valid because they have been formed in accordance with the Spanish normative possibilities (Escandell, 2020). Some of these forms are fully integrated in the social conscience and others, on the other hand, are less accepted, possibly due to their lower frequency of use: *la generala* ('the general'), *la música* ('the musician') or *la portavoza* ('the spokeswoman'), this latter option being even redundant, since the second term of the compound is already marked as [+f] (*la voz*; 'the voice'). Nevertheless, nothing prevents its formation and use since the grammatical procedures used to create both gender forms of dimorphic nouns have been respected.

Despite this, scholars insist that gender stereotypes and sexism can survive any linguistic change, as it is a matter of collective mindset, rather than language (Bosque, 2012; Medívil Giró, 2020). On the other hand, there are linguists who support the systematic use of slash-form gender doublets for all nouns whose referent has a biological sex, arguing that the

grammatical masculine gender cannot be considered generic or unmarked, but exclusive of women, and its overuse should therefore be avoided (Cabeza Pereiro & Rodríguez Barcia, 2013).

3. The Unmarked Masculine and the Doublet Form as a Gender Inclusive Choice

From a linguistic point of view, the masculine cannot be interpreted as inclusive of both sexes when it comes to heteronymous nouns in which the root changes according to the biological sex referred to, i.e. *fraile* is not an inclusive form which refers to both *frailes* ('friars') and *monjas* ('nuns') (Escandell, 2020). On the contrary, probably no Spanish speaker would give a negative answer to the question (5).

> (5)   *¿Tienes hijos?*
>
> *- Sí, dos niñas.*
>
> *- # No. No, tengo dos hijas.*
>
> 'Do you have children?
>
> - Yes, two girls.
>
> - # No. No, I have two daughters.'

This is because the masculine plural nouns are acknowledged as inclusive of both sexes; it is a linguistic phenomenon that forms part of the socio-communicative awareness of Spanish speakers in all age groups, as has been empirically demonstrated through surveys (Barrera Llinares, 2020). By measuring reaction times to questions and assessing the appropriateness of answers, experimental linguistics has shown that the inclusive masculine is generally processed as inclusive of both biological sexes, unless it refers to groups associated with a highly marked social gender stereotype, i.e. secretaries or plumbers (cf. Stetie & Zunino, 2022) (Note 2).

Gender stereotyped collective nouns are indeed the only cases in which, during speech production, the speaker consciously decides to use gender doublets to reinforce the presence of both biological sexes, while in the case of collective nouns that refers to groups traditionally made up of men and women, the speaker tends to use the masculine plural form as the inclusive one (Herrera Guevara & Reig Alamillo, 2020) (Note 3). Furthermore, in the field of Spanish as a second language, the cognitive efforts generated by the use of doublets versus the neutral masculine forms have been measured, and the results show that non-native speakers of Spanish with a B1 level require higher reading times to process the gender doublets, which are processed as the marked option against the neutral masculine (Nadal & Sainz, in press).

Thus, inclusive use of the generic masculine in commonly used by the press of various political orientations.

> (6) *Las enmiendas del PSOE a la 'ley trans': los menores de 16 años necesitarán aval judicial para cambiar de sexo en el registro* (El País, 28/10/2022).

'The PSOE's amendments to the 'trans law': minors under 16 will need judicial approval to change sex in the registry.'

When reading a headline like (6), most speakers would interpret *los menores* as a form that includes both girls and boys under 16, as it is unlikely that the law applies only to one of the two sexes. On the other hand, in a fragment like (7), the context of rape inevitably leads the reader to the male sex, as the use of the pronouns *uno de ellos* ('one of both') later confirms.

(7) *Detenidos en Palma dos menores por violar a una chica en una fiesta y difundirlo en directo en redes*

Uno de ellos acabó agrediendo sexualmente a otra menor aprovechando que estaba ebria, casi inconsciente, según ha denunciado su madre a la Policía (ABC, 28/10/2022).

'Two minors arrested in Palma for raping a girl at a party and broadcasting it live on networks

One of them ended up sexually assaulting another minor, taking advantage of the fact that she was drunk and almost unconscious, according to what her mother reported to the police.'

Finally, if the news were about the violation of norms, the masculine in (8) would again be interpreted as generic and inclusive of both sexes.

(8) *Detenidos en Palma dos menores por violar las normas de tráfico y difundirlo en directo en redes. Se trataba de un joven de 15 años y una adolescente de 17. Los dos han sido detenidos y llevados a la comisaría más cercana.*

'Two minors arrested in Palma for violating traffic regulations and broadcasting it live on social media. They were a 15 year old boy and a 17 year old girl. Both were arrested and taken to the nearest police station.'

Language, after all, is only a guide for the retrieval process that takes place in the ostensive-inferential communication (Wilson & Sperber, 2004). Linguistic stimuli are always underdetermined, and it is the reader who ultimately interprets the author's communicative intention using all the contextual elements available (the communicative context in which the stimulus is embedded and the reader's prior cognitive background).

Thus, the use of gender doublets is restricted to those cases in which it is necessary to mark the presence of both sexes to convey the speaker's communicative intention (Escandell, 2020).

(9) *Los niños y las niñas deben asistir juntos a los mismos colegios y compartir las aulas.*

'Boys and girls should attend the same schools together and share classrooms.'

Beyond these particular cases, gender doublets would be unnecessary and not recommended (Escandell, 2020, p. 12).

(10) *#El tren descarrilado transportaba más de 500 pasajeros y pasajeras.*

'The derailed train was carrying more than 500 passengers.'

(11) *#Este año ha disminuido el número de alumnos y alumnas matriculados en la carrera de Traducción y Mediación Cultural.*

'This year the number of students enrolled in the Translation and Cultural Mediation degree course has decreased.'

In both (10) and (11), the use of gender doublets is unnecessary and even detrimental to proper understanding. In (10), the use of the masculine in *500 pasajeros* would hardly lead readers to think that the crashed train was carrying only men. In (11), "the number of students" would be interpreted by default as including both male and female students, unless we were talking about a university designed for gender-isolated education. It is therefore reasonable to assume that unnecessary doublets in those contexts in which a generic masculine can be interpreted as the inclusive form will require a higher cognitive effort during reading (Escandell, 2020, p. 11).

4. Experimental Study

4.1 Hypotheses and Independent Variables

In our eyetracking experiment, the reading times recorded for sentences with the following type of structure were compared:

a) *Los vecinos* se quedaron *conmocionados* ante la terrible noticia.

b) *Los/as vecinos/as* se quedaron *conmocionados/as* ante la terrible noticia.

(a) (b) 'The neighbours were deeply touched by the terrible news.'

The independent variable of the experiment is, therefore, the gender desinence which is attached to the noun phrase that opens sentences and to the predicative adjective that follows the verb. It is a two-level variable: in condition (a) the gender desinence is the neutral or unmarked masculine and in condition (b) it uses the slash-form doublet as a mark of inclusive language. Overall, 24 replicas of each condition were created in different topics, which were distributed in four experimental lists according to a Latin square design including filler items in a 2:1 ratio (Keating & Jegerski, 2015).

The analysis of reading times aims to verify whether the following alternative hypothesis holds true:

H1: The use of the slash-form doublet "os/as" as a mark of inclusive language in contexts where the masculine can be interpreted as neuter or unmarked (b) will result in higher reading times compared to the use of the masculine plural form in the generic sense (a). The increase in reading times will be evident both locally on the units containing the doublets and globally in the reading of the whole sentence.

4.2 The Eyetracking Experimental Technique

The eyetracking technology is used in experimental linguistics, especially in experimental pragmatics (Loureda et al., 2020), and it allows to draw conclusions about the cognitive processes that take place during the visualisation of stimuli, since gaze and eye movements as perceptual systems offer a way to access the processes going on in our central system (Eckstein et al., 2016, p. 23). At any given moment, that part of the visual stimulus that lies within the field of view, which covers barely a 2° angle (foveal vision), is processed, while everything that extends to the right and left of this angle is no longer the main object of processing since it is perceived less clearly (parafoveal and perifoveal vision) (Rayner 2009).

The way in which stimuli are viewed is comparable to film frames. When the frames are displayed continuously, the viewer no longer perceives them as static images, but as a single moving image. Similarly, the human eye takes frames of the displayed stimulus, but the jump from one image to another occurs so quickly that the central system perceives it as a continuous stream. Each of these frames are called fixations, fractions of a second during which the eye pauses on the words - when reading a text - to obtain information (Rayner, 1998); the jump from one fixation to another occurs through saccadic movements, during which neither is new information processed, nor is the general processing interrupted (Duchowski, 2007, p. 42).

An eyetracking controlled reading experiment allow to record the duration of fixations during reading (in milliseconds) and, therefore, to obtain in real time the information extraction route followed by the reader in the processing of sentences (cfr. eye-mind assumption, Just & Carpenter, 1980). In this way, it is possible to compare the reading times spent in the processing of both experimental conditions.

4.3 Participants and Procedure

Data were collected from 88 participants, all of whom were native speakers of Spanish (Colombian variety). The age range was between 18 and 22 years (51 females and 37 males). They were students at the National University of Colombia enrolled in various degree programmes. Informants were required to sign a consent form authorising the researchers to use the data recorded and ensuring voluntary participation in the reading test.

The informants were seated at roughly 70 cm from the screen on which the experimental items were displayed and below which the Eyelink 1000 eyetracker was positioned, with a recording frequency of 1000 Hertz. All participants were able to read the stimuli without visual difficulties.

The informants were provided with all the written instructions at the beginning of the experiment to avoid possible variations caused by the researcher's spoken comments. Before starting the reading test, each participant underwent an eye-tracker calibration test with the cameras so that the eyetracker could capture the reader's pupil (the exercise consisted of fixing nine dots that appeared at different positions on the screen). After having read the instructions regarding the whole procedure and having completed the calibration test, the informants read two trial stimuli to familiarise themselves with the exercise and to avoid

questions during the data recording. Each of the stimuli displayed on the screen was preceded by a fixation cross, and only when the informant had been fixating the cross for more than 500 milliseconds the experimental item was displayed. This ensures that the informant's first fixation is placed on the exact coordinates in which begins the textual stimulus (Conklin et al. 2018).

4.4 Dependent Variables and Regions of Interest

The average reading times per word were recorded for three regions of interest (ROI) into which the experimental items are divided:

- [Los vecinos] ROI 1 = gender mark 1 as an inherent category of the noun

- [conmocionados] ROI 2 = gender mark 2 as adjective-dependent category

- [Los vecinos se quedaron conmocionados ante la terrible noticia] ROI 3 = full utterance

The aim is to observe whether there are localised alterations in the reading times of the units containing the gender marks (ROI 1 and 2) and whether these alterations affect the overall processing time (of the whole utterance).

Reading times per word were measured through three dependent variables or analysis parameters, which consider the different processing phases (Raney et al., 2014, p. 5). First, the total reading time was analysed; this parameter that does not make a distinction between the processing phases, but rather considers all the fixations that have been made within a region of interest (Holmqvist et al., 2011, p. 389-390).

Looking at the reading scheme in chart 1, the total reading time of the gender region 1 (noun phrase *los alumnos*) is obtained by adding up the duration of each of the three fixations that fall on this region [fixation 1 = 150 ms] + [fixation 2 = 150 ms] + [fixation 5 = 190 ms].
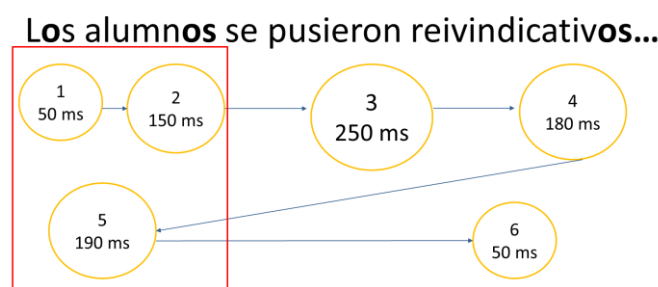

Chart 1. Total Reading time

The next dependent variable refers only to those fixations that are made on a region of interest during the first processing phase, i.e. when the reader views the region for the first time, before moving on to process other parts of the stimulus. This is the first pass dwell time, which is calculated by summing just the first two fixations [fixation 1 = 150 ms] + [fixation 2 = 150 ms] (Holmqvist et al. 2011:390).
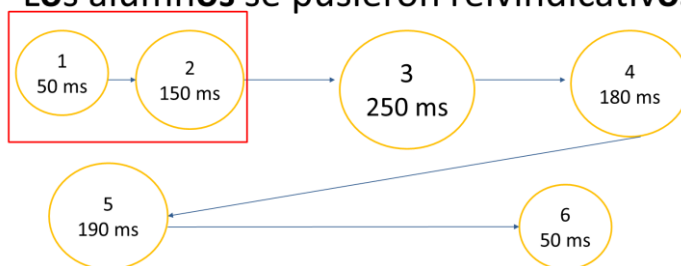
Chart 2. First pass reading time

The first pass dwell time gives information about the time needed to carry out all the cognitive operations required to form a mental representation from the ostensive stimulus. In this first phase, several cognitive processes take place, that is the graphemic decoding, the assignment of meaning to words, syntactic parsing and pragmatic enrichment. These are highly automated processes, which means that they cannot be avoided when a stimulus is displayed (Nadal, 2019, p. 34).

Finally, once a first mental representation has been formed and the assumption has been obtained, the reader can then verify it by a rereading phase. Rereading is not compulsory, but it is more frequently undertaken by the reader when misunderstandings or inconsistencies arise, or when a general check is required (Reichle et al., 2003, p. 450). To obtain this parameter, only refixations [fixation 5 = 190 ms] are taken, that is, those fixations made in the region of interest after having left it for the first time (Hyönä et al., 2003).
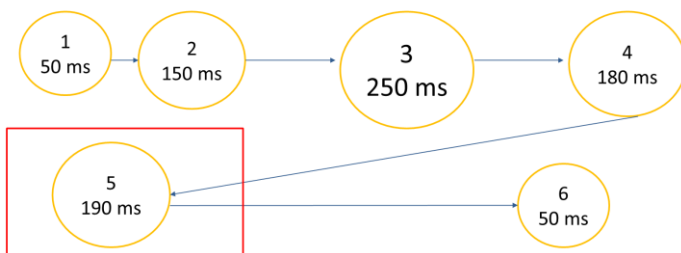

Chart 3. Rereading time

4.5 Statistical Analysis

Data were analysed statistically using generalised mixed models (Winter, 2020). The analysis was carried out using the R software with the glmmTMB package (Brooks et al., 2017; R Core Team, 2022). The aim of the models is to test whether the average processing times per word differ for the four types of experimental sentences with gender marks. Two models were calculated, model 1 aimed at estimating the reading times per word within the region of the utterance and model 2 aimed at estimating the reading times per word for the regions of interest of the gender mark 1 (noun phrase) and gender mark 2 (predicative adjective).

Before modelling, outliers were removed based on four criteria (Pickering et al. 2000; Keating & Jegerski 2015):

- First reading is 0 for region 3 Utterance. No outliers were found.

- Both the first pass reading time and the rereading time have an average per word of less than 80 ms for the region 3 Utterance. A total of 625 observations were found, corresponding to 9.86% of the total data.

- The total reading time yields an average per word higher than 800 ms for the region 3 Utterance. A total of 21 cases were found, representing 0.33% of the total data.

- The average reading time per word shows 2 standard deviations higher or lower than the average. For model 1, 258 outlier cases were found, corresponding to 17.6% of the total data. For model 2, 583 outliers were found, corresponding to 13.8% of the total data.

Therefore, out of the 6336 total cases, a percentage of 23.6% was removed, leaving 4838 for modelling (Model 1: 1208 observations, Model 2: 3630 observations).

The models include as fixed effects the different regions of interest mentioned above. In addition, the different reading paces of the participants, the different topics of the experimental items and the length of the words were integrated as random effects (mixed models:
https://drive.google.com/file/d/1ZR6dprDP9L0xu61dcNWh9npDNWQvtcEN/view?usp=sharing).

5. Results and Analysis

5.1 Region 1: The Noun Phrase

To begin with, the reading times per word in milliseconds (ms) obtained for the first region of interest, the noun phrase containing the gender desinence (*Los vecinos*) are shown. The bar chart 1 represents the average cognitive efforts spent on the noun phrase for each of the dependent variables analysed (total reading time, first pass reading time and rereading).
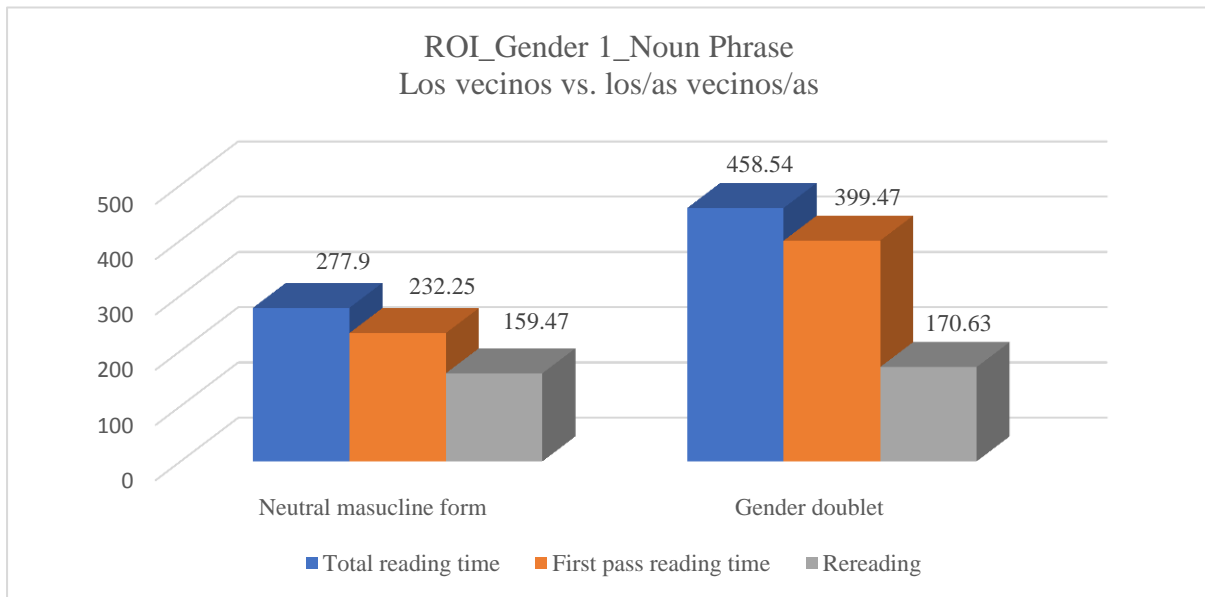
Chart 1. Reading times per word within ROI 1

As it can be observed, the cognitive efforts recorded for the first noun phrase opening the utterance are lower when the gender desinence is the unmarked masculine compared to the cognitive efforts generated by the same noun phrase when it contains the doublets (*los/as vecinos/as*). In particular, the increase (in percentage) that has occurred in the experimental condition with gender doublets compared to the neutral or unmarked condition can be seen in Table 1.

Table 1. Relative percentage change of doublets compared to neutral masculine form (ROI 1)

ROI Gender 1 NP	**Total reading time**	**First pass reading time**	**Rereading time**
Neutral masculine form	277.9 ms	232.25 ms	159.47 ms
Gender doublet	+ 65% -> $p < .001$***	+ 72% -> $p < .001$***	+ 7% -> $p > .05$

In the total reading times, the processing of the noun phrase *los vecinos* requires a total reading time of 277.9 ms per word; compared to this value, the introduction of the doublet as a mark of inclusive language (*los/as vecinos/as*) represents an increase in the cognitive effort of 65%. Apart from being quite a considerable effect (cf. Loureda et al., 2020), this difference is highly statistically significant, as the p-value is equal to or less than 0.001 (Note 4).

During the first pass reading time, it takes an average of 232.25 ms to process a word of the masculine noun phrase, whereas when the doublet appears, this value rises to 399.47 ms. Thus, graphemic decoding, meaning assignment, syntactic parsing and pragmatic enrichment

that take place during this first reading phase, require higher cognitive effort when the noun phrase, functioning as subject, breaks the gender desinences into doublets. Specifically, this very increase in cognitive efforts amounts to 72%. The reader must process and integrate two procedural instructions, that is the combination of masculine and feminine, as well as establish two syntactic concordances instead of one. The higher efforts are likely to be mainly associated with graphemic decoding and syntactic parsing.

On the other hand, the presence of doublets in this first region does not result in higher rereading times; readers need an average of 159.47 ms to reread the syntagm with the neutral masculine form; whereas when doublets are used, this value rises to 170.63 ms. This is a 7% increase, a difference which does not prove to be statistically significant.

In the noun phrase *los vecinos* or *los/as vecinos/as*, the reader detects the gender desinence for the first time in the sentence. Observing a shift from the neutral condition (the unmarked masculine), the native reader wonders why there is a need to make the two genders explicit if a masculine plural desinence would make it possible to achieve the same mental representation (mixed group of male and female neighbours) (Escandell, 2020). At this initial point of the sentence, the answer is still left open, as the processing hypotheses are still in the making. However, the cognitive overload to which the doublets give rise at this point of the sentence is a proven fact and is an example of how the reader perceives the doublets as a marked option opposite to the neutral (singular) masculine.

5.2 Region 2: The Predicative Adjective

The following bar chart shows the reading times recorded for the adjective (*conmocionados*) which serves as a predicative complement and contains the gender desinence in agreement with the previous noun phrase.

Broadly speaking, higher cognitive efforts are observed for the doublets in both the first and the total reading times. The average total reading time generated by the predicative adjective was 538.38 ms for the generic masculine, whereas when the doublet appears as a mark of inclusive language, it increases to 617.31 ms. In the first pass reading time, users require an average of 432.29 ms to carry out all the processing operations to obtain the first assumption communicated, while with the doublets, this value rises to 536.91 ms.
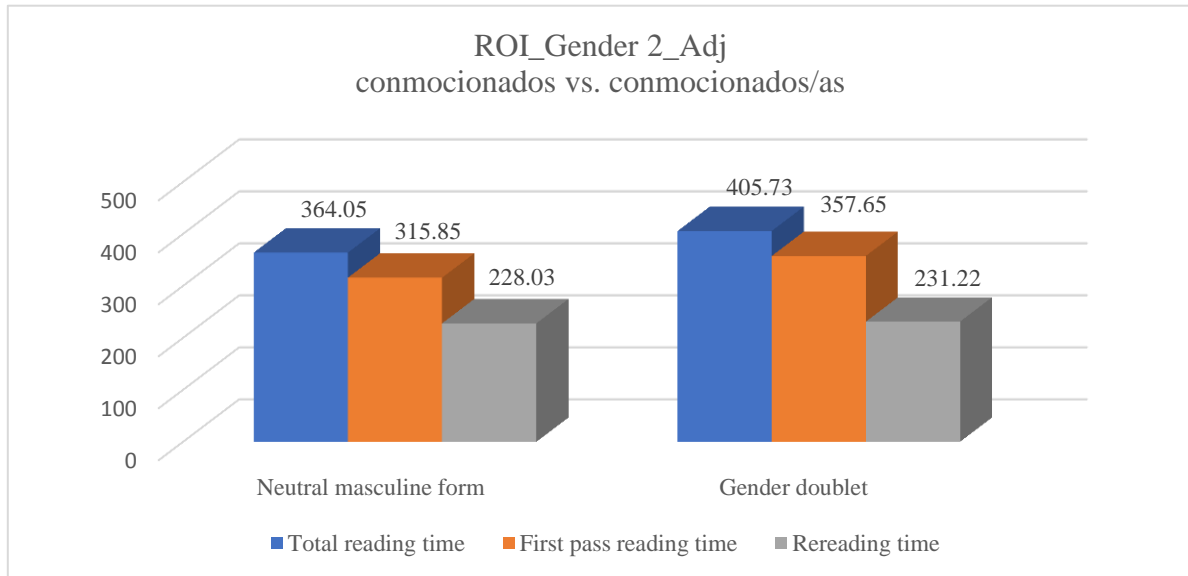
Chart 2. ROI 2 reading times

The gender marks appear for the second time within the stimulus that is being processed, so the reader might be more used to reading the gender inclusive mark. However, the differences found in cognitive efforts to process the information are still statistically significant as shown in Table 2.

Table 2. Relative percentage change of doublets compared to neutral masculine form (ROI 2)

| ROI Geneder 2 Adj.	Total Reading time	First pass reading time	Rereading
Neutral masculine form	364.05 ms	315.85 ms	228.03 ms
Doublets	+ 11.45% -> $p < .001$***	+ 13.23% -> $p < .001$***	+ 1.4% -> $p > .05$

During the first reading phase, among other ones, syntactic parsing is carried out, thus processing hypotheses are executed which aim to establish morphosyntactic agreement between the elements that make up a sentence. This operation is simplified when agreement is only based on a single gender morpheme (-os), while it is slowed down when agreement between the noun phrase and the adjective must be established on a doublet of morphemes (os/as). There is a 13.23% overload when doublets are used with respect to the neutral masculine. This cognitive overload is reflected in the total reading time, where the effect of the doublet reaches an 11.45%. These results allow us to infer two observations: on the one hand, the doublet form is processed as a marked option opposed to the neutral one associated with the plural masculine (Roca, 2005; Escandell, 2018); on the other hand, the presence of a doublet that is not considered essential in the context (due to the need to highlight the

presence of both biological sexes), gives rise to a cognitive overload in native readers of Spanish (Escandell, 2020).

In this region of the sentence, the effects of doublets are only observed in the total reading times and during the first pass reading time, with no statistically significant differences being found in the rereading phase. Once the marked condition has been assimilated during a first processing phase, the reader does not see the need to carry out a rereading check due to the gender inclusive mark. The adjective introduces gender information for the second time in the sentence, hence the effects caused by the doublet are considerably reduced compared to the effects produced within ROI1 (they stay between 11% and 14%).

5.3 Region 3: The Utterance

Finally, reading times of the whole utterance were measured. The bar chart 3 shows the reading times per word of the whole utterance.
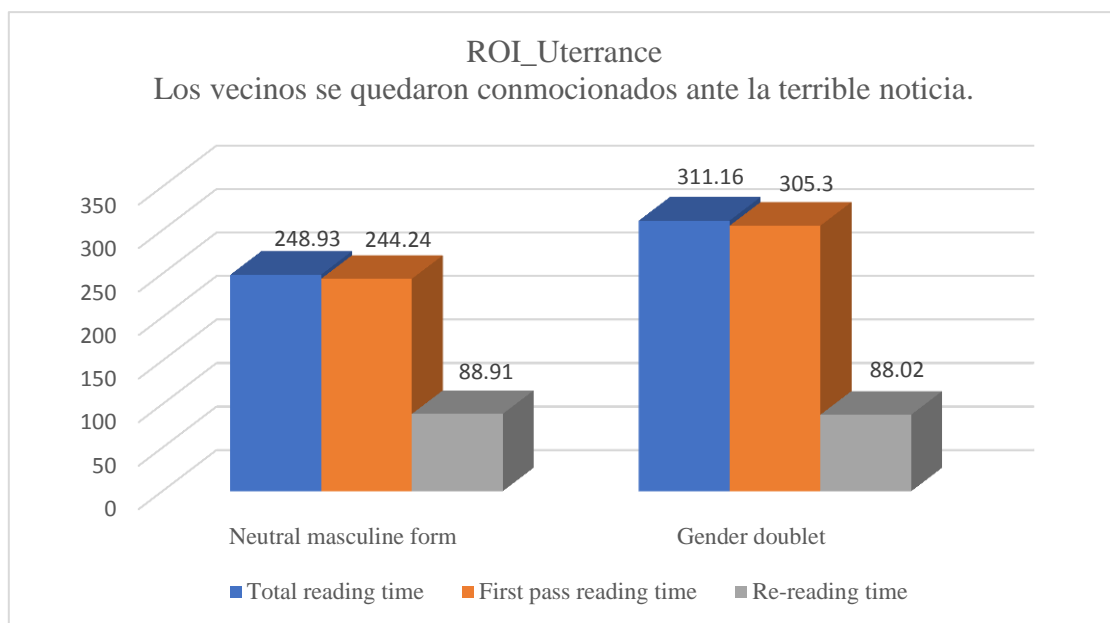
Bar chart 3. ROI 3 reading times

Average processing times per word also rise when doublet is used as a gender inclusive mark. Processing one word of the neutral or unmarked utterance takes 248.93 ms on average, while inclusive language marks cause this average to increase to 311.16 ms over the total reading time. These additional efforts derive from the first reading phase, where the neutral masculine form requires a processing cost of 244.24 ms and the presence of the doublet generates an average reading time of 305.30 ms. These differences are statistically relevant as can be seen in Table 3.

Table 3. Relative percentage change of doublets compared to neutral masculine form (ROI 3)

ROI Gender 3 Utterance	Total reading time	First pass reading time	Rereading time
Neutral masculine form	248.93 ms	244.24 ms	88.91 ms
Gender doublet	+ 25% -> $p < .001$***	+ 25% -> $p < .001$***	- 1% -> $p > .05$

The rereading phase of the entire utterance region is almost absent, even though a second sentence was added after each experimental item (but not object of analysis) with the aim of avoiding the so-called wrap up effect (Rayner, 1998). This is an effect according to which readers dwells longer at the end of sentences and, above all, at the end of paragraphs to assimilate and integrate into the discourse everything they have read up to that point. The lack of rereading times in the entire sentence region suggests that the comprehension of the experimental items did not cause any significant problems for the informants.

It is, however, the data from the first pass reading time and the total reading time which show that replacing the neutral or unmarked form of the plural masculine with a doublet of morphemes leads to a considerable increase in the cognitive efforts required to process the whole utterance. The higher efforts found in the areas containing the gender markers (region 1, nominal syntagm, and region 2, adjective) are transferred globally to the whole sentence reading. In its report on inclusive language, the Royal Academy (RAE) hints at what would happen if the Spanish Constitution were to be drafted by systematically using doublets for all the currently masculine plural nouns: this option "requires reiterations and paraphrases, and also conceals the fact that the definite expressions of person that are alluded to, constructed in masculine and singular, have both meanings in Spanish" (RAE 2016:16). As the data reported in this paper show, these redundancies involve higher cognitive efforts. Indeed, the reader invests more time in resolving some question within the processing of the statement: why is the information marked if it should be processed as unmarked? Likewise, why is the doublet used if the generic masculine leads to the same assumption? Moreover, this extra time focused locally on the units with gender marks reflects globally in the reading of the whole sentence. Thus, effectively, as the RAE reiterates in its report (2016) and as Barreras Llinares (2020) empirically proves through surveys, the masculine forms part of the socio-communicative awareness of speakers. The hypothesis put forward intuitively by Escandell (2020) is confirmed by our data: the doublets generate a cognitive overload when it is not essential for the correct interpretation of the assumption.

6. Conclusions

The topic of inclusive language generates a debate that hardly culminates in a meeting point between the different opinions, which is why the studies carried out by linguists and academics who provide objective data with no intention of taking one side or the other become particularly important. These studies have been done for the Spanish language from

different linguistic methodologies such as discourse analysis (Llamas, 2015; Cuenca, 2018; Bolívar, 2019; Guerrero Salazar, 2021; García Negroni & Hall, 2022) or from empirical and experimental linguistics (Barrera Llinares, 2020; Herrera Guevara & Reig Almillo, 2020; Stetie & Zunino, 2022; Zunino & Stetie, 2022), to name just a few examples. This research complements the theoretical-descriptive investigations from which hypotheses arise (Roca, 2005; Escandell, 2018, 2020). Our study provides data on the reading times generated by the neutral or unmarked masculine forms and doublets or disjunction forms as one of the earlier, more conservative gender inclusive language alternatives. As far as we are currently aware, there is no previous research measuring the processing costs generated by the different gender desinences in native speakers of Spanish (cf. Nadal & Sainz, in press for L2 Spanish speakers), so this paper provides relevant data for the study of inclusive language in Spanish from the perspective of experimental linguistics.

The reading times show that native speakers make higher cognitive efforts when, instead of using the generic masculine form, doublets are used systematically. The increase in the cognitive effort is found only during the first pass reading phase, when graphemic decoding, meaning assignment, syntactic parsing and pragmatic enrichment take place to achieve the ostensive-communicated stimulus. The rereading check is not carried out when a gender desinence other than the masculine plural is used. On the other hand, it should be stressed that the use of gender doublets does not require higher cognitive efforts on the units that make up the gender desinences, but that this choice has consequences, cognitively speaking, on the reading of the entire sentence.

The experiment therefore allows us to validate the alternative hypothesis put forward. These data confirm that the masculine is processed as the neutral and unmarked option, the basic condition (Bosque, 2012; RAE, 2016; Roca, 2005; Escandell, 2018). The non-native reader wonders why there is a need to make both genders explicit when there is already a more limited option in Spanish from which the same information can be inferred (inclusion of both sexes). The data indicate that the gender doublets involve unnecessary redundancies (Bosque, 2012; RAE, 2016) which generate a cognitive overload (Escandell, 2020). Likewise, the fact that Spanish speakers process the masculine plural as the most neutral option is an indicator that the value of the masculine plural morpheme continues to be transmitted in teaching as the desinence that encodes the presence of both biological sexes above all others.

The measurement of reading times using an online measurement technique such as eye tracking has proven to be a valid methodology to obtain objective data that can be generalised to a certain type of population, to test hypotheses based on intuition and to complement theoretical, descriptive, or empirical studies. Thus, this study should be extended with experimental data measuring the processing costs generated by other gender inclusive language alternatives (e.g. @, =, x, e) and replicated in other languages.

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Notes

Note 1. The experiment we present here is a replica of the study carried out with non-native speakers of Spanish (Nadal, in press).

Note 2. The authors conducted an experiment within the Spanish language in which they showed an experimental stimulus that followed the following structure: a) *Los/xs/es maestros/xs/es usan recursos variados durante la alfabetización inicial* 'Teachers use various resources during early education' (marked as the experimental condition -stereotypical) or b) *Los/lxs/es plomeros/xs/es utilizan herramientas variadas para la revisión hidráulica* 'Plumbers use various tools for hydraulics test' (marked as the experimental condition + stereotypical). After viewing one of these stimuli, informants had to answer the following multiple-choice question *¿A quién puede hacer referencia la frase? a) A Juan, Esteban y otros hombres*; b) A *María, Luisa y otras mujeres; c) A Laura, Pablo y otras personas; c) No lo sé, ninguna de las anteriores?* ('Who does the sentence refer to? a) John, Stephen and other men; b) Mary, Louise and other women; c) Laura, Paul and other people; d) I don't know, none of the above'). The dependent variables of the study were the times of reaction recorded to answer the questions and the appropriateness of the answers. In general, the masculine neutral from resulted in shorter reaction times (unmarked option) and was processed as generic and inclusive of both sexes (option c in this example) in condition (a)

-stereotypical, while condition (b) showed the opposite tendency (Stetie & Zunino, 2022; Zunino & Stetie, 2022).

Note 3. The authors showed informants photographs with groups of professionals made up of men and women (e.g. a mixed group of fishermen or a group of fashion designers); given the photographs, the speakers had to describe the scene (Herrera Guevara & Reig Almillo, 2020).

Note 4. Statistical significance tests whether there is a sufficiently high probability to disprove hypothesis 0 and accept the alternative hypothesis. In the social sciences, $p < 0.05$ is taken as the alpha value, i.e. if p is less than 0.05, an observed difference is considered to be statistically significant, in other words, the probability that the difference found is due to the independent variable studied and not to chance is greater than 95% (Gries, 2013).