Non-binary Language Forms in Spanish: Consciously Using it Facilitates Processing during Comprehension?

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Abstract

Several grammatical studies have focused on the study of morphological innovations used as non-binary forms in Spanish (-x; -e). However, there are no experimental studies that analyze their psycholinguistic processing or the multiple and complex relationships between production and comprehension in non-binary language. To analyze this phenomenon, we performed a sentence reading and comprehension task. We recorded reading times, response times, and accuracy. We considered morphology, stereotypicality and frequency of use of non-binary forms in the participants as predictors. The results show specialization of the non-binary forms as generic morphological variants, as opposed to the generic masculine. The non- binary forms consistently elicited a reference to mixed groups and response times showed that these morphological variants do not carry a higher processing cost than the generic masculine. Moreover, it is possible to see that the conscious use of non-binary forms influences the comprehension processes of the different variants of gender morphology: as the voluntary use of non-binary forms increases, the generic masculine seems to concentrate its reference to groups of men exclusively. Thus, in addition to showing general evidence regarding the processing costs and comprehension of gender morphology in Spanish, our data allow us to observe a potential reciprocal link between production and comprehension processes that deserves further study.

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1 Introduction

There are numerous and diverse lines of study on gender in the different natural languages. They offer not only strictly grammatical but also lexicographic, pragmatic, sociolinguistic, and psycholinguistic perspectives.

It is well known that different languages mark grammatical gender in different ways. In this sense, various taxonomies have been proposed over the years (Corbett 1991, Dixon 1987, Gygax et al. 2019, Hellinger and Bußmann 2001, Leaper 2014, Prewitt-Freilino et al. 2012). One of the most recent classifications (Gygax et al. 2019) distinguishes between five types of languages: with grammatical gender, with a combination of grammatical and natural gender, with natural gender, without gender with some traces of grammatical gender, and without gender. Within the first group, where languages such as Spanish, German and Italian are found, gender controls grammatical agreement and both nouns that refer to animate and inanimate entities have assigned gender.

Specifically, the gender paradigm in Spanish assumes a binary distinction (male/female) but exhibits a certain complexity, which has led to several attempts at systematization (Ambadiang 1999, Mendívil Giró 2020, Roca 2006). The different proposals to describe gender inflection in Spanish tend to vary in terms of the degree of arbitrariness or motivation of gender in nouns. Most try organizing this systematization defining gender by semantic and formal features. However, numerous studies indicate that gender, in languages in general and in Spanish in particular, is also linked and conditioned by extralinguistic factors (Ambadiang 1999, Barrera Linares 2019, Cabeza Pereiro and Rodríguez Barcía 2013, López, 2020).

A perspective that has been widely analyzed is one that addresses gender in terms of marked and unmarked elements. It is from this distinction that the so-called "generic masculine" has usually been studied (Ambadiang 1999, Barrera Linares 2019, Cabeza Pereiro and Rodríguez Barcía 2013, Márquez 2013, Mendívil Giró 2020). Ambadiang (1999) offers a traditional definition to show that masculine is the unmarked gender in Spanish. The feminine gender, instead, is the gender marked in Spanish, that is, it is associated with ending variants that must be present to assign that gender. From sociolinguistic and pragmatic perspectives, few studies deny a notably asymmetric function in the generic masculine (Ambadiang 1999, Barrera Linares 2019, Cabeza Pereiro and Rodríguez Barcía 2013, Márquez 2013, Menegotto 2020).

Besides analyzing these phenomena from theoretical perspectives, we can study their (psycho)linguistic processing. When we analyze the processes of language comprehension and production in a broad cognitive framework, links begin to emerge with the organization of mental representations and concepts, prior world knowledge, and beliefs. From these perspectives, a classic debate is the one that occurs around the hypothesis of linguistic relativism that postulates that the language we speak influences or conditions, in some way, thought (Sapir 1921, Scotto and Pérez 2020, Slobin 1996, Whorf 1956, Zlatev and Blomberg 2015). In other words, due to the different categories and distinctions, especially semantic ones, that each language makes, its speakers are forced to pay attention to different aspects of the environment and that ultimately leads them to generate different representations about world events.

Psycholinguistic research about how people perceive gender has shown various biases associated with the particularities of gender marks in natural languages. These marks are not limited to grammatical elements, but are multiple and highly varied. They also operate in the discursive uses of linguistic forms and even in the way constructions are organized (Leaper 2014, Pérez and Moragas 2020, Pinheiro and Freitag 2020, Stahlberg et al. 2007). One of the most studied phenomena in relation to gender bias in languages is the interpretation of the generic masculine in role names. Different psycholinguistic studies (Brauer 2008, Braun et al. 2005, Cacciari and Padovani 2007, Gygax and Gabriel 2008, Gygax et al. 2008, Marchesini 2019, Misersky et al. 2018, Pinheiro and

Freitag 2020) suggest that the generic masculine presents an interpretation bias: it tends to be interpreted with exclusive reference to men. This, in addition, can interact with linguistic and non-linguistic factors.

The study that we present here takes up a series of elements from works in other languages and constitutes one of the first psycholinguistic experiments in Spanish that analyzes how non-binary morphological forms are processed in contrast to the generic masculine. It is an exploratory study, which will serve as a starting point. We expect to develop a line of research that makes it possible to specify and provide empirical evidence on a complex phenomenon, which needs to be analyzed from multiple perspectives.

2 Experiment

The task was designed to analyze online psycholinguistic processing during the comprehension of sentences that included phrases to refer to groups of people with non-uniform gender identities. It was hoped to verify which were the implicit sex-generic representations that the speakers constructed as a reference for those phrases during the comprehension process. To do this, we designed a sentence comprehension task that involves reading a sentence at its own pace and answering a question about the possible reference of the noun phrase in subject position.

Our central hypotheses assume that: 1. there will be an effect of the Stereotypicality factor of the role nouns for the selection of possible referents; 2. there will be an interaction between Stereotypicality and Morphology that will focus not only on the type of option chosen but also on the time it takes to make the choice; 3. although the selection of referents of non-binary forms will be more consistent toward groups with non-uniform gender, the time to make this choice may show an advantage for the generic masculine form, as an unmarked form in Spanish; 4. the difficulty in the comprehension process will be modulated by the frequency of conscious Use of non-binary forms that the speakers report.

The proposed experimental design includes two factors for the items: Morphology (with 3 levels: -o, -x, -e) and Stereotypicality (with 3 levels: low, medium and high). In addition, based on the participants' report on the voluntary Use of non-binary forms, three groups were organized, which constituted a third factor of analysis in this work. Thus, the final analysis assumes a 3x3x3 design.

2.1 Participants

551 participants finished the task. Data for 36 participants (under 18 years old, people who did not state their age or who were not from Argentina) were eliminated. Of the remaining (515), 373 were women (age: M=34.50; SD=11.70; min=19; max=98), 123 were men (age: M=33.90; SD=12.20; min=18; min=82) and 17 people identified as non-cisgender (age: M=29.30; SD=8.51; min=19; max=55). To operationalize the variable "Use of non-binary forms", they were asked if they used any form of non-binary language: 127 declared that they did not, 108 that they used it little or occasionally and 280 that they used it frequently.

2.2 Materials

We elaborated 18 sentences with simple noun phrases (Det + N) as subject and these were presented in the three morphological variants. In (1) examples are presented for each condition of Stereotypicality.

(1) a. Low stereotypicality:
   Los maestros/Lxs maestrxs/Les maestres   usan recursos variados   durante la
   Teachers-M/Teachers-NB[1]/Teachers-NB   use   a variety of resources   during
   alfabetización inicial.
   initial   literacy.
   b. Medium stereotypicality:
   Los cocineros/Lxs cocinerxs/Les cocineres siempre organizan los ingredientes sobre

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[1]"NB" corresponds to "non-binary forms".

The chefs-M/The chefs-NB/The chefs-NB   always   organize   the   ingredients   on
la   mesada   para cocinar.
the cooking   table.
c. High stereotypicality:
Los plomeros/Lxs plomerxs/Les plomeres   con   matrícula pueden hacer trabajos en
Plumbers-M/Plumbers-NB/Plumbers-NB   with license   can   do   works   on
edificios   y   consorcios.
buildings and consortiums.

A multiple-choice question corresponded to each sentence, in order to indicate whether the noun phrase referred to a group of women, men, or a non-uniform gender group. In addition, three more response options were added that worked as distractors. For this, we use proper names that, in Argentina, consistently refer to women or men. An example question and its answer options are presented in (2). Specifically, we were interested in measuring the distinction between options c. and e. (the order of the options changed randomly). These specific options referred to a mixed group of people and to a group of men.

(2) ¿Cuál de las siguientes opciones puede referir a "los maestros"?
Which of the following can "the teachers-M" refer to?
a. Carolina. / b. Juan. / c. Juan, Marta y otras personas.. / d. Carolina, Marta y
a. Caroline / b. John / c. John, Martha and other people. / d. Caroline, Martha and
otras mujeres. / e. Juan, Federico y otros varones. / f. Ninguna de las anteriores.
other women. / e. John, Frederick, and other men. / f. None of the above options.

40 fillers were included: 18 sentences with the noun phrases in feminine, to which another 12 distractors were added that used the three generic variants, but that contained a different comprehension question. In this way, exposure to various sentences and questions was balanced, for avoiding learning or training within the task. An example is presented in (3).

(3) Painters prefer to work with oils to achieve better textures and reliefs.
What do painters prefer?
a. Work with oils. / b. Paint with watercolors. / c. Use many colors. / d. Use wide brushes. /
e. Make fine strokes. / f. None of the above options.

Stimuli were divided into three counterbalanced lists. Each list consisted of 48 items: 18 experimental and 30 fillers, the same for all three lists.

2.3 Procedure

The task was designed and run with PCIbex (Zehr and Schwarz 2018). Each list was assigned to a different participant, randomly. In all cases, an informed consent was submitted first, which had to be accepted to access the questions on sociodemographic data and the experiment. Participants were asked to indicate gender identity[2], highest level of formal studies reached, age, nationality, city of residence and how often they used some non-binary morphological form. Then the task was introduced: they were instructed to read the sentences first and then to answer a multiple-choice question as quickly as possible and based on their first impression. It was clarified that they would have three practice sentences, followed by three more training sentences that were discarded afterwards, which for the participants were already part of the experimental task.

The experiment was published through social networks among Spanish speakers in Argentina. Participation was voluntary and without any remuneration in return.

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[2]Because the group of participants who self-identified as non-cisgender was very small, only 17 participants representing 3.3% of the sample, and statistical comparisons require balanced groups, we chose not to consider this group for the statistical analyses in this paper. It is necessary to define a suitable way to balance the groups in a future experiment.

2.4 Results

The data of three dependent variables were analyzed: reading (RRT) and response (RTr) times and type of response (ToR). The data were processed using R in the R Studio interface. The packages lme4 (Bates et al. 2015), lmerTest (Kuznetsova et al. 2017), car (Fox and Weisberg 2019) and MASS (Venables and Ripley 2002) were used. For the final analysis, only the responses that referred to a group of men or a mixed group of people were taken, and those that referred to a single person, a group of women, or none were discarded.

2.4.1 Reading Times

Since the task was carried out over the Internet, it was especially difficult to control the experimental situation in which the participants were doing it. So, a lower and an upper time limit for the task was established a priori. The lower limit was 300 milliseconds, while the upper limit was 45,000 milliseconds for each trial. This implied removing 41 data points that were equivalent to 0.69% of the total sample. Figure 1 shows the mean RRT according to participants' Gender identity, Stereotypicality and Morphology.
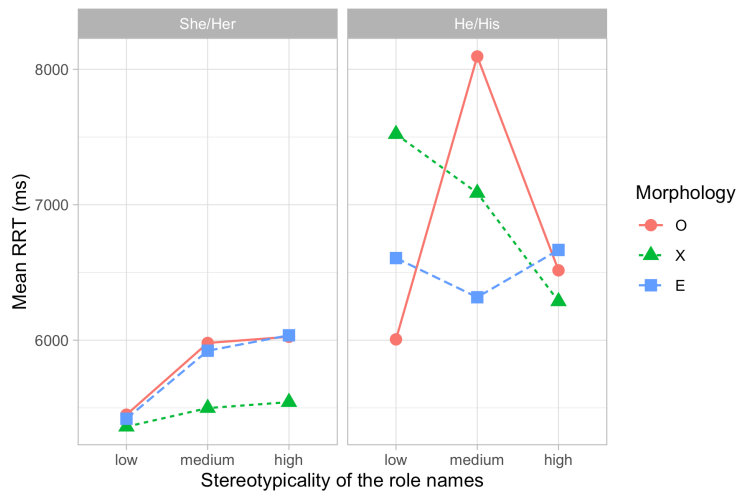

Figure 1: Mean RRT in milliseconds by participants' Gender identity, Morphology and Stereotypicality.

Taking into account the experimental hypotheses, several linear mixed models (LMM) were performed with one, two, three and four variables as fixed effects (Morphology, Stereotypicality, Gender identity, Use of non-binary forms), with and without interactions. Since there were two and three-level factors, all contrasts were coded as repeated contrasts. After testing assumptions of normality and homoscedasticity, we decided to perform a logarithmic transformation of RRT and RTr for data analysis (Winter 2019, Vasishth et al. 2021). In all models, Participants and Items were computed as random effects. To select the most appropriate model, we performed model comparisons with ANOVA and combined with Akaike's information criterion (AIC).

The chosen model included Gender identity as a fixed effect and Participants and Items as random effects[3]. The factors Morphology, Stereotypicality of the role names and Use of non-binary forms did not make a statistically significant contribution to the RRT analysis model. A main effect of Gender identity was found ($\beta_{\text{men-women}}$=0.08170, t=2.324, p=0.0205). As shown in Figure 1, women had shorter reading times than men.

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[3]The R code for the resulting model was: lmer(log(RRT) ~ Gender identity + (1|Participants) + (1|Items)). Number of observations: 8580. Participants: 498. Items: 54.

2.4.2 Response Types

As evidenced in Figure 2, both non-binary morphological variants (-x and -e) consistently generated an unambiguous representation and reference to mixed groups of people, regardless of the level of Stereotypicality of the role names. However, the same is not the case with the generic masculine (-o). First, the responses obtained indicate that it does not appear to function unequivocally as generic. Second, the representation and reference it constructs seem to depend on the level of Stereotypicality. Names with low Stereotypicality ('children', 'teachers') generate more effectively generic representations, while those with high Stereotypicality ('plumbers', 'blacksmiths') generate eminently masculine representations.
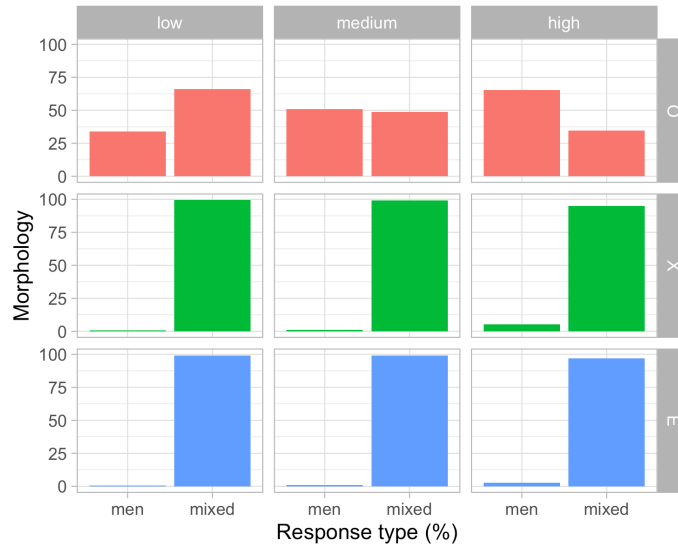

Figure 2: Response type percentages by Morphology and Stereotypicality.

In addition, as shown in Figure 3, an in-depth analyses of the generic masculine responses evidence that the representations appear to vary according to the participant's Gender identity and to the Use of non-binary language.
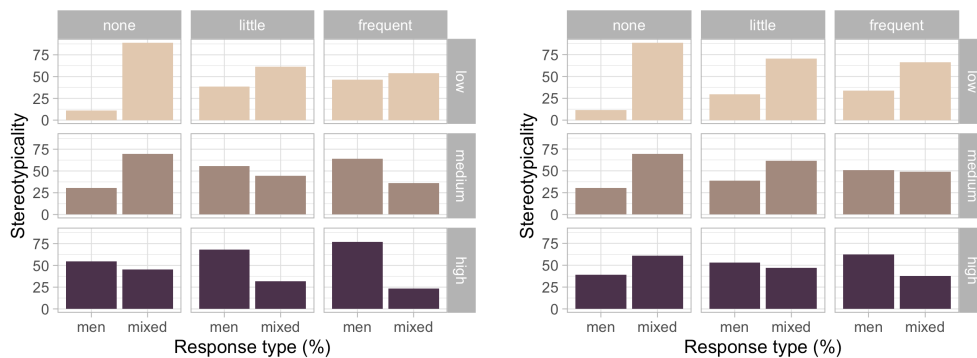

Figure 3: Response type percentages by Use of non-binary forms and Stereotypicality for women (left) and men (right).

Due to the differences in response type, statistical analyses were performed only on the generic masculine responses, the only ones that effectively enabled a response for both response types. For the analysis of the generic masculine's responses, a generalized mixed model was performed. The

chosen model included Stereotypicality, Gender identity and Use of non-binary forms as fixed effects and Participants and Items as random effects[4]. Three main effects were found: Stereotypicality of role names ($\beta_{medium-low}$=-1.8884, z=-5.280, p=<0.0001; $\beta_{high-medium}$=-1.5766, z=-4.459, p=<0.0001), Gender identity ($\beta_{men-women}$=1.3721, z=3.243, p=0.00118) and Use of non-binary forms ($\beta_{little-none}$=-2.2032, z=-4.150, p=<0.0001; $\beta_{frequent-little}$=-0.9917, z=-2.168, p=0.03014). As shown in Figure 3, in the case of low Stereotypicality, participants opted in greater proportion for answers referring to a mixed group, and this preference decreased as the level of Stereotypicality increased. Regarding Gender identity, women showed a greater tendency to interpret the generic masculine as referring to a group of men than male participants. In relation to the Use of non-binary forms, people who did not use non-binary language interpreted the generic masculine as a generic referent, while those who were accustomed to the use of non-binary forms presented a greater interpretation of the masculine as referring exclusively to men.

2.4.3 Response Times

For response times, the same analysis developed for reading times was used. In Figure 4 are the RTr for the responses that considered a mixed group of people as the reference of the role name, while Figure 5 shows the RTr for the different responses obtained from the noun phrases with the morphological variant -o, i.e. generic masculine.
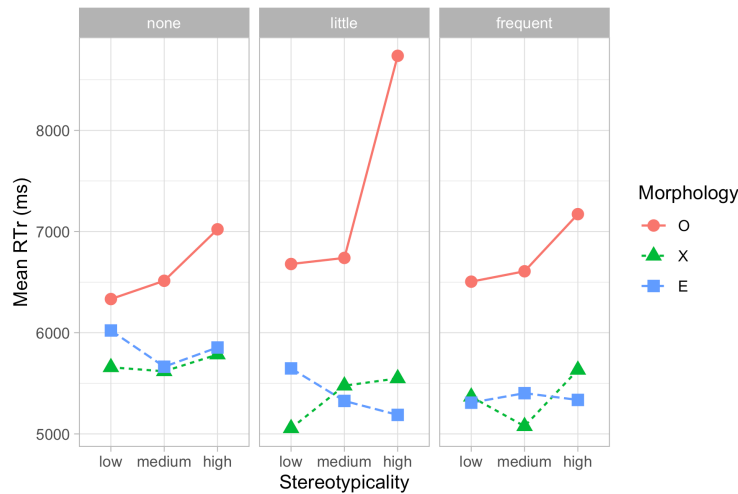

Figure 4: Mean RTr in milliseconds by Morphology, Stereotypicality and Use of non-binary forms.

The chosen model for the statistical analysis included Used of non-binary forms as a fixed effect, Morphology and Response type as nested effects and Participants and Items as random effects[5]. The factors Gender identity and Stereotypicality of the role names did not make a statistically significant contribution to the RTr analysis model. However, it is worth clarifying: initially, the Stereotypicality variable explained the variation in our data, but when we added more variables to the model, i.e. Use of non-binary forms, at least some of the variation in the data came to be explained by the Use for the response time measure. Moreover, Figures 4 and 5 and the analysis of Response types show that the Stereotypicality variable influences somehow on the processing and representations constructed by these noun phrases.

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[4]The R code for the resulting model was: glmer(Response type ~ Stereotypicality + Gender identity + Use of non-binary forms + (1|Participants) + (1|Items)). Number of observations: 2956. Participants: 498. Items: 18.

[5]The R code for the resulting model was: lmer(log(RTr) ~ Use of non-binary forms / (Morphology / Response type) + (1|Participants) + (1|Items)). Number of observations: 8580. Participants: 498. Items: 54.

There was not a main effect of Use of non-binary forms ($ß_{medium-low}$=-7.518e-02, t=-1.308, p=0.19112; $ß_{high-medium}$=-1.975e-02, t=-0.374, p=0.70833). We did find a nested effect of Morphology for the frequent level of Use of non-binary forms ($ß_{frequent\_X-O}$=-1.693e-01, t=-4.483, p=<0.0001). There was also an effect of Response type nested on the generic masculine level of Morphology ($ß_{none\_O\_mixed-men}$=1.054e-01, t=3.039, p=0.00238; $ß_{little\_O\_mixed-men}$=2.177e-01, t=6.269, p=<0.0001; $ß_{frequent\_O\_mixed-men}$=2.059e-01, t=9.128, p=<0.0001). As shown in Figure 4, participants had longer RTr for the generic masculine than for both non-binary forms (-x, -e). Additionally, Figure 5 shows that participants took longer to opt for a mixed group interpretation with the generic masculine morphological form.
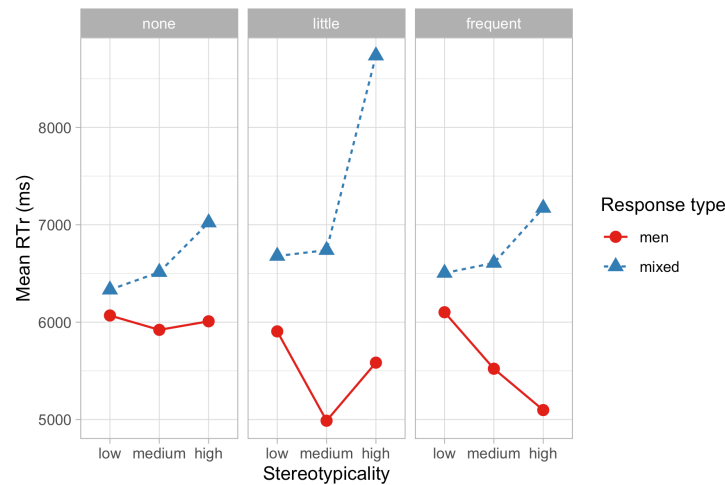

Figure 5: Mean RTr in milliseconds for generic masculine (-o) by Response type, Stereotypicality and Use of non-binary forms.

2.5 Discussion

In the present work, we analyze the results of an exploratory experiment that evaluates the processing of three morphological variants of generic in Spanish: the generic masculine (-o) and two morphological innovations (-x, -e). We analyze this through a sentence reading comprehension task. Three measures were recorded: one offline and two online. On the one hand, the reading times (RRT). On the other hand, the type of response chosen (ToR) to a multiple-choice question about the reference constructed for the noun phrase in the subject position. Lastly, the time it took to make the choice (RTr) of one of several possible options was also recorded. In addition to the Morphology factor, a second factor was analyzed for the items: Stereotypicality of the role names. Finally, the voluntary Use of non-binary forms reported by the participants was considered as the third predictor variable.

In relation to reading times, one of our hypotheses considered that non-binary forms, as they represented a morphological innovation, could imply a higher processing cost that would translate into longer reading times. The results do not support this prediction, although they do show a Stereotypicality effect, another of the initial hypotheses. This element is fundamental to analyze the underlying process. The reading process does not seem to be conditioned by the morphology used; that is, there are no impeding effects for non-binary forms even when they are innovations for Spanish. However, the degree of stereotypical association of role names with a given sex-generic representation modulates the reading process. Role names with a high degree of association with masculine stereotypes, high stereotypicality: i.e. "plumbers", show longer reading times. On this point, it is worth highlighting two issues: 1. in the present study, the Stereotypicality was systematically associated with stereotypically masculine representations; 2. the levels of this factor could be co-varying with the variable Frequency of the lexical form itself. In a new experiment, currently in development, we are studying these elements in greater detail.

Second, we analyze the type of response, that is, the references built from noun phrases in different morphological variants. For the case studied here, simple noun phrases in plural, we find a consistent pattern: the operation of non-binary forms as specialized in the reference of groups with non-uniform gender, independent of the level of stereotypicality. Regardless of whether a role name is strongly associated with a gender representation, i.e. "plumbers", the presentation of the noun phrase in a non-binary form (-x or -e) consistently generates a mixed or gender-indistinct reference. These results support our initial hypothesis: the selection of referents of the non-binary forms will be more consistent toward groups with non-uniform gender. For future studies, we are interested in evaluating whether the reference generated by the direct non-binary language (-x, -e) is replicated in the case of the indirect non-binary language (López 2020).

Alternatively, for the generic masculine, the pattern found was different: the construction of its reference is strongly conditioned by the stereotypicality of the role names. These results are in line with our experimental hypotheses, but require greater precision for future work. Similar results were obtained in experimental studies conducted in other languages: there is consensus that the generic masculine produces a bias toward an exclusive reference of men (Brauer 2008, Braun et al. 2005, Cacciari and Padovani 2007, Gygax and Gabriel 2008, Gygax et al. 2008, Marchesini 2019, Misersky et al. 2018, Pinheiro and Freitag 2020). Besides, there are findings regarding the role played by the stereotypicality of role names for the referential process (Gabriel et al. 2008). In a new study, we are evaluating whether non-binary forms achieve mixed reference also in cases of stereotypically feminine role names.

It is worth highlighting the pattern of responses for items with masculine morphology. Here, both the gender identity and the use of non-binary forms of the participants, as well as the stereotypicality of the role names showed significant effects (Figure 3). The -o morphology achieves a mixed reference consistently only in cases of low use of non-binary forms and with role names with low stereotypicality. As stereotypicality and the voluntary use of non-binary forms grow, the generic masculine seems to concentrate its reference toward groups of men exclusively. This pattern offers evidence regarding the effective functioning of the so-called generic masculine. Even when, in Spanish, it can refer to groups of people without uniform gender, this occurs consistently only in particular cases, strongly conditioned by the stereotypicality of the role name. Additionally, this possibility of generic reference decreases significantly when the speakers frequently use non-binary forms to refer to mixed groups or without uniform gender, leaving the masculine restricted to the reference of groups of men.

The third measure we recorded was response times. On the one hand, we analyzed the times of the responses that opted for a generic reference. We found shorter times for the non-binary variants and, in this case, the difference concerning the generic masculine was significant. This indicates that morphological innovations do not entail a higher processing cost, rather in contrast, the establishment of a generic reference is transversal to the different levels of stereotypicality and does not seem to show ambiguity.

On the other hand, there is an effect of response type nested to the morphology. Specifically, when a mixed reference is chosen as a response to the generic masculine, the times are higher. These results contradict our initial hypothesis that the generic masculine would show a processing advantage. While non-binary forms generate a kind of specialization in the mixed reference, the generic masculine (and its double possibility of reference) seems to create an obstacle during processing, which is reflected in the longer response times. These findings provide empirical evidence that the generic masculine in Spanish can impose an interpretive bias toward a group of men.

In addition, if we consider the consistent reference to mixed groups generated by the non-binary forms (-x and -e) and this is taken in conjunction with the facilitation exhibited in the online process, we can conclude that, regardless of whether a person decides to use non-binary forms voluntarily or not, the phrases with non-binary forms are understood and generate mixed or non-uniform gender references.

Finally, we want to point out that it is important to investigate in greater depth these preliminary results, of an exploratory nature, in relation to the possible links that could be found between production and comprehension processes. Our data exhibit the need to specify, through a confirmatory experiment, the hypothesis that the frequent and voluntary use of non-binary forms can facilitate comprehension and the reference generation instance. Understanding this feedback mechanism in

more detail will be of vital importance to better comprehend the possible deployment of this phenomenon in a community of speakers.

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