You can't do the math without the words

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Most people learn to count when they are children. Yet surprisingly, not all languages have words for numbers. A recent study published in the journal of *Cognitive Science* shows that a few tongues lack number words and as a result, people in these cultures have a difficult time performing common quantitative tasks. The findings add new insight to the way people acquire knowledge, perception and reasoning.

The Piraha people of the Amazon are a group of about 700 semi-nomadic people living in small villages of about 10-15 adults, along the Maici River, a tributary of the Amazon. According to University of Miami (UM) anthropological linguist Caleb Everett, the Piraha are surprisingly unable to represent exact amounts. Their language contains just three imprecise words for quantities: Hòi means "small size or amount," hoì, means "somewhat larger amount," and baàgiso indicates to "cause to come together, or many." Linguists refer to languages that do not have number specific words as anumeric.

"The Piraha is a really fascinating group because they are really only one or two groups in the world that are totally anumeric," says Everett, assistant professor in the Department of Anthropology at the UM College of Arts and Sciences. "This is maybe one of the most extreme cases of language actually restricting how people think."

His study "Quantity Recognition Among speakers of an Anumeric Language" demonstrates that number words are essential tools of thought required to solve even the simplest quantitative problems, such as one-to-one correspondence.

"I'm interested in how the language you speak affects the way that you think," says Everett. "The question here is what tools like number words really allows us to do and how they change the way we think about the world."

The work was motivated by contradictory results on the numerical performance of the Piraha. An earlier article reported the people incapable of performing simple numeric tasks with quantities greater than three, while another showed they were capable of accomplishing such tasks.

Everett repeated all the field experiments of the two previous studies. The results indicated that the Piraha could not consistently perform simple mathematical tasks. For example, one test involved 14 adults in one village that were presented with lines of spools of thread and were asked to create a matching line of empty rubber balloons. The people were not able to do the one-to-one correspondence, when the numbers were greater than two or three.

The study provides a simple explanation for the controversy. Unbeknown to other researchers, the villagers that participated in one of the previous studies had received basic numerical training by Keren Madora, an American missionary that has worked with the indigenous people of the Amazon for 33 years, and co-author of this study. "Her knowledge of what had happened in that village was crucial. I understood then why they got the results that they did," Everett says.

Madora used the Piraha language to create number words. For instance she used the words "all the sons of the hand," to indicate the number four. The introduction of number words into the village provides a reasonable explanation for the disagreement in the previous studies.

The findings support the idea that language is a key component in

processes of the mind. "When they've been introduced to those words, their performance improved, so it's clearly a linguistic effect, rather than a generally cultural factor," Everett says. The study highlights the unique insight we gain about people and society by studying mother languages.

"Preservation of mother tongues is important because languages can tell us about aspects of human history, human cognition, and human culture that we would not have access to if the languages are gone," he says. "From a scientific perspective I think it's important, but it's most important from the perspective of the people, because they lose a lot of their cultural heritage when their languages die."

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