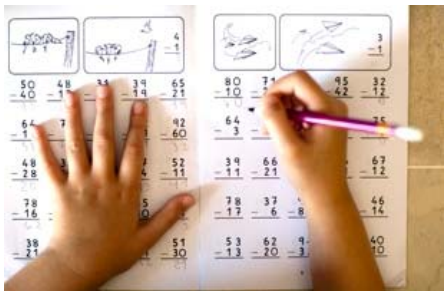
Study: Why Language Has More to Do with Math than You Think

By **MEREDITH MELNICK** Wednesday, February 9, 2011 | **148 COMMENTS**



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A study of deaf people in Nicaragua offers fascinating insights into the link between language acquisition and the understanding of numbers.

The findings are b ı Spaepen, the lead author of the study, and colleagues over three trips to Nicaragua between 2006 anc esigning" adults for their language skills and facility with numbers. Homesigners communicate through entirely made-up hand gestures — while their language is adequate for communication with friends and family, it lacks consistent grammar or specific number words. (**More on TIME.com:** Why Are College Students Reporting Record High Stress Levels?)

What researchers found was that the homesigning adults had a hard time understanding numbers greater than 3, likely because they didn't have words to represent larger sums. By contrast, deaf people who learn conventional sign language learn the values of large numbers because they learn a counting routine early in childhood, just like hearing children who acquire spoken language.

"It's not just the vocabulary words that matter, but understanding the relationships that underlie the words — the fact that 'eight' is one more than 'seven' and one less than 'nine.' Without having a set of number words to guide them, deaf homesigners in the study failed to understand that numbers build on each other in value," said Susan Goldin-Meadow, a University of Chicago psychologist and co-author, in a statement. (**More on TIME.com:** A Severe Migraine Could Give You A New Accent)

In the experiments conducted in Nicaragua, researchers gave the volunteers a series of tasks to see how well they could determine monetary amounts. When asked to identify whether a 10-córdoba bill or a 20-córdoba bill had more value, the deaf homesigners did well. When asked whether nine 10-córdoba coins were worth more or less than a 100-córdoba bill, they also succeeded. The researchers surmised that they were working off the shape and color of the currency, however, rather than its actual value.

Once the questions became more abstract, homesigners began to falter. They were shown animated videos centering around numbers — for instance, one video showed eight frogs on lily pads; four jumped away at once, then two came back one at a time. When the homesigners were asked to explain the sequence of events to friends after watching the video, they had difficulty communicating numbers bigger than 3 or 4.

In another game of counting, researchers showed the homesigners a row of one to 20 poker chips, and asked them to recreate the lineup. When the chips were visible, the homesigners were able to copy the arrangement, but when the original row of chips was covered, they couldn't figure out the correct number of chips. Yet another test had the volunteers counting pictures of items — like fish or beach balls — on flash cards. The

homesigners were successful at identifying up to about three items at a time. (**More on TIME.com:** Analyzing Baby Sounds to Predict Autism Early?)

Researchers gave the same tests to two control groups as well: hearing Nicaraguans who had never been to school and deaf adults who had learned American Sign Language, in order to rule out the effects of illiteracy or deafness. Both of these groups showed an understanding of larger numbers that the homesigners did not.

The findings, published in the current issue of the *Proceedings of the National Academy of Sciences*, may help researchers understand how children learn numbers, and figure out ways to improve math literacy in kids who have trouble. As *Wired* reported:

> Research on child development shows that kids start by memorizing numbers as an ordered list. They can recite the numbers from 1 through 10, but if you ask them to give you three apples, they're just as likely to give you five or seven.
>
> The age at which kids start connecting their ordered list to numbers of things depends a lot on how much reinforcement they have from adults. Some children learn to count by age two; others, usually from disadvantaged households, arrive at school not knowing what "two" means. The homesigners represent those disadvantaged kids taken to the extreme.

"Language input is important for everybody's representation of number, and how counting works," Spaepen told *Wired*. "This isn't something you just get for free because you're human. It depends on the quality and amount of input you get. If you're not getting it in your language, you're not going to just come up with it on your own."

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