

Grammatical Gender and Anthropomorphism: “It” Depends on the Language

Alican Mecit¹, Tina M. Lowrey², and L. J. Shrum²

¹ MINT Research Center, SKEMA Business School, Université Côte d’Azur

² Department of Marketing, HEC Paris

When English speakers anthropomorphize animals or objects, they refer to such entities using human pronouns (e.g., *he* or *she* instead of *it*). Unlike English, which marks gender only for humans, gendered languages such as French grammatically mark gender not only for humans but also for nonhumans. Research has shown that in gendered languages, although gender marking of nonhuman nouns is semantically arbitrary, people ascribe male and female properties to nonhuman entities consistent with their grammatical gender. Because grammatical gender conveys human-related properties, we question whether grammatically gender-marking nonhumans may elicit anthropomorphism tendencies. Across six studies, we show that gender marking of nonhuman nouns in gendered languages influences the way individuals mentally represent these entities and increases their anthropomorphism tendencies. We demonstrate the effects both by comparing anthropomorphism as a function of natural differences in languages with French–English bilinguals (Study 1) and by training native English speakers to use gender marking for nonhuman nouns as speakers of gendered languages do (Study 2). The following studies further demonstrate the effects within the French language by measuring (Study 3a) and manipulating (Studies 3b and 4) the salience of gender markings of nonhuman nouns. In Study 5 (preregistered), we replicate our basic finding and establish grammatical gender as an important linguistic element in shaping French speakers’ anthropomorphism tendencies. We discuss the findings and the limitations in the culture–language–cognition triad and layout their implications for the debate on the extent to which language can mediate categorical and perceptual judgments.

Keywords: anthropomorphism, language, grammatical gender, gender

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Humans frequently attribute humanlike characteristics, motives, and behaviors to nonhuman entities. Although different interpretations of this tendency exist in various disciplines, anthropomorphic thinking is considered by most to be both natural and universal (Boyer, 1996; Dacey, 2017; Harris & Fiske, 2008; Hume, 1957). Nevertheless, both individuals and cultures differ on the extent to which they spontaneously anthropomorphize (Cullen et al., 2014; Waytz et al., 2010). For example, children engage more in anthropomorphic thinking than adults (Airenti, 2015; Piaget, 1929), and some cultures are known for their anthropomorphic worldviews, such as the Shinto belief in Japanese culture, which views mountains, lakes, and rivers as having sacred spirits (Teeuwen & Scheid, 2002).

In natural gender languages such as English, which do not grammatically mark gender for nonhuman entities, one indicator of anthropomorphism is referring to objects using human pronouns (e.g., *he* or *she*) as if they were human (Harrison & Hall, 2010). Accordingly, in research with English speakers, anthropomorphism is also often primed by using human pronouns (*he*, *she*) to refer to nonhumans, which increases anthropomorphic tendencies (Aggarwal & McGill, 2007; Puzakova & Aggarwal, 2018; Tam et al., 2013). However, consider gendered languages, whose grammatical systems mark gender for both humans and nonhuman entities. In those languages, pronouns such as *he* and *she* are assigned to objects as well as humans in ways that are indistinguishable from the anthropomorphic primes for English speakers

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Alican Mecit  <https://orcid.org/0000-0002-5388-2815>

Tina M. Lowrey  <https://orcid.org/0000-0002-2185-6313>

L. J. Shrum  <https://orcid.org/0000-0001-7112-6418>

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Correspondence concerning this article should be addressed to Alican Mecit, MINT Research Center, SKEMA Business School, Université Côte d’Azur, 5 Quai Marcel Dassault, Suresnes 92150, France. Email: alican.mecit@skema.edu

just described. In addition, all nouns, whether animate or inanimate entities, are marked for their grammatical gender. The question we address in this research is whether grammatically marking gender may have similar anthropomorphizing effects, effectively acting as a natural prime that may increase anthropomorphism tendencies.

Anthropomorphism

Anthropomorphism is the human tendency to attribute human characteristics to nonhuman entities or to interpret nonhuman behavior in terms of human feelings and mental states (Guthrie, 1993). Although there are a number of determinants of anthropomorphism tendencies (e.g., attachment style, Norberg et al., 2018; paralinguistic cues, Schroeder & Epley, 2016), one that is particularly relevant for our research is what Epley et al. (2007, p. 865) term “accessible knowledge structures.” They posit that one reason people anthropomorphize is because knowledge structures related to the broad category of humans are activated and accessible. For example, explicit cues that remind individuals of the human form can increase the temporary accessibility of knowledge about humans when interacting with objects (Waytz et al., 2010). Consequently, individuals are particularly likely to anthropomorphize objects when the objects have humanlike features (Jipson & Gelman, 2007; Woodward, 1999).

The accessibility of anthropomorphic knowledge structures also differs across people. That is, although anthropomorphism may be a universal tendency (Dacey, 2017; Harris & Fiske, 2008), not everyone does it to the same degree. Individual differences in the extent to which people attribute human characteristics to nonhumans are stable over time, and may arise for a number of reasons, including differences in culture, norms, education, experience, and cognitive reasoning styles, among others (Waytz et al., 2010).

In natural gender languages (e.g., English), when people anthropomorphize animals or objects, they refer to such entities using pronouns referring to humans (e.g., he or she) as if they refer to humans (Harrison & Hall, 2010). Similarly, when people use human pronouns to refer to an object, they become more likely to regard the object in human terms (Aggarwal & McGill, 2007), and in research with English speakers, anthropomorphism is often primed by using human pronouns (he, she) to refer to nonhumans (Puzakova & Aggarwal, 2018; Tam et al., 2013). The same holds true for the inverse process of anthropomorphism (dehumanization). Using the pronoun *it* to refer a human being is generally perceived as a refusal to attribute human status (McConnell-Ginet, 2014), which is consistent with the pronoun *it*’s representation of nonhumanity. Language, therefore, is an important correlate of anthropomorphism tendencies. This raises an intriguing question for languages that do not have an ontological distinction concerning the grammatical gender categories. For gendered languages (e.g., French and Italian) that assign either a masculine or a feminine grammatical gender to nonhuman nouns, by virtue of conveying connotations of masculinity and femininity, grammatical gender may elicit knowledge structures related to the broad category of humans. In the next sections, we provide a theoretical framework for this proposition.

Language, Thought, and Behavior

The relation between language and thought has been the subject of contentious debate over the last few decades. On one side of the

argument are scholars who hold the universalist view, and argue that thought is independent of language (Brown & Lenneberg, 1954; Chomsky, 1964; Pinker, 1994, 2007). According to this view, language is merely a reflection of thought, and speakers of all languages have similar conceptual categories regardless of the language they speak. On the other side of the argument is the view that language shapes thought (and thus subsequent behavior), referred to as the Sapir–Whorf hypothesis of linguistic relativity. This view argues that language influences the way people perceive and understand the world (Whorf, 1952), and consequently people who speak different languages perceive the world differently (Logan, 1987; von Humboldt & von Humboldt, 1999). The Sapir–Whorf hypothesis takes two forms, often called the strong and weak versions (Gentner & Goldin-Meadow, 2003). The strong version posits that language *determines* thought, and thus speakers of different languages develop different broad worldviews. In this view, limits of the language translate as the limits of thought (Wittgenstein, 1921). Most contemporary scholars do not adhere to the strong version (Gleitman & Papafragou, 2013; Slobin, 2003). The weak version, by making a distinction between semantic and conceptual representations, posits that a semantic representation of an entity does not solely reflect its conceptual properties but also binds them to linguistic information (Levinson, 2003). Therefore, language *shapes* thought as the mental representations are intermediary representations that are influenced by both conceptual and linguistic information (Kousta et al., 2008; Vigliocco et al., 2004). According to this view, the cross-linguistic differences stem from the differential effects of linguistic properties on semantic representations rather than the differences in conceptual properties, which contradicts the strong version’s argument that different languages inherently have different conceptual structures. Overall, the weak relativity thesis, by adopting a decomposed view of conceptual representations, offers a reconciliation between the view that conceptual representations remain relatively constant across different cultures and the findings that demonstrate cross-linguistic differences in various domains (Vigliocco & Kita, 2006).

Empirical findings support the weak version of the relativity thesis by showing interactive relations between language and cognitive functions in several domains, including time perception (Casasanto & Boroditsky, 2008), emotions (Gendron et al., 2012), and motion (Meteyard et al., 2007). For example, languages differ in the way they require encoding source information (i.e., evidentiality)—whether the information is first-hand knowledge or based on indirect information (e.g., hearsay). Although all languages allow their speakers to indicate the source information, in languages such as Turkish, evidentiality is required to form sentences in the past tense (Aksu-Koc & Slobin, 1986). Research shows that this requirement attunes Turkish speakers to source information and leads to better memory for first-hand information compared with indirect information (Tosun et al., 2013).

Such differences across speakers of different languages presumably arise because linguistic elements turn perception into a language-mediated categorization process (Lupyan, 2012; Roberson et al., 2008). Through exposure to frequently occurring associations, languages influence speakers’ categorical and perceptual judgments, and thus different labeling patterns in a language create different groupings of sensory representations for speakers of different languages (Casasanto, 2008; Lupyan, 2012). In this process, although individuals may have an innate predisposition to perceive the outside world in a

certain manner, after language is acquired, the labels provided by the language guide this predisposition (Franklin et al., 2008; Perlovsky, 2009). For example, after learning to associate certain colors with the category “blue,” perceiving a blue-colored entity gets “warped” by the category label’s top-down feedback (Lupyan, 2012, p. 2), such that category members, in this case blue-colored objects, are perceived as more similar to each other and more dissimilar to noncategory members (e.g., red objects). As a result, cross-linguistic differences in color labeling lead to different ways of categorizing, perceiving, and recalling colors for speakers of different languages (Davies & Corbett, 1998; Thierry et al., 2009). Moreover, because both prior and current knowledge together influence mental representations, perception and categorization judgments can be influenced even with short training sessions. For example, a color-learning task that trained participants on a new color category boundary influenced their categorical perception of colors (Özgen & Davies, 2002). Therefore, the activation of category labels (prior or transient) when processing information provides top-down feedback on categorical perception, resulting in different mental representations for speakers of different languages (Lupyan, 2012).

Grammatical Gender

One dimension on which languages differ is whether and how their grammatical systems assign gender. Languages can be grouped into three broad categories: genderless, natural gender, and gendered languages (Corbett, 2014). Genderless languages are characterized by the complete absence of grammatical gender markers for all types of nouns; neither human nor nonhuman nouns carry a gender mark in these languages. For example, corresponding to *he*, *she*, and *it* in English, a single pronoun (*o*) is used in Turkish to refer to all human and nonhuman nouns. In contrast, natural gender languages, such as English, only mark gender for humans, indicating either the biological sex or the gender identity of the referent entity (e.g., *he* and *she*). Nonhuman nouns¹ are not gender marked in these languages (e.g., *it*). Finally, gendered languages, such as French, assign gender to all nouns, including nonhuman nouns, through definite (*la*, *le*) and indefinite (*une*, *un*) articles, and pronouns (*elle*, *il*). Therefore, when referring to nonhuman entities, French speakers use either *il* (he) or *elle* (she), depending on the grammatical gender of the object. For example, when referring to a red table, in English it would be “it is red,” whereas for French speakers, it would be “*elle est rouge*” (she is red). Although in gendered languages, the gender markers for humans tend to be consistent with the biological sex or the gender identity of the referent (boy is a grammatically masculine noun, girl is a grammatically feminine noun), the assignment of gender markers to nonhuman entities is typically semantically arbitrary, and thus unrelated to the qualities of the object. For example, in French, necktie is feminine (*la cravate*), but mascara is masculine (*le mascara*).

Despite the arbitrariness of gender mark assignment in gendered languages, ample evidence suggests that grammatical gender can affect cognitive processes, particularly in ways that are consistent with gender stereotyping (Cubelli et al., 2005; Saalbach et al., 2012; Sera et al., 2002). For example, the word for *key* is feminine in Spanish but masculine in German, whereas the word for *bridge* is masculine in Spanish but feminine in German. When native Spanish and German speakers were asked to spontaneously come up with three adjectives to describe a key, German speakers came up with

adjectives carrying more masculine connotations (e.g., heavy, hard, metal), whereas Spanish speakers generated adjectives carrying more feminine connotations (e.g., shiny, lovely, tiny), and the opposite was true when they came up with adjectives for a bridge (Boroditsky et al., 2003). Similarly, in a study comparing Spanish and German speakers using words that had opposite gender markers in the two languages, masculine-marked words were rated as more potent than feminine-marked words (Konishi, 1993). In another study, Segel and Boroditsky (2011) coded artists’ depictions of the gender of various concepts (love, death, etc.) and analyzed the fit between the personified gender in the artistic depictions and the grammatical gender of the concept in the artists’ language. Based on their analysis of over 750 representations made by Spanish, Italian, French, and German artists, artists’ depictions of gender matched the grammatical gender of the concepts in 78% of the cases.

Research studying grammatical gender effects also provides evidence for the weak relativity thesis’ assumption that semantic representations, which bind conceptual and linguistic information, develop during the childhood (Vigliocco & Kita, 2006). For example, when asked to assign a female or a male voice to nonhuman entities, including inanimate objects, grammatical gender influenced the assignment of gender consistent with the connotations of masculinity and femininity for speakers of gendered languages over the age of seven (Sera et al., 2002), supporting the view that after language is acquired, labels in a language to guide perception and categorization (Lupyan, 2012). Importantly, in the same study grammatical gender effects were persistent even in the absence of any linguistic cue or label (Sera et al., 2002). Extending this finding, recent research showed that in gendered languages, the absence of verbal labels does not prevent individuals retrieving the grammatical gender information, and by simply being exposed to objects can activate the grammatical gender category related to the object, leading to grammatical gender effects even in nonlinguistic tasks (Sato & Athanasopoulos, 2018).

In addition to the effects on perceptions, grammatical gender also affects attitudes and behaviors in gender-stereotypical ways. For example, in a study that manipulated the grammatical gender of coronavirus disease (COVID-19), participants primed with the feminine gender mark (*la COVID-19*) perceived the disease to be less dangerous and indicated lower intentions to engage in preventative behaviors than did those primed with the masculine gender mark (*le COVID-19*), and this effect was mediated by grammatical gender induced femininity–masculinity connotations and moderated by individual differences in chronic gender stereotyping (Mecit et al., 2021). At a cultural level, compared to genderless languages, cultures with gendered languages exhibit greater gender prejudice (DeFranza et al., 2020) and less gender equality (Prewitt-Freilino et al., 2012). Moreover, these effects tend to be stronger in gendered languages with two grammatical gender categories because it allows a more straightforward mapping between grammatical gender and biological sex compared to gendered languages with more than two grammatical gender categories (e.g., German; Koch et al., 2007).

Recent empirical accounts of grammatical gender effects, therefore, provide evidence for the relativity thesis in different domains,

¹ Technically, nouns referring to animals may be gender marked, but the usage is not that common, unless one has personal involvement with, closeness to, or empathy with the animal (e.g., pets; MacKay & Konishi, 1980).

primarily by showing that grammatical gender of nonhuman nouns prompt speakers of gendered languages to rely on gender stereotypes in the way they conceptualize these entities (Boroditsky & Schmidt, 2000; Semenuks et al., 2017). Thus, it appears that despite the arbitrariness of the gender markers, they influence the gender-related traits that are ascribed to nonhuman entities by leading individuals to selectively attend to an object's masculine or feminine qualities through associative learning, and these processes occur nonconsciously (Boutonnet et al., 2012; Sato et al., 2020).

Grammatical Gender and Anthropomorphism

For speakers of gendered languages, the anthropomorphism prime used in previous research with English speakers (human pronouns) is effectively a part of their daily language through the gender marking of nonhuman nouns. The research just reviewed provides evidence that grammatical gender influences perceptions of objects that are consistent with gender stereotypes. Although this research is not typically positioned in terms of anthropomorphism, it suggests that grammatical gender can carry connotations of masculinity and femininity even for nonhuman entities. If so, then it seems plausible that the use of grammatical gender markers may increase anthropomorphism tendencies more generally. More specifically, the use of grammatical gender markers for nonhuman nouns may induce anthropomorphism tendencies by increasing the accessibility of knowledge structures related to humans. This proposition resonates with the cognitive theory of language use, which posits that pronoun systems in a language can affect the structure of relations between different entities and contribute to the construction of social reality (Langacker, 1987; Logan, 1987; Mühlhäusler & Harré, 1990). It is also consistent with the label-feedback thesis, which proposes that label categories in a language distort the mental representations of entities, resulting in a language-mediated categorical perception (Lupyan, 2012).

If grammatical gender markers for nonhuman nouns increase anthropomorphic tendencies, then we would expect to observe cross-cultural differences in anthropomorphism tendencies, such that speakers of gendered languages (e.g., French, Italian) anthropomorphize more than speakers of languages that do not have grammatical gender marking for nonhumans (e.g., English). However, because culture and language are intertwined, one fundamental difficulty is demonstrating that the grammatical gender system is indeed the driver of differences in anthropomorphism, and not culture or some other unmeasured variable. If grammatical gender is the true driver of anthropomorphism tendencies, then we would also expect to observe within-language differences, such that the salience and nature of grammatical gender markers are also related to anthropomorphism tendencies.

Empirical Overview

Across one pilot and six studies, we test the proposition that a language's grammatical gender system—in particular the use of grammatical gender markers—affects individuals' mental representations of nonhuman entities and their anthropomorphism tendencies. The first three studies test the proposition in between-language contexts. The pilot study compares individual differences in anthropomorphism tendencies of native speakers of two different gendered languages (French, Italian) with native English speakers. Study 1

addresses issues of causality by manipulating language of administration (LOA) for French–English bilingual speakers who are equally fluent in both languages. Study 2 further addresses issues of causality by manipulating grammatical gender assignment for nonhumans through a learning task in which English-speaking participants are trained to assign grammatical gender to nonhuman nouns. The remaining studies demonstrate the effects with French speakers by measuring (Study 3a) and manipulating (Studies 3b and 4) the salience of gender markings of nonhuman nouns. In Study 5 (preregistered), we replicate our basic finding that the grammatical gender of nonhuman nouns acts as a cue that facilitates the process by which French speakers attribute human characteristics to nonhumans.

In all studies, participants provided informed consent, and we analyzed the data only after all measures had been collected. We excluded participants based on a priori rules (described within each study) that were applied before any data analyses, and for all studies, data exclusions did not substantively differ across conditions. All measures and manipulations are provided in the [Online Supplemental Materials](#), and all stimuli, data, and [Supplemental Materials](#) are posted at <https://osf.io/m2w5g>. For each study, we also estimated the level of precision (i.e., how close is the difference in sample means between different conditions in our studies to the difference in population means between these conditions for a given confidence interval) in an a posteriori fashion (Trafimow, 2019; Trafimow et al., 2020; see [Appendix J of the Online Supplemental Materials](#)).

Pilot Study: Cross-Cultural Differences in Anthropomorphism

The pilot study tested the hypothesis that native speakers of a gendered language anthropomorphize more than do native speakers of a language that does not attribute gender to nonhuman entities. To do so, we compared native French, Italian, and English speakers' chronic tendency to anthropomorphize nonhuman entities. English does not assign grammatical gender to nonhuman entities, but French (*le*, *la*) and Italian (*il*, *la*) do.

Method

Participants and Design

We did not calculate an a priori sample size for this study because it was exploratory. Participants ($N = 300$) were members of the Prolific Academic U.K. online research panel, and were either British and native English speakers ($n = 100$; 55 women, 43 men, 2 other; $M_{\text{age}} = 33.3$, $SD = 12.36$), French and native French speakers ($n = 100$; 38 women, 59 men, 2 other, 1 not indicated; $M_{\text{age}} = 27.95$, $SD = 9.09$), or Italian and native Italian speakers ($n = 100$; 39 women, 59 men, 2 other; $M_{\text{age}} = 25.33$, $SD = 6.89$). The design was a one-factor study in which native language (English, French, Italian) was measured.

Procedure and Measures

Participants were told that they would be participating in a study about their perceptions of themselves and the outside world. We administered the individual differences in anthropomorphism questionnaire (IDAQ; Waytz et al., 2010; see [Appendix A of the Online](#)

Supplemental Materials for full details) in French ($\alpha = .88$), Italian ($\alpha = .87$), or English ($\alpha = .86$), depending on the condition, measured along an 11-point scale. Within the IDAQ scale items, we included an attention check measure. Participants then indicated their age, gender, and mood. Finally, they answered a series of questions that measured their fluency in their native language to confirm their fluency and in English as a second language (for French and Italian speakers) to control for potential confounds. Age, mood, and fluency in English as a second language were unrelated to the IDAQ score, and all participants were fluent in the language they indicated as their native language. Women scored higher on the IDAQ than did men, but controlling for gender did not substantively affect the results.

Results and Discussion

Data Exclusions

Twenty-two participants (9 in the English, 7 in the French, and 6 in the Italian condition) failed the attention check measure and thus were excluded from analyses. The data were analyzed for the remaining 278 participants.

Hypothesis Testing

We expected that French and Italian speakers would score higher on the IDAQ scale than would English speakers. The one-way analysis of variance (ANOVA) was significant, $F(2, 275) = 4.12$, $p = .017$, $\eta^2 = .029$. We tested the two a priori hypotheses using Bonferroni-adjusted α levels of .025 per test (.05/2). As predicted, French speakers scored higher on the IDAQ ($M = 3.81$, $SD = 1.52$) than did English speakers, $M = 3.22$, $SD = 1.42$; $t(182) = 2.64$, $p = .008$, $d = .41$, and Italian speakers also scored higher on the IDAQ ($M = 3.72$, $SD = 1.52$) than did English speakers, $M = 3.22$, $SD = 1.42$; $t(183) = 2.36$, $p = .019$, $d = .34$. IDAQ scores of French and Italian speakers did not differ ($p > .70$).

The results of the pilot study show that speakers of the two gendered languages (French, Italian) are more prone to attributing human characteristics to nonhumans than those whose native language lacks grammatical gender for nonhuman entities. However, the design is correlational and there may be a number of reasons why cultures differ on anthropomorphism, independent of the effect of language. We address these issues in the next studies.

Study 1: Manipulating Language of Administration for Bilingual Speakers

To address issues of causality, we manipulated LOA for French–English bilingual speakers. Research comparing speakers of different languages (primarily English–Spanish and English–Chinese bilinguals) shows that the language native bilinguals use can prime the corresponding cultural norms for the self-concept (Trafimow et al., 1997), personality traits (Ramírez-Esparza et al., 2006), values (Bond, 1983), and emotional expressions (Matsumoto & Assar, 1992). Research also shows that for bilinguals, language not only primes a corresponding mindset but also leads to intraspeaker differences in terms of their semantic representations and categorization judgments (Kousta et al., 2008). For example, in a categorization task, German–English

bilinguals classified motion events based on the language in which the task is administered (Athanasopoulos et al., 2015).

Native bilinguals are those who learned both languages in the same context (e.g., growing up in a bilingual household) and are relatively equally fluent in both. Given that in gendered languages (e.g., French), grammatical gender has connotations of humanlike characteristics such as femininity and masculinity (Konishi, 1993; Sera et al., 1994), we expect that French–English bilingual speakers will anthropomorphize more when they use French than when they use English.

Method

Participants and Design

We planned our sample based on the effect size of the previous study of differences in anthropomorphism between French and English participants ($d = .41$). An a priori power analysis using G*Power yielded a sample size recommendation of 190 for .80 power and $p = .05$. Participants were members of the Prolific Academic U.K. online research panel ($N = 190$; 101 women, 85 men, 2 other, 2 not indicated; $M_{\text{age}} = 30.7$ years, $SD = 11.71$) who were randomly assigned to conditions in a one-factor (LOA: French, English) between-subjects design. We restricted participation to French–English native bilinguals who indicated on the screening questions that they were raised bilingual.

Procedure and Measures

Participants were told that they would be participating in a study about their perceptions of themselves and the outside world. We administered an adapted version of the IDAQ, measured along a 7-point scale, either in French ($\alpha = .89$) or in English ($\alpha = .87$), depending on the condition. For the French version of the IDAQ, two independent translators fluent in both languages translated the scale into French using a back-translation method. Within the IDAQ scale items, we included an attention check. Participants then indicated their age, gender, and mood. Finally, they answered a series of questions that measured their fluency in English and French to ensure that participants were fluent in both languages. These questions included self-reported fluency ratings on a 7-point scale for French and English, and the age they started speaking French and English. Participants indicated high levels of fluency on a 7-point scale, both in French ($M = 6.03$, $SD = 1.21$) and in English ($M = 6.66$, $SD = 0.75$). They also indicated that they started speaking both languages at an early age (French, $M_{\text{age}} = 5.94$, $SD = 7.88$; English, $M_{\text{age}} = 5.41$, $SD = 7.98$). Controlling for the fluency measures did not affect the results. Mood was positively correlated with the IDAQ score ($r = .144$, $p = .048$). However, controlling for mood did not affect the results.

Results and Discussion

Data Exclusions

Two participants failed the attention check measure and thus were excluded from analyses. The data were analyzed for the remaining 188 participants.

Hypothesis Testing

We expected that French–English bilingual speakers would anthropomorphize more when they use French than when they use English. Consistent with our prediction, LOA significantly affected anthropomorphism tendencies. Participants who answered the survey in French exhibited higher IDAQ scores ($M = 3.63$, $SD = 1.01$) than did those who answered the survey in English, $M = 3.30$, $SD = .93$; $t(186) = 2.29$, $p = .023$, $d = .32$. Neither fluency measure affected the results (all $ps > .25$). These results provide support for the proposition that language can influence individuals' anthropomorphism tendencies. These findings are also compatible with those of previous research demonstrating that bilingual individuals adapt to the language in which they operate and act like a monolingual speaker in that language, and in that sense, they are important in showing the malleability of judgments about semantic representations.

The manipulation of LOA provides causal evidence via an arguably conservative test that primed different linguistic mindsets. The next studies probe further to determine whether the grammatical gender component in gendered languages can account for these differences.

Study 2: Gender-Marking Nonhumans and Object Descriptions

In Study 1, we manipulated LOA for native bilinguals to show the effects of grammatical gender on anthropomorphism. However, even though the experimental design largely controls for cultural differences via random assignment, it is possible that the language of administration could have primed different cultural norms about how humans relate to nonhumans, independent of the grammatical gender system. Although it is difficult to totally separate the effects of language from those of culture, in this study, we attempt to do so with a training task with speakers of a natural gender language (English). Previous research shows that training participants to learn new categories and labels alters perception and categorization judgments in the short term in various domains such as pitch representations (Dolscheid et al., 2013), color perception (Özgen & Davies, 2002), and motion perception (Kersten et al., 2010).

Accordingly, we expect that training native English speakers to assign grammatical gender to nonhuman nouns, like native French speakers do, will increase their propensity to anthropomorphize. We operationalized anthropomorphism with the Heider–Simmel illusion, which is an animated film of simple moving shapes (Heider & Simmel, 1944), and asked participants to describe what they watched. Using text analysis on individuals' descriptions of moving shapes, we tested whether the training task increases individuals' tendency to ascribe human characteristics to the moving shapes. This measure has been successfully used in prior research on anthropomorphism (Fussell et al., 2008; Scheele et al., 2015).

Method

Participants and Design

We planned our sample based on the effect size of the previous studies ($d = .41$, Pilot Study; $d = .32$, Study 1; average $d = .37$) and studies using a similar measure of anthropomorphism ($d = .56$; Scheele et al., 2015). For .80 power, $d = .47$, and $p = .05$, an a priori power analysis using G*Power yielded a sample size

recommendation of 145. Participants were native English-speaking members of the Prolific Academic U.K. online research panel ($N = 147$; 109 women, 37 men, 1 other; $M_{\text{age}} = 35.8$ years, $SD = 12.74$) who were randomly assigned to conditions in a one-factor (learning task: yes, no) between-subjects design.

Procedure and Measures

Participants were told that they would be completing two different studies. In the first study, ostensibly about understanding the pronoun use of native English speakers, participants first completed the learning task, during which all participants rewrote 60 sentences by replacing an underlined noun with a pronoun, which represented the manipulation of grammatical gender usage. Those in the control group replaced the nouns with pronouns in the usual way for English, for example, participants transformed the sentences in the following way: The apple pie was delicious. → It was delicious./Jane ate the apple. → She ate the apple. In contrast, in the treatment group, participants were instructed to use either *he* or *she*, depending on the arbitrary grammatical gender indicated in parentheses next to the underlined noun. For example, they transformed sentences in the following way: The apple pie (f) was delicious. → She was delicious./Jane ate the apple. → She ate the apple (see Online Supplemental Materials, Appendix D). Next, in a second study ostensibly about visual information recollection, participants watched the 1-min version of the Heider–Simmel illusion of simple geometric shapes, and then wrote a description of what they saw in the video. Finally, participants provided demographic information.

Heider–Simmel Illusion Task. In this task, participants watch an abstract film of simple geometrical shapes moving around (Heider & Simmel, 1944). Viewers commonly attribute human characteristics, such as emotional states, to these shapes when they are asked to describe their movements (Heberlein & Adolphs, 2004). We content analyzed the descriptions to create two different measures of anthropomorphism. For the first measure, consistent with previous research that has used this task to measure anthropomorphism tendencies (Scheele et al., 2015), two independent coders rated the extent to which the participants attributed humanlike characteristics to the shapes along a 5-point scale (1 = not at all, 5 = very much). The intercoder reliability was 0.86. For the second measure, we used the extent to which participants attributed emotional states to the moving shapes as another proxy of anthropomorphism (Fussell et al., 2008). To calculate the participants' attributions of emotional states to the moving shapes in each narrative, we used the Linguistic Inquiry and Word Count 2015 (LIWC2015) with a previously established internal English dictionary (Tausczik & Pennebaker, 2010). More specifically, we used the LIWC's affect category, which included words for all types of affective states and processes (e.g., happy, hate, anger, nervous, cry).

Results and Discussion

Data Exclusions

Data from 25 participants who did not follow the instructions of the learning task were excluded from analyses. The excluded participants either did not correctly rewrite the sentences replacing the pronouns or did not rewrite the sentences at all. Additionally, we excluded three participants because they had a technical problem and could not watch the 1-min video of moving shapes. The data were analyzed for the remaining 119 participants.

Hypothesis Testing

We expected that participants in the treatment condition, who did not use the pronoun *it*, but instead used gendered pronouns for the nonhuman entities, would anthropomorphize more than would those in the control condition. Consistent with our prediction, participants in the treatment group ($M = 3.65$, $SD = 1.21$) attributed humanlike characteristics to the shapes more so than did participants in the control group, $M = 3.12$, $SD = 1.27$; $t(117) = 2.32$, $p = .022$, $d = .41$. Similarly, participants in the treatment condition attributed emotional states to the shapes ($M = 2.98$, $SD = 2.89$) more so than did those in the control group, $M = 1.88$, $SD = 2.97$; $t(117) = 2.04$, $p = .044$, $d = .37$. The results did not substantively change if we included all participants (no exclusions) in the analysis (see [Online Supplemental Materials, Appendix I](#)).

The first set of studies provided support for the proposition that speakers of languages that assign grammatical gender to nonhumans anthropomorphize more than speakers of languages that do not assign gender to nonhumans. We did so by comparing anthropomorphism tendencies as a function of natural differences in languages (e.g., French, Italian, English), manipulating LOA, and manipulating pronoun use via a learning task. In the next studies, we test the role grammatical gender plays in shaping anthropomorphism tendencies in gendered languages. Specifically, we test whether the salience of grammatical gender influences anthropomorphism tendencies by measuring (Study 3a) and manipulating (Studies 3b and 4) grammatical gender salience.

Study 3a: Grammatical Gender and Human–Nonhuman Categorization

In Study 3a, we operationalized the salience of grammatical gender using a categorization task. People organize and classify objects based on perceived attribute similarities, which is the basis of taxonomic categorization ([Rosch, 1975](#)). For example, if people are given the quadruplet *man/table/woman/piano* and are asked which two go together, the choice *man/woman* and *table/piano* suggests a taxonomic categorization organized around a human–nonhuman distinction (animacy dimension). However, cognition and reasoning styles differ depending on the context, and language can influence the way people group objects ([Ji et al., 2004](#)). Grammatical gender can act as a perceptual cue in gendered languages ([Cubelli et al., 2011](#)), and thus another viable grouping for French speakers is to categorize the quadruplet *man/table/woman/piano* by grammatical gender. Thus, French speakers might choose a categorization such as *man/piano* and *woman/table*, because the French language assigns the masculine grammatical gender to man (*le homme*) and piano (*le piano*), and the feminine grammatical gender to woman (*la femme*) and table (*la table*).

To the extent that spontaneous categorization by grammatical gender reflects the salience of grammatical gender, then we would expect categorizing by grammatical gender (vs. human–nonhuman) would positively predict anthropomorphism tendencies.

Method

Participants and Design

We planned our sample based on the effect size of the pilot study of the differences in anthropomorphism between French and English participants ($d = .41$). An a priori power analysis using

G*Power yielded a sample size recommendation of 190 for .80 power and $p = .05$. Participants ($N = 200$) were French and native French-speaking members of the Prolific U.K. online panel (87 women, 112 men, 1 other; $M_{\text{age}} = 30.78$, $SD = 10.65$). The design was a one-factor study in which the categorization type (grammatical gender vs. human–nonhuman distinction) was measured. The study was conducted in French.

Procedure and Measures

Participants completed the categorization task (described next), which served as our measure of accessibility of grammatical gender. Following the categorization task, participants completed a six-item measure of anthropomorphism adapted from [Neave et al. \(2015\)](#), measured along a 7-point scale. A pretest indicated that the items loaded on one factor ($\alpha = 0.79$). Examples of items include “I sometimes wonder if my computer deliberately runs more slowly after I have shouted at it,” “On occasion, I feel that the weather conditions are being deliberately bad in order to ruin a social event.” The order of the categorization task and the anthropomorphism questionnaire was randomized. After completing the categorization task and answering the anthropomorphism questionnaire, participants completed an attention check question, which also served as a measure of French proficiency. The question was posed in French “Combien font treize moins quatre?” (What is 13 minus 4?). Participants then indicated their age, gender, mood, and native language. Mood, gender, and age did not affect the results.

Categorization Task. Participants were given a list of 12 nouns (e.g., man, piano, woman, chair) and asked to form two categories according to their criterion of choice. The presentation order of the nouns was randomized. Of those nouns, we crossed whether they were human or nonhuman, and whether their grammatical gender (based on the article) was masculine or feminine. Thus, six were human and six were nonhuman; six had a masculine grammatical gender and six had a feminine grammatical gender. Participants dragged the randomly listed 12 nouns into two pre-designed boxes that were labeled as Category One and Category Two. Based on the way participants categorized the 12 nouns, we labeled their categorization as based on the gender of the nouns, based on the human–nonhuman distinction, or other (see [Online Supplemental Materials, Appendix E](#), for full details of stimuli and coding).

Results and Discussion

Data Exclusions

Data from four participants who failed the attention check or indicated a language other than French as their native language were excluded from analyses. The data were analyzed for the remaining 196 participants.

Hypothesis Testing

We expected the salience of grammatical gender to predict anthropomorphism tendencies. To test this hypothesis, we first coded whether participants categorized by the human–nonhuman distinction, by grammatical gender, or other. Of the 196 participants, 139 categorized the entities according to the human–nonhuman distinction, 45 categorized according to grammatical gender, and 12 categorized in a random manner. Next, we coded categorization type

(0 = human–nonhuman, 1 = grammatical gender), excluded those who characterized by other, and regressed categorization type on the anthropomorphism score. As expected, categorization type significantly predicted individuals' anthropomorphism tendencies, $\beta = .19$, $t(182) = 2.55$, $p = .012$. Moreover, the vast portion (71%) of the participants categorized according to the human–nonhuman distinction, suggesting that grammatical gender does not override nonlinguistic ways of categorization, and French speakers mostly do categorize entities as one would expect to see for speakers of a natural gender language. However, the current results also indicate that grammatical gender can serve as a categorization cue, and to the extent that it is salient in categorization judgments, it is correlated with higher anthropomorphism tendencies. However, given that salience is measured, we do not know whether it is the salience of grammatical gender that affects anthropomorphism tendencies, or vice versa. We address this issue in Study 3b.

Study 3b: Manipulating the Salience of Grammatical Gender

In the previous study, we measured the salience of grammatical gender based on the categorization type. In this study, to provide causal evidence, we manipulated grammatical gender salience by manipulating whether participants categorized the same 12 nouns used in Study 3a, either by grammatical gender or human–nonhuman distinctions. We expected that participants who categorized by grammatical gender (vs. human–nonhuman) would score higher on a measure of anthropomorphism.

Method

Participants and Design

We used the same logic as Study 3a to determine the sample size. Participants ($N = 200$) were French and native French-speaking members of the Prolific U.K. online panel (90 women, 106 men, 5 other; $M_{\text{age}} = 28.51$, $SD = 9.17$) who were randomly assigned to conditions in a one-factor (categorization type: grammatical gender, human–nonhuman distinction) between-subjects design. The study was administered in French.

Procedure and Measures

Participants first completed the categorization task that manipulated accessibility of grammatical gender. Participants were instructed to drag the randomly listed 12 nouns into two predesigned boxes, either based on the grammatical gender or human–nonhuman distinction, depending on the condition. Following the categorization task, participants completed the same measure of anthropomorphism used in Study 3a ($\alpha = .74$). Next, participants answered a series of questions that included the same attention check question used in Study 3a. Participants then indicated their age, gender, mood, and native language. Mood, gender, and age did not affect the results.

Results and Discussion

Data Exclusions

Data from 17 participants who failed either the attention check, did not follow the categorization task instructions, or indicated a

native language other than French were excluded from analyses. The data were analyzed for the remaining 183 participants.

Hypothesis Testing

We expected that increasing the salience of grammatical gender would increase anthropomorphism, and thus participants in the grammatical gender (vs. human–nonhuman distinction) categorization condition would exhibit higher levels of anthropomorphism. Consistent with this prediction, participants who categorized by grammatical gender scored higher on the anthropomorphism scale ($M = 2.64$, $SD = 1.25$) than did those who categorized by the human–nonhuman distinction, $M = 2.17$, $SD = 0.99$, $t(181) = 2.79$, $p = .006$, $d = .42$. The results did not substantively change if we included all participants (no exclusions) in the analysis (see [Online Supplemental Materials, Appendix I](#)).

Study 3b provides further evidence on the relation between the salience of grammatical gender and anthropomorphism tendencies, and more importantly, it shows that the salience of grammatical gender makes individuals see nonhuman entities in more human terms. However, one potential shortcoming of the experiment is that the task might have come across as unnatural (e.g., asking participants explicitly to focus on the human–nonhuman vs. grammatical gender distinction) and could have led to a demand effect when they answered questions about their anthropomorphism tendencies. To address this issue, in Study 4, we again manipulate the salience of grammatical gender with a different manipulation of salience and a different measure of anthropomorphism, which we believe is more ecologically valid.

Study 4

In Study 4, we used a product context in which we manipulated the salience of grammatical gender and assessed its effect on anthropomorphism. We also manipulated grammatical gender of the product to rule out possible confounds.

Method

Participants and Design

An a priori power analysis using G*Power for an ANOVA (main effects and interactions) yielded a sample size recommendation of 170 for .80 power, $d = .42$ (effect size of the previous study), and $p = .05$. However, given that the effect size of the previous study captures only the effect of grammatical gender salience and not its type (masculine vs. feminine), we increased the sample size to be conservative. Accordingly, 240 French and native French-speaking members of the Prolific U.K. online panel (106 women, 128 men, 6 other; $M_{\text{age}} = 29.72$, $SD = 10.17$) participated in the study and were randomly assigned to conditions in a 2 (grammatical gender: salience: high, low) \times 2 (grammatical gender: masculine, feminine) between-subjects design. The study was conducted in French.

Procedure and Measures

Participants were told that they would be participating in a study to evaluate a new generation product. They were presented with a three-page brochure of a robot vacuum cleaner of a fictitious brand "Netto." Grammatical gender was manipulated by slightly varying the product category. In the masculine condition, the robot vacuum

cleaner was introduced as a “device,” which is masculine in French (*un appareil*), whereas in the feminine condition, it was introduced as a “machine,” which is feminine in French (*une machine*). The salience of grammatical gender was manipulated with the pronouns referring to the product. In the high salience condition, we used the subject pronouns, consistent with the grammatical gender of the product (e.g., *il* or *elle*). In the low salience condition, we used the demonstrative pronoun to refer to the product (e.g., *ça*; see Appendix G of the Online Supplemental Materials for full details of the scenario).

Next, participants were asked to answer five questions concerning the robot vacuum cleaner featured in the product brochure that served as the dependent measure of anthropomorphism: the extent to which Netto is intelligent, is capable of thinking on its own, is like a person, acts like a human, and can have feelings (1 = strongly disagree, 7 = strongly agree; $\alpha = 0.75$). Participants then completed the same attention check measure used in the previous studies, and indicated their age, gender, mood, and native language. Mood, gender, and age did not affect the results.

Results and Discussion

Data Exclusions

Data from five participants who failed the attention check or indicated a language other than French as their native language were excluded from analyses. The data were analyzed for the remaining 235 participants.

Hypothesis Testing

A 2 (grammatical gender salience) \times 2 (grammatical gender) ANOVA yielded only a main effect of grammatical gender salience, $F(1, 231) = 13.64, p < .001, \eta^2 = .056$. As predicted, participants in the high salience condition were more prone to attribute human characteristics to the robot vacuum cleaner ($M = 2.64, SD = 1.12$) than were participants in the low salience condition, $M = 2.15, SD = 0.93, t(233) = 3.66, p < .001, d = .46$.

The findings of Study 4 again show that the salience of grammatical gender of a particular nonhuman noun influences individuals' anthropomorphism of the nonhuman in question. When the salience of grammatical gender of a nonhuman noun was high (vs. low), individuals attributed humanlike characteristics to a greater extent to the nonhuman robot. These results show that grammatical gender can act as a situational anthropomorphism prime.

Study 5: Grammatical Gender and Anthropomorphism of Animals

The previous studies showed that the accessibility of grammatical gender is associated with increased levels of anthropomorphism, such that training participants who are not native speakers of a gendered language to learn a new category boundary centered around the grammatical gender distinction (Study 2) and making the grammatical gender distinction more salient for speakers of gendered languages (Studies 3b and 4) increased individuals' anthropomorphism tendencies. If grammatical gender influences anthropomorphism tendencies, then the attribution of humanlike characteristics to nonhuman entities should be consistent with

different stereotypical associations speakers have with both grammatical genders.

Study 5 used animals as stimuli to test whether grammatical gender of an animal noun (masculine vs. feminine) acts as a cue that facilitates attributing human gender roles to nonhuman entities. In gendered languages, the grammatical gender of nonhuman nouns is orthogonal to their semantic connotations (Corbett, 1991). However, for human nouns, their membership to grammatical gender categories is determined by their biological sex or gender identity. In the case of animals, although an animal can be biologically male or female, the semantically arbitrary assignment of grammatical gender applies to animal nouns as well. For example, although biologically speaking, a giraffe can be male, and a beaver can be female, in French, “giraffe” (*la girafe*) is a grammatically feminine noun, whereas “beaver” (*le castor*) is a grammatically masculine noun. We argue that if grammatical gender serves as a facilitator of anthropomorphism, then native French speakers should assign humanlike characteristics to nonhuman entities in line with gender traits associated with grammatical gender. Therefore, they should be more likely to view nonhuman entities taking the feminine grammatical gender in female human roles, and similarly, for those taking the masculine grammatical gender in male human roles. More specifically, French speakers should be more likely to assign an animal to the human category (i.e., anthropomorphize) when the grammatical gender of the animal and the grammatical gender of the human are congruent than when it is incongruent. We preregistered the study on OSF Registries: <https://osf.io/e85xt>.

Method

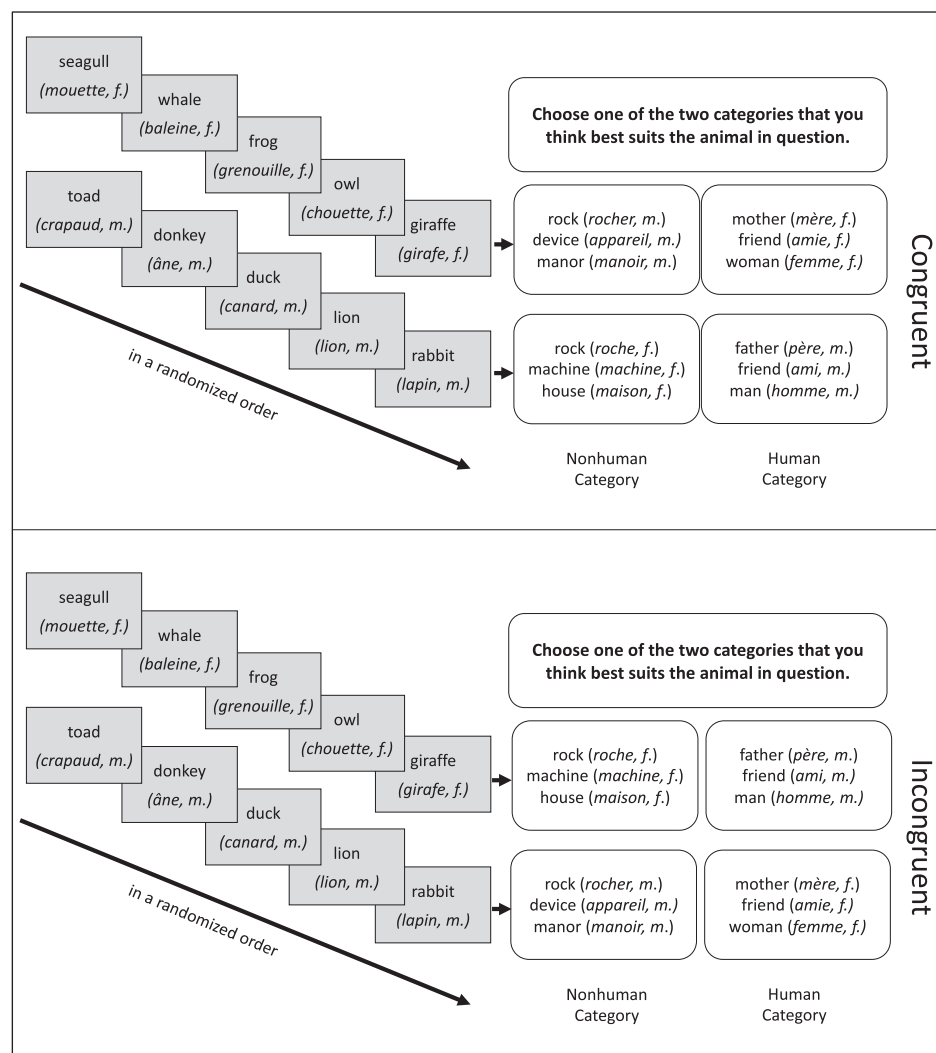
Participants and Design

We planned our sample based on the average effect size of the previous studies ($d = .39$) and studies using a similar design to test grammatical gender effects ($d = .81$, Sera et al., 2002). An a priori power analysis using G*Power yielded a sample size recommendation of 90, for .80 power, $d = .60$, and $p = .05$. However, as with the previous study, we increased the sample size to be conservative. Accordingly, we recruited 150 native French-speaking members from the Prolific U.K. research panel (61 women, 83 men, 6 other; $M_{\text{age}} = 27.98, SD = 9.29$). The design was a one-factor study in which the congruency between the grammatical gender of the target noun and that of the human noun category was manipulated (congruent vs. incongruent), with random assignment to conditions. The study was conducted in French.

Procedure and Measures

In a study ostensibly about predictions and categorizations, participants were shown 10 different animals, and asked to assign the animal in question to one of the two categories. The two categories included different nouns such that one option consisted of nonhuman nouns (e.g., home, rock, etc.), and the other option consisted of human nouns (e.g., mother, father, etc.; see Figure 1 for the full list). We manipulated the grammatical gender congruency between the target animal noun and the nouns in the human category. In the congruent condition, the option featuring the human nouns had the same grammatical gender as the animal in question, whereas the nonhuman nouns option consisted of nouns with the opposite grammatical

Figure 1
Illustration of the Experimental Setup (Study 5)



gender. In contrast, in the incongruent condition, the option featuring the human nouns had the opposite grammatical gender of the animal noun and the nonhuman nouns option consisted of nouns with the same grammatical gender (see Figure 1).

After being assigned to one of the two conditions, participants were asked to choose one of the two categories that they think best suits the animal in question. Each participant categorized the same 10 animals (one per page and in a random order). Five of the animals had the masculine grammatical gender (toad, donkey, duck, lion, rabbit) and the other five had the feminine grammatical gender (seagull, whale, frog, owl, giraffe). To make our test more conservative and to minimize demand effects, we did not include grammatical gender information for either the animal nouns or for the nouns in the two categories (human, nonhuman). Furthermore, different from Study 2 and Study 3b, the instructions did not mention the grammatical gender dimension or the human–nonhuman distinction. We created a composite anthropomorphism score by coding whether participants assigned the animals to either the nonhuman (coded as 0) or human

(coded as 1) categories, and averaging the total, with the higher composite scores indicating greater propensity of associating the animal with human characteristics (i.e., anthropomorphism). Participants then answered an attention check question (please leave this question empty if you are reading this statement) and indicated their gender, age, and native language.

Results and Discussion

Data Exclusions

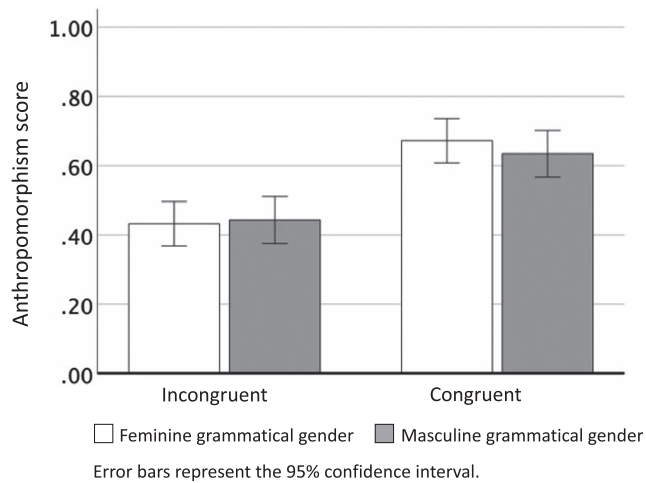
Data from one participant who indicated a language other than French as her native language were excluded from analyses. The data were analyzed for the remaining 149 participants.

Hypothesis Testing

We expected that grammatical gender would facilitate the attribution of human characteristics to nonhumans such that participants

Figure 2

Anthropomorphism Scores as a Function of Congruency and Grammatical Gender (Study 5)



would be more likely to assign the animal noun to the human category when the grammatical gender of the animal noun and that of the nouns in the human category are congruent than when they are incongruent. Consistent with our prediction, participants in the congruent condition were more likely to assign the animals to the human category ($M = 0.65$, $SD = 0.24$) than were participants in the incongruent condition, $M = 0.44$, $SD = 0.26$; $t(147) = 5.24$, $p < .001$, $d = .83$. When we treated grammatical gender as a within-subjects variable, there was no difference between individuals' anthropomorphism of animals taking the feminine and the masculine grammatical gender (the interaction was not significant, $p = .29$; see Figure 2). Overall, the results support our hypothesis that grammatical gender of nonhuman nouns facilitates the attribution of human characteristics to nonhumans and French speakers tend to attribute female and male human roles consistent with the nonhuman nouns' grammatical gender.

General Discussion

The concept of anthropomorphism has been around for centuries. It is considered a natural human tendency that everyone displays to some degree. However, this tendency to spontaneously attribute human characteristics to nonhuman entities varies across individuals, cultures, and situations. In the present research, we questioned what makes some individuals more likely to anthropomorphize than others. We identified the grammatical gender system of a language as an antecedent of anthropomorphism. Although assignment of grammatical gender is typically semantically arbitrary, research has shown that grammatical gender nevertheless nonconsciously affects judgments in gender-stereotypical ways (Boroditsky et al., 2003; Boutonnet et al., 2012; Konishi, 1993; Mecit et al., 2021). In the current research, we go beyond previous research by showing that grammatical gender usage—both chronic and situational—increases more generalized anthropomorphism tendencies by making knowledge structures related to humans more accessible, which in turn affects judgments of nonhuman entities in anthropomorphic-consistent ways.

The current research provides support for these propositions. Across six studies, we showed that both chronic and situational use of grammatical gender is associated with increased anthropomorphism, and these effects are robust across different operationalizations of anthropomorphism (trait measures, categorization tasks, text analysis). In the first three studies, we demonstrated the effect in between-language contexts. The pilot study showed that native speakers of gendered languages (French, Italian) score higher on an individual difference measure of anthropomorphism than do native speakers of a natural gender language (English). Study 1 provided causal evidence of this effect by manipulating the language of administration (French vs. English) of true bilingual speakers and showing that those who completed the same individual difference measure in French scored higher on the anthropomorphism scale than did those who completed the measure in English. Study 2 also addressed issues of causality by training native English speakers, whose language does not mark gender, to assign gender to nonhuman nouns like speakers of gendered languages do, and showing that it also increases anthropomorphism.

Four additional studies provided support for the relation between grammatical gender use and anthropomorphism in within-language contexts. Study 3a used a categorization task to show that individual differences in the accessibility of grammatical gender are associated with increased levels of anthropomorphism, and Study 3b manipulated the accessibility to show the same effects. Finally, the remaining two studies showed that grammatical gender saliency influences individuals' anthropomorphism tendencies (Study 4), and facilitates the attribution of human characteristics to nonhumans consistent with the stereotypical associations elicited by grammatical gender (Study 5).

Theoretical Insights

Language and Anthropomorphism

Our research provides insights into the determinants of anthropomorphism by identifying language as a novel antecedent of anthropomorphism. Our findings suggest that grammatical gender systems influence the accessibility and content of knowledge structures when reasoning about nonhuman entities. Gendered languages, such as French, by assigning gender to both human and nonhuman entities, highlight similarities between humans and nonhumans, which we suggest results in increased tendencies to anthropomorphize nonhuman entities, compared to speakers of natural gender languages such as English. In typical anthropomorphism priming studies with English speakers, researchers often prime anthropomorphism by effectively emulating gendered grammatical gender systems, and assigning gender markers to (nonhuman) products or brands (e.g., pronouns such as he and she). In other words, what is a situational linguistic prime for speakers of a natural gender language is a constant natural linguistic prime for speakers of a gendered language, suggesting that priming the humanlike form is not essential to anthropomorphize nonhuman entities. Speakers of languages whose grammatical structure blurs the distinction between human and nonhuman categories already attribute human characteristics to nonhumans without any additional cue in their environment.

Language and Thought

Our research also adds to the larger theoretical debate as to whether and to what extent language influences thought. Our

findings are consistent with the recent empirical evidence supporting the weak version of the Sapir–Whorf hypothesis. We show that the grammatical gender system of a language can influence speakers' judgments of the human–nonhuman divide, and in turn their anthropomorphism tendencies, which confirms and extends research on the effects of grammatical gender on object descriptions (Boroditsky et al., 2003), categorization (Cubelli et al., 2011; Sera et al., 1994), and attitudes, intentions, and behaviors (DeFranza et al., 2020; Mecit et al., 2021; Prewitt-Freilino et al., 2012).

Consistent with the previous studies investigating the relativity thesis with bilingual participants (Kousta et al., 2008), we found that French–English bilingual speakers' answers differed in each of their languages (Study 1). Coupled with the finding that French speakers, without any intervention, mostly perceived and categorized entities as one would expect to see for speakers of a natural gender language (Study 3a), the current results do not provide evidence for the strong relativity thesis that speakers of different languages inherently have different conceptual representations. Testing the strong version of the hypothesis to establish cross-linguistic differences on the conceptual level also requires nonlinguistic tasks, in which the mental representations are strictly conceptual and not influenced by linguistic information. Although we demonstrated the grammatical gender effects on anthropomorphism in studies involving the use of language, in light of recent research showing that even in nonlinguistic tasks, simply being exposed to objects can activate the grammatical gender category of the object (Sato & Athanasopoulos, 2018), one would expect to observe grammatical gender effects on anthropomorphism tendencies in nonlinguistic tasks as well, suggesting potential cross-linguistic differences on the conceptual level.

Limitations and Future Research

One limitation of our research is that, apart from the inclusion of Italian as a comparison language in the pilot study, we focused primarily on comparing only two languages. We specifically chose to compare English and French speakers for several reasons, some practical. English and French are ubiquitous languages (first and tenth most commonly spoken; Dorren, 2018), and thus are relevant to a large number of individuals. Second, in terms of maximizing internal validity, we wanted to avoid issues involved with multiple translations. There were also issues of our own access to participants and language expertise. Thus, a more comprehensive study across multiple languages would be beneficial. For example, given that grammatical gender effects are more likely to occur in languages with only two grammatical genders (Maciuszek et al., 2019), such as French and Spanish (Sera et al., 1994), one avenue for future research is to test the generalizability of the effect in languages with more than two grammatical genders. That said, recent research investigating the effects of grammatical gender systems on gender prejudice (DeFranza et al., 2020) and gender equality (Prewitt-Freilino et al., 2012) compared across multiple countries (45 and 101, respectively). Thus, the generalizability of the effect, at least in terms of gender equality and prejudice, seems to be firmly established.

Another limitation is that we only compared a gendered and natural gender language, and thus did not include a genderless language in the comparison set. This omission has implications for some ambiguities in how to interpret our findings and underlying process. We proposed that the differences in anthropomorphism between speakers of gendered versus natural gender languages

occur because natural gender languages grammatically distinguish between humans and nonhumans, whereas gendered languages do not. A natural gender language such as English grammatically distinguishes between humans by using the pronoun *it* to refer to nonhumans, whereas a gendered language such as French avoids such distinguishing by gender marking all nouns and pronouns. However, consider a genderless language such as Turkish. As noted earlier, the Turkish language does not gender mark *any* words; it does not gender mark nouns, and it has only one pronoun that is used for all entities. Thus, Turkish also does not grammatically distinguish between humans and nonhumans by not grammatically marking any nouns or pronouns, rather than gender marking all nouns and pronouns, as in French.

Consequently, our current research cannot determine whether the grammatical anthropomorphism is driven by the presence of gender markers or the lack of a grammatical distinction between humans and nonhumans (or both). Based on the findings of the last three studies, which manipulated the salience of grammatical gender, the presence of grammatical gender markers clearly plays a role, and conducting a similar test in a genderless language would be impossible. However, if the grammatical distinction versus lack of distinction also drives the effect, then speakers of genderless languages should also anthropomorphize more than speakers of natural gender languages. Future research would benefit from testing whether the absence of grammatical distinction leads to similar anthropomorphism tendencies and shed light on the process.

Conclusion

Although the debates surrounding the linguistic relativity hypothesis are far from resolved (Pinker, 2007), accumulating literature on the effects of grammatical gender supports the weak version of the hypothesis—that language can shape thought by orienting attention toward gender-related concepts. Our findings are consistent with this research, but push the boundaries of these effects by showing that grammatical gender usage influences more generalized tendencies to view nonhuman entities in human terms. Thus, grammatical gender appears to not only orient attention toward gender-related qualities of a nonhuman entity, but also influences perceptions of nonhuman entities in terms of other characteristics that are typically associated only with humans. These findings, therefore, go beyond previous research in showing that the presence of a linguistic category can alter the perception of the natural divide between humans and nonhumans by virtue of pushing all entities into same gender classes. Although language cannot change the reality, by providing ways of categorization for otherwise unrelated concepts, it can influence how one perceives and mentally represents the constructions of reality, even when they concern fundamental differences and boundaries, like that between humans and nonhumans.

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