

4

Sex, Syntax, and Semantics

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4.1 Introduction

Speakers of different languages must attend to and encode strikingly different aspects of the world in order to use their language properly (Sapir 1921; Slobin 1996). For example, to say that “the elephant ate the peanuts” in English, we must include tense—the fact that the event happened in the past. In Mandarin, indicating when the event occurred would be optional and couldn’t be included in the verb. In Russian, the verb would need to include tense, whether the peanut-eater was male or female (though only in the past tense), and whether said peanut-eater ate all of the peanuts or just a portion of them. In Turkish, one would specify whether the event being reported was witnessed or hearsay. Do these quirks of languages affect the way their speakers think about the world? Do English, Mandarin, Russian, and Turkish speakers end up thinking about the world differently simply because they speak different languages?

The idea that thought is shaped by language is most commonly associated with the writings of Benjamin Lee Whorf. Whorf, impressed by linguistic diversity, proposed that the categories and distinctions of each language enshrine a way of perceiving, analyzing, and acting in the world. Insofar as languages differ, their speakers too should differ in how they perceive and act in objectively similar situations (Whorf 1956). This strong Whorfian view—that thought and action are entirely determined by language—has long been abandoned in cognitive science. However, definitively answering less deterministic versions of the “Does language shape thought?” question has proven very difficult. Some studies have

claimed evidence to the affirmative (e.g., Boroditsky 1999, 2001; Bowerman 1996; Davidoff, Davies, and Roberson 1999; Imai and Gentner 1997; Levinson 1996; Lucy 1992; Slobin 1996); others, evidence to the contrary (e.g., [Rosch] Heider 1972; Li and Gleitman 2002).

4.2 Thinking for Speaking

In part, the “Does language shape thought?” question has been difficult to answer because it is so imprecise. A different phrasing has been suggested by Slobin (1996), who proposed replacing *language* and *thought* with *speaking*, *thinking*, and *thinking for speaking*. One advantage of this substitution is that it allows us to distinguish between what are often called linguistic and nonlinguistic thought. Basically, cognitive processes involved in accessing and selecting words, placing them in grammatical structures, planning speech, and so on, are all instances of thinking for speaking. Thinking for speaking differs from one language to another. For example, when planning to utter a verb, English speakers never need to worry about grammatical gender agreement between the verb and the subject of the sentence. By contrast, Russian speakers do need to worry about this, and so their thinking for speaking will necessarily be different from that of English speakers.

4.3 Beyond *Thinking for Speaking*

A further question to ask is whether the habits that people acquire in thinking for speaking a particular language will manifest themselves in their thinking even when they are not planning speech in that language. What if people are performing some nonlinguistic task (i.e., a task that can be accomplished through some nonlinguistic means) or thinking for a different language? For example, are native Russian speakers more likely to notice whether all or only some of the peanuts were eaten even when they’re speaking English? One way to rephrase the “Does language shape thought?” question is to ask, “Does thinking for speaking a particular language have an effect on how people think when not thinking for speaking that same language?”

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Further, how (through what cognitive mechanisms) can thinking for speaking a particular language exert influence over other types of thinking? Are some cognitive domains more susceptible to linguistic influence than others, and if so, why? For example, early work on color showed striking similarity in color memory among speakers of different languages despite wide variation in color terminology (Heider 1972; but see Davidoff, Davies, and Roberson 1999; Kay and Kempton 1984; Lucy and Shweder 1979). However, research into how people conceptualize more abstract domains like time has uncovered striking crosslinguistic differences in thought (Boroditsky 1999, 2001). Why would there be such strong evidence for universality in color perception, but quite the opposite for thinking about time? One possibility is that language is most powerful in influencing thought for more abstract domains, that is, ones not so reliant on sensory experience (Boroditsky 1999, 2000, 2001). While the ability to perceive colors is heavily constrained by universals of physics and physiology, the conception of time (say, as a vertical or a horizontal medium) is not constrained by physical experience and so is free to vary across languages and cultures (see Boroditsky 2000, 2001, for further discussion).

In this chapter, I consider an extreme point along this concrete-abstract continuum: the influence of grammatical gender on the way people think about inanimate 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 gender of objects is only available in language (and only in those languages that have grammatical gender). This chapter examines whether people's mental representations of objects are influenced by the grammatical genders assigned to these objects' names in their native language.

4.4 Grammatical Gender

Unlike English, many languages have a grammatical gender system whereby all nouns (e.g., the words that refer to 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 and gendered pronouns, and often they need to modify adjectives or even verbs to agree in gender with the nouns. Does talking about inanimate objects as if they were masculine or feminine actually lead people to think of inanimate objects as having a gender? Could the grammatical genders assigned to objects by a language influence people's mental representations of objects?

4.4.1 Why Might Grammatical Gender Be Taken as Meaningful?

A priori, there are 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. As Mark Twain noted in *A Tramp Abroad*, "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." Second, the grammatical genders assigned to names of particular objects vary greatly across languages (Braine 1987).¹ For example, the name for the sun is feminine in German, masculine in Spanish, and neuter in Russian. The name for the moon, on the other hand, is feminine in Spanish and Russian, but masculine in German.

But there are also reasons to think that people *would* take grammatical gender as meaningful. 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 reflected the essential properties of objects, and even took a considerable amount of pride in the thought that the natural genders of objects were captured in the grammatical subtlety of their language (see Fodor 1959 for a history). Children learning a language may make similar (though perhaps less patriotically minded) hypotheses. Further, 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.

4.4.2 How Could Grammatical Gender Affect Meaning?

How might people's representations of objects be affected by the grammatical gender of their labels? One possibility is that in order to efficiently learn the grammatical gender of a noun to begin with, people focus on some property of that noun's referent that may pick it out as masculine or feminine. For example, if the word for "sun" is masculine in one's language, one might try to remember this by conceiving of the sun in terms of what are perceived as stereotypically masculine properties like powerful and threatening. If the word for "sun" is feminine, on the other hand, one might focus on its warming and nourishing qualities.

Even after the grammatical genders of nouns are learned, language may influence thought during thinking for speaking (Slobin 1996). When speaking a language with grammatical gender, speakers often need to mark objects as gendered through definite articles (e.g., *le* and *la* in French), refer to objects using gendered pronouns (e.g., if the word for "fork" is masculine, a speaker might say the equivalent of *He is sharp*), and alter adjectives or even verbs to agree in gender with the nouns (e.g., in Russian, verbs in the past tense must agree in gender with their subject nouns). Needing to refer to an object as masculine or feminine may lead people to selectively attend to that object's masculine or feminine qualities, thus making them more salient in the representation.

4.4.3 Does Grammatical Gender Affect Meaning?

So, does talking about inanimate objects as if they were masculine or feminine lead people to think of them as masculine or feminine? Preliminary evidence suggests that it may (Jakobson 1966; Konishi 1993; Sera, Berge, and del Castillo 1994). In one early study, Russian speakers were asked to personify days of the week (reported in Jakobson 1966). They consistently personified the grammatically masculine days of the week (Monday, Tuesday, and Thursday) as males, and the grammatically feminine days of the week (Wednesday, Friday, and Saturday) as females, though they could not explicitly say why they did so.

In another study, German and Spanish speakers rated a set of nouns on the dimension of potency (a dimension highly associated with masculinity) (Konishi 1993). Half of the nouns were grammatically masculine in German and feminine in Spanish, and the other half were masculine in Spanish and feminine in German. Both German and Spanish speakers judged the word for "man" to be more potent than the word for "woman." Interestingly, they also judged nouns that were grammatically masculine in their native language to be more potent than nouns that were grammatically feminine. This was true even though all of the test nouns referred to objects or entities that had no biological gender (including names of inanimate objects, places, events, and abstract entities).

Converging evidence comes from a series of studies in which Spanish speakers were asked to rate pictures of objects as masculine or feminine (Sera, Berge, and del Castillo 1994). Spanish speakers consistently classified pictured objects in accordance with their grammatical gender in Spanish. The effect was more pronounced when the pictures were accompanied by their Spanish labels. The grammatical gender consistency effect also showed up when subjects were asked to attribute a man's or a woman's voice to each picture. Finally, Sera, Berge, and del Castillo found that by about second grade, Spanish-speaking children assigned voices to objects in accordance with the grammatical gender of their labels.

4.4.4 Limitations of Previous Evidence

Although results of these studies are suggestive, there are serious limitations common to these and most other studies of linguistic determinism. First, speakers of different languages are usually tested only in their native language. Any differences in these comparisons can only show the effect of a language on thinking for that particular language. These studies cannot reveal whether experience with a language affects language-independent thought such as thought for other languages or thought in nonlinguistic tasks.

Second, comparing studies conducted in different languages poses a deeper problem: there is simply no way to be certain that the stimuli and instructions are truly the same in both languages. This problem remains

even if the verbal instructions are minimal. For example, even if the task is nonlinguistic, and participants are asked simply their language's equivalent of "Which one is the same?", one cannot be sure that the words used for "same" mean the same thing in both languages. If in one language the word for "same" is closer in meaning to "identical," while in the other language it is closer to "relationally similar," speakers of different languages may behave differently, but only because of the difference in instructions, not because of any interesting differences in thought. There is no sure way to guard against this possibility when tasks are translated into different languages. Since there is no way to know that participants tested in different languages are performing the same task, it is difficult to deem the comparisons meaningful.

Finally, in all of the tasks described so far, participants were asked to provide some subjective judgment (there were no right or wrong answers). Providing such a judgment requires participants to decide on a strategy for completing the task. When figuring out how to perform the task, participants may simply make a conscious decision to follow the grammatical gender divisions in their language. Evidence collected from such subjective judgments cannot reveal whether gender is actually part of a person's conceptual representation of an object, or whether (left with no other criterion for making the subjective judgment) the person just explicitly decided to use grammatical gender in answering the experimenter's questions.

Showing that experience with a language affects thought in some broader sense (other than thinking for that particular language) requires observing a crosslinguistic difference on some more covert measure in a non-language-specific task. The studies described in this chapter do just that. People are tested in tasks where the purpose of the experiment is covert or where the task requires participants to provide a correct answer (i.e., not a subjective judgment). Further, Spanish and German speakers are tested in English (and sometimes in nonlinguistic tasks), allowing us to assess the effects of people's native language on their thinking more generally (not just thinking for that same language). Finally, a series of studies shows that crosslinguistic differences in thought can be produced just by grammatical differences and in the absence of other cultural factors.

So, does talking about inanimate objects as if they were masculine or feminine actually lead people to think of inanimate objects as having a gender? Could the grammatical genders assigned to objects by a language influence people's mental representations of objects?

4.5 Grammatical Gender and Memory

To investigate this, Boroditsky, Schmidt, and Phillips (2002) taught a group of Spanish and German speakers proper names for 24 objects (e.g., an apple may have been called *Patrick*) and then tested their memory for these object-name pairs. The experiment was conducted entirely in English, and all objects were chosen to have opposite grammatical genders in Spanish and German. For both Spanish and German speakers, half of the time the gender of the proper name assigned to an object was consistent with the grammatical gender of the object's name (in their native language), and half of the time it was inconsistent. All of the participants were native speakers of either Spanish or German, but both groups were highly proficient in English.

The prediction was that German speakers would be better at remembering a proper name for "apple" if the name was *Patrick* than if it was *Patricia*, and the opposite should be true for Spanish speakers (because the word for "apple" is masculine in German, but feminine in Spanish). As predicted, Spanish and German speakers' memory for object-name pairs (e.g., apple-Patricia) was better for pairs where the gender of the proper name was consistent with the grammatical gender of the object name (in their native language) than when the two genders were inconsistent. Since the object names used in this study had opposite grammatical genders in Spanish and German, Spanish and German speakers showed opposite memory biases: for those objects for which Spanish speakers were most likely to remember female names, German speakers were most likely to remember male names (and vice versa). Further, a group of native English speakers (similar in age and education to the Spanish and German speakers) were tested in the same task. They were able to correctly remember the object-name pairs as well as Spanish and German speakers did for consistent pairs, and better than they did for inconsistent pairs. This suggests that Spanish and German speakers'

previous language experience actually interfered with their ability to remember object-name pairs when the pairs happened to be conceptually inconsistent in gender. Since both groups performed the task in English, it appears that the semantic representation of gender (once it has been established) is not language specific. Objects do appear to have conceptual gender, and this gender is consistent with the grammatical gender assigned by language.

But what does it mean for a turnip to be conceptually feminine or for a toaster to be conceptually masculine? How does gender actually make its way into the representations of objects? As suggested earlier, one possibility is that, depending on grammatical gender, different (stereotypically masculine or feminine) aspects of objects may become more or less salient in the representations of those objects. For example, if the noun that names a toaster is masculine, then perhaps its metallic and technological properties may become more salient; but if the noun is feminine, then perhaps its warmth, domesticity, and ability to provide nourishment are given more importance.

4.6 Grammatical Gender and Object Descriptions

To test whether grammatical gender really does focus speakers of different languages on different aspects of objects, Boroditsky, Schmidt, and Phillips (2002) created a list of 24 object names that had opposite grammatical genders in Spanish and German (half were masculine and half feminine in each language), and then asked a group of native Spanish speakers and another group of native German speakers to write down the first three adjectives that came to mind to describe each object on the list. The study was conducted entirely in English, and none of the participants were aware of the purpose of the study. The question was whether the grammatical genders of object names in Spanish and German would be reflected in the kinds of adjectives that Spanish and German speakers generated. All of the participants were native speakers of either Spanish or German, but both groups were highly proficient in English. Since the experiment was conducted entirely in English (a language with no grammatical gender system), this is a particularly conservative test of whether grammatical gender influences the way people think about objects.

After all of the adjectives provided by Spanish and German speakers were collected, a group of English speakers (unaware of the purpose of the study) rated the adjectives as describing masculine or feminine properties of the objects (+1 = feminine, -1 = masculine). The adjectives were arranged in alphabetical order and were not identified as having been produced by a Spanish or a German speaker.

As predicted, Spanish and German speakers generated adjectives that were rated more masculine for items whose names were grammatically masculine in their native language than for items whose names were grammatically feminine. Because all object names used in this study had opposite genders in Spanish and German, Spanish and German speakers produced very different adjectives to describe the objects. For items that were grammatically masculine in Spanish but feminine in German, adjectives provided by Spanish speakers were rated more masculine than those provided by German speakers. For items that were grammatically masculine in German but feminine in Spanish, adjectives provided by German speakers were rated more masculine than those provided by Spanish speakers.

There were also observable qualitative differences between the kinds of adjectives Spanish and German speakers produced. For example, the word for "key" is masculine in German and feminine in Spanish. German speakers described keys as *hard, heavy, jagged, metal, serrated,* and *useful*, while Spanish speakers said they were *golden, intricate, little, lovely, shiny,* and *tiny*. The word for "bridge," on the other hand, is feminine in German and masculine in Spanish. German speakers described bridges as *beautiful, elegant, fragile, peaceful, pretty,* and *slender*, while Spanish speakers said they were *big, dangerous, long, strong, sturdy,* and *towering*.

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 differences in language per se lead to differences in thought, or whether other cultural differences act as intermediary causal factors. For example, the way objects are personified in fairy tales or in poetry may depend on the grammatical genders of their names. Further, grammatical genders might affect the design

of artifacts such that German bridges may differ from Spanish bridges in a way consistent with grammatical gender.

4.7 Separating Effects of Language and Culture

To test whether grammatical gender in a language can indeed exert a causal power over thought (without intermediary cultural factors), Boroditsky, Schmidt, and Phillips (2002) taught native English speakers about a soupative/oosative distinction in the fictional Gumbuzi language. Participants were shown drawings of 4 males and 4 females along with 12 inanimate objects and were taught which would be soupative (preceded by *son*) and which oosative (preceded by *oos*) 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 subject might have learned that pans, forks, pencils, ballerinas, and girls are soupative, while pots, spoons, pens, giants, and boys are oosative. Which objects were designated as grammatically masculine and which feminine was counter-balanced across subjects such that each object was assigned to the same grammatical category as biological females for half of the subjects, and assigned to the same grammatical category as males for the other half.

After subjects had mastered the oosative/soupative distinction, they were shown all the pictures again one at a time (unlabeled) and asked to generate adjectives to describe the objects. These adjectives were then independently rated as depicting masculine or feminine properties of the objects.

As predicted, English speakers produced more masculine adjectives to describe objects when they (i.e., their names) belonged to a grammatical category with biological males than when the same objects belonged to a grammatical category with biological females. Just as with the Spanish and German speakers, there was also an observable *qualitative* difference between the adjectives produced for an item when it was grammatically grouped with males than when it was grouped with females. For example, when the violin was grammatically feminine in Gumbuzi, English speakers described a picture of a violin as *artsy*, *beautiful*, *beautiful*,

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creative, curvy, delicate, elegant, interesting, pretty, and wooden. When it was grammatically masculine, English speakers described it as *chirping, difficult, impressive, noisy, overused, piercing, shiny, slender, voluptuous, and wooden.* It appears that just differences in grammar, with no concomitant differences in culture, are enough to influence how people think about objects.

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. But all of the studies described so far have included some linguistic component in the tasks (albeit the linguistic component was in a language other than the one producing the effects). Subjects were asked either to remember names for objects or to produce adjectives in response to words or pictures. Could grammatical gender have an effect even if no words were used in a study?

4.8 Grammatical Gender and Picture Similarity

Several recent studies have investigated the effects of grammatical gender in tasks involving no words, only pictures (Boroditsky, Schmidt, and Phillips 2002). In one study, Spanish and German speakers rated the similarity of pairs of unlabeled pictures depicting objects and people. All of the objects were chosen to have opposite grammatical genders in Spanish and German, and the picture of each object was compared to pictures of several biological males and females. Even in this non-linguistic task (involving no labels and no verbalization in any language), Spanish and German speakers produced similarity ratings consistent with the gender assignments of their native language. Both Spanish and German speakers rated an object more similar to a person when the grammatical gender of the object matched the biological gender of the person than when the genders did not match. This was true even though participants were instructed and tested in English and all of the objects had opposite grammatical genders in Spanish and German. The same differences were obtained even when Spanish and German speakers made their similarity judgments while performing a verbal interference task (shadowing randomly generated letter strings).

66

Further, a group of Spanish/German bilinguals was tested in the same task. The degree to which a subject's pattern of similarity scores corresponded to either the Spanish or the German grammatical gender system was well predicted by that person's relative skill in Spanish versus German as well as by other aspects of linguistic experience such as whether the person was born in a Spanish- or German-speaking country, how much earlier the person started learning one language versus the other, and how many years the person had spoken the two languages.

In another set of studies, English speakers were taught the Gumbuzi oosative/soupative grammatical distinctions as described earlier, and were then asked to rate the similarity of pairs of pictures depicting people and objects that were either in the same grammatical category or in different grammatical categories in Gumbuzi. Just as was observed with Spanish and German speakers, pairs of items that were in the same grammatical category were rated more similar than items that came from different grammatical categories. Just as before, the effects did not go away when subjects made the similarity ratings while performing a verbal interference task. These findings once again suggest that learning new grammatical categories can shape the way people think about objects (in this case demonstrated as an increase in the perceived similarity of pictures).

4.9 But *How* Does Language Affect Thought?

Beyond demonstrating that learning linguistic categories can affect people's descriptions of objects or similarity ratings, 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 laboratory), 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). This would explain both the increased within-category similarity (Boroditsky, Schmidt, and Phillips 2002) and the bias in descriptions observed in the

earlier studies. 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 2002; see also Gentner and Namy 1999; Loewenstein and Gentner 1998).

However, there might also be a more mundane explanation for all this. Perhaps people give higher similarity ratings to items assigned to the same grammatical category not because they have discovered or highlighted their similarities, but simply because these items share a new common feature—the name of the category they belong to. That is, maybe just the fact that both items are called “oosative” or “soupative” is enough to produce the increase in within-category similarity. To test this explanation, Boroditsky, Schmidt, and Phillips (2002) taught a new group of subjects a new variation on the oosative/soupative distinction in Gumbuzi. Instead of being based on biological gender (thus making it possible to carry out a meaningful set of consistent comparisons), the categories were made arbitrary with regard to gender. Unlike the old Gumbuzi categories that included either 4 instances of males or 4 instances of females, the new arbitrary categories included a mix of males and females in each category. As before, subjects were trained until they could categorize the objects perfectly into oosative and soupative, and then they were asked to rate similarity between pairs of pictures that were either in the same category or in different categories. Although these subjects had the same proficiency with the categories as the subjects in the old studies, and although (just as before) all objects in a category shared the same category name (oosative or soupative), there was no increase in similarity for within-category comparisons. It appears that (at least in these studies) just sharing a category name is not sufficient to significantly increase the similarity between two objects. Only when a category is meaningful, somehow interpretable beyond rote memorization, does the similarity of items within a category increase.

So it appears that linguistic categories can influence people's thinking by encouraging them to 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 or

perhaps make comparison-relevant features more salient in the representations. Clearly, many parts of this proposal remain to be specified and tested. One prediction made by this view is that after learning a meaningful category, people should be faster and/or better able to name similarities between category members because they have already carried out the comparisons and may have stored the similarities. Some preliminary evidence suggests that this is indeed the case (Boroditsky, Schmidt, and Phillips 2002). After being taught the Gumbuzi *oosative/soupative* categories (the gender-based versions), subjects were asked to name similarities between as many person-object pairs as they could in a period of five minutes (a time period far too short to complete all pairs). Answers such as *oosative*, *soupative*, *masculine*, and *feminine* were excluded from all analyses (only five of these were produced across all subjects). When the pairs consisted of items from the same category, people were able to generate more similarities than when the pairs contained items from different categories. These findings suggest that learning to group objects into meaningful categories does encourage the discovery or at least the highlighting of their similarities.

4.10 So, Does Language Shape Thought?

The results reviewed in this chapter demonstrate that a grammatical distinction in language has the power to bias people's memory, their descriptions of words and pictures, their assessments of picture similarities, and their ability to generate similarities between pictures. This is true even though people perform tasks in a language different from the one they learned the distinction in, perform tasks involving no words (just pictures), or perform tasks where the point of the experiment is covert (e.g., the adjectives 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 host of tests in ways that are consistent with the distinctions made in their language. But does all this evidence mean that language affects thought? In particular, does it mean that linguistic categories

(e.g., a noun's being grammatically feminine or masculine) actually alter nonlinguistic 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 nonlinguistic representations remain truly separate, and everybody's nonlinguistic representations are in fact the same.

This is an interesting possibility, and a difficult one to rule out empirically. For example, Boroditsky, Schmidt, and Phillips (2002) 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 disappeared under these conditions, then we might have been able to infer that grammatical categories had not affected nonlinguistic representations. Instead, it would seem that language affected thinking in this case because people covertly invoked linguistic representations in a set of seemingly nonlinguistic tasks. But it turned out that tying up the linguistic faculties had no effect on the results (the effects of grammatical gender were equally strong when subjects were shadowing speech as when they were not). Can we now conclude that grammatical gender definitely does affect people's nonlinguistic representations? This seems premature. Perhaps the shadowing task simply did not 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 does not 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 in no small part due to the difficulty of deciding on what counts as linguistic and nonlinguistic processing in the first place).

Fortunately, being able to discriminate between these two possibilities is not necessary here. Regardless of which possibility is correct, it appears that language plays an important role in thinking. Whether people's native language is covertly involved in all manner of seemingly nonlinguistic tasks (even despite verbal interference, in nonlinguistic tasks, and in tasks conducted in other languages), or whether aspects of grammar are able to influence nonlinguistic representations directly, it

appears that thinking involves a collaboration between many different linguistic and nonlinguistic 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 language, but in all manner of cognitive tasks.

4.11 Conclusions

A body of evidence suggests 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 descriptions of objects, their assessments of similarity between pictures of objects, and their ability to remember proper names for objects. Another set of studies showed that 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 arbitrary designation of a noun as 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.

Notes

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1. Despite wide variation in the assignment of grammatical genders, speakers across languages do share some common beliefs about the genders of objects. For example, when asked to classify names or pictures of objects into masculine and feminine, English and Spanish speakers tend to judge natural objects as more feminine and artifacts as more masculine (Mullen 1990; Sera, Berge, and del Castillo 1994). It is also interesting that English speakers make consistent judgments about the genders of objects, despite the lack of a grammatical gender system in English (Sera, Berge, and del Castillo 1994). Finally, English speakers'

intuitions about the genders of animals correspond well with the grammatical genders assigned to those animals' names in Spanish, German, and Russian (Boroditsky and Schmidt 2000). Clearly, further studies involving non-Indo-European languages are necessary to assess the generality of these findings.

References

- Boroditsky, L. (1999). First-language thinking of second-language understanding: Mandarin and English speakers' conceptions of time. *Proceedings of the Cognitive Science Society*, 21, 84–89.
- Boroditsky, L. (2000). Metaphoric structuring: Understanding time through spatial metaphors. *Cognition*, 75, 1–28.
- Boroditsky, L. (2001). Does Language Shape Thought? Mandarin and English speakers' conceptions of time. *Cognitive Psychology*, 43, 1–22.
- Boroditsky, L. (2002). *The role of comparison in the development of similarity*. Manuscript submitted for publication.
- Boroditsky, L., and Schmidt, L. (2000). Sex, syntax, and semantics. *Proceedings of the Cognitive Science Society*, 22, 42–47.
- Boroditsky, L., and Schmidt, L., and Phillips, W. (2002). *Can quirks of grammar affect the way you think? Spanish and German speakers' ideas about the genders of objects*. Manuscript submitted for publication.
- Bowerman, M. (1996). The origins of children's spatial semantic categories: Cognitive versus linguistic determinants. In J. J. Gumperz and S. C. Levinson (Eds.), *Rethinking linguistic relativity* (pp. 145–176). Cambridge: Cambridge University Press.
- Braine, M. (1987). What is learned in acquiring word classes: A step toward an acquisition theory. In B. MacWhinney (Ed.), *Mechanisms of language acquisition* (pp. 65–87). Hillsdale, NJ: Erlbaum.
- Choi, S., and Bowerman, M. (1991). Learning to express motion events in English and Korean: The influence of language-specific lexicalization patterns. *Cognition*, 41, 1–3, 83–121.
- Davidoff, J., Davies I., and Roberson, D. (1999). Colour categories in a Stone-Age tribe. *Nature*, 398, 203–204.
- Fodor, I. (1959). The origin of grammatical gender I. *Lingua*, 8, 1.
- Gentner, D., and Imai, M. (1997). A cross-linguistic study of early word meaning: Universal ontology and linguistic influence. *Cognition*, 62, 169–200.
- Gentner, D., and Namy, L. (1999). Comparison in the development of categories. *Cognitive Development*, 14, 487–513.
- Heider, E. (1972). Universals in color naming and memory. *Journal of Experimental Psychology*, 93, 10–20.

Uls

- Imai, M., and Gentner, D. (1997). A cross-linguistic study of early world meaning: Universal ontology and linguistic influence. *Cognition*, 62, 169–200.
- Jakobson, R. (1966). On linguistic aspects of translation. In R. A. Brower (Ed.), *On translation* (pp. 232–239). New York: Oxford University Press.
- Kay, P., and Kempton, W. (1984). What is the Sapir-Whorf hypothesis? *American Anthropologist*, 86, 65–79.
- Konishi, T. (1993). The semantics of grammatical gender: A cross-cultural study. *Journal of Psycholinguistic Research*, 22, 519–534.
- Levinson, S. C. (1996). Frames of reference and Molyneux's question: Cross-linguistic evidence. In P. Bloom, M. Peterson, L. Nadel, and M. Garrett (Eds.), *Language and space* (pp. 109–169). Cambridge, MA: MIT Press.
- Li, P., and Gleitman, L. (2002). Turning the tables. *Cognition*, 83, 265–294.
- Loewenstein, J., and Gentner, D. (1998). Relational language facilitates analogy in children. *Proceedings of the Cognitive Science Society*, 20, 615–620.
- Lucy, J. (1992). *Grammatical categories and cognition: A case study of the linguistic relativity hypothesis*. Cambridge: Cambridge University Press.
- Lucy, J., and Shweder, R. (1979). Whorf and his critics: Linguistic and non-linguistic influences on color memory. *American Anthropologist*, 81, 581–618.
- Mullen, M. K. (1990). Children's classification of nature and artifact pictures into female and male categories. *Sex Roles*, 23, 577–587.
- Sapir, E. (1921). *Language*. New York: Harcourt, Brace, and World.
- Sera, M., Berge, C., and del Castillo, J. (1994). Grammatical and conceptual forces in the attribution of gender by English and Spanish speakers. *Cognitive Development*, 9, 261–292.
- Slobin, D. (1996). From "thought and language" to "thinking for speaking." In J. J. Gumperz and S. C. Levinson (Eds.), *Rethinking linguistic relativity* (pp. 70–96). Cambridge: Cambridge University Press.
- Twain, M. (1880). *A tramp abroad*. Leipzig: Bernhard Tauchnitz.
- Whorf, B. (1956). *Language, thought, and reality: Selected writings of Benjamin Lee Whorf* (J. B. Carroll, Ed.). Cambridge, MA: MIT Press.