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COGNITIVE PSYCHOLOGY

How Language Shapes Thought

The languages we speak affect our perceptions of the world

By Lera Boroditsky

I AM STANDING NEXT TO A FIVE-YEAR OLD GIRL IN PORMPURAAW, A SMALL Aboriginal community on the western edge of Cape York in northern Australia. When I ask her to point north, she points precisely and without hesitation. My compass says she is right. Later, back in a lecture hall at Stanford University, I make the same request of an audience of distinguished scholars—winners of science medals and genius prizes. Some of them have come to this very room to hear lectures for more than 40 years. I ask them to close their eyes (so they don't cheat) and point north. Many refuse; they do not know the answer. Those who do point take a while to think about it and then aim in all possible directions. I have repeated this exercise at Harvard and Princeton and in Moscow, London and Beijing, always with the same results.

A five-year-old in one culture can do something with ease that eminent scientists in other cultures struggle with. This is a big difference in cognitive ability. What could explain it? The surprising answer, it turns out, may be language.

The notion that different languages may impart different cognitive skills goes back centuries. Since the 1930s it has become associated with American linguists Edward Sapir and Benjamin Lee Whorf, who studied how languages vary and proposed ways that speakers of different tongues may think differently. Although their ideas met with much excitement early on, there was one small problem: a near complete lack of evidence to support their claims. By the 1970s many scientists had become disenchanted with the Sapir-Whorf hypothesis, and it was all but abandoned as a new set of theories claiming that language and thought are universal muscled onto the scene. But now, decades later, a solid body of empirical evidence showing how languages shape thinking has finally emerged. The evidence overturns the long-standing dogma about universality and yields fascinating insights into the origins of knowledge and the construction of reality. The results have important implications for law, politics and education.

IN BRIEF

People communicate using a multitude of languages that vary considerably in the information they convey.
Scholars have long wondered whether different languages might impart different cognitive abilities.
In recent years empirical evidence for this causal relation has emerged, indicating that one's mother tongue does indeed mold the way one thinks about many aspects of the world, including space and time.
The latest findings also hint that language is part and parcel of many more aspects of thought than scientists had previously realized.

Illustration by Tom Whalen

UNDER THE INFLUENCE

AROUND THE WORLD people communicate with one another using a dazzling array of languages—7,000 or so all told—and each language requires very different things from its speakers. For example, suppose I want to tell you that I saw *Uncle Vanya* on 42nd Street. In Mian, a language spoken in Papua New Guinea, the verb I used would reveal whether the event happened just now, yesterday or in the distant past, whereas in Indonesian, the verb wouldn't even give away whether it had already happened or was still coming up. In Russian, the verb would reveal my gender. In Mandarin, I would have to specify whether the titular uncle is maternal or paternal and whether he is related by blood or marriage, because there are different words for all these different types of uncles and then some (he happens to be a mother's brother, as the Chinese translation clearly states). And in Pirahã, a language spoken in the Amazon, I couldn't say "42nd," because there are no words for exact numbers, just words for "few" and "many."

Languages differ from one another in innumerable ways, but just because people talk differently does not necessarily mean they think differently. How can we tell whether speakers of Mian, Russian, Indonesian, Mandarin or Pirahã actually end up attending to, remembering and reasoning about the world in different ways because of the languages they speak? Research in my lab and in many others has been uncovering how language shapes even the most fundamental dimensions of human experience: space, time, causality and relationships to others.

Let us return to Pormpuraaw. Unlike English, the Kuuk Thaayorre language spoken in Pormpuraaw does not use relative spatial terms such as left and right. Rather Kuuk Thaayorre speakers talk in terms of absolute cardinal directions (north, south, east, west, and so forth). Of course, in English we also use cardinal direction terms but only for large spatial scales. We would not say, for example, "They set the salad forks southeast of the dinner forks—the philistines!" But in Kuuk Thaayorre cardinal directions are used at all scales. This means one ends up saying things like "the cup is southeast of the plate" or "the boy standing to the south of Mary is my brother." In Pormpuraaw, one must always stay oriented, just to be able to speak properly.

Moreover, groundbreaking work conducted by Stephen C. Levinson of the Max Planck Institute for Psycholinguistics in Nijmegen, the Netherlands, and John B. Haviland of the University of California, San Diego, over the past two decades has demonstrated that people who speak languages that rely on absolute directions are remarkably good at keeping track of where they are, even in unfamiliar landscapes or inside unfamiliar buildings. They do this better than folks who live in the same environments but do not speak such languages and in fact better than scientists thought humans ever could. The requirements of their languages enforce and train this cognitive prowess.

People who think differently about space are also likely to think differently about time. For example, my colleague Alice Gaby of the University of California, Berkeley, and I gave Kuuk Thaayorre speakers sets of pictures that showed temporal progressions—a man aging, a crocodile growing, a banana being eaten. We then asked them to arrange the shuffled photographs on the ground to indicate the correct temporal order.

Speakers of different languages differ in how well they can remember who did what.

We tested each person twice, each time facing in a different cardinal direction. English speakers given this task will arrange the cards so that time proceeds from left to right. Hebrew speakers will tend to lay out the cards from right to left. This shows that writing direction in a language influences how we organize time. The Kuuk Thaayorre, however, did not routinely arrange the cards from left to right or right to left. They arranged them from east to west. That is, when they were seated facing south, the cards went left to right. When they faced north, the cards went from right to left. When they faced east, the cards came toward the body, and so on. We never told anyone which direction they were facing—the Kuuk Thaayorre knew that already and spontaneously used this spatial orientation to construct their representations of time.

Representations of time vary in many other ways around the world. For example, English speakers consider the future to be "ahead" and the past "behind." In 2010 Lynden Miles of the University of Aberdeen in Scotland and his colleagues discovered that English speakers unconsciously sway their bodies forward when thinking about the future and back when thinking about the past. But in Aymara, a language spoken in the Andes, the past is said to be in front and the future behind. And the Aymara speakers' body language matches their way of talking: in 2006 Raphael Núñez of U.C.S.D. and Eve Sweetser of U.C. Berkeley found that Aymara gesture in front of them when talking about the past and behind them when discussing the future.

REMEMBERING WHODUNIT

SPEAKERS OF DIFFERENT LANGUAGES also differ in how they describe events and, as a result, how well they can remember who did what. All events, even split-second accidents, are complicated and require us to construe and interpret what happened. Take, for example, former vice president Dick Cheney's quail-hunting accident, in which he accidentally shot Harry Whittington. One could say that "Cheney shot Whittington" (wherein Cheney is the direct cause), or "Whittington got shot by Cheney" (distancing Cheney from the outcome), or "Whittington got peppered pretty good" (leaving Cheney out altogether). Cheney himself said "Ultimately I'm the guy who pulled the trigger that fired the round that hit Harry," interposing a long chain of events between himself and the outcome. President George Bush's take—"he heard a bird flush, and he turned and pulled the trigger and saw his friend get wounded"—was an even more masterful exculpation, transforming Cheney from agent to mere witness in less than a sentence.

The American public is rarely impressed with such linguistic wiggling because nonagentive language sounds evasive in English, the province of guilt-shirking children and politicians. English speakers tend to phrase things in terms of people doing things, preferring transitive constructions like "John broke the vase" even for accidents. Speakers of Japanese or Spanish, in contrast, are less likely to mention the agent when describing an accidental event. In Spanish one might say "*Se rompió el florero,*" which translates to "the vase broke" or "the vase broke itself."

My student Caitlin M. Fausey and I have found that such linguistic differences influence how people construe what happened and have consequences for eyewitness memory. In our studies, published in 2010, speakers of English, Spanish and

Japanese watched videos of two guys popping balloons, breaking eggs and spilling drinks either intentionally or accidentally. Later we gave them a surprise memory test. For each event they had witnessed, they had to say which guy did it, just like in a police line-up. Another group of English, Spanish and Japanese speakers described the same events. When we looked at the memory data, we found exactly the differences in eyewitness memory predicted by patterns in language. Speakers of all three languages described intentional events agentively, saying things such as "He popped the balloon," and all three groups remembered who did these intentional actions equally well. When it came to accidents, however, interesting differences emerged. Spanish and Japanese speakers were less likely to describe the accidents agentively than were English speakers, and they correspondingly remembered who did it less well than English speakers did. This was not because they had poorer memory overall—they remembered the agents of intentional events (for which their languages would naturally mention the agent) just as well as English speakers did.

Not only do languages influence what we remember, but the structures of languages can make it easier or harder for us to learn new things. For instance, because the number words in some languages reveal the underlying base-10 structure more transparently than do the number words in English (there are no troublesome teens like 11 or 13 in Mandarin, for instance), kids learning those languages are able to learn the base-10 insight sooner. And depending on how many syllables the number words have, it will be easier or harder to keep a phone number in mind or to do mental calculation. Language can even affect how quickly children figure out whether they are male or female. In 1983 Alexander Guiora of the University of Michigan at Ann Arbor compared three groups of kids growing up with Hebrew, English or Finnish as their native language. Hebrew marks gender prolifically (even the word "you" is different depending on gender), Finnish has no gender marking and English is somewhere in between. Accordingly, children growing up in a Hebrew-speaking environment figure out their own gender about a year earlier than Finnish-speaking children; English-speaking kids fall in the middle.

ADDITIONAL RESOURCES
ScientificAmerican.com/feb2011/language

WHAT SHAPES WHAT?

These are just some of the many fascinating findings of cross-linguistic differences in cognition. But how do we know whether differences in language create differences in thought, or the other way around? The answer, it turns out, is both—the way we think influences the way we speak, but the influence also goes the other way. The past decade has seen a host of ingenious demonstrations establishing that language indeed plays a causal role in shaping cognition. Studies have shown that changing how people talk changes how they think. Teaching people new color words, for instance, changes their ability to discriminate colors. And teaching people a new way of talking about time gives them a new way of thinking about it.

Another way to get at this question is to study people who are fluent in two languages. Studies have shown that bilinguals change how they see the world depending on which language they are speaking. Two sets of findings published in 2010 demonstrate that even something as fundamental as who you like and do not like depends on the language in which you are asked. The studies, one by Oludamini Ogunnaike and his colleagues at Harvard and another by Shai Danziger and his colleagues at Ben-Gurion University of the Negev in Israel, looked at Arabic-French bilinguals in Morocco, Spanish-English bilinguals in the U.S. and Arabic-Hebrew bilinguals in Israel, in each case testing the participants' implicit biases. For example, Arabic-Hebrew bilinguals were asked to quickly press buttons in response to words under various conditions. In one condition if they saw a Jewish name like "Yair" or a positive trait like "good" or "strong," they were instructed to press "M,"; if they saw an Arab name like "Ahmed" or a negative trait like "mean" or "weak," they were told to press "X." In another condition the pairing was reversed so that Jewish names and negative traits shared a response key, and Arab names and positive traits shared a response key. The researchers measured how quickly subjects were able to respond under the two conditions. This task has been widely used to measure involuntary or automatic biases—how naturally things such as positive traits and ethnic groups seem to go together in people's minds.

Surprisingly, the investigators found big shifts in these involuntary automatic biases in bilinguals depending on the language in which they were tested. The Arabic-Hebrew bilinguals, for their part, showed more positive implicit attitudes toward Jews when tested in Hebrew than when tested in Arabic.

Language also appears to be involved in many more aspects of our mental lives than scientists had previously supposed. People rely on language even when doing simple things like distinguishing patches of color, counting dots on a screen or orienting in a small room: my colleagues and I have found that limiting people's ability to access their language faculties fluently—by giving them a competing demanding verbal task such as repeating a news report, for instance—impairs their ability to perform these tasks. This means that the categories and distinctions that exist in particular languages are meddling in our mental lives very broadly. What researchers have been calling "thinking" this whole time actually appears to be a collection of both linguistic and nonlinguistic processes. As a result, there may not be a lot of adult human thinking where language does not play a role.

A hallmark feature of human intelligence is its adaptability, the ability to invent and rearrange conceptions of the world to suit changing goals and environments. One consequence of this flexibility is the great diversity of languages that have emerged around the globe. Each provides its own cognitive toolkit and encapsulates the knowledge and worldview developed over thousands of years within a culture. Each contains a way of perceiving, categorizing and making meaning in the world, an invaluable guidebook developed and honed by our ancestors. Research into how the languages we speak shape the way we think is helping scientists to unravel how we create knowledge and construct reality and how we got to be as smart and sophisticated as we are. And this insight, in turn, helps us understand the very essence of what makes us human. SA

MORE TO EXPLORE

Language Changes Implicit Associations between Ethnic Groups and Evaluation in Bilinguals. Shai Danziger and Robert Ward in *Psychological Science,* Vol. 21, No. 6, pages 799–800; June 2010.

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