

The unexpected power of baby math: Adults still think about numbers like kids

Children understand numbers differently than adults. For kids, one and two seem much further apart than 101 and 102, because two is twice as big as one, and 102 is just a little bigger than 101. It's only after years of schooling that we're persuaded to see the numbers in both sets as only one integer apart on a number line.

Now Dror Dotan, a doctoral student at Tel Aviv University's School of Education and Sagol School of Neuroscience and Prof. Stanislas Dehaene of the Collège de France, a leader in the field of numerical cognition, have found new evidence that educated adults retain traces of their childhood, or innate, number sense -- and that it's more powerful than many scientists think.

"We were surprised when we saw that people never completely stop thinking about numbers as they did when they were children," said Dotan. "The innate human number sense has an impact, even on thinking about double-digit numbers." The findings, a significant step forward in understanding how people process numbers, could contribute to the development of methods to more effectively educate or treat children with learning disabilities and people with brain injuries.

Digital proof of a primal sense

Educated adults understand numbers "linearly," based on the familiar number line from 0 to infinity. But children and uneducated adults, like tribes people in the Amazon, understand numbers "logarithmically" -- in terms of what percentage one number is of another. To analyze how educated adults process numbers in real time, Dotan and Dehaene asked the participants in their study to place numbers on a number line displayed on an iPad using a finger.

Previous studies showed that people who understand numbers linearly perform the task differently than people who understand numbers logarithmically. For example, linear thinkers place the number 20 in the middle of a number line marked from 0 to 40. But

logarithmic thinkers like children may place the number 6 in the middle of the number line, because 1 is about the same percentage of 6 as 6 is of 40.

On the iPad used in the study, the participants were shown a number line marked only with "0" on one end and "40" on the other. Numbers popped up one at a time at the top of the iPad screen, and the participants dragged a finger from the middle of the screen down to the place on the number line where they thought each number belonged. Software tracked the path the finger took.

Changing course

Statistical analysis of the results showed that the participants placed the numbers on the number line in a linear way, as expected. But surprisingly -- for only a few hundred milliseconds -- they appeared to be influenced by their innate number sense. In the case of 20, for example, the participants drifted slightly rightward with their finger -- toward where 20 would belong in a ratio-based number line -- and then quickly corrected course. The results provide some of the most direct evidence to date that the innate number sense remains active, even if largely dormant, in educated adults.

"It really looks like the two systems in the brain compete with each other," said Dotan.

Significantly, the drift effect was found with two-digit as well as one-digit numbers. Many researchers believe that people can only convert two-digit numbers into quantities using the learned linear numerical system, which processes the quantity of each digit separately -- for example, 34 is processed as 3 tens plus 4 ones. But Dotan and Dehaene's research showed that the innate number sense is, in fact, capable of handling the complexity of two-digit numbers as well.

Answer:

What connections can you make between the ideas contained in this article and those contained in the article from last class, *What Happens When You Can't Count Past Four*? Explain.