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ARTICLE

Dresses and ties: the effect of grammatical gender and stereotypical semantic bias in three Spanish-speaking communities

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Abstract

Stereotype construction is a complex process, with multiple relations to language processing, that combines collective sociocultural factors with individual cognitive elements. Regarding gendered languages, there is a debate about the effect of grammatical gender on the representation of inanimate entities. To evaluate the potential interaction between gender stereotypes and gender morphology on words that refer to inanimate entities in three different communities of Spanish speakers, we developed a task of conscious judgments on the level of association to men or women of words that refer to objects. In a 3 × 2 × 3 × 2 design, we manipulated Semantic Bias (gender stereotypicality), with three levels (male, e.g., martillo, hammer-M; female, e.g., vestido, dress-M; neutral, e.g., lápiz, pencil-M); Morphology, with two levels (masculine, e.g., vestido, dress-M; feminine, e.g., pulsera, bracelet-F); Linguistic variety, with three levels (Argentine, Chilean and Peninsular) and Questionnaire, with two levels (related to men vs. related to women). The results showed that grammatical gender has an effect on words that refer to inanimate entities when those words do not carry a strong stereotypical association (neutral items), semantic bias related to gender stereotypes overshadows any potential effect of grammatical gender in biased items, and there are differences depending on the community (Argentine, Chilean and Peninsular).

Keywords: gendered languages; gender stereotypes; grammatical gender; lexical processing; mental representation

1. Introduction

1.1. Gender morphology in the world's languages and the case of Spanish

There are several diverse studies on *gender* across the natural languages of the world. The different approaches offer not only grammatical perspectives but also lexicographic, pragmatic, discursive, sociolinguistic and psycholinguistic perspectives. Within this framework, taxonomies describing gender marking in languages vary, but there are certain general categories with a broad consensus (Gygax et al., 2019; Hellinger & Bußmann, 2001; Leaper, 2014). One of the most recent classifications distinguish five types of languages (Gygax et al., 2019): grammatical gender languages, natural gender languages, languages with a combination of grammatical and natural gender, genderless languages with some traces of grammatical gender and genderless languages. Within the first group, where languages such as Spanish, German and Italian are found, gender controls grammatical agreement and nouns referring to both animate and inanimate entities have assigned gender.

Spanish is an inherently gendered language and assumes a basic binary distinction (masculine/feminine), but it exhibits some complexity in the gender assignment process, which has generated several attempts for systematization (Ambadiang, 1999; Cabeza Pereiro & Rodríguez Barcia, 2013; Roca, 2006). There is an agreement that it is possible to understand and define gender based on both semantic and formal features. The different proposals usually vary in the degree of arbitrariness or motivation of gender in nouns and there is a special interest in nouns that refer to people (Ambadiang, 1999).

Within the process of gender assignment for nouns referring to people, there is consensus that sociolinguistic, pragmatic and grammatical factors are involved. As some studies have observed, gender in nouns referring to people 'tends to be biological' (Ambadiang, 1999) and does not exclusively rely on grammatical cues but it is also linked to extralinguistic information such as sociolinguistic factors, gender stereotypes, type of referent, pragmatic and communicative situation and sociohistorical context (Ambadiang, 1999; Cabeza Pereiro & Rodríguez Barcia, 2013; López, 2020; Mecit et al., 2022). For example, in Spanish, there are epicene nouns (those that present a single gender invariable form that refers indistinctly to men and women, for example, *persona*, 'person' in English). However, most nouns that refer to people, and in general to animate entities, form gender pairs, which many studies classify as heteronyms: *maestro/maestra*, 'teacher' in English. The place where the gender marking is found in these pairs can vary: (1) the root (*varón* and *mujer*, 'man' and 'woman' in English) (2) the desinence (*emperador* and *emperatriz*, 'emperor' and 'empress' in English; *niño* and *niña*, 'child' in English).

The traditional approach to gender inflection defines the problem in terms of marked and unmarked elements. This is usually the framework from which the so-called 'generic masculine' has been analyzed (Ambadiang, 1999; Márquez, 2013). Ambadiang (1999) offered a widely accepted definition of masculine as the unmarked gender in Spanish. Feminine gender, instead, is the marked variant in Spanish; that is, it is associated with a desinential morphology that must be present to assign a gender different from the masculine, taken by default. From sociolinguistic and pragmatic perspectives, there are studies that propose an asymmetrical function of the generic masculine and argue that the Spanish's inflectional system hides women by generating an initial male bias (Ambadiang, 1999; Cabeza Pereiro & Rodríguez Barcia, 2013; Márquez, 2013). This male bias of generic masculine has been also extensively

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reported in other languages with grammatical gender (Horvath et al., 2016; Menegatti & Rubini, 2017; Schmitz, 2023).

1.2. Gender stereotypes and language

Just as it is possible to analyze the relationship between beliefs and language by studying the effects of morphology or lexical semantics on the construction of mental representations, it is also possible to reflect on how gender stereotypes, as part of our beliefs and prior knowledge about the world, influence language production, language comprehension and even communicative interactions (Bojarska, 2013; Carreiras et al., 1996; Casado et al., 2021; Duffy & Keir, 2004; Horvath et al., 2016; Lewis & Lupyan, 2020; Lindvall-Östing et al., 2020; Menegatti & Rubini, 2017; Neves et al., 2023; Samuel et al., 2019; Sato & Athanasopoulos, 2018; Stetie & Zunino, 2022; Zunino & Stetie, 2022).

Gender stereotypes usually combine collective sociocultural factors with individual cognitive elements (Gelman, 2004; Lindvall-Östing et al., 2020; Zemore et al., 2000); they are established as individual stable mental representations but are always strongly associated with sociocultural factors. Several studies have examined the construction and projection of gender stereotypes from a developmental perspective (Eckes & Trautner, 2000). In adults, gender seems to be a ubiquitous attentional focus in multiple contexts and has also been studied in relation to other dimensions such as race, age and social roles (Zemore et al., 2000). Gender stereotypes are frequently divided into two categories: descriptive (beliefs about key characteristics of men and women) and prescriptive (expectations and imposition about how men and women must be or behave).

Furthermore, some researchers have even proposed that information about gender stereotypes is part of our general knowledge about the world (and even impose biases for the acquisition of new knowledge) but it would have distinctive and specific characteristics that maintain particular relationships with language, both in its grammatical and semantic dimensions (Contreras et al., 2012; Mecit et al., 2022; Menegatti & Rubini, 2017; Molinaro et al., 2016; Sato & Athanasopoulos, 2018).

Carreiras et al. (1996) and Duffy and Keir (2004) have been pioneers in many ways. Both studies analyzed the influence of gender stereotypes on the construction of mental models during sentence and text comprehension in Spanish and English. They evaluated the congruency and incongruency of explicit and implicit semantic information provided by gender stereotypes with respect to morphologically gendered personal pronouns and reported an early incidence of gender-stereotypical information during comprehension. However, Carreiras et al. (1996) also tested Spanish speakers and found differences with English ones. For Spanish, a language that morphologically marks gender through inflections in nouns and determiners, the clues about a referent's gender come not only from representations associated with stereotypes but also from explicit morphological marking.

Kreiner et al. (2008) went a step further by examining whether different types of semantic information affect the processing of gender incongruencies between English nouns and pronouns. In two eye-tracking studies, they compared the processing of stereotypical nouns ('minister') and definitional nouns (in which gender information is part of the definition of the work, like in 'king') in anaphora (i.e., the pronoun refers to an antecedent) and cataphora sentences (i.e., the pronoun refers to

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the following noun). Gender stereotypical role nouns activate world knowledge information, which is not specifically linguistic. By contrast, definitional nouns are lexically specified for gender. The results suggest that the grammatical gender information provided by the pronoun consistently and unambiguously guides the construction of a mental representation of gender. Of note, pragmatic gender inferences in stereotypical nouns are influenced by syntactic constraints (i.e., anaphora vs. cataphora).

Furthermore, there are some interesting findings around the possible implicit activation of gender-stereotypical information during language processing. For example, Canal et al. (2015) investigated gender stereotypes during language processing in English individuals by manipulating congruency (between nouns and pronouns) and the type of gender information encoded in the noun (definitional vs. stereotypical). Gender agreement mismatches following stereotypical gender nouns modulated the amplitude of left anterior negativity and the P600 component. These findings were interpreted in terms of additional efforts to map the pronoun with the possible, although less likely, counter-stereotypical antecedent. Following a similar approach, Siyanova-Chanturia et al. (2012) found that Italian individuals experienced increased difficulties when linking nouns denoting masculine stereotypes with their pronoun referents, as indexed by enhanced N400 responses. Of note, these effects were not observed for gender mismatches between female stereotypical nouns and their antecedents.

More recently, Pesciarelli et al. (2019) conducted a masked and unmasked priming ERP study in Italians, to explore the implicit effect of grammatical and stereotypical gender during processing of gender violations. The study was conducted in Italians and the authors analyzed processing on a third-person pronoun presented after. Participants were asked to judge the grammatical gender of the target pronoun following a prime that could be either a grammatically marked or stereotypically biased role name. Gender-incongruent stereotypical primes elicited larger N400 responses in both masked and unmasked conditions, which provides compelling evidence about the influence of gender stereotypes even under unconscious conditions.

Finally, in a very recent paper, under a gender-priming paradigm, Casado et al. (2023) explored implicit activation of gender stereotypes during the lexical processing of nouns that refer to animate entities (animals or people). Based on the study by Pesciarelli et al. (2019), they analyzed role names with and without stereotypicality bias and epicene nouns referring to animals. They found a gender-congruency effect for all prime conditions, even with epicene nouns. This may indicate that grammatical gender can bias the gender-congruency effect even when the noun is not conceptually related to the gender. The authors conclude that not just high-level conceptual information but also lexical and grammatical information are involved in the gender-congruency effect.

Many studies show a reciprocal conditioning between gender stereotypes and linguistic forms (Braun et al., 2005; Horvath et al., 2016; Lewis & Lupyan, 2020; Lindvall-Östing et al., 2020; Menegatti & Rubini, 2017), and that the nonuse of gender-inclusive forms[1] reproduces the focus on stereotypes based on heteronorm

[1]Most of these studies consider gender-inclusive forms that refer to men and women but leave aside other sex-gender identities.

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and androcentrism (Menegatti & Rubini, 2017; Renström et al., 2022). In contrast, the use of paired forms (masculine/feminine: '*enfermero/enfermera*') or the varied gender-inclusive forms used across different languages (Körner et al., 2022; Lindqvist et al., 2019; Renström et al., 2022) increases the visibility of women, decreases androcentric representations projected by the use of the generic masculine and has been shown to have a consistent impact on the mental representations of men and women during language comprehension (Braun et al., 2005; Horvath et al., 2016; Lewis & Lupyan, 2020; Menegatti & Rubini, 2017).

Research has also focused on the impact of grammatical gender on the representation of inanimate objects or entities. After the seminal work of Konishi (1993), some of the most traditional studies around this topic were developed by Boroditsky and colleagues. Phillips and Boroditsky (2003), in a classical paper, showed a significant effect of grammatical gender on the perception of inanimate entities in different tasks that evaluate similarities between objects and people. The authors claim that this effect persists even in non-linguistic tasks and with verbal interference. So, one strong conclusion is that grammatical gender might influence how people conceptualize objects. For its part, Elpers et al. (2022) developed a high-powered registered replication of this study. Their results do not show the same scene: when sources of error variance are considered, the grammatical gender effect disappears for speakers of grammatical gender languages (Spanish and German) but some effects persist for English speakers previously trained in gender-like categories. Those results exhibit a more complex phenomenon that needs more research about the contexts and mechanisms involved in this effect.

Mecit et al. (2022) pointed out that grammatical gender in words that refer to inanimate entities seems to influence, in some way, how those entities are mentally represented. They explained that this effect is due to a tendency toward anthropomorphism toward objects, which increases in grammatical gender languages. Grammatical gender features in words that refer to objects would make human characteristics linked to gender more accessible in the mental representation of those entities. Findings of this type have been linked to weak versions of the Sapir–Whorf hypothesis.

For the specific case of Spanish, Casado et al. (2021) conducted a word repetition, a lexical decision and a gender decision task, in the auditory modality, to test whether the grammatical gender of words can function as a prime of conceptual representations linked to gender stereotypes. They used items that refer to inanimate entities stereotypically linked to women or men, and controlled the congruency or incongruency between stereotypicality bias and grammatical gender: *corbata* (tie-F, incongruent: feminine grammatical gender but male stereotypical bias) versus *falda* (skirt-F, congruent: feminine grammatical gender and female stereotypical bias). They found an effect of grammatical gender only when the task involved attending to gender information. Items that showed congruency between grammatical gender and stereotypicality were easily processed.

There are also interesting findings concerning bilingual speakers, particularly in cases where the two languages mark gender in a different way. Neves et al. (2023) and Sato and Athanasopoulos (2018) found that grammatical gender markings bias participants' perceptual judgments of animals and objects only in grammatical gender languages, such as Portuguese and French, and not in natural gender languages like English. Gender information provided by grammatical gender markings seems to be used to solve tasks that involve strategically and consciously

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recovering it for its resolution, but it also operates in an automatic and implicit way to modulate perceptual judgments (Sato & Athanasopoulos, 2018).

1.3. Gender and differences by (linguistic) communities

Cognitive theories of gender have been proven in different cultures: there are gender stereotypes susceptible to being defined as pan-cultural (Gibbons, 2000). However, stereotype construction is a complex process that seems to be defined by stable and very systematic factors but also shows degrees of variability between different communities and even between individuals from the same community (Cuddy et al., 2015; Gelman, 2004; Gibbons, 2000; Lindvall-Östing et al., 2020; Menegatti & Rubini, 2017; Molinaro et al., 2016; Zemore et al., 2000). Likewise, the relationship between gender stereotypes and different languages can also be variable (Mecit et al., 2022; Sato & Athanasopoulos, 2018), particularly when accounting for the grammatical gender features of each language (Fábregas, 2022; Motschenbacher, 2014).

Some authors have highlighted the methodological problems for adequate cross-cultural research but there are still several studies that analyze this issue (Gibbons, 2000; Lomazzi & Seddig, 2020).

Regarding the link between cultural differences and linguistic differences associated with gender (and the relationship between grammatical and social gender), we have shown that there are classic works that analyze the relations between language and the construction, perception and attitudes around gender stereotypes at a cognitive level (Flaherty, 2001; Lewis & Lupyan, 2020; Prewitt-Freilino et al., 2012).

However, Williams et al. (2019, 2021) pose another line of research that critically takes up the traditional assumptions of grammatical approaches in relation to the arbitrariness in the gender assignment of names in languages with grammatical gender. As a complement to experimental work within the framework of human cognition that was addressed in the past section, the authors have developed large-scale corpora studies that support the idea that the assignment of grammatical gender, even in the case of names that refer to objects, would not be arbitrary but rather exhibits a consistent association with the meaning of those names.

Likewise, in another recent study, DeFranza et al. (2020), through a large-scale corpora study with an automated Natural Language Processing (NLP) method in 45 languages, showed that when gender is a salient feature in a language (the case of languages with grammatical gender), stronger and more frequent associations with social gender are generated.

Finally, it is worth highlighting that, as far as we know, there are no systematic works that analyze cultural differences among speakers of different varieties of the same language. This perspective is of particular interest as it jointly addresses potential cultural differences, in communities that share the language but not the same variety of that language. Therefore, it takes into account the phenomena of linguistic variation that tend to remain poorly observed (Fábregas, 2022; Moreno Cabrera, 2008; Stetie et al., 2023).

1.4. Gender judgments and (potential) differences by gender identity

To the best of our knowledge, there are no systematic studies that analyze the potential effects of gender identity during the processing of gendered (or gender-related)

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language, specifically for words or sentences that involve an interaction between gender stereotypes and grammatical gender. However, some authors have investigated differences linked to gender identity, the perception of gender biases and the projection of gender stereotypes in their judgments and everyday attitudes. For example, Sczesny et al. (2004) found that the male-leader-boss stereotype is more present in men than in women in the three countries analyzed (i.e., Australia, Germany and India).

More recently, Hentschel et al. (2019) analyzed how men and women perceive and characterize others and themselves. The authors propose an experimental study in which North American men and women describe other people and themselves on a multidimensional scale that considers assertiveness, independence, instrumental competence, leadership ability, concern for others, sociability and emotional sensitivity. The results show marked differences in the characterization that women and men make of both other people and themselves. For example, men describe women as less agentic, while women make finer-grained distinctions such as women being less assertive but equally competent for leadership. In the case of self-assessment, the differences are also interesting: taken globally, the data show that women tend to self-characterize under more stereotypical parameters than they characterize other women, while men show the opposite pattern.

García-González et al. (2019), for their part, studied the perception of gender bias in Spanish research institutions. Based on a questionnaire already used by the British Athena Survey of Science, Engineering and Technology (ASSET2016), they collected data in Spain and found that women perceive a greater degree of inequality than men do. Their results coincide with those found in the United Kingdom, so the authors conclude that men and women do not share perceptions of gender inequality and this pattern is relatively consistent in two large European populations.

Finally, outside of behavioral research on perceptions and attitudes, it is worth mentioning the study conducted by Wang et al. (2019). Using transcranial direct current stimulation, they found that men and women had different behavioral and neural correlates of gender stereotypes and concluded that the medial prefrontal cortex plays a causal role in controlling implicit gender stereotypes. The authors suggest that men and women might have different neural bases for the processing and representation of gender stereotypes.

Following this line and in the absence of systematic studies that analyze this point during lexical processing, we believe that it is worth considering an exploratory hypothesis on the potential effects of the participants' gender identity in the association judgments between gender stereotypes and words that refer to objects.

1.5. The current study

In this study, we want to focus on linguistic varieties as the starting point. Differences between Argentine, Chilean and Peninsular Spanish varieties are well documented as diatopic varieties of Spanish (Moreno-Fernández & Caravedo, 2022) and diatopic variation around grammatical gender is also a key issue in theoretical and grammatical studies. Possible idiosyncratic variations have been studied, for example, in the gender assignment for names that refer to inanimate entities ('el sartén'/'la sartén') or in the difference between the varieties of American and Peninsular Spanish on the acceptance of noun phrases like 'la juez' (where gender is marked on the determiner

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but not on the noun and do not maintain the agreement between determiner and noun) versus 'la jueza' (where agreement is maintained and gender marking functions, as usual for Spanish, as a nominal classifier) (Fábregas, 2024).

At the same time, as we have outlined in Section 1, there are sociocultural differences that are projected to the formation of social gender and the formation of gender stereotypes. Although we acknowledge that generic indices may not be representative or rigorous enough to verify subtle cultural differences, given that we do not have previous studies that analyze specific cultural differences around gender between the communities studied here, we will use the Gender Inequality Index (GII)[2] belonging to the United Nations Development Programme (2024) as a descriptive basis of potential differences between the communities of Argentina, Chile and Spain. The last data available is for 2022: Argentina shows a GII of 0.292 (−0.04 with respect to 2021); Chile has a GII of 0.190 (−0.007 with respect to 2021) and Spain registers a GII of 0.059 (+0.002 with respect to 2021).

Within this general scene, we justify the comparative study across three Spanish-speaking communities in two main ways. On the one hand, we are interested in analyzing the effects of linguistic elements analyzed from a diatopic variation perspective. On the other hand, we investigate the potential effects linked to sociocultural differences. Under the first axis and given that there are documented differences in the realization of grammatical gender in the varieties of American Spanish compared to those of Peninsular Spanish (Fábregas, 2024), we expect these differences to be projected in lexical processing. However, as it is known that grammatical gender processing can be influenced by gender stereotypes even in the case of names that refer to inanimate entities (Casado et al., 2021; Lewis & Lupyan, 2020; Lindvall-Östing et al., 2020; Mecit et al., 2022) and we know that the gender stereotypes construction can be conditioned by the social and cultural context in a community (Cuddy et al., 2015; Gelman, 2004; Gibbons, 2000; Lindvall-Östing et al., 2020; Menegatti & Rubini, 2017; Molinaro et al., 2016; Zemore et al., 2000), we also considered non-strictly linguistic characteristics. If, indeed, gender marking interacts with other non-linguistic factors, differences that are not strictly due to linguistic variety may arise between communities. In particular, we can expect that a lower GII may reduce the processing bias of stereotypical information.

We focused on the analysis of perceptions and attitudes through explicit judgments. The central objective is to evaluate the potential interaction between gender stereotypes and gender morphology on words that refer to inanimate entities in three different communities of Spanish speakers: Argentina, Chile and Spain.

Considering these three communities will allow us to:

a. around the linguistic axis, compare two communities of Spanish speakers from America with some documented differences (Moreno-Fernández & Caravedo, 2022) and a community of Peninsular Spanish speakers; therefore, we will be able to verify not only if there are differences around grammatical gender between American and Peninsular Spanish but also between American varieties;

[2]GII is a composite metric of gender inequality considering three dimensions: reproductive health, empowerment and the labor market. A low GII value indicates low inequality between women and men, while a higher value indicates higher inequality.

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b. around the sociocultural axis, we will be able to compare two communities of American Spanish speakers that share similar GII and have improved their index in the last period with respect to a community with lower GII (i.e., a context that is defined as more egalitarian with respect to gender) but its index has worsened in the last period.

This is a task of open and conscious judgments, measured using a Likert scale, on the level of association to men or women of words that refer to inanimate objects. We start from the assumption that there are objects stereotypically linked to men ('tie'), objects that are stereotypically linked to women ('dress') and objects that can be considered neutral in that sense ('pencil'). Based on the results reported by other research and as discussed in Section 1, we also intended to study whether, in a language with grammatical gender, this morphological element can modulate the effect on the conscious perception of stereotypical associations guided by lexical semantics. Besides, given that stereotypicality biases could vary between communities, we postulated a study that would evaluate this phenomenon in three different Spanish-speaking communities.

In a 3 × 2 × 3 × 2 design, we manipulated Semantic Bias, that is, the stereotypicality of words' referents with three levels (male, e.g., *martillo*, hammer-M; female, e.g., *vestido*, dress-M; neutral, e.g., *lápiz*, pencil-M); Morphology, with two levels (masculine, e.g., *vestido*, dress-M; feminine, e.g., *pulsera*, bracelet-F); Linguistic variety (linguistic community), with three levels (Argentine, Chilean and Spanish) and Questionnaire by direction of gender association (related to men vs. related to women). Organizing two Questionnaires that elicit different directions in gender association might be understood as a counterbalancing mechanism. Since having judgments just for only one (male or female) association question could ostensibly bias the results and generate a confounding variable, we decided that all items should go through a judgment elicited by a women-related question ('How closely linked to women do these words seem to you?') and also by a men-related question ('How closely linked to men do these words seem to you?'). By doing so, all items went through the two conditions of the eliciting question.

We hypothesize that the congruency/incongruency between semantic bias and gender morphology will impact on participants' judgments. Furthermore, we explore potential modulations between linguistic communities rooted in the different sociocultural contexts (Cuddy et al., 2015; Gibbons, 2000) and the possible effects of participants' gender identity (Hentschel et al., 2019; Sczesny et al., 2004).

Therefore, we postulate one confirmatory and two exploratory hypotheses:

1. There will be an effect of morphology on neutral items: neutral items with masculine grammatical gender will be rated as more masculine and neutral items with feminine grammatical gender will be rated as more feminine;
2. The same effect of morphology may apply to items with male or female bias but the effect may be reduced due to a stronger semantic bias. We expect a congruency effect, so as the male-biased items with masculine grammatical gender (*taladro*, drill-M) will be rated as more masculine and female biased with feminine grammatical gender items (*pulsera*, bracelet-F) will be rated as more feminine. Conversely, we expect an (opposite) incongruency effect for

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items in which grammatical gender and semantic bias do not coincide (vestido, dress-M; corbata, tie-F).

Based on the existence of linguistic differences between the three varieties of Spanish (and also considering GII scores), we expect that the effect of Morphology may be modulated by Linguistic variety, so as the magnitude of the effect varies depending on the linguistic and sociocultural community.

Participants' gender identity may generate a bias on the object association to gender stereotypes.

2. Method

2.1. Participants

The initial sample consisted of 649 participants. We defined two inclusion criteria before data analysis and following standards in the literature (e.g., Brysbaert et al., 2014; Ćoso et al., 2022, for similar studies). First, we removed 60 participants who had the same score on more than 80% of the items[3]. Second, we removed participants whose correlations with other participants' ratings were lower than 0.1 (N = 39). These two criteria were meant to warrant that all participants understood and properly performed the task (Brysbaert et al., 2014; Ćoso et al., 2022). Inclusion criteria are particularly important when conducting experiments remotely as previous research shows that participants tend to pay less attention or get easily distracted; therefore, it is crucial to be strict or even conservative in experiments with online data collection (Rodd, 2024).

Of the remaining 550 participants, only 4 subjects identified themselves as nonbinary. For models that do not involve gender identity as a predictive variable, we included the full sample. For the model that includes gender identity as a predictive variable, we seek to conform equilibrated subsamples for men and women to adequately compare groups (for further explanation, see Section 3).

The final sample consisted of 550 participants (age: M = 35.45; SD = 12.26; min = 18; max = 85), 207 from Argentina, 121 from Chile and 222 from Spain. All participants are native Spanish speakers, their places of residence correspond to urban areas of each of these countries and they do not present language impairments. Participation was voluntary and unpaid. Table 1 presents participants' demographic characteristics.

2.2. Materials

We selected 90 nouns with inanimate referents and manipulated two variables: Morphology and Semantic Bias. Regarding Morphology, half of the nouns had masculine grammatical gender and the other half had feminine grammatical gender. As for the Semantic Bias, that is, the stereotypicality of words' referents, we created three groups: 30 nouns with a male bias, 30 with a female bias and 30 with a neutral

[3]Detecting and removing those data points is especially important because it not only helps to control the degree of attention to the task in a remote collection but also avoids that this lack of attention or motivation ends in extremely awkward judgments: for example, to judge *corpiño* ('bra') as strongly related to men.

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Table 1. Participants' demographic characteristics

	Age			
	M (*SD*)	Min.–Max.	Gender identity	Education
Argentina (*N* = 207)	36.71 (10.69)	18–70	161 women 44 men 2 nonbinary	9 high school 36 at university 162 completed university
Chile (*N* = 121)	29.29 (8.56)	18–64	78 women 43 men	6 high school 45 at university 70 completed university
Spain (*N* = 222)	37.64 (14.15)	18–85	157 women 63 men 2 nonbinary	19 high school 55 at university 148 completed university
Total (*N* = 550)	35.45 (12.26)	18–85	396 women 150 men 4 nonbinary	34 high school 136 at university 380 completed university

bias. In (1), (2) and (3), we present examples of each semantic bias in masculine and feminine grammatical gender.

(1) male semantic bias: *taladro* (drill-M), *corbata* (tie-F)
(2) female semantic bias: *vestido* (dress-M), *pulsera* (bracelet-F)
(3) neutral semantic bias: *lápiz* (pencil-M), *toalla* (towel-F)

We controlled for the length and frequency of the items. The selected words were all between five and seven letters, and between two and three syllables. As for the frequency, we used the Es-Pal database (Duchon et al., 2013) and considered Frequency per million. We controlled that all conditions had the same mean frequency (M = 10.31, SD = 6.43). Although we used the same words for the three linguistic communities, we made some small changes to adapt the items to each dialectal variety. For example, the word *pollera* ('skirt'), used in Argentina, was replaced by *falda* for Chile and Spain. The complete list of items is available at https://osf.io/e5uvn/.

2.3. Procedure

Participants judged whether word referents were more likely related to men or women on a 7-point Likert scale. The questionnaire was administered online with a between-participant presentation, so no participant saw the same item twice. First, participants were asked to accept an informed consent to access the task and to provide their sociodemographic characteristics. They were asked to indicate their age, gender identity, highest level of studies achieved, linguistic variety, nationality and city of residence.

We designed two versions of the questionnaire with different scale referents. In the first version, participants had to judge how feminine the items were, while in the second version, they had to judge how masculine the items were. In both versions, the linguistic items were the same and were pseudo-randomized, controlling that many items of the same condition did not appear together. Both versions of the questionnaire were assigned equally to participants from different linguistic communities and gender identities. The instructions for the task were as follows:

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> *We will present you with a series of words that refer to inanimate entities. For each of them, you have to answer how related to women*[4] *these words seem to you, on a scale of 1 to 7: 1 would correspond to not related and 7 would correspond to very related.*

The task was conducted using a *Google form*. It could be performed on any electronic device with an Internet connection. Participants were recruited through social media and through seminars and lectures. Completing the task took between 5 and 10 minutes depending on the participant. Participation was voluntary and it did not involve any compensation.

3. Results

Statistical analysis was performed using R software version 4.3.1 in the R Studio interface (R Core Team, 2023). Data, analysis code and Supplementary materials are available at Open Science Framework: https://osf.io/e5uvn/.

In addition to the previously mentioned inclusion criteria, for the final analysis, we checked for outliers, that is, responses that exceed the two standard deviations. As is the standard in the literature, we considered 2 SD to detect outliers (Cousineau & Chartier, 2010) but we did not find any data point outside this limit. Therefore, the only two inclusion criteria applied were the ones already discussed in Section 2.1.

3.1. Descriptive statistics

We ran an experiment with a 3 × 2 × 3 design in which we had three independent variables: Semantic Bias, with three levels; Morphology, with two levels and Linguistic variety, with three levels. For data analysis, we also included Questionnaire as a relevant factor. We measure 'association judgment' as the dependent variable, through a 7-point Likert scale. Figures 1 and 2 present the descriptive data[5].

3.2. Inferential statistics

First, we evaluated the distribution of our dependent variable. The results indicated that judgment is normally distributed, with a skewness of −0.060 and a kurtosis of 2.46, suggesting that data meet normality assumptions. Data were analyzed with linear mixed models. We coded the levels of fixed factors as centered-contrasts and sum contrasts, depending on the number of levels of each variable. The models used for the analysis included Questionnaire, Semantic Bias, Morphology, Linguistic variety and Gender Identity as fixed effects, and Participants and Items as random effects. Model selection was done by AIC between convergent models[6]. Moreover, as we expected different patterns for neutral and biased items – Hypotheses 1 (i) and 1 (ii) – the analyses are splitted.

[4]In the men-association condition of the task, the eliciting question was '*For each of them, you have to answer how related to men these words seem to you, on a scale of 1 to 7*'.

[5]Additional descriptive statistics are provided in Supplementary materials.

[6]All the selected models were the most parsimonious models that converged. We also present non-convergent models in Supplementary materials.

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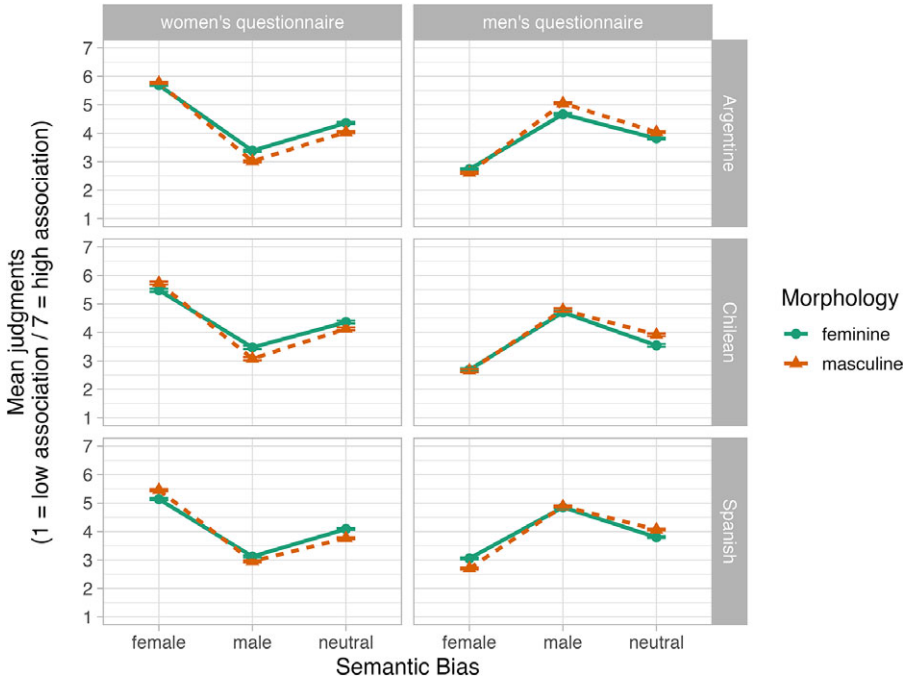

Figure 1. Mean judgments by Semantic Bias, Morphology, Linguistic variety and questionnaire.

To test Hypothesis 1 (i), we run a model for neutral items in which Morphology was included as a fixed effect nested to Questionnaire, Participants and Items were included as random effects and we included random slopes by Morphology: lmer (judgment ~ questionnaire/morphology + (1 + morphology|id_part) + (1|item)). To test Hypothesis 1 (ii), we run a model with Semantic Bias and Morphology nested to Questionnaire as fixed effects[7], Participants and Items as random effects and random slopes by Bias: lmer(judgment ~ questionnaire / (bias/morphology) + (1 + bias| id_part) + (1| item)). The results are summarized in Table 2.

From these results, we observe an effect of Morphology, especially notable in neutral items, although we also find that it depends on the Questionnaire. For items without semantic bias, feminine morphology generated significantly higher scores for the association with the women's questionnaire and much lower ones for the association with the men's questionnaire, compared to the effect generated by masculine morphology in both questionnaires. In summary, feminine morphology generates a significantly more powerful bias than masculine morphology, magnifying the contrast of judgments between questionnaires.

For biased items, there is a main effect of Semantic Bias and Questionnaire: items with female bias, regardless of their morphology, have high scores for association with women and the same occurs with items with male bias. Furthermore, for the

[7]We also present omnibus analysis with full interactions in Supplementary materials but they are not preferent because, in testing spurious interactions or contrasts that are not relevant to our hypothesis, models usually lose statistical power (Schad et al., 2020; Vasishth & Nicenboim, 2016).

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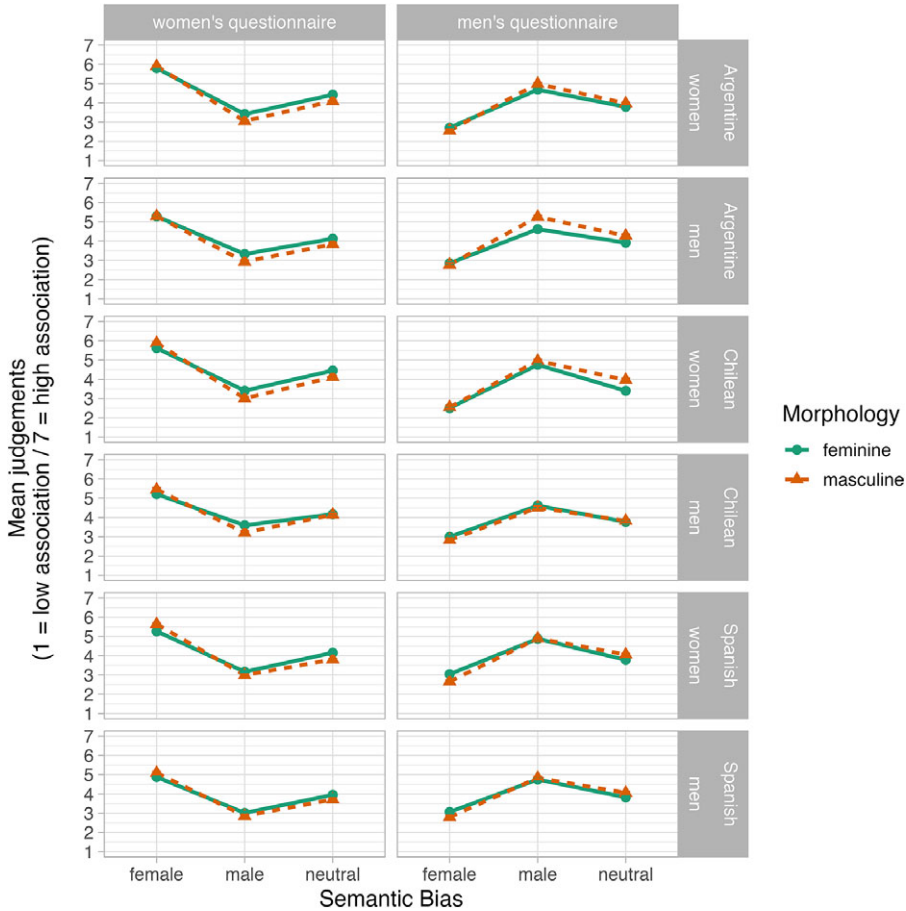

Figure 2. Mean judgments by Semantic Bias, Morphology, Linguistic variety, Gender Identity and Questionnaire.

association with the women's Questionnaire, all scores are higher than those given in the men's Questionnaire. In sum, we found interesting differential patterns modulated by the Questionnaire. Morphology has an effect on both conditions of Semantic bias just in the women's Questionnaire: male-biased items with masculine morphology (congruency) generate lower ratings than male-biased items with feminine morphology (incongruency); however, female-biased items with feminine morphology (congruency) do not generate higher ratings than female-biased items with masculine morphology (incongruency). For the men's Questionnaire, Morphology has an effect just for items with female Semantic bias; for female-biased items, there is an effect of congruency, with higher scores for feminine grammatical gender, whereas for male-biased items morphology has no effect at all.

To study Hypothesis 2, we run a model for neutral items in which Morphology and Linguistic variety, nested to Questionnaire, were included as fixed effects, Participants and Items as random effects and we included random slopes by Morphology: lmer(judgment ~ questionnaire / (morphology/ling_variety) + (1 + morphology|

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Table 2. Summary of LMM analyses for the first hypothesis

	Fixed effects	Estimate	SE	CI	*t*-Value	*p*-Value
Neutral items (*N* = 16,102)	Questionnaire	−0.496	0.077	−0.65 – −0.34	−6.431	**<.0001**
	Questionnaire_w: morph	−0.346	0.090	−0.52 – −0.17	−3.861	**.0003**
	Questionnaire_m: morph	0.226	0.089	0.05–0.40	2.549	**.0140**
	Marginal R^2/ conditional R^2			.017 / .453		
Biased items (*N* = 31,952)	Questionnaire	−0.558	0.047	−0.65 – −0.47	−11.802	**<.0001**
	Questionnaire_w: bias	2.113	0.112	1.89–2.33	18.934	**<.0001**
	Questionnaire_m: bias	−1.901	0.109	−2.12 – −1.69	−17.381	**<.0001**
	Questionnaire_w: bias_fem: morph	0.189	0.088	0.02–0.36	2.147	**.0353**
	Questionnaire_m: bias_fem: morph	−0.225	0.087	−0.40 – −0.05	−2.576	**.0121**
	Questionnaire_w: bias_masc: morph	−0.298	0.090	−0.48 – −0.12	−3.300	**.0015**
	Questionnaire_m: bias_masc: morph	0.174	0.090	−0.00 – 0.35	1.935	.0572
	Marginal R^2/ conditional R^2			.407 / .502		

Abbreviations: Questionnaire_w = Questionnaire related to women; Questionnaire_m = Questionnaire related to men; bias_fem = feminine bias; masc = masculine bias; morph = morphology. All bolded *p*-values are statistically significant.

id_part) + (1|item)). Then, a second model for biased items was performed, with also Semantic Bias included as a fixed effect: lmer(judgment ~ questionnaire / (bias/ morphology/ling_variety) + (1 + morphology|id_part) + (1|item)). Table 3 presents the results.

For neutral items, in addition to the main effect of the Questionnaire and the interaction with Morphology, we observe a distinctive pattern for Spain. Both conditions of Morphology have a significant effect for the Spanish sample; meanwhile, for Argentina and Chile, just feminine grammatical gender generates a clear bias on neutral items. Our results show that the effect caused by Morphology on neutral items is strongly linked to the Questionnaire, especially in Spain: neutral items with feminine grammatical gender are scored as more feminine in the women's Questionnaire and neutral items with masculine grammatical gender as more masculine in the men's Questionnaire. This pattern is not the same for Argentina and Chile, where the interaction between the two factors is not that strong: in Argentina, masculine morphology does not generate bias on neutral items, and in Chile, it seems always guided by the Questionnaire. So, for communities from Argentina and Chile, masculine grammatical gender does not show a clear effect on neutral items, whereas feminine grammatical gender generates neutral items to be modulated by the question present in each Questionnaire.

For biased items, we also found the main effects of the Questionnaire and Semantic Bias and an effect of Morphology modulated by the Questionnaire. Furthermore, there is an effect of Morphology only observed for male-biased items. Moreover, it is worth noting that although the pattern according to Linguistic variety

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Table 3. Summary of LMM analyses for the second hypothesis

	Fixed effects	Estimate	SE	CI	*t*-Value	*p*-Value
Neutral items (*N* = 16,102)	Questionnaire	−0.542	0.125	−0.79 – −0.30	−4.347	**<.0001**
	Questionnaire_w: morph	−0.367	0.108	−0.58 – −0.16	−3.409	**.0009**
	Questionnaire_m: morph	0.178	0.105	0.03–0.38	1.693	.0938
	Questionnaire_w: morph_fem: Arg_Chi	−0.006	0.150	−0.30 – 0.29	−0.042	.9668
	Questionnaire_m: morph_fem: Arg_Chi	−0.268	0.142	−0.55 – 0.01	−1.886	.0598
	Questionnaire_w: morph_masc: Arg_Chi	0.083	0.151	−0.21 – 0.38	0.550	.5824
	Questionnaire_m: morph_masc: Arg_Chi	−0.128	0.143	−0.41 – 0.15	−0.879	.3796
	Questionnaire_w: morph_fem: Arg_Spa	−0.275	0.126	−0.52 – −0.03	−2.192	**.0288**
	Questionnaire_m: morph_fem: Arg_Spa	−0.021	0.120	−0.26 – 0.21	−0.173	.8627
	Questionnaire_w: morph_masc: Arg_Spa	−0.272	0.127	−0.52 – −0.02	−2.145	**.0324**
	Questionnaire_m: morph_masc: Arg_Spa	0.023	0.121	−0.21 – 0.26	0.188	.8513
	Marginal R^2/conditional R^2			.024 / .455		
Biased items (*N* = 31,952)	Questionnaire	−0.834	0.080	−0.99 – −0.68	−10.436	**<.0001**
	Questionnaire_w: bias	2.305	0.098	2.11–2.50	23.435	**<.0001**
	Questionnaire_m: bias	−1.932	0.097	−2.12 – −1.74	−19.908	**<.0001**
	Questionnaire_w: bias_fem: morph	0.053	0.105	−0.15 – 0.26	0.503	.6159
	Questionnaire_m: bias_fem: morph	−0.153	0.103	−0.35 – −0.05	−1.483	.1405
	Questionnaire_w: bias_masc: morph	0.373	0.107	−0.58 – −0.16	−3.483	**.0007**
	Questionnaire_m: bias_masc: morph	0.379	0.105	0.17–0.58	3.606	**.0005**
	Questionnaire_w: bias_fem: morph_fem: Arg_Chi	−0.214	0.106	−0.42 – −0.01	−2.022	**.0435**
	Questionnaire_m: bias_fem: morph_fem: Arg_Chi	−0.055	0.100	−0.25 – 0.14	−0.546	.5851
	Questionnaire_w: bias_masc: morph_fem: Arg_Chi	0.076	0.106	−0.13 – 0.28	0.718	.4733
	Questionnaire_m: bias_masc: morph_fem: Arg_Chi	0.021	0.100	−0.18 – 0.22	0.208	.8349
	Questionnaire_w: bias_fem: morph_masc: Arg_Chi	−0.054	0.109	−0.27 – 0.16	−0.491	.6234
	Questionnaire_m: bias_fem: morph_masc: Arg_Chi	0.022	0.103	−0.18 – 0.22	0.214	.8306
	Questionnaire_w: bias_masc: morph_masc: Arg_Chi	0.078	0.108	−0.13 – 0.29	0.718	.4729

(*Continued*)

Table 3. (*Continued*)

	Fixed effects	Estimate	SE	CI	*t*-Value	*p*-Value
	Questionnaire_m: bias_masc: morph_masc: Arg_Chi	−0.241	0.102	−0.44 – −0.04	−2.353	**.01889**
	Questionnaire_w: bias_fem: morph_fem: Arg_Spa	−0.566	0.088	−0.74 – −0.39	−6.413	**<.0001**
	Questionnaire_m: bias_fem: morph_fem: Arg_Spa	0.300	0.084	0.13–0.47	3.550	**.0004**
	Questionnaire_w: bias_masc: morph_fem: Arg_Spa	−0.251	0.088	−0.42 – −0.08	−2.839	**.0046**
	Questionnaire_m: bias_masc: morph_fem: Arg_Spa	0.193	0.084	0.03–0.36	2.286	**.0225**
	Questionnaire_w: bias_fem: morph_masc: Arg_Spa	−0.321	0.090	−0.50 – −0.15	−3.583	**.0004**
	Questionnaire_m: bias_fem: morph_masc: Arg_Spa	0.085	0.086	−0.08 – 0.25	0.995	.3200
	Questionnaire_w: bias_masc: morph_masc: Arg_Spa	−0.064	0.089	−0.24 – 0.11	−0.721	.4711
	Questionnaire_m: bias_masc: morph_masc: Arg_Spa	−0.174	0.085	−0.34 – −0.01	−2.036	**.0421**
	Marginal R^2/conditional R^2			.379 / .471		

Abbreviations: Questionnaire_w = Questionnaire related to women; Questionnaire_m = Questionnaire related to men; bias_fem = feminine bias; masc = masculine bias; morph_fem = feminine morphology; morph_masc = masculine morphology; Arg = Argentina; Chi = Chile; Spa = Spain. All bolded *p*-values are statistically significant.

does not vary uniformly through all conditions, there is an identifiable pattern. There are some specific differences in some conditions of interaction, especially between the communities of Spain and those of Latin America; the differences are especially notable in the female-biased items, which, among speakers from Spain, are judged with lower scores, especially when the morphology is congruent with that bias.

Finally, to study Hypothesis 3[8], we run a model for neutral items in which Morphology and Gender Identity, nested to Questionnaire, were included as fixed effects, Participants and Items as random effects and random slopes by Morphology: lmer(judgment~questionnaire/(morphology/gender_id) + (1 + morphology|id_part) + (1|item)). The model for biased items included Semantic Bias, Morphology and Gender Identity, nested to Questionnaire, as fixed effects, Participants and Items as random effects and random slopes by Bias: lmer(judgment ~ questionnaire / (bias/morphology/gender_id) + (1 + bias|id_part) + (1|item))). The results are summarized in Table 4.

For the neutral items, we found almost no effect of Gender Identity. However, for biased items, we observe a Gender Identity effect: judgments for almost all female-biased items, regardless of morphology, appear modulated by Gender Identity, especially in women's Questionnaire. Generally, women rate the items in that condition with more extreme values than men.

4. Discussion

In the current study, we were particularly interested in the debate about the limits of the effects of linguistic forms and morphological marking on mental representation: is it the same talking about people (i.e., role names) as talking about objects or inanimate entities?

To study this phenomenon at the lexical level, we started a line of experiments that focus on this problem and especially observe potential variations between different communities within the same language. We maintain the core grammatical characteristics of the language (Spanish, in our case) but observe potential differences that can emerge from sociocultural (Gibbons, 2000; Sczesny et al., 2004) and sociolinguistic factors in three different Spanish-speaking communities (Moreno-Fernández & Caravedo, 2022).

As a general aim, we evaluated the potential effect of grammatical gender in interaction with semantic bias (congruency vs. incongruency) on gender association judgments for words referring to objects. In particular, we predicted that both male and female conceptually related nouns will be scored lower when they have an incongruent grammatical gender (e.g., *corbata*, tie-F; *vestido*, dress-M). Besides, we expected that gender marking would have a different effect on neutral items, considered without a gender stereotypical bias ('pencil') than on stereotypically biased items ('tie' or 'dress'). Furthermore, we expected some differences related to linguistic variety (Moreno-Fernández & Caravedo, 2022) and participants' gender

[8]Considering the imbalance between the number of men and women who participated in this study, we included an extra analysis in the Supplementary materials. We randomly selected a subset of women that was equal to the number of men, considering every linguistic variety, and we ran the same LMM in that subset of the sample. The gender identity differences found in the total sample are maintained in the subset for both neutral and biased items.

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Table 4. Summary of LMM analyses for the third hypothesis

	Fixed effects	Estimate	SE	CI	*t*-Value	*p*-Value
Neutral items (*N* = 15,982)	Questionnaire	−0.412	0.087	−0.58 – −0.24	−4.757	**<.0001**
	Questionnaire_w: morph	−0.313	0.093	−0.50 – −0.13	−3.368	**.0013**
	Questionnaire_m: morph	0.209	0.092	0.03–0.39	2.282	**.0263**
	Questionnaire_w: morph_fem: Gender_id	0.263	0.126	0.02–0.51	2.093	**.0368**
	Questionnaire_m: morph_fem: Gender_id	−0.120	0.119	−0.35 – 0.11	−1.009	.3133
	Questionnaire_w: morph_masc: Gender_id	−0.117	0.127	−0.13 – 0.37	0.916	.3602
	Questionnaire_m: morph_masc: Gender_id	−0.049	0.121	−0.29 – 0.19	−0.402	.6880
	Marginal R^2/conditional R^2			.020 / .454		
Biased items (*N* = 31,714)	Questionnaire	−2.424	0.072	−2.56 – −2.28	−33.690	**<.0001**
	Questionnaire_w: bias	−2.019	0.117	−2.25 – −1.79	−17.194	**<.0001**
	Questionnaire_m: bias	1.837	0.115	1.61–2.06	16.037	**<.0001**
	Questionnaire_w: bias_fem: morph	0.173	0.089	0.00–0.35	1.939	.0563
	Questionnaire_m: bias_fem: morph	−0.220	0.088	−0.39 – −0.05	−2.483	**.0015**
	Questionnaire_w: bias_masc: morph	−0.295	0.092	−0.47 – −0.12	−3.217	**.0019**
	Questionnaire_m: bias_masc: morph	0.185	0.091	0.01–0.36	2.033	**.0457**
	Questionnaire_w: bias_fem: morph_fem: Gender_id	0.483	0.104	0.28–0.69	4.625	**<.0001**
	Questionnaire_m: bias_fem: morph_fem: Gender_id	−0.171	0.099	−0.37 – 0.02	−1.729	.0842
	Questionnaire_w: bias_masc: morph_fem: Gender_id	0.064	0.119	−0.17 – 0.30	0.544	.5868
	Questionnaire_m: bias_masc: morph_fem: Gender_id	0.113	0.113	−0.11 – 0.33	1.000	.3175
	Questionnaire_w: bias_fem: morph_masc: Gender_id	0.567	0.105	0.36–0.77	5.422	**<.0001**
	Questionnaire_m: bias_fem: morph_masc: Gender_id	−0.199	0.099	−0.39 – 0.00	−2.005	**.0454**
	Questionnaire_w: bias_masc: morph_masc: Gender_id	0.047	0.119	−0.19 – 0.28	0.399	.6899
	Questionnaire_m: bias_masc: morph_masc: Gender_id	0.069	0.113	−0.15 – 0.29	0.613	.5400
	Marginal R^2/conditional R^2			.387 / .533		

Abbreviations: Questionnaire_w = Questionnaire related to women; Questionnaire_m = Questionnaire related to men; bias_fem = feminine bias; masc = masculine bias; morph_fem = feminine morphology; morph_masc = masculine morphology; Gender_id = Gender identity. All bolded *p*-values are statistically significant.

identity (Hentschel et al., 2019). We will then discuss these general questions organized according to each hypothesis.

4.1. First hypothesis: relation between semantic bias and gender morphology

Our first hypothesis postulated that, for neutral items, there would be an effect of morphology. We also predicted that this effect would apply to biased items, through a congruency effect: male-biased items with masculine grammatical gender will be rated as more masculine and female biased with feminine grammatical gender items will be rated as more feminine. We did not expect the same effect for neutral items (*a priori* without semantic gender bias) because no congruency–incongruency effect applies to those.

Indeed, a key element to highlight from our results is the differential morphology effect observed for neutral and biased items. Nonetheless, another factor especially notable is the Questionnaire effect. When a neutral item with a feminine grammatical gender such as *bufanda* ('scarf'-F) is tested for its association with women, the score is much higher than for a neutral item with a masculine grammatical gender such as *zapato* ('shoe'-M). The inverse occurs for the same items with feminine grammatical gender in the questionnaire that asks for the association with men. Masculine grammatical gender, on the other hand, does not seem to significantly affect perceptions and attitudes on neutral items in both questionnaires: it always obtained intermediate scores (4 on the Likert scale).

For biased items, it is crucial to observe how the congruence–incongruence between semantic bias and morphological marking operates in each questionnaire. Feminine congruent items (*pulsera*, bracelet-F) presented in the women's Questionnaire obtained higher scores than masculine congruent items (*taladro*, drill-M) presented in the men's Questionnaire. The greatest reinforcement of congruence occurs for the female bias and feminine morphology condition when asked about associations with women. Second, when incongruent conditions are observed, we found a greater weight of congruence–incongruence between the Semantic Bias and the question of each Questionnaire than between the Semantic Bias and the Morphology: the items in which the semantic bias coincided with the associations requested in the questionnaire (to women or men) obtained the highest scores regardless of the Morphology condition and they are always more extreme for the female-biased items.

From these elements, it is possible to draw three preliminary conclusions linked to our first hypothesis. Gender morphology has a clear effect on perceptions and attitudes only for neutral items. In those cases, grammatical gender marking, especially feminine grammatical gender, generates a tendency to perceive those objects as more associated with women. This evidence seems to support the claim that grammatical gender marking can influence perceptions and mental representations of gender (Carreiras et al., 1996; Duffy & Keir, 2004; Kreiner et al., 2008), even for inanimate objects (Elpers et al., 2022; Konishi, 1993; Mecit et al., 2022; Phillips & Boroditsky, 2003).

We can interpret these results in line with Casado et al. (2021) and some of the findings discussed in Mecit et al. (2022): in gendered languages, grammatical gender might 'prime' the activation of conceptual representations related to gender stereotypes even on words that refer to inanimate entities. However, Casado et al. (2021)

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investigated the congruence–incongruence effect but did not analyze what we treated here as neutral items. They observed an incongruence effect that we did not find, but we did find a significant effect of grammatical gender on those items that were not *a priori* biased. We believe that this neutral condition allowed us to see the morphological effect isolated and in a more rigorous way. Nevertheless, to strictly compare both studies, we would need to analyze the results in a masked priming task, to observe the morphological effects on subliminal processing. The present study, with explicit judgments, could show strategic or conscient processing.

We also need to especially discuss the bias found for Questionnaire. Several studies show that salience on gender has a measurable effect (see Samuel et al., 2019 for a review; Sato & Athanasopoulos, 2018). We think that the principal effect of Questionnaire could be interpreted in that vein: the question in each questionnaire explicitly focuses on one or another gender stereotype (women or men), and this focus seems to have a significant effect on the association with mental representations. The fact that this explicit key also shows an interaction with grammatical gender offers evidence, especially in line with Sato and Athanasopoulos (2018) who discussed the simultaneous automatic and implicit recovery of gender information through morphology and their impact on perception judgments. Although the methodology of our study differs from theirs, because we had an obligatory lexical processing, a relation might be mentioned since we found an effect due to the explicit salience generated by the Questionnaire, but we also observed an effect of morphology that may exhibit a more subliminal process.

In addition, it is especially interesting to note that this subliminal effect is not the same for masculine and feminine grammatical gender. We propose that this difference requires discussing the distinction between marked and unmarked elements. There is consensus that, for Spanish, the feminine form is the marked form (Ambadiang, 1999; Fábregas, 2022) and this aspect might guide the interpretation of the results. The masculine form, as an unmarked or default form, does not contribute much to the semantic interpretation and mental representation associated with gender, whereas the feminine form, as a marked form, does impose a significant semantic bias. This could also be interpreted in relation to some remarks made by Zemore et al. (2000): there is a systematic difference between the number of traits associated with women's gender stereotypes with respect to men's gender stereotypes. Women stereotypes might be socially marked, not just grammatically marked.

From the analysis of the congruence–incongruence between Semantic Bias and Morphology in biased items, we can conclude that the first factor is the determinant and seems to be powerful enough to not be systematically affected by its incongruence with the gender morphological marking.

4.2. Second hypothesis: differences between linguistic varieties

Based on some of the theoretical and empirical antecedents cited in this study (Casado et al., 2018, 2021; Gibbons, 2000; Lindvall-Östing et al., 2020; Moreno-Fernández & Caravedo, 2022; Sczesny et al., 2004; Stetie et al., 2023; United Nations Development Programme, 2024), we postulated our second hypothesis as exploratory: the effect of Morphology may be modulated by Linguistic variety, so as the magnitude of the effect varies depending on the linguistic and sociocultural community.

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In this case, results also exhibit distinctive patterns for neutral and biased items. For the former, there is a difference in the patterns of responses between the Spanish community and the two communities of Latin America, Chile and Argentina. Spain exhibits a pattern in which Morphology operates clearly and equally in both conditions: masculine and feminine gender markings generate a significant bias and show an interaction with the Questionnaire. Our data show that items with masculine grammatical gender (i.e., *zapato*, 'shoe'-M) are scored as more masculine in the men's Questionnaire and, respectively, items with feminine grammatical gender (i.e., *bufanda*, 'scarf'-F) are scored as more feminine in the women's Questionnaire. On the other hand, in the two Latin American communities, in contrast with the sample of Spain, the difference in ratings according to the questionnaire only occurs with feminine grammatical items, while masculine grammatical items exhibit almost no differences between questionnaires. We want to focus the discussion on linguistic varieties but this pattern could also be interpreted in relation to the differences in GII scores.

This pattern is consistent with the previously discussed interpretation of the behavior and processing of marked versus unmarked items. However, interestingly, in the Peninsular Spanish community, this pattern changes significantly. Some differences around gender marking between Peninsular and American Spanish have been described in grammatical studies (Ambadiang, 1999; Del Barrio de la Rosa, 2023; Urrutia Cárdenas & Ramirez Luengo, 2005). For example, the fact that American varieties are more strongly guided by gender agreement for female innovations in role names as *ministra* ('minister'-F) or *jueza* ('judge'-F). As long as in Spain *la ministro* ('the-F minister-M') or *la juez* ('the-F judge-M') are accepted and frequent nominal phrases, in America these are very unusual and speakers tend to respect agreement between determiners and nouns, as in *la ministra* ('the-F minister-F') or *la jueza* ('the-F judge-F'). Therefore, our results might be interpreted as empirical evidence for some of these grammatical differences already reported in corpus and typology studies of Spanish varieties. In our study, Peninsular Spanish shows a more balanced effect of binary gender morphology, since both masculine and feminine generate some bias. On the other hand, varieties from Argentina and Chile showed a clear difference for feminine morphology, in line with a tendency to explicitly mark the feminine form.

For biased items, instead, there is no difference between the three communities and there is a main effect of Semantic Bias, already analyzed in the previous section; the semantic bias of stereotypical association is powerful and reduces the differential effects of morphology. However, it is especially interesting the difference observed between Spain and the two Latin American communities for female-biased items. Especially when there is congruence between semantic bias and morphology, female-biased items exhibit higher scores in Argentina and Chile, while for the male-biased items this difference does not seem to arise based on Linguistic variety. This point can be interpreted along the same lines discussed previously for the effect of feminine morphology: the female semantic bias could also be interpreted as an element specifically marked in Latin American communities but not in Spain.

Therefore, our hypothesis about the possible modulation of the effects depending on Linguistic variety is confirmed but not strictly in the postulated sense. We expected possible variations based on differences in stereotypical representations in each community. However, our results could be exhibiting a linguistic difference

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between varieties of Spanish, since we found a differential effect of gender morphology on the perception of neutral items but not for semantic biased items.

4.3. Third hypothesis: differences between participant's gender identity

In the path of trying to understand not just the common roots but also the individual and sociocultural variation of stereotypes and based on previous work (Hentschel et al., 2019; Sczesny et al., 2004; Wang et al., 2019), we postulated a third exploratory hypothesis: participants' gender identity may influence their perception of objects.

First, it should be noted that the only effect of gender identity observed on neutral items was for the feminine grammatical items in the women's questionnaire. This is particularly interesting for exploring and deepening the links between stereotypes and gender identity, and our results suggest future research directions. Regarding the biased items, a specific effect on female-biased items also emerges here and is shown specifically for female participants. Women in the three communities rated female-biased items, regardless of their morphological marking, as more feminine than men; with the only exception for congruence items with feminine Semantic bias-Morphology (i.e., *cartera*, 'purse'-F). That is, women showed a bias toward items that are stereotypically associated with their own gender identity; men tend to assimilate these judgments just when feminine Semantic bias was also morphologically marked. The feminizing bias in female participants' judgments can be interpreted in line with Hentschel et al. (2019): women tend to self-characterize within stereotypical parameters more than men. The pattern in men's judgments opens an interesting question for future studies: why does grammatical gender marking seem to influence gender association judgments more in male participants? Is it possible that the effect of marked grammatical gender (feminine) is different for men and women?

The results of both neutral and biased items are in line with several studies about the significant imbalance between men and women on attitudes and perception of gender biases in several social dimensions and some of them even show different neural bases for manipulating gender stereotypes (Bonnin & Zunino, 2024; García-González et al., 2019; Hentschel et al., 2019; Wang et al., 2019). Women tend to be more conscious of gender bias in social situations, to use linguistic forms that avoid strong gender biases, and in the present study we observed that they also seem to strengthen the perception of gender bias in words that refer to objects associated with female gender stereotypes.

We believe this builds an interesting perspective and potential breaking point on the dimension of 'masculine' and 'feminine', which can be interpreted in the light of unmarked versus marked features in a broader sense. There does not seem to be a balance between perceptions of semantic bias in words referring to objects stereotypically linked to women and men, even in a binary paradigm in which we might expect it. In addition, there does not seem to be a balance in how the gender identity of those who perceive affect the judgements: we found a reinforcement of the congruence between gender identity and semantic bias, thus increasing the initial imbalance for the dimension of the 'feminine' as marked. Once again, this result can be interpreted in line with Zemore et al. (2000) and Hentschel et al. (2019): the idea of a 'social markedness' for women stereotypes. Masculine and feminine do not appear to be two sides of the same coin. Instead, there seems to be two complex dimensions that articulate multiple sociocultural factors to construct consistently different stereotypical

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representations and the female dimension seems not to be interpreted as the default gender but to function as the marked one.

5. Conclusions

Synthetically, from our findings, we can identify four key elements:

1. Grammatical gender has an effect on words that refer to inanimate entities when those words do not carry a strong stereotypical association and can be considered neutral items in terms of their semantic bias.
2. The semantic bias related to gender stereotypes exhibits such notable power that it overshadows any potential effect of grammatical gender, so no significant congruence or incongruence effects are produced.
3. There are differences depending on the Linguistic variety (Argentine, Chilean and Peninsular), since the distinctions observed focus on the effect of grammatical gender on neutral items rather than on biased items. However, it is also necessary to deeply investigate potential differences between communities in the perception and attitudes regarding female-biased items, since they could be in line with the hypothesis of 'female' as a 'marked stereotype'.
4. Gender identity seems to reinforce the 'female' bias and morphology as marked elements. This opens new hypotheses about how to understand the distinction between marked and unmarked around gender: perhaps the phenomenon should not be restricted to the classical grammatical notion that operates on gender morphology but can also be thought of as a broader sociocultural dimension that is also projected on stereotypical gender representations that men and women hold.

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References

Ambadiang, T. (1999). La flexión nominal: género y número. In I. Bosque & V. Demonte (dirs.), *Gramática Descriptiva de la Lengua Española* (pp. 4843–4914). Espasa Calpe.

Bojarska, K. (2013). Responding to lexical stimuli with gender associations: A cognitive–cultural model. *Journal of Language and Social Psychology*, 32(1), 46–61. https://doi.org/10.1177/0261927X12463008

Bonnin, J. E., & Zunino, G. M. (2024). Using inclusive language at school: reported and perceived use among teachers in Buenos Aires. In C. Soares & G. Silva (Eds.), *Inclusiveness beyond the (non)binary in romance languages: From research to classroom implementation*. Routledge.

https://doi.org/10.1017/langcog.2025.4 Published online by Cambridge University Press

Braun, F., Sczesny, S., & Stahlberg, D. (2005). Cognitive effects of masculine generics in German. An overview of empirical findings. *Communications*, 30(1), 1–21. http://doi.org/10.1515/comm.2005.30.1.1

Brysbaert, M., Warriner, A. B., & Kuperman, V. (2014). Concreteness ratings for 40 thousand generally known English word lemmas. *Behavior Research Methods*, 46, 904–911. https://doi.org/10.3758/s13428-013-0403-5

Cabeza Pereiro, M. C., & Rodríguez Barcia, S. (2013). Aspectos ideológicos, gramaticales y léxicos del sexismo lingüístico. *Estudios Filológicos*, (52), 7–27. https://doi.org/10.4067/S0071-17132013000200001

Canal, P., Garnham, A., & Oakhill, J. (2015). Beyond gender stereotypes in language comprehension: Self sex-role descriptions affect the brain's potentials associated with agreement processing. *Frontiers in Psychology*, 6, 1953. https://doi.org/10.3389/fpsyg.2015.01953

Carreiras, M., Garnham, A., Oakhill, J., & Cain, K. (1996). The use of stereotypical gender information in constructing a mental model: Evidence from English and Spanish. *The Quarterly Journal of Experimental Psychology Section A*, 49(3), 639–663. https://doi.org/10.1080/713755647

Casado, A., Palma, A., & Paolieri, D. (2018). The influence of sex information on gender word processing. *Journal of Psycholinguistic Research*, 47, 557–583. https://doi.org/10.1007/s10936-017-9546-3

Casado, A., Palma, A., & Paolieri, D. (2021). The scope of grammatical gender in Spanish: Transference to the conceptual level. *Acta Psychologica*, 218, 103361. https://doi.org/10.1016/j.actpsy.2021.103361

Casado, A., Sá-Leite, A. R., Pesciarelli, F., & Paolieri, D. (2023). Exploring the nature of the gender-congruency effect: implicit gender activation and social bias. *Frontiers in Psychology*, 14, 1160836. https://doi.org/10.3389/fpsyg.2023.1160836

Contreras, J. M., Banaji, M. R., & Mitchell, J. P. (2012). Dissociable neural correlates of stereotypes and other forms of semantic knowledge. *Social Cognitive and Affective Neuroscience*, 7(7), 764–770. https://doi.org/10.1093/scan/nsr053

Ćoso, B., Guasch, M., Bogunović, I., Ferré, P., & Hinojosa, J. A. (2022). CROWD-5e: A Croatian psycholinguistic database of affective norms for five discrete emotions. *Behavior Research Methods*, 1–17. https://doi.org/10.3758/s13428-022-02003-2

Cousineau, D., & Chartier, S. (2010). Outliers detection and treatment: a review. *International Journal of Psychological Research*, 3(1), 58–67.

Cuddy, A. J., Wolf, E. B., Glick, P., Crotty, S., Chong, J., & Norton, M. I. (2015). Men as cultural ideals: Cultural values moderate gender stereotype content. *Journal of Personality and Social Psychology*, 109(4), 622–635. https://doi.org/10.1037/pspi0000027

DeFranza, D., Mishra, H., & Mishra, A. (2020). How language shapes prejudice against women: An examination across 45 world languages. *Journal of Personality and Social Psychology*, 119(1), 7–22. https://doi.org/10.1037/pspa0000188

Del Barrio de la Rosa, F. (2023). A fork in the road: Grammatical gender assignment to nouns in Spanish dialects. *Languages*, 8(4), 257. https://doi.org/10.3390/languages8040257

Duchon, A., Perea, M., Sebastián-Gallés, N., Martí, A., & Carreiras, M. (2013). EsPal: One-stop shopping for Spanish word properties. *Behavior Research Methods*, 45, 1246–1258. https://doi.org/10.3758/s13428-013-0326-1

Duffy, S. A., & Keir, J. A. (2004). Violating stereotypes: Eye movements and comprehension processes when text conflicts with world knowledge. *Memory & Cognition*, 32(4), 551–559. https://doi.org/10.3758/BF03195846

Eckes. T., & Trautner, H. M. (2000). *The developmental social psychology of gender*. Psychology Press.

Elpers, N., Jensen, G., & Holmes, K. J. (2022). Does grammatical gender affect object concepts? Registered replication of Phillips and Boroditsky (2003). *Journal of Memory and Language*, 127, 104357. https://doi.org/10.1016/j.jml.2022.104357

Fábregas, A. (2022). El género inclusivo: una mirada gramatical. *Cuadernos de Investigación Filológica*, 51, 25–46. https://doi.org/10.18172/cif.5292

Fábregas, A. (2024). *The Fined-grained Structure of the Lexical Area. Gender, appreciatives, and nominal suffixes in Spanish*. Amsterdam: John Benjamins.

Flaherty, M. (2001). How a language gender system creeps into perception. *Cross-Cultural Psychology*, 32(1), 18–31. http://doi.org/10.1177/0022022101032001000

García-González, J., Forcén, P., & Jimenez-Sanchez, M. (2019). Men and women differ in their perception of gender bias in research institutions. *PLoS ONE*, 14(12), e0225763. https://doi.org/10.1371/journal.pone.0225763

https://doi.org/10.1017/langcog.2025.4 Published online by Cambridge University Press

Gelman, S. A. (2004). Psychological essentialism in children. *Trends in Cognitive Sciences*, 8(9), 404–409. https://doi.org/10.1016/j.tics.2004.07.001

Gibbons, J. L. (2000). Gender development in cross-cultural perspective. In T. Eckes & H. M. Trautner (Eds.), *The developmental social psychology of gender* (pp. 403–430). Psychology Press.

Gygax, P. M., Elmiger, D., Zufferey, S., Garnham, A., Sczesny, S., Von Stockhausen, L., Braun, F., & Oakhill, J. (2019). A language index of grammatical gender dimensions to study the impact of grammatical gender on the way we perceive women and men. *Frontiers in Psychology*, 10, 1604. https://doi.org/10.3389/fpsyg.2019.01604

Hellinger, M., & Bußmann, H. (2001). *Gender across languages: The linguistic representation of women and men* (Vol. 1). John Benjamins Publishing Company.

Hentschel, T., Heilman, M. E., & Peus, C. V. (2019). The multiple dimensions of gender stereotypes: A current look at men's and women's characterizations of others and themselves. *Frontiers in Psychology*, 10, 376558. https://doi.org/10.3389/fpsyg.2019.00011

Horvath, L. K., Merkel, E. F., Maass, A., & Sczesny, S. (2016). Does gender-fair language pay off? The social perception of professions from a cross-linguistic perspective. *Frontiers in Psychology*, 6, 2018. https://doi.org/10.3389/fpsyg.2015.02018

Konishi, T. (1993). The semantics of grammatical gender: A cross-cultural study. *Journal of Psycholinguistic Research*, 22, 519–534. https://doi.org/10.1007/BF01068252

Körner, A., Abraham, B., Rummer, R., & Strack, F. (2022). Gender representations elicited by the gender star form. *Journal of Language and Social Psychology*, 41(5), 553–571. https://doi.org/10.1177/0261927X221080181

Kreiner, H., Sturt, P., & Garrod, S. (2008). Processing definitional and stereotypical gender in reference resolution: Evidence from eye-movements. *Journal of Memory and Language*, 58(2), 239–261. https://doi.org/10.1016/j.jml.2007.09.003

Leaper, C. (2014). Gender similarities and differences in language. In T. M. Holtgraves (Ed.), *The oxford handbook of language and social psychology* (pp. 62–81). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199838639.013.002

Lewis, M., & Lupyan, G. (2020). Gender stereotypes are reflected in the distributional structure of 25 languages. *Nature Human Behaviour*, 4(10), 1021–1028. https://doi.org/10.1038/s41562-020-0918-6

Lindqvist, A., Renström, E. A., & Gustafsson Sendén, M. (2019). Reducing a male bias in language? Establishing the efficiency of three different gender-fair language strategies. *Sex Roles*, 81, 109–117. https://doi.org/10.1007/s11199-018-0974-9

Lindvall-Östling, M., Deutschmann, M., & Steinvall, A. (2020). An exploratory study on linguistic gender stereotypes and their effects on perception. *Open Linguistics*, 6(1), 567–583. https://doi.org/10.1515/opli-2020-0033I

Lomazzi, V., & Seddig, D. (2020). Gender role attitudes in the international social survey programme: Cross-national comparability and relationships to cultural values. *Cross-Cultural Research*, 54(4), 398–431. https://doi.org/10.1177/1069397120915454

López, Á. (2020). Cuando el lenguaje excluye: consideraciones sobre el lenguaje no binario indirecto. *Cuarenta Naipes. Revista de Cultura y Literatura*, 3, 295–312.

Márquez, M. (2013). *Género gramatical y discurso sexista*. Síntesis.

Mecit, A., Lowrey, T. M., & Shrum, L. J. (2022). Grammatical gender and anthropomorphism: "It" depends on the language. *Journal of Personality and Social Psychology*, 123(3), 503–517. https://doi.org/10.1037/pspa0000309

Menegatti, M., & Rubini, M. (2017). Gender bias and sexism in language. In *Oxford research encyclopedia of communication*. https://doi.org/10.1093/acrefore/9780190228613.013.470

Molinaro, N., Su, J. J., & Carreiras, M. (2016). Stereotypes override grammar: Social knowledge in sentence comprehension. *Brain and Language*, 155, 36–43. https://doi.org/10.1016/j.bandl.2016.03.002

Moreno Cabrera, J. C. (2008). *El nacionalismo lingüístico: una ideología destructiva*. Ediciones Península.

Moreno-Fernández, F., & Caravedo, R. (2022). *Dialectología Hispánica: The Routledge handbook of Spanish dialectology*. https://doi.org/10.4324/9780429294259

Motschenbacher, H. (2014). Grammatical gender as a challenge for language policy: The (im) possibility of non-heteronormative language use in German versus English. *Language Policy*, 13, 243–261. https://doi.org/10.1007/s10993-013-9300-0

Neves, J., Costa, I., Oliveira, J., Silva, B., & Maia, J. (2023). Can gender nouns influence the stereotypes of animals? *Animals*, 13(16), 2604. https://doi.org/10.3390/ani13162604

Pesciarelli, F., Scorolli, C., & Cacciari, C. (2019). Neural correlates of the implicit processing of grammatical and stereotypical gender violations: A masked and unmasked priming study. *Biological Psychology*, 146, 107714. https://doi.org/10.1016/j.biopsycho.2019.06.002

Phillips, W., & Boroditsky, L. (2003). Can quirks of grammar affect the way you think? Grammatical gender and object concepts. In R. Alterman & D. Kirsh (Eds.), *Proceedings of the 25th annual conference of the cognitive science society* (pp. 928–933). Cognitive Science Society.

Prewitt-Freilino, J. L., Caswell, T. A., & Laakso, E. K. (2012). The gendering of language: a comparison of gender equality in countries with gendered, natural gender, and genderless languages. *Sex Roles*, 66(3–4), 268–281. https://doi.org/10.1007/s11199-011-0083-5

R Core Team. (2023). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.

Renström, E. A., Lindqvist, A., & Gustafsson Sendén, M. (2022). The multiple meanings of the gender-inclusive pronoun hen: Predicting attitudes and use. *European Journal of Social Psychology*, 52(1), 71–90. https://doi.org/10.1002/ejsp.2816

Roca, I. M. (2006). La gramática y la biología en el género del español (2da parte). *Revista Española de Lingüística*, 35(2), 397–492.

Rodd, J. M. (2024). Moving experimental psychology online: How to obtain high quality data when we can't see our participants. *Journal of Memory and Language*, 134, 104472. https://doi.org/10.1016/j.jml.2023.104472

Samuel, S., Cole, G., & Eacott, M. J. (2019). Grammatical gender and linguistic relativity: A systematic review. *Psychonomic Bulletin & Review*, 26, 1767–1786. https://doi.org/10.3758/s13423-019-01652-3

Sato, S., & Athanasopoulos, P. (2018). Grammatical gender affects gender perception: Evidence for the structural-feedback hypothesis. *Cognition*, 176, 220–231. https://doi.org/10.1016/j.cognition.2018.03.014

Schad, D. J., Vasishth, S., Hohenstein, S., & Kliegl, R. (2020). How to capitalize on a priori contrasts in linear (mixed) models: A tutorial. *Journal of Memory and Language*, 110, 104038. https://doi.org/10.1016/j.jml.2019.104038

Schmitz, D. (2023). Instances of bias: The gendered semantics of generic masculines in German revealed by instance vectors. Preprint. https://doi.org/10.31234/osf.io/73k4m

Sczesny, S., Bosak, J., Neff, D., & Schyns, B. (2004). Gender stereotypes and the attribution of leadership traits: A cross-cultural comparison. *Sex Roles*, 51, 631–645. https://doi.org/10.1007/s11199-004-0715-0

Siyanova-Chanturia, A., Pesciarelli, F., & Cacciari, C. (2012). The electrophysiological underpinnings of processing gender stereotypes in language. *PloS One*, 7(12), e48712. https://doi.org/10.1371/journal.pone.0048712

Stetie, N. A., Martínez Rebolledo, C., & Zunino, G. M. (2023). Diversidad de género y variación lingüística en el español de América: procesamiento de estereotipos y morfología de género en Argentina y Chile/Gender diversity and linguistic variation in American Spanish: Processing gender stereotypes and morphology in Argentina and Chile. *Revista de Estudos da Linguagem*, 31(2), 636–687. https://doi.org/10.17851/2237-2083.0.0.%25p

Stetie, N. A., & Zunino, G. M. (2022). Non-binary language in Spanish? Comprehension of non-binary morphological forms: A psycholinguistic study. *Glossa: A Journal of General Linguistics*, 7(1). https://doi.org/10.16995/glossa.6144

United Nations Development Programme. (2024). *Gender inequality index*. The Human Development Report. http://hdr.undp.org/en/content/gender-inequality-index-gii

Urrutia Cárdenas, H., & Ramirez Luengo, J. L. (2005). El morfema de género en el español de América. *Boletín de Filología*, 15, 263–284.

Vasishth, S., & Nicenboim, B. (2016). Statistical methods for linguistic research: Foundational ideas–Part I. *Language and Linguistics Compass*, 10(8), 349–369. https://doi.org/10.1111/lnc3.12201

Wang, S., Wang, J., Guo, W., Ye, H., Lu, X., Luo, J., & Zheng, H. (2019). Gender difference in gender bias: Transcranial direct current stimulation reduces male's gender stereotypes. *Frontiers in Human Neuroscience*, 13, 403. https://doi.org/10.3389/fnhum.2019.00403

Williams, A., Cotterell, R., Wolf-Sonkin, L., Blasi, D., & Wallach, H. (2019). Quantifying the semantic core of gender systems. In Proceedings of the 2019 conference on empirical methods in natural language

processing and the 9th international joint conference on natural language processing *(EMNLP-IJCNLP)*, (pp. 5734–5739). Hong Kong, China: Association for Computational Linguistics.

Williams, A., Cotterell, R., Wolf-Sonkin, L., Blasi, D., & Wallach, H. (2021). On the relationships between the grammatical genders of inanimate nouns and their co-occurring adjectives and verbs. *Transactions of the Association for Computational Linguistics*, 9, 139–159. https://doi.org/10.1162/tacl_a_00355

Zemore, S. E., Fiske, S. T., & Kim, H. J. (2000). Gender stereotypes and the dynamics of social interaction. In T. Eckes & H. M. Trautner (Eds.), *The Developmental Social Psychology of Gender* (pp. 221–256). Psychology Press.

Zunino, G. M., & Stetie, N. A. (2022). Binary or non-binary? Gender morphology in Spanish: Differences dependent on the task. *ALFA: Revista de Lingüística*, 66, e14546. https://doi.org/10.1590/1981-5794-e14546

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