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Assessing the impact of gender grammaticization on thought: A psychological and psycholinguistic perspective

Abstract

A critical question that has gained a resurgence of interest in recent years is the view that the languages we speak may be responsible for the way we think. In light of two theoretical approaches, *linguistic relativity* and the *thinking-for-speaking hypothesis*, the present paper offers a review of the empirical methods and findings of research on the relationship between language and thought. A particular focus is placed on the influence of *grammatical gender cues* on the cognitive representations of human and non-human entities. We demonstrate that formal linguistic features carry semantic denotations of sex, which are consequently projected to noun categories that should not necessarily bear these denotations. Moreover, we argue that the diverse empirical methods provide distinct insights into the extent to which language influences thought.

1. Introduction

Research has long attempted to tackle the role that language plays in the mechanisms underlying our basic cognitive processes, with recent empirical evidence indicating that distinct language properties may bear a significant role in shaping our thoughts. Numerous theoretical frameworks have postulated notions that account for the relationship between language and thought, with Benjamin Lee Whorf's *linguistic relativity hypothesis* bearing the central foundation of many of these interpretations (Whorf 1956). Whorf's hypothesis posits that regularities unique to a language are responsible for how we perceive our experiences and the world, which may result in cross-linguistic variation among speakers' mental processes.[1] In other words, language systems orient our attention to specific aspects of reality that eventually contribute to

1 For motion event construal, see, for instance, Athanasopoulos / Bylund (2013); Flecken / Carroll / Weimar / Von Stutterheim (2015); for categorization see Boutonnet / Athanasopoulos / Thierry (2012); for color perception see Thierry / Athanasopoulos / Wiggett / Dering / Kuipers (2009).

the structuring of our conceptual categories (e.g. Davidoff / Davies / Roberson 1999; Lucy 1992).

Whorf's theory proved to be provocative and for decades has stirred much scholarly debate in numerous areas of scientific research. Initially, evidence intended to substantiate Whorf's claim was hardly convincing, yet recent years have witnessed a resurgence of interest in approaching the issue. Current critical approaches offer contingent means in interpreting linguistic relativity, confining the influences of language to conditions that are task-specific. A prominent approach proposed by Slobin's *thinking-for-speaking hypothesis* (Slobin 1996, 76; Slobin 2003, 158-161) stipulates that languages may play a central role during *language-mediated* cognition rather than shape our non-linguistic cognition per se. Specifically, when confronted with complex cognitive tasks, language is commonly employed to facilitate cognitive structuring and reasoning. As languages play a mediating role in these tasks, perceivers are required to attend to the grammatical and lexical structures unique to the language being used. Properties that are emphasized in a language are consequently attended to and become reflected in the language users' semantic representations.

Although these theoretical notions appear closely related to one another, it is critical to differentiate them. On the one hand, the former view of linguistic relativism focuses on non-linguistic cognition, as often operationalized by recall and categorization tasks, intended to touch on conceptual representations. On the other hand, the notion of thinking-for-speaking requires linguistic processing, which is assessed by tasks that require production and comprehension. Effects linked to thinking-for-speaking would, therefore, be essentially tied to semantic representations. Researchers examining the general influence of language on thought agree on the strong link between the two, although questions remain as to whether the extent of this influence touches on semantic representations (i.e. links to word meanings and linguistic processing), or extend even onto conceptual representations (i.e. abstract non-linguistic). To put it broadly, while there is a general agreement to support the thinking-for-speaking account, the debate on linguistic relativity remains unsettled, as studies show both positive (e.g. Imai / Gentner 1997; Lucy 1992; Thierry / Athanasopoulos / Wiggett / Dering / Kuipers 2009) and contradicting (e.g. Gennari / Sloman / Malt / Fitch 2002; Papafragou / Hulbert / Trueswell 2008) evidence that result from diverging empirical methods.

The studies that are detailed in the following sections were aimed at presenting the ongoing debate on the relationship between language and

thought, as well as at highlighting the empirical complexity of assessing this relationship. In this paper, we place a particular focus on *grammatical gender,* a general grammatical classification among languages which designates nouns to arbitrary gender classes (Corbett 1991, 1). In the case of human references, grammatical gender often shows a correspondence with the sex[2] to which it refers (e.g. Russian: *šotalandec*$_{Masculine}$ [Scotsman] vs. *šotlandka*$_{Feminine}$ [Scotswoman]; Corbett 1991, 34), although functioning strictly as a formal property for nouns referring to non-human entities. Language users may assume a direct link between grammar and sex that may be applied to cases where this rule is not relevant, making it a convenient instance to test the linguistic influences on thought.

The present paper reviews the research addressing this relationship by outlining the general properties of grammatical gender systems and showcasing studies, which examine the influences of gender grammaticization on the representation of human and non-human entities. The findings of these studies will then be discussed in light of the empirical and theoretical implications they bring to bear in the conceptualization of the thinking-for-speaking and linguistic relativist accounts.

2. The grammaticization of gender in languages

A prominent characteristic that differentiates languages is the realization of gender information in their linguistic system. Gender information can either be expressed semantically to refer to one's sex or can be incorporated into a language as a formal grammatical property. Languages differ in the means and the degree to which gender is expressed (Corbett 1991), with some languages referencing gender only semantically and others integrating gender systematically in their grammar. Contrary to natural gender languages such as English where the denotation of a person's sex occurs only sporadically (e.g. by definition, as seen in *king* or occasionally morphologically as seen in *waitr-*

2 The term *sex* usually refers to the biological characteristics of maleness and femaleness, whereas *gender* refers to the social, psychological, and behavioral aspects of women and men (Pryzgoda / Chrisler 2000). In the context of this article, the term *sex* is used to refer to the biological and sociocultural properties pertaining to person references, whereas the term *gender* is used to refer to the grammatical and linguistic aspects grounded in language systems. Note, however, that grammatical gender oftentimes reflects a referent's sex, in which case the term *gender* may be inclusive of both aspects or be used to denote the social, psychological and behavioral aspects of maleness and femaleness (e.g. stereotype gender).

ess), grammatical gender languages such as French and German impose all animate and inanimate nouns to a grammatical gender category (e.g. feminine, masculine, and also neuter in German) that may or may not be linked to a stereotypical gender (cf. Stahlberg / Braun / Irmen / Sczesny 2007 164-167, for a detailed classification of languages based on gender markedness).

With regard to person references, the gender class commonly shows a direct correspondence to one's sex, with the masculine form being associated with men and the feminine form with women (e.g. French: *infirmier*$_{\text{Masculine}}$ [male nurse] and *infirmière*$_{\text{Feminine}}$ [female nurse]). Exceptions exist where such a relationship is not transparent. In such cases, grammatical gender does not denote a specific sex, but functions purely as a formal morphological cue. For example, epicene nouns refer to cases where grammatical gender is fixed irrespective of the person's sex (e.g. Italian: *vittima*$_{\text{Feminine}}$ [male or female victim]). Another example, and this will be discussed later, is the masculine grammatical form which can allow for multiple interpretations, showing that its grammatical marking in certain contexts is detached from reference to a specific sex and in other contexts it is not.

As far as non-human nouns are concerned, with exceptions from a handful of sex-specific nouns referring to animals (e.g. French: *cheval*$_{\text{Masculine}}$ [horse]; *jument*$_{\text{Feminine}}$ [mare]), all nouns are classified to a specific gender category. Although there is some correspondence between gender and word-endings within a given language (e.g. French: *-eau, -age* endings are usually masculine, *-asse, -aille* endings are usually feminine), gender assignment is largely arbitrary and varies across languages, bearing no relation to the semantic content it conveys (e.g. Italian: *zebra*$_{\text{Feminine}}$ and French: *zebre*$_{\text{Masculine}}$ [male or female zebra]; German: *Sonne*$_{\text{Feminine}}$ and French: *soleil*$_{\text{Masculine}}$ [sun]). Speakers must, therefore, familiarize themselves with the unique classifications in each language, as they are central to the inflections imposed during language processing.

A plausible rationale to explain the potential impact of grammatical gender on thought is its flexibility to undertake a formal morphological function while occasionally bearing a semantic denotation. If language users assume that the morphological form directly denotes the referent's sex, any instances where such a case does not apply would most likely result in readers or listeners incorrectly generating gender inferences. These assumptions are in line with the views integrated by Slobin's thinking-for-speaking hypothesis.

3. Thinking-for-speaking effects of gender grammaticization on the representation of person references

Slobin (1996, 76) postulated that the mental activities associated with the on-line processing of language motivate us to mentally attend to properties that are grammaticized within a language which may extend to different forms of language processing (Berman / Slobin 1994; Slobin 2003). In the case of grammatical gender, speakers and listeners are driven to gender information, as there are syntactic and morphological dependencies that require encoding. In other words, the very presence of these syntactic and morphological constraints compels speakers and listeners to map the grammatical form to a possible sex.

The difficulty in doing so, however, becomes particularly evident when the sex associated with the grammatical gender does not see eye to eye, which may result in skewed gender inferences. A sound example of this can be viewed in the representation of the masculine form, also supposedly interpretable as *generic*. While the masculine form is formally associated with the male gender in many grammatical gender languages, it can also bear reference to a person whose sex is unknown or irrelevant, or in its plural form, to a group consisting of both men and women. A correct representation of the masculine form as generic requires the language user to consider the masculine form as strictly grammatical and to disambiguate its multiple interpretation possibilities. However, notwithstanding its potential reference to women, the masculine form has been shown to direct language users' attention to men (Braun / Sczesny / Stahlberg 2005; Maas / Arcuri 1996, 201-202; Stahlberg et al. 2007), as language users assume that it refers to the male sex.

In a series of off-line studies (i.e. aimed at addressing the processes occurring after participants have read the target stimuli) in German, Braun / Sczesny / Stahlberg (2005) compared the impact of using the masculine plural form (e.g. *die Geophysiker* [the geophysicists]) to that of using so-called gender-fair forms (e.g. pair forms: *Geophysikerinnen*$_{\text{Feminine}}$ *und Geophysiker*$_{\text{Masculine}}$ [female and male geophysicists], neutralizing forms: *die Geophysik* [the geophysics]) to refer to role noun words denoting a collective group. Participants in their study were asked to read an article on a fictitious meeting, written in either the masculine or a gender-fair form, and were instructed to estimate the gender breakdown of attendees to the meeting. The authors found that although the masculine form maintained a stronger association with men, the gender-fair form augmented the estimated number of women, or neutralized gender estimations completely. Similar findings have also been reported where

participants referenced male figures more prominently when presented with the masculine form as opposed to gender-fair forms (French: Brauer / Landry 2008; German: Gabriel 2008; Gabriel / Mellenberger 2004; Stahlberg / Sczesny 2001; Stahlberg / Sczesny / Braun 2001).

These results are consistent with studies employing on-line paradigms (i.e. aimed at addressing the ongoing processes that occur as participants read the target stimuli), where participants are assessed for their ability to equally map both genders onto the masculine form. For instance, Irmen (Experiment 1, 2007) investigated the eye-movements of German speakers while they read passages that contained role nouns associated with a specific stereotypical gender. The role nouns were referred to in the masculine form (e.g. *Soldaten*$_{\text{Masculine}}$ [soldiers], *Floristen*$_{\text{Masculine}}$ [florists]), and a following anaphoric expression specified the gender of the group (e.g. *diese Männer* [these men] or *diese Frauen* [these women]). The author found that a mismatch between the grammatical gender of the role noun, although interpretable as a generic, and the sex specified by the anaphor slowed down reading. These results demonstrated that the use of the masculine form enhanced the cognitive salience of the male gender, which hindered reading when information incompatible with the grammatical form (i.e. the specification of women) was introduced into the discourse. Similar results have also been reported in other languages, establishing the robustness of the male bias instigated by the masculine grammatical form (e.g. Norwegian: Gabriel / Gygax 2008; French: Gygax / Gabriel / Sarrasin / Oakhill / Garnham 2008; Lévy / Gygax / Gabriel 2014).

These studies provide support for the claim that grammatical gender cues are readily interpreted as connoting sex. Although the masculine plural form consisting of multiple interpretation possibilities should function purely as a grammatical feature, it is nonetheless semantically linked to the male sex, being interpreted as having a male-specific denotation. Gygax et al. (2012) offer an explanation for the underlying mechanism, stating that a male-specific interpretation is passively activated without any control processes, where the surface form spontaneously directs language users' attention to men. This specific activation is robust and difficult to suppress, even when participants are explicitly instructed to do so. As for the generic interpretation, language users need to strategically process grammatical information, consciously activating the generic interpretation (Gygax et al. 2012). In contrast, gender-fair forms that emphasize the link to the female gender or the lack thereof lead to a symmetrical representation of the sexes.

Evidently, in the absence of similar grammatical cues, readers or listeners of natural gender languages do not show a parallel male bias, but merely gender biases that are associated with their stereotypical knowledge (e.g. Kennison / Trofe 2003; Oakhill / Garnham / Reynolds 2005). Sato / Gygax / Gabriel (2013) investigated these distinct biases among bilinguals who spoke typologically different languages and found these biases to be malleable, with gender representations switching according to the language at use. When French and English speaking bilinguals read sentences about groups of people (e.g. English: *nurses*, French: *infirmiers*$_{\text{Masculine}}$), their representations were found to be stereotyped in English, but male-biased in French. Corroborating thinking-for-speaking accounts, these results indicate that the constraints imposed by each language are the basis for distinct gender inference activation.

Importantly, due to the spontaneous activation of the male-specific interpretation, the difficulty in interpreting the masculine form as a generic form has serious implications on issues pertaining to gender inequality. In a study by Wasserman / Weseley (2009), native English speakers learning Spanish or French were evaluated on their levels of sexism based on questionnaires, after having read excerpts of the novel *Harry Potter* in either their first or second language. They found that participants who read the excerpts in a grammatical gender language scored higher on the sexism questionnaires than did those who read the excerpts in English. These results indicate that merely reading a text in a grammatical gender language may already direct our attention to gendered dimensions. In fact, an in-depth analysis of sexism indicators, as measured by the Global Gender Gap Index, suggested that countries speaking a grammatical gender language had lower indices of gender equality than those speaking non-gender marked languages (Prewitt-Freilino / Caswell / Laakso 2012). It should, however, be noted that there are always difficulties to control for other factors that may be more prominent in gender inequality.

In terms of job and career perceptions, Chatard / Guimont / Martinot (2005) showed that French-speaking adolescents' (14 to 15 years of age) perception of their success in different occupations depended on the grammatical form in which these occupations were presented (i.e. masculine-only, pair form or gender-fair form). Vervecken / Gygax / Gabriel / Guillod / Hannover (2015) further demonstrated that for a similar age group (12 to 17 years of age), presenting occupations in a pair form generated less stereotypical representations of these occupations. Namely, when being presented with occupations in the masculine form, participants felt that men would have a higher chance to succeed in male and neutral stereotyped occupations (i.e.

male bias), whereas women would stand more chance of success in female stereotyped occupations. However, when presented with occupations in pair form, participants considered both women and men as having a more equal chance of success in these occupations independent of the stereotype of the occupation. Testing young adults (i.e. university students), Horvath / Sczesny (2016) also found that participants perceived high-status positions as being less appropriate for women when the masculine form was employed, although the women were perceived as being just as competent as men.

In sum, these studies provide support for the claim that speakers of grammatical gender languages have an enhanced awareness of gender that may bring rise to gender biases in applied settings. Interestingly, these influences are not confined to human references, but extend to non-human references where sex is irrelevant.

4. Does gender grammaticization shape thought? – Linking grammatical gender to sexuated properties

Early approaches to investigating the influence of grammatical gender and sex worked under the assumption that grammatical gender assignment and conceptual properties of non-human entities were unrelated. In other words, there should be no preconception to assume that nouns such as the *sun* should be considered as female or male. Nonetheless, it is not uncommon for such entities to be personified even among natural gender languages, where gender is not systematically realized in its linguistic structure. This is certainly the case for a handful of nouns in English, where words such as *ship* and *country* regularly bear female pronouns (e.g. Svartengren 1927). These examples are considered as carrying sexuated properties and provide a strong theoretical motivation to assume that the habitual use of grammatical gender categories may very well contribute to assuming gendered perceptions of inanimate entities.

Numerous studies have employed different empirical approaches to assess the effect of grammatical gender categories on the perception of non-human entities. For instance, a study by Konishi (1993) examined how grammatical gender information in German and Spanish would influence the personification of animals and objects. Using a semantic differential scale that evaluates affective meaning, German and Spanish-speaking participants rated words that had opposing grammatical gender categories in the two languages (German: *Uhr*$_{\text{Feminine}}$; Spanish: *reloj*$_{\text{Masculine}}$ [clock]). The results indicated that grammatically masculine nouns in each language received higher potency ratings (i.e.

a dimension that is closely related to male attributes: weak – strong) than grammatically feminine nouns.

Employing a series of gender attribution tasks (e.g. attributing proper names and attributing female or male traits), Flaherty (2001) explored how English and Spanish-speaking adults and children (5 to 10 years of age) allocate gender to animals and objects. Results indicated that Spanish-speaking participants' attribution of gender to nouns was dependent on the gender marking corresponding to the object (e.g. a grammatically masculine noun would be given a male name). Although this effect was prevalent among Spanish-speaking adults, such an effect was not found for native English speakers and younger Spanish-speaking children (5 to 7 years of age). The authors attributed the lack of these effects to the absence of a fully acquired grammatical gender system (children between 5 to 7 years of age tended to attribute gender according to their sex), suggesting that grammatical gender is used as a meaningful feature for the categorization of non-human referents. Similar results have also been reported by studies employing voice attribution (Sera et al. 2002; Sera / Berge / del Castillo-Pintado 1994) and picture sorting (Martinez / Shatz 1996).

A widely cited study by Boroditsky / Schmidt / Phillips (2003) reported unpublished data demonstrating the significance of grammatical gender during the processing of inanimate entities. Spanish-English and German-English bilinguals were taught pairings of an object (e.g. apple) and a gender-specific proper name (e.g. Patrick vs. Patricia). A recall task conducted solely in English indicated that both groups had better memory when the gender of the proper name was coherent with the grammatical gender of the noun than when they were incoherent. In a follow-up experiment, the authors also found that participants associated target objects with adjectives that were prototypical of the gender corresponding to the grammatical marking (e.g. masculine: *hard*, *heavy*; feminine: *elegant, fragile*). These findings, however, have failed to be replicated (Mickan / Schiefke / Stefanowitsch 2014), which have casted doubt on their reliability.

These studies show that properties typically associated with a specific gender are also attributed to non-human entities and that they depend on the grammatical gender of the entity. However, the paradigms employed in most of these studies motivated participants to rely on their linguistic knowledge of grammatical gender categories (e.g., recall: Boroditsky / Schmidt / Phillips 2003; gender allocation by forced association: Flaherty 2001, 2001; Sera et al. 2002; Sera / Berge / del Castillo-Pintado 1994; semantic differential scale:

Konishi 1993). Consequently, criticisms remain as to whether these studies are informative with regard to the broader influence of language on thought.

Vigliocco / Vinson / Paganelli / Dworzynski (2005) introduced the *sex and gender hypothesis*, claiming that the effects of mapping gender to non-human references would be restricted to entities where gender serves as an essential property. Specifically, this hypothesis holds that language users initially learn to make basic connections between grammatical gender of person references and the denoted sex it may refer to. Despite its strictly grammatical function, this rule is subsequently generalized to nouns where sex may be considered as having meaningful features, as seen in nouns referring to animals. Sexuated properties associated with a specific gender can, therefore, be attributed to animals belonging to the corresponding grammatical gender category. In their study, Vigliocco et al. (2005) employed an odd-one-out task on a triad of pictures or words referring to animals and objects, granting that nouns should be perceived as being similar if they share the same grammatical gender category. This task reduced the explicit reference to gender seen in past studies where participants needed to make a judgment based on gender, such as allocating a name. Consistent with their hypothesis, only entities referring to animals were judged as being similar if they belonged to the same grammatical gender class, although this was not the case for inanimate objects. Importantly, these effects were only found when participants were presented with verbal but not pictorial stimuli, further indicating the effects as being confined to thinking-for-speaking effects. Ramos / Roberson (2011) argued that there may be more influencing variables and carried out several studies manipulating the explicitness of gender on task instructions and the presentation modality[3] of their stimuli. They found that Portuguese speakers were likely to map gendered properties to inanimate objects consistent with their grammatical gender marking. However, the magnitude of this effect was stronger when the task instructions made an explicit reference to gender (i.e. voice attribution) than when they were made more discrete (i.e. similarity judgments). This effect was further modulated by the modality of stimuli presentation, indicating that presenting pictorial stimuli substantially reduced the effects compared to verbal stimuli.

3 *Presentation modality* refers to the means by which information is encoded and thus experienced by a person. For example, researchers can manipulate how stimuli is presented to a participant. The study mentioned here by Ramos / Roberson (2011) manipulated presentation modality by comparing textual and pictorial stimuli.

In sum, three essential issues emerge from the studies presented in this section with regard to the conditions that define the broader influence of language on thought. First, they question the extent to which effects linking grammatical gender to sex arise as a function of the task at hand. Earlier studies can be criticized given that the experimental task required the explicit application of grammatical gender categories. Typically, participants in these studies were (a) given instructions that explicitly made references to gender and (b) were confronted with tasks that involved making binary choices about gender categories (e.g. "Decide if an *apple* is a man or a woman"; "Should the voice of this *apple* be feminine or masculine?"). Consequently, it would seem plausible that there was a strategic reliance on a familiar grammatical system to fulfill the task requirements. When task instructions were made less explicit, as in Vigliocco et al. (2005) and Ramos / Roberson (2011), the effects were constrained.

The second issue is concerned with the kind of effects these studies were in fact addressing. The nature of the task employed in early studies made it possible to employ language as a strategic means to allocate gender (e.g. Konishi 1993; Sera et al. 1994). Such an outcome would indicate linguistic effects on language-mediated tasks, an assumption consistent with thinking-for-speaking rather than linguistic relativist accounts. This is further confirmed by later studies that report the influences of grammatical gender to be limited to verbal stimuli, but is not observable with pictorial stimuli (Ramos / Roberson 2011; Vigliocco et al. 2005).

A third and final issue is associated with the target entity in which gender influences are observed. Vigliocco et al. (2005) have argued that grammatical gender effects pertaining to linguistic processing is only applied to animate entities where sex serves as a meaningful property. Language users may generalize the idea that formal grammatical features map directly onto sex, which in turn, may lead them to attribute sexuated properties that are irrelevant. On the other hand, Ramos / Roberson (2011) show that this is not necessarily the case, demonstrating gender effects on inanimate entities, and argue that it may be dependent on factors such as task instruction or the presentation modality of the stimuli.

Taken together, these studies shed light on the conditions and extent to which grammatical gender may be mapped onto semantic representations, effects consistent with *thinking-for-speaking* effects. These studies, however, have only demonstrated that linking grammatical gender to sexuated properties may be dependent on linguistic encoding, which does not directly offer

an insight into the broader effects of language on thought. Even studies that employ less explicit tasks, as demonstrated by Ramos / Roberson (2011) in their manipulation and by Vigliocco et al. (2005), acknowledge their results as being limited to linguistic-processing. Consequently, the view that languages may have broader effects on non-linguistic processes, an account consistent with linguistic relativity, can neither be accepted nor refuted.

5. Gender grammaticization as forming categories: Implicit effects of gender grammaticization

There is a general scarcity of convincing evidence to support linguistic relativity, particularly when looking strictly at studies examining grammatical gender. One primary reason for its absence can be attributed to the empirical challenge of devising tasks impervious to linguistic mediation. Providing compelling evidence for the broader influence of language requires employing conceptual tasks that can address the effects of grammatical gender without having participants make any direct or explicit associations to gender or language. Recent conceptualizations to this problem have been addressed by considering knowledge of gender grammaticization as forming categories in a language speaker, which may or may not implicitly impact cognitive processes such as object categorization.

For instance, a recent study by Cubelli / Paolieri / Lotto / Job (2011) employed a semantic decision task in which gender was not explicitly mentioned or needed in order to fulfill the task. English, Italian and Spanish-speaking participants in their study had to decide whether two pictures of non-human entities presented together belonged to the same semantic category. Unknown to the participants, the pairs were manipulated for both semantic and grammatical gender congruency (e.g., *naso*$_{\text{Masculine}}$ [nose] – *sedano*$_{\text{Masculine}}$ [celery] vs. *naso*$_{\text{Masculine}}$ [nose] – *bocca*$_{\text{Feminine}}$ [mouth]). Italian and Spanish-speaking participants in their study showed an advantage in response times when the pictures were grammatically congruent, for both semantically congruent and incongruent trials. In contrast, English-speaking participants only showed a response time advantage for semantically congruent trials. The efforts to eliminate a reference to gender in the experimental manipulation can be considered as providing convincing empirical evidence for the impact of language on thought. Nonetheless, when participants performed a language intrusion task, which obstructed verbal processing, this effect was eliminated. The authors speculated that lexical representations were accessed during the course of the

task and that grammatical gender information is not integrated as part of the conceptual representation for Italian and Spanish-speaking participants.

Despite the attempts to eliminate the explicit effects of language even among tasks that do not require referencing gender, some argue that language is fundamental in general cognition. One pioneering theory, coined the *label-feedback hypothesis*, recognizes language as being an integral part of an interactive cognitive system (Lupyan 2012). Essentially, learning a categorical label is viewed as augmenting cognition and perception, which may penetrate even into early visual and perceptual processes (Boutonnet / Lupyan 2015; Lupyan / Ward 2013). This is exemplified by research on color perception, demonstrating that languages that have distinct labels for different shades of the same color may compel their speakers to perceive them differently (e.g. Athanasopoulos / Damjanovic / Krajciova / Sasaki 2011; Thierry et al. 2009). Learning and habitually using particular labels creates categories that may affect our awareness, to the extent that the labels will activate both perceptual and semantic properties.

To illustrate this, Boutonnet et al. (2012) demonstrated the unconscious activation of grammatical gender information in a task that did not require participants to consciously use or rely on familiar grammatical systems. In addition to response times, they examined event-related potentials (i.e. ERP, electrophysiological brain responses), which in contrast to traditional behavioral data gauges early perceptual effects. They revised Cubelli et al.'s study (2011), maintaining the hidden manipulation for grammatical gender congruency. Spanish-English bilinguals and English native speakers were presented with a triad of pictures and were instructed to decide if the third picture was or was not semantically related to the first two pictures. ERP data revealed effects of semantic congruency for all participants, although Spanish-English bilinguals also showed an early effect of grammatical gender congruency in a task where gender was irrelevant. Response times, however, did not reveal effects of either manipulation.

As illustrated by studies on the influence of language on color perception (Athanasopoulos 2009; Davidoff et al. 1999; Thierry et al. 2009) or motion event construal (Athanasopoulos et al. 2015; Athanasopoulos / Bylund 2013; Flecken et al. 2015), recent views pertaining to the relationship between language and cognition may not necessarily consider language as detached from cognition, but as being integrated in processes that operate intricately together. Learning and habitually using a particular language leads to form-

ing categories, as seen in grammatical gender, which implicitly impact our cognitive processes in domains such as object categorization.

6. Conclusion

In the present paper, we have outlined studies dedicated to investigating the impact of language on thought, with a primary focus on the effects of gender grammaticization on the cognitive processing of human and non-human entities. Most of the studies presented in this paper are conceived within Slobin's thinking-for-speaking hypothesis, which were dedicated to investigating mental representations of gender that result when speakers of grammatical gender languages are engaged in linguistic processing. We have argued that – because grammatical gender classifications exercise both a formal grammatical function and occasionally a semantic function that denotes a referent's sex –, language users may be inclined to apply this link even in cases where this association is not applicable.

With regard to the interpretation of person references, the masculine form as generic is interpreted as referring specifically to the male sex, as the association to the male gender is made cognitively salient. The consequences are not trivial, as illustrated by studies looking at the real-life implications they bring to bear. As for non-human entities, the link between grammatical gender and sex can extend to other animate entities (Vigliocco et al. 2005) and inanimate entities depending on the task at hand (Ramos / Roberson 2011).

With regard to the debate surrounding these empirical approaches, research examining linguistic relativity remains yet to be explored. Importantly, these discussions provide insight into how language users are influenced by grammatical gender, even when the task does not require them to consciously activate gender categories. Future work investigating language effects on thought should consider what specific tasks are modulated by language rather than simply scrutinizing the means to eliminate language from these tasks to address linguistic relativity (Lupyan 2012). In fact, acquiring a linguistic system may regulate how we categorize entities of our world, which in turn may affect performance on tasks that do not necessarily require linguistic processing. However, we stress that thinking-for-speaking effects should not be considered trivial in the face of linguistic relativity effects. As suggested by Imai / Schalk / Saalbach / Okada (2014), processing grammatical gender constitutes a reality that speakers face in everyday interaction and which is carried over to a wide range of cognitive processes.

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