# Fear of predators may have helped us conceptualise the idea of zero

A fear of predators may have helped many animals recognise when they weren't there. Now, it seems humans built on this understanding of absence to utilise the concept of "zero"

Zeros are critical to mathematics, astronomy and engineering

Carol Yepes / Getty

The human brain may have learned to comprehend the figure zero and apply it to our lives by making a primitive neural pathway more sophisticated.

Better understanding this could help people who struggle to understand numbers after a stroke.

Zeros are used in many aspects of society, from astronomy and engineering to accounting and literature. To understand the figure's origin, Benjy Barnett and Steve Fleming at University College London used magnetoencephalography (MEG) to record the magnetic fields produced by 29 people's brains while they completed two tasks.

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In the first, they were asked to compare whether two consecutive patterns were made up of the same numbers of dots, from 0 to 5. In the second, they were shown 10 numbers, also from 0 to 5, each for 250 milliseconds. Half of these were orange and the rest blue. They were then asked to report which coloured numbers had the highest value.

To compare the participants' brain activity when they saw a "0" with them seeing other numbers, the MEG data was fed into a machine learning algorithm.

Scientists have long known that there are neurons in the brain that respond specifically to someone seeing a "1" or a "2" and so on until at least "9", says Barnett.

"We showed that the neural activity across different brain areas in response to '0' was most similar to the activity underlying '1', compared to other numbers," he says. "What's more, the neural activity for '0' became less similar to brain patterns evoked by other numbers as these other numbers got larger, suggesting it has a place at the beginning of the neural number

line – next to ‘1’, and two less than ‘2’, and so on.”

The pair also looked for any similarities between the brain’s response to “0” and a blank screen, finding that both activated the same brain activity pattern. This suggests that our understanding of the concept of zeros may have evolved from the perception of absences.

“If I’m an antelope on the savannah and I perform a quick visual scan to check if I can see any predators, the brain activity that leads me to decide ‘no, I haven’t seen anything’ might be the precursor to the number zero in the brain,” says Barnett. Humans and other animals seem to have the ability to understand absence, but people have built on this to utilise zeros, he says.

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A previous study of more than 650 people who had had a stroke found that around 15 per cent were unable to accurately process numbers containing zeros in the following weeks.

“Our results may well contribute to a better understanding of this phenomenon and help inform potential treatments,” says Barnett. “It is also a good example of ‘cortical recycling’, where the brain co-opts existing circuits responsible for basic sensory functions in order to develop more complex cognitive capacities without having to create an entirely new set of neural circuits.”

Jorge Morales at Northeastern University in Boston, Massachusetts, says that despite the importance of zero in mathematics and various cultures, this study suggests it originates from the ability to notice absences, which we probably share with other animals.