

## You Say Up, I Say Yesterday

Can language shape how we think? A Stanford researcher says yes, and her work speaks volumes about what makes people tick.

BY JOAN O'C. HAMILTON

**LERA BORODITSKY'S JOURNEY** to answer one of psychology's most intriguing and fractious questions has been a curious one. She's spent hours showing Spanish-speakers videos of balloons popping, eggs cracking and paper ripping. She's scoured Stanford and MIT's math and computer science departments for Russian speakers willing to spend an hour sorting shades of blue. She's even traipsed to a remote aboriginal village in Australia where small children shook their heads at what they considered her pitiable sense of direction and took her hand to show her how to avoid being gobbled by a crocodile. Yet she needs little more than a teacup on her office coffee table to explain the essence of her research.

"In English," she says, moving her hand toward the cup, "if I knock this cup off the table, even accidentally, you would likely say, 'She broke the cup.'" However, in Japanese or Spanish, she explains, intent matters.

If one deliberately knocks the cup, there is a verb form to indicate as much. But if the act were an accident, Boroditsky explains, a smile dances across her lips as she translates from Spanish, the speaker would essentially say, "The cup broke itself."

The question is: Does the fact that one language tends to play the blame game while the other does not mean speakers of those languages think differently about what happened? If so, what might linguistic differences tell us about cognition, perception and memory—and with what implications for such perennial debates as the influence of nature versus nurture? Welcome to the intensely spirited academic debate on which Boroditsky has spent the last decade shining a bright new light.

**AS ANYONE** who's studied a new language understands well, languages differ in myriad ways beyond simply having, as comedian Steve Martin once observed, "a different word for everything." They may assign nouns different genders—in German, moon is masculine; in French and Spanish, feminine—or none. Others require specific verb choices depending on whether an action was completed or not, or whether the speaker witnessed it or is reporting secondhand.

But Boroditsky, PhD '01, is not a linguist. She is a cognitive scientist—specifically, an assistant professor of psychology, neuroscience and symbolic systems—who pays attention to what a speaker of a given language thinks, perceives and remembers about an event. In that realm, the answer to the blame-game question turns out not to be obvious at all.

Boroditsky's research suggests, for example, that the mechanics of using a language such as English, which tends to assign an agent to an action regardless of the agent's intent, also tends to more vividly imprint that agent in the speaker's memory. Other linguistic differences help young children in aboriginal cultures achieve powers of navigation that would confound a Harvard professor. She is amassing a body of intriguing and creative evidence that language influences how its speakers focus their attention, remember events and people, and think about the world around them. And these influences may provide insight to a given culture's conception of time, space, color or even justice.



Photo: Toni Gauthier

Boroditsky's colleagues and mentors say her research is generating breakthrough insights. She is "one of the first to show truly convincing effects of language on cognitive processes," including mental imagery, reasoning, perception and problem solving, says Daniel Slobin, a professor emeritus of psychology and linguistics at UC-Berkeley. Slobin coined the term "thinking for speaking" to describe how the language-specific ways different cultures talk about space and time shape how they think about space and time. He adds that Boroditsky "has taken on some of the major dimensions of abstract thought."

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Slobin, like Boroditsky, is often called a "neo-Whorfian" cognitive scientist. The connection between language and thought has long captivated poets, philosophers, linguists and thinkers of many sorts, but the modern debate has its roots in the work of the early 20th-century American linguist Benjamin Whorf and his Yale mentor, Edward Sapir. They thought that the structure of language was integral to both thought and cultural evolution, a notion sometimes called linguistic relativity.

However, others—most notably MIT linguist Noam Chomsky—later argued that all languages share the same deep structure of thought and that thought has a universal quality separate from language. (Babies think before they learn to speak, so thought is not dependent on language.) Those scientists believe that languages express thinking and perception in different ways but do not shape the thinking and perception. In the case of the teacup, that school would argue that surely a speaker of any language absorbs the same information at the scene regardless of the conventions of verb form used and, if pressed, can convey exactly what happened by adding more specific descriptions.

Boroditsky's research suggests that may not be so. She has shown that speakers of languages that use "non-agentive" verb forms—those that don't indicate an animate actor—are less likely to remember who was involved in an incident. In one experiment, native Spanish speakers are shown videos of several kinds of acts that can be classified as either accidental or intentional, such as an egg breaking or paper tearing. In one, for example, a man sitting at a table clearly and deliberately sticks a pin into the balloon. In another variation, the same man moves his hand toward the balloon and appears surprised when it pops. The Spanish speakers tend to remember the person who deliberately punctured the balloon, but they do not as easily recall the person who witnesses the pop but did not deliberately cause it. English speakers tend to remember the individual in both the videos equally; they don't pay more or less attention based on the intention of the person in the video.

Almost a decade ago, Boroditsky, then a young assistant professor at MIT, conducted a study of Mandarin speakers that thrust her into the spotlight. English speakers, she explains, tend to see time on a horizontal plane: The best years are ahead; he put his past behind him. Speakers of Mandarin, however, tend to see time both horizontally and vertically, with new events emerging from the ground like a spring of water, the past above and the future below. Boroditsky's first paper on this work attracted what her colleagues say were unusually spirited rebuffs claiming the work was flawed and could not be duplicated. But later studies have shown the same results.

One vocal critic of neo-Whorfian ideas is Lila Gleitman, professor emerita of psychology and linguistics at the University of Pennsylvania. Gleitman argues that Boroditsky and other neo-Whorfians' results are highly dependent on the context in which these experiments take place.



They neglect the reality that "linguistic representations under-determine the conceptual contents they are used to convey: Language is sketchy compared with the richness of our thoughts," Gleitman says. In other words, however precise and specific the conventions of one language may be, the lack of those conventions in another language does not mean a speaker's thinking or perception is similarly sparse.

**BORODITSKY'S OWN JOURNEY** began in Belarus, where she was the only child of parents who were both engineers. At 12, she says, she spoke Russian and struggled with Belarusian and Ukrainian. She was learning English in school when her parents got the opportunity to emigrate. A close friend had preceded them by three months and settled in Skokie, Ill., where they went as well. Boroditsky's background and passion for argument earned her the nickname "Red Fury" in high school, she says with a laugh. She recalls thinking even as a teenager about the degree to which language could shape an argument and exaggerate the differences between people.

She enrolled at Northwestern, where she intended to work on a larger-scale theory of cognitive science. Dedre Gentner, a professor of psychology, became a mentor. Gentner says Boroditsky immediately distinguished herself among undergraduates. "She asked just fabulous questions and I grabbed her and said, 'Are you doing research?'" Gentner brought her into her research group and says that from day one Boroditsky displayed courage and cleverness. "She is just fearless about pursuing information."

For her PhD, Boroditsky came to Stanford and worked with psychology professor Gordon Bower. She became an assistant professor in the department of brain and cognitive sciences at MIT before she returned to Stanford in 2004. "It's exceedingly rare for us to hire back our own graduate students," notes Bower, who was Boroditsky's thesis adviser. "She brought a very high IQ and a tremendous ability for penetrating analysis."

Boroditsky, 33, blends intellectual gravitas with an unmistakable love of whimsy. The day we meet, her sparkly silver shoes contrast nicely with her huge, bright aubergine couch, and photographs show her driving a banana-like vehicle around the Burning Man festival. She has dubbed her lab "Cognition," and her tongue-in-cheek website includes funny profiles of her graduate students and an invitation to sing along to the "Cognition national anthem," a music clip of Groucho Marx singing, "Whatever it is, I'm against it."

The former Red Fury had to be fearless to pursue her research fascination. "Language influencing thought was extremely controversial for decades," explains Gentner. "If you talked about language's impact on cognition, you were considered an idiot or a lunatic. We talked about it in my lab, but I used to warn the students not to talk about it outside the lab. Lera," she adds with a chuckle, "was bold enough to ignore that warning. It's now a fully researched and discussed issue."

Boroditsky focuses on linguistic features that may inform more fundamental differences in how cultures convey their relationship to concepts such as space, time or gender. "What I'm really interested in are the ingredients of meaning. I don't believe we can explain how we construct meaning without understanding patterns in metaphor and language."

Consider space. About a third of the world's languages do not rely on words for right and left. Instead, their speakers use what are called absolute directions—north, south, east and west. For everything. In Australia, for example, if Tara VanDerveer were giving a basketball clinic to the aboriginal Thaayorre in their native language, she'd have to order her players to dribble up the south side of the court, fake east, go west, then make a layup on the west side of the basket.

This orientation to the compass points affects all sorts of tasks. When speakers of these languages are asked to arrange photographs showing a time sequence, they line them up east to west. English speakers tend to view time-sequence photographs as going from left to right, while Hebrew speakers line them up right to left. The upshot of the need to constantly stay oriented in order to communicate the simplest concept, says

Boroditsky, is that in communities of these speakers, even small children can perform phenomenal feats of navigation, and everyone is constantly mentally synchronizing their spatial relationships.

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Or consider: Is color perception linked to what we call colors? In another experiment, Boroditsky compared the ability of English speakers and Russian speakers to distinguish between shades of blue. She picked those languages because Russian does not have a single word for blue that covers all shades of what English speakers would call blue; rather, it has classifications for lighter blues and darker blues as different as the English words yellow and orange. Her hypothesis was that Russians thus pay closer attention to shades of blue than English speakers, who lump many more shades under one name and use more vague distinctions. The experiment confirmed her hypothesis. Russian speakers could distinguish between hues of blue faster if they were called by different names in Russian. English speakers showed no increased sensitivity for the same colors. This suggests, says Boroditsky, that Russian speakers have a "psychologically active perceptual boundary where English speakers do not."

Boroditsky also is fascinated with how cultures perceive and communicate ideas about time. Some languages require their speakers to include temporal information in every utterance. In the Yagua language of Peru, there are five distinct grammatical forms of the past tense, for example, to describe when an event occurred: a few hours prior; the day before; roughly one week to a month ago; roughly two months to two years ago; and the distant or legendary past. English is not that precise, but it is true that every time you use a verb in English, you are conveying information about time. Depending on whether something has happened already (I made dinner), is happening now (I am making dinner), or will happen in the future (I will make dinner), the speaker must pick different verb forms. Without the temporal information, the utterance would feel incomplete, ungrammatical. You couldn't just say I make dinner in all three cases.

Not so in Indonesian. Unlike English, Indonesian verbs never change to express time: Make is always just make. Although Indonesian speakers can add words like already or soon, this is optional. It doesn't feel incomplete or ungrammatical to just say, I make dinner.

This led to another fascinating experimental result—and to Boroditsky's opening up a laboratory in Indonesia. A student from Indonesia assured Boroditsky, who was still skeptical, that most Indonesians simply do not bother to mark time when they speak. So she challenged the student to set up an experiment where Indonesian speakers would be shown photographs of the same act in a time progression: a man about to kick a soccer ball, a man kicking a soccer ball, a man who has kicked the ball, which is flying away. Boroditsky and the student made a bet. Is it possible that Indonesian speakers wouldn't mark time progression? If they did not care about time, what would they pay attention to?



Photo: Toni Gauthier; Illustration: Joel Holland

The student's hypothesis was proven right. Indonesian speakers, after looking at the three photographs, tended to not only use the same descriptions for each photograph with no time markers—the man kick the ball—but many also said later there was no difference between the photos. Realize that to English speakers, these were not subtle differences—each photograph of the man and the ball was distinctly different.

Moreover, when the researchers mixed in photographs of different individuals kicking the ball, the Indonesian participants were more likely to describe two photographs as similar when the person doing the kicking was the same, regardless of which of the three different actions was being performed. English speakers were more likely to say photographs were similar when the actors in the photos were doing the same action in time.

Similar to the balloon-popping experiment, Boroditsky's argument is that Indonesians' language structure cues their attention. If you need to figure something out to put it into words, then you pay attention to those details; but if you don't, you don't.

**BORODITSKY'S RESULTS** are attracting more and more researchers to the field and producing additional evidence for measured acceptance of Whorfian arguments. "I'm not sure I would have gone into this if I'd known it was so controversial," she says. But an emotional and intense

response from psychologists who previously rejected the idea that language affects thinking is not surprising, she says.

"This work is at the center of some of the biggest debates in the study of the mind—nature versus nurture; is the mind divided into modular regions; is there a special encapsulated language 'organ' in the brain. It's pretty bothersome for someone to come along and say that perhaps many of the phenomena that we in psychology have been studying could differ from language to language. It would be much easier if we could just study American college sophomores and assume our observations would be the same everywhere."

One implication of Boroditsky's research is its relationship to what psychologists call "framing." In a paper due to be published this year, she and her team used the infamous 2004 Super Bowl halftime show in which singer Justin Timberlake seemed to pull off the front of Janet Jackson's costume, revealing her breast. Timberlake later described the incident as a "wardrobe malfunction" (conceptually not unlike that teacup breaking itself). Even when test subjects saw the same video of the event, and even when they had read and heard about the incident prior to the study, Boroditsky reports that when the researchers described the event then asked the subjects to assess a financial liability to Justin Timberlake, their responses were divided. The group that heard an "agentive" description, in which "Timberlake ripped the costume," recommended a much higher fine than the group that was told "the costume ripped." According to Boroditsky, "Linguistic framing affected people's judgments of blame and financial liability in all conditions; language mattered whether it was presented before, after or without video evidence."

She says other work has raised intriguing questions about the accuracy of translations—in courtrooms, for example—of languages such as Spanish that tend to be non-agentive. Might a Spanish-speaking juror interpret a phrase like "the gun went off" differently from an English-speaking juror? Might seemingly age-old conflicts around the world have any connection to language-based influences that render geographical neighbors somewhat inscrutable to one another?

Gleitman says there is no debate that specific word choice and use of language can influence other people's thinking—after all, that partly is what language is for, she notes. Boroditsky counters that there is nothing in human endeavor to which language is not connected. Thus, she argues, why not the very mechanisms of how we perceive, remember and process?

Just as genetic analysis of intelligence or aptitude can be controversial, research in this field can raise questions about underlying differences between cultures and spark debate about when "different" is implicitly a suggestion of "better." Gleitman, despite her own skepticism of the Whorfian arguments, nonetheless grants that increased work in this area is important. "The questions have been raised provocatively and usefully by Lera Boroditsky, among other scientists." The journey to find answers continues.

Source: [www.stanfordalumni.org/news/magazine/2010/mayjun/features/boroditsky.html](http://www.stanfordalumni.org/news/magazine/2010/mayjun/features/boroditsky.html)