Can Quirks of Grammar Affect the Way You Think? Grammatical Gender and Object Concepts

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Abstract

Can the language you speak affect the way you think? Unlike English, many languages have a grammatical gender system whereby all nouns are assigned a gender. Does talking about inanimate objects as if they were masculine or feminine actually lead people to think of inanimate objects as having a gender? A series of studies found effects of grammatical gender on people's perceptions of similarity between objects and people. This was true even though the tasks were performed in English (a language devoid of grammatical gender), even when the tasks were non-linguistic (e.g., rating similarities between unlabeled pictures), and even while subjects were engaged in a verbal interference task. Finally, results showed that cross-linguistic differences in thought can be produced just by grammatical differences and in the absence of other cultural factors.

Introduction

Humans communicate with one another using a dazzling array of languages, and each language differs from the next in innumerable ways (from obvious differences in pronunciation and vocabulary to more subtle differences in grammar). For example, to say that "someone ate the cheese" in English, we must include tense - the fact that the event happened in the past. In Russian, the verb would also have to include whether the cheese-eater was male or female, and whether said cheese-eater ate all of the cheese or just a portion of it. Speakers of different languages have to attend to and encode strikingly different aspects of the world in order to use their language properly (Sapir, 1921; Slobin, 1996).

Yet despite all these differences, speakers of all languages inhabit very similar bodies, and need to communicate about very similar physical worlds. This has lead some scholars to argue that speakers of different languages vary only in their speaking, and not in their thinking. Beyond the surface structure of languages, the argument goes, lies a universal language of thought (Fodor, 1975).

The question of universality of mental representations (whether or not speakers of different languages think differently about the world) has long been at the center of controversy attracting scholars from Plato to Chomsky, but despite much attention and debate, definitive answers have not been forthcoming. Findings presented in this paper suggest that people's mental representations of the world are not universal. Even people's ideas about concrete objects can be shaped by implementational quirks of their languages.

Grammatical Gender

Unlike English, many languages have a grammatical gender system whereby all nouns (e.g., penguins, pockets, and toasters) are assigned a gender. Many languages only have masculine and feminine genders, but some also assign neuter, vegetative, and other more obscure genders. When speaking a language with grammatical gender, speakers are required to mark objects as gendered through definite articles, gendered pronouns, and often need to modify adjectives or even verbs to agree in gender with the nouns. Could the grammatical genders assigned to objects by a language influence people's mental representations of objects?

Forks and frying pans do not (by virtue of being inanimate) have a biological gender. The perceptual information available for most objects does not provide much evidence as to their gender, and so conclusive information about the genders of objects is only available in language (and only in those languages that have grammatical gender). It is possible that language has the greatest influence on thought in abstract domains like grammatical gender – ones not so reliant on sensory experience (Boroditsky, 2000; 2001). For example, people's subjective conception of time (say as a vertical or a horizontal medium) is not constrained by sensory experience, and appears to vary across languages and cultures (see Boroditsky, 2000; 2001 for further discussion).

This paper examines whether people's mental representations of objects are influenced by the grammatical genders assigned to the objects' names in their native language.

But Isn't Grammatical Gender Arbitrary?

The assumption that grammatical gender has no meaning is widespread in the field. For example, the purely grammatical nature of grammatical gender has been a key (though untested) assumption in the recent debate about the tip-of-the-tongue phenomenon (Caramazza & Miozzo,

1997; Vigliocco et al., 1997). Indeed, a priori, there are several reasons to think that people would not take grammatical gender as meaningful. First, the assignment of grammatical gender to object names often appears to be semantically arbitrary (and sometimes downright absurd).

As Mark Twain noted, "In German, a young lady has no sex, while a turnip has…a tree is male, its buds are female, its leaves are neuter; horses are sexless, dogs are male, cats are female... tomcats included." Further, the grammatical genders assigned to names of particular objects vary greatly across languages (Braine, 1987). For example, the sun is feminine in German, but masculine in Spanish, and neuter in Russian. The moon, on the other hand, is feminine in Spanish and Russian, but masculine in German.

On the other hand, there are also reasons why we might expect people to take grammatical gender as meaningful. First, since many other grammatical distinctions reflect differences that are observable in the world (the plural inflection, for example), children learning to speak a language with a grammatical gender system have no a priori reason to believe that grammatical gender doesn't indicate a meaningful distinction between types of objects. Indeed, many adult philosophers throughout history have thought that grammatical gender systems were a reflection of the essential properties of objects, and even took a considerable amount of pride in the thought that the natural genders of objects would be captured in the grammatical subtlety of their language (Fodor, 1959). Children learning a language may make similar (though perhaps less patriotically minded) hypotheses.

Second, since most children grow up learning only one language, they have no opportunity to perform the comparative linguistics necessary to discover the seemingly arbitrary nature of grammatical gender assignment. For all they know, the grammatical genders assigned by their language are the true universal genders of objects. Finally, speakers of languages with grammatical gender must mark gender almost every time they utter a noun (hundreds or thousands of times a day). The sheer weight of repetition (of needing to refer to objects as masculine or feminine) may leave its semantic traces, making the objects' masculine or feminine qualities more salient in the representation.

Can Grammatical Gender Affect Concepts?

We hypothesize that the grammatical genders assigned to objects by a language influence people's mental representations of objects.

Experiment 1: Picture Similarity

Experiment 1 was designed to test whether an objects' name being grammatically feminine or masculine in a language leads speakers of that language to think of the object itself as more like a male or female. Spanish and German speakers were asked to rate the similarity of objects and animals to human males and females. All subjects were tested in English, all items were presented as unlabeled pictures, and all of the objects and animals chosen for this study had opposite grammatical genders in Spanish and German. We hypothesized that same-gender pairs would be rated as more similar.

Participants Twenty-two Spanish-English bilinguals, and thirty-three German-English bilinguals participated in the study on a volunteer basis. Participants ranged in age from 17 to 69 years (M=32.9 yrs old). All of the Spanish and German speakers considered Spanish and German (respectively) to be their native language, but both groups were highly proficient in English and had an average of 15.9 years of experience with English (16.4 years for German speakers, and 15.4 years for Spanish speakers).

Materials Materials used in this study comprised 14 pictures of objects and animals, and 8 pictures of people. Of the pictures of people, 4 were pictures of females (a woman, a ballerina, a bride, and a girl), and 4 were pictures of males (a man, a king, a giant, and a boy). Of the objects, half were items whose names are masculine in German but feminine in Spanish (toaster, moon, spoon, broom, whale, frog, fox), and half were items whose names are feminine in German, but masculine in Spanish (clock, sun, fork, toothbrush, mouse, snail, cat). The pictures of objects and animals were chosen such that they had a single dominant label in both Spanish & German which had opposite genders in the two languages.

Each participant provided a similarity rating for every possible person—object comparison (a total of 112) on a scale of 1 (not similar) to 9 (very similar). A new random order for the comparisons was generated for each subject.

Spanish and German speakers completed the same experimental task, and both groups completed the task in English. Participants read the following instructions "In this study, you will see pairs of pictures appear on the screen. In each pair, there will be a picture of a person on the left and a picture of an object or animal on the right. Your task is to tell us how similar you think the two things being depicted are. You will see a scale where 1=not similar and 9= very similar. For each pair of pictures, please choose a number between 1 and 9 to indicate how similar you think the two things are. Please use the whole scale (give some 1's and some 9's and some of all the numbers in-between)."

Procedure Participants were tested individually. A computer presented the experimental materials and recorded the participants' responses. Each pair of pictures remained on the screen until a participant made a response. Participants made responses by clicking on one of the boxes (numbered 1 through 9) on the screen to signify a similarity score.

Results and Discussion Subjects found greater similarity between people and objects of matching gender than between people and objects of non-matching gender (by subjects: $t = 3.08$, $df = 42$, $p < .0018$; by items: $t = 4.62$, $df = 7$, $p = .0012$). This suggests that Spanish and German speakers indeed end up thinking about objects as more similar to biological males and females, depending on the object's grammatical gender in their native language.

Experience with a language that uses grammatical gender appears to bias one's representations of objects. This raises a further question: what would happen if a person spoke two languages that gave opposite grammatical genders to an object? Would the discovery that grammatical genders can vary lead people to discount grammatical gender biases? Would people stick with the biases of whichever language they learned first?

Experiment 2: Spanish-German Bilinguals

To investigate these questions, Experiment 2 tested people who spoke both Spanish and German in the same similarity task as described in Experiment 1.

Participants Thirty-six Spanish-German bilinguals who were also fluent in English participated in the study on a volunteer basis. Each participant had some experience with both Spanish & German, and all were also proficient in English. Participants had an average of 23.1 years of experience with Spanish (ranging from 1 to 61 years), an average of 26.1 years of experience with German (ranging from 1 to 67 years), and an average of 21.5 years of experience with English (ranging from 2 to 62 years). On a scale of 1 (not fluent) to 5 (very fluent), participants rated themselves on average 4.19 in Spanish, 4.27 in German, and 4.28 in English.

Materials and Procedures Materials and Procedures were the same as in Experiment 1.

Results and Discussion For each subject, a similarity-rating score was calculated by taking their average similarity rating for gender-consistent pairs (relative to Spanish), and subtracting their average similarity rating for gender-inconsistent pairs. Since all objects used had opposite genders in Spanish & German, a resulting positive score would indicate a Spanish bias in similarity ratings, and a negative score would indicate a German bias. Each subject's relative language skill was calculated by subtracting their German-fluency score (provided on a scale of 1= not fluent to 5=very fluent) from their Spanish-fluency score. Again, a positive number indicated higher relative proficiency in Spanish, and a negative number indicated higher relative proficiency in German.

There was a significant positive correlation between people's relative proficiency in Spanish/German and their biases in the similarity task, $r=.40$, $N=36$, $p<.01$. The more relatively proficient a subject was in Spanish, the more consistent with Spanish grammatical gender their similarity ratings. And the more relatively proficient a subject was in German, the more consistent with German grammatical gender their similarity ratings. Subjects' relative skill in the two languages was the best predictor of their similarity scores, faring better than whether one was born in a Spanish or German speaking country ($r=.325$, $N=36$, $p<.05$), and which of the two languages one has known for a longer amount of time ($r=.158$, $N=36$, $p=.178$).

Experiment 3: Verbal Interference

We repeated Experiment 1 with the addition of a verbal interference task, in order to rule out the hypothesis that the effect is due to the subjects subvocally naming the objects.

Participants Seven Spanish-English bilinguals and seven German-English bilinguals participated in the study in exchange for payment. Both groups were highly proficient in English and had an average of 17.04 years of experience with English (19.57 years for German speakers, and 14.5 years for Spanish speakers). None of the Spanish speakers spoke German and none of the German speakers spoke Spanish. None of the subjects had a self-rated proficiency greater than 2 (on a scale of 1 to 5, where 5 is fluent) in any other languages that use grammatical gender.

Materials All of the similarity task materials were exactly the same as in Experiment 1. In addition to the similarity task, subjects performed a verbal shadowing task. A computer played an audio-stream of randomly generated English letters at a speed of 1 per second, and subjects were asked to repeat each letter aloud as it was played.

Procedure The procedures were similar to Experiment 1 with the following changes. Subjects were asked to perform the shadowing task described above the entire time that they were rating similarities. Subjects' verbal shadowing performance was recorded by a tape-recorder. Just as in Experiment 1, all of the participants were tested in English with English instructions.

Results and Discussion Verbal interference did not change Spanish and German speakers similarity ratings. Just as in Experiment 1, Spanish and German speakers rated person—object pairs more similar when the grammatical gender of the object's name in their native language was consistent with the biological gender of the person in the comparison ($M=3.15$) than when the two genders were inconsistent ($M=2.98$), $t=2.20$, $df=13$, $p<.05$ (by subjects). This interaction between person-gender and object-gender was also confirmed in a 2 x2 repeated measures ANOVA (2 person gender X 2 object-gender), $F(1, 13)=4.85$, $p<.05$ (by subjects). Because all of the objects chosen for this study had opposite genders in Spanish and German, Spanish and German speakers rated opposite pairs as more similar. This was confirmed by a 3-way interaction of person-gender, object-gender (relative to one of the languages), and native language, $F(1, 12)=4.77$, $p<.05$ (by subjects).

Comparing the results of Experiments 1 and 3, there was no effect of the verbal interference task on the effect of gender-consistency as confirmed by a lack of consistency by interference interaction in a 2x2 repeated measures ANOVA (2 (gender consistent or inconsistent) X 2 (interference (Exp. 6) or no interference (Exp. 4)), $F(1,67)=.075$, $p=.786$ (by subjects), and $F(1,26)=.073$, $p=.789$ (by items). The same analysis confirmed an overall main effect of grammatical gender consistency both by subjects ($F(1, 67) = 8.18$, $p<.01$) and by items ($F(1,26) = 7.57$, $p<.02$ across the two experiments.

Finally, participants in the interference condition performed at an average of 90% correct on the shadowing task. This confirms that the failure of the verbal interference manipulation to override the effect of consistency was not due to the subjects' failure to engage in the shadowing task.

These findings once again indicate that people's thinking about objects is influenced by the grammatical genders their native language assigns to the objects' names. A further question is whether such differences in similarity can be obtained just by differences in grammar, and without concomitant cultural differences.

Experiments 4 and 5: Gumbuzi Similarity

Experiment 4 was designed to test whether grammatical gender in a language can indeed exert a causal power over thought without intermediary cultural factors. Native English speakers were taught about the soupative/oosative distinction in the fictional Gumbuzi language. Participants were shown pictures of males and females along with many inanimate objects and were taught which would be considered soupative and which oosative in Gumbuzi. The soupative/oosative distinction always corresponded to biological gender (all females were in one category and all males in the other) but also extended to inanimate objects. A given participant might have learned that pans, forks, pencils, ballerinas, and girls are soupative, while pots, spoons, pens, giants, and boys are oosative.

After participants had mastered the oosative/soupative distinction, they rated the similarity of each person-object pair, much like the Spanish and German speakers in Experiment 1. Experiment 5 adds verbal inteference condition. We hypothesized that with or without interference, same-gender pairs would be rated as more similar.

Participants Twenty-two native English speakers participated in the study in exchange for payment. Twelve of these participated in the verbal interference version of the task, while the remaining ten did not do the verbal interference.

Materials A set of 20 pictures was constructed to include 8 pictures of people and 12 pictures of inanimate objects. The inanimate objects were chosen in pairs such that the members of each pair were quite similar to each other (e.g., fork and spoon, pen and pencil, bowl and cup, guitar and violin, apple and pear, pot and pan). The members of each pair were assigned to different grammatical categories (if "pot" was oosative, "pan" would be soupative). This was done so that participants had to pay attention to the particulars of each object and couldn't simply develop a heuristic like "kitchen things are soupative" or "fruits are oosative". Pears, forks, violins, pots, pens, and cups were said to be oosative, and apples, spoons, guitars, pans, pencils, and bowls were said to be soupative.

The pictures of people included 4 pictures of males (a man, a boy, a giant, and a king), and 4 pictures of females (a woman, a girl, a ballerina, and a bride). For half of the participants the females were said to be oosative and the males soupative, and for the other half it was the reverse. This meant that each inanimate object was grouped with females for half of the participants, and with males for the other half. Overall, each participant learned to classify 20 pictures into two categories (oosative or soupative) with each category containing 4 pictures of people of the same gender and 6 pictures of inanimate objects.

Procedure Participants read the following instructions: "In this study you will learn a bit about the Gumbuzi language. In Gumbuzi, there are two different words for 'the.' For example, in order to say 'the chair' you would say 'sou chair,' and in order to say 'the table' you would say 'oos table.' This is called the oosative/soupative distinction. Some nouns are always preceded by 'sou' and some are always preceded by 'oos.'" Participants were then shown pictures on a computer screen one at a time with each picture accompanied by a label (a picture of a pear for example would be accompanied by "oos pear").

After they had seen all the items three times, they were tested on how well they had learned the oosative/soupative distinction. Participants were shown the pictures one at a time and had to indicate whether each item would be considered oosative or soupative in Gumbuzi by pressing one of two keys on a keyboard. If they answered correctly, the computer went on to the next item. If they answered incorrectly, it beeped and waited for them to provide the correct answer. Participants were tested until they could answer all twenty items correctly in a row.

After they had learned the oosative/soupative distinction perfectly, participants proceeded to the similarity-ratings portion of the study. Just as the Spanish & German speakers in Experiments 1-3, participants rated the similarity of every possible person—object pair (a total of 96 comparisons) on a scale of 1 (not similar) to 9 (very similar). The computer generated a random order of pairs for each subject. Each pair was kept on the screen until the participant made their response by pressing one of the number keys on the keyboard. One group of participants performed the similarity-ratings task on its own, while another rated similarities while at the same time performing the verbal interference task described in Experiment 3.

Results and Discussion Just as the Spanish and German speakers, participants in this study rated person—object pairs more similar when they were consistent in gender ($M=4.43$) than when the two genders were inconsistent ($M=3.79$), $F(1,11)=26.8$, $p<.001$ (by items), $F(1,20)=7.14$, $p<.05$ (by subjects). The effect was present equally for both the verbal shadowing and the non-shadowing groups: without verbal shadowing $M=4.63$ when the genders were consistent and $M=3.97$ when they were inconsistent, $t=3.24$, $df=11$, $p<.01$, and with verbal shadowing $M=4.27$ when the genders were consistent and $M=3.65$ when they were inconsistent, $t=4.24$, $df=11$, $p<.001$. There was no effect of the shadowing task on the effect of consistency as confirmed by a lack of consistency by shadowing interaction in a 2x2 repeated measures ANOVA (2 (consistent or inconsistent) X 2 (shadowing or no shadowing)), $F(1,20)=.005$, $p=.942$ (by subjects), and $F(1,11)=.019$, $p=.892$ (by items). Finally, participants in the

shadowing condition performed at an average of 96% correct on the shadowing task. This confirms that the failure of the verbal shadowing manipulation to override the effect of consistency was not due to the subjects' failure to engage in the shadowing task.

These results show that the effects of grammatical gender on object representations can be produced in the absence of culture, even under verbal interference.

Discussion Beyond demonstrating that learning linguistic categories can affect people's descriptions of objects or similarity ratings,

General Discussion

These findings suggest that people's ideas about the genders of objects can indeed be influenced by the grammatical genders assigned to those objects in a language. Further, this effect can be produced just by grammatical differences and in the absence of other cultural factors it is important to consider how learning such categories can have this effect.

One possibility is that in order to make sense of the grammatical categories they encounter in language (or in the lab) people deliberately look for similarities between items assigned to the same grammatical category. If a meaningful and consistent set of similarities is discovered, these similarities can then be stored (or perhaps the features that are relevant to the similarity can be made more salient in the representation), and this would explain both the increased within-category similarity reported in this paper and the bias in descriptions observed in the earlier studies (Boroditsky & Schmidt, 2000; under review). This type of mechanism is supported by recent findings suggesting that comparison leads to an increase in similarity (so long as the items being compared make it possible to discover meaningful similarities) (Boroditsky, under review; see also Gentner & Namy, 1999; Lowenstein & Gentner, 1998).

One interesting question is how learning what we've called here a "grammatical category" can change people's ideas about objects. One possibility is that grammatical categories in language function just like other category names (e.g., penguin, game, etc). By calling things by the same name, or putting them in the same grammatical category, languages may invite their speakers to (not necessarily consciously) carry out comparisons that they wouldn't have otherwise carried out (or perhaps wouldn't have carried out as often or with the same goals in mind). In the process of carrying out these comparisons, people may discover meaningful similarities between objects. Any discovered similarities may then be stored or highlighted in the representations of the objects. There is no claim being made here about the specialness of language in having this effect. There are many ways to direct a person's attention to the similarities or differences of a pair of items, or to classify a group of items into two categories – language just happens to be a popular and convenient medium for doing so.

So does all this mean that language affects thought? Or, more precisely, does all this mean that thinking for speaking a particular language can have an effect on how people think even when not thinking for that same language?

The results reviewed and described in this paper demonstrate that a grammatical distinction in language has the power to bias people's memory for and their descriptions of objects and has an effect on people's ratings of similarity between pictures of objects. This is true even though people perform tasks in a language different from the one they learned the grammatical distinction in, perform tasks involving no words (just pictures), and even despite interference from a verbal shadowing task. Previous evidence also suggests that the same grammatical distinction affects people's decision making (e.g., assigning voices to animated characters), personification of nouns (as in the Russian days of the week), and ratings of object characteristics (e.g., potency). In short, speakers of different languages behave differently in a wide range of cognitive tasks in ways that are consistent with the grammatical distinctions made in their languages.

But does all this evidence mean that language affects thought? In particular, does it mean that linguistic categories (e.g., a noun being grammatically feminine or masculine) actually alter non-linguistic representations? Perhaps linguistic categories simply get recruited covertly for all these tasks, so even though speakers of different languages may exhibit different patterns in behavior, linguistic and non-linguistic representations remain truly separate, and everybody's non-linguistic representations are in fact the same.

This is an interesting possibility, and a difficult one to rule out empirically. The fact that grammatical distinctions learned in one language seem to have an effect even when a task is performed in another language may favor the view that grammatical knowledge actually plays a role in shaping the underlying non-linguistic representation (hence the ease of transfer between languages). Still, this kind of evidence does not rule out the possibility that grammatical information (even from the wrong language) is covertly recruited in all sorts of tasks that don't seem to require it. To test this further, we attempted to disable people's linguistic faculties by asking them to shadow speech while they performed the similarity-rating tasks described earlier. If effects of grammatical gender had disappeared under these verbal interference conditions, then we may have been able to infer that grammatical categories hadn't affected non-linguistic representations.

Instead, it would seem that language affected thinking in this case because people covertly invoked linguistic representations in a set of seemingly non-linguistic tasks. But it turned out that tying up the linguistic faculties had no effect on the results (that effects of grammatical gender were equally strong when subjects were under verbal interference as when not). Can we now conclude that grammatical gender definitely does affect people's non-linguistic representations? Perhaps the shadowing task simply didn't disable all of the aspects of language that could have been covertly recruited for the task? Perhaps some different, more complex verbal interference task would have changed the results. Several other tasks could be tried, but as long as the verbal interference doesn't get rid of the effect of language on thought, there will always be doubt about whether or not all of the necessary linguistic faculties

were properly interfered with. There seems to be no sure way to disable all linguistic processes (and this is not in small part due to the difficulty in deciding on what counts as linguistic and non-linguistic processing in the first place).

Fortunately, being able to discriminate between these two possibilities is not necessary here. Most likely, both possibilities are true to some degree. Regardless of the answer, it appears that language plays an important role in thinking. Whether people's native language is covertly involved in all manner of seemingly non-linguistic tasks (even despite verbal interference, in tasks conducted entirely in pictures, and in tasks conducted in other languages), or whether aspects of grammar are able to influence non-linguistic representations directly, it appears that (what we colloquially call) thinking involves a collaboration between many different linguistic and non-linguistic representations and processes. This means that the private mental lives of speakers of different languages may differ dramatically – and not only when they are thinking for speaking their particular languages, but in all manner of cognitive tasks.

Conclusions

The findings presented in this paper suggest that people's thinking about objects can be influenced by aspects of grammar that differ across languages. A series of studies found effects of grammatical gender on people's perceptions of similarity between objects and people. This was true even though the tasks were performed in English (a language devoid of grammatical gender), even when the tasks were non-linguistic (e.g., rating similarities between unlabeled pictures), and even while subjects were engaged in a verbal interference task. Finally, results showed that cross-linguistic differences in thought can be produced just by grammatical differences and in the absence of other cultural factors. It is striking that even a fluke of grammar (the nearly arbitrary assignment of a noun to be masculine or feminine) can have an effect on how people think about things in the world. Considering the many ways in which languages differ, our findings suggest that the private mental lives of people who speak different languages may differ much more than previously thought.

Acknowledgments

This research was funded by an NSF Graduate Research Fellowship to Lera Boroditsky. Partial support was also provided by NIMH research grant MH-47575 to Gordon Bower. The authors would like to thank Michael Ramscar, Herbert H. Clark, Eve Clark, Barbara Tversky, Gordon Bower, and Steven Pinker for helpful comments and insightful discussions of this research. We would also like to thank Lauren Schmidt for her foundational contributions to this research, and Jill M. Schmidt who generously contributed most of the pictures used in these studies.

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