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COGNITIVE NEUROSCIENCE

Cultural differences

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Arabic numbers and arithmetic rules are almost universally used among people speaking different languages. A collaborative study between Chinese and US researchers reports the intriguing finding that the native language we speak might affect how our brains process numbers and solve mathematical puzzles.

The researchers recruited 12 native Chinese speakers (NCS) and 12 native English speakers (NES), who were matched for age, gender and level of education. Functional MRI (fMRI) studies showed that there were remarkable differences in the brain activation patterns, especially in the left hemisphere, between NCS and NES when they were viewing Arabic digits. The activation was greater in the left supplementary motor area (SMA), Broca's and Wernicke's areas in NES, compared with the corresponding areas in NCS. Much stronger brain activation was found in a region between Brodmann's area (BA) 6, BA8 and BA9 in NCS. This region is known as the premotor association (PMA) area, and has been associated with visuospatial processing and various functions that are more closely related to cognition than to motor processes.

These differences in brain activation patterns between NCS and NES were more pronounced during two simple arithmetic tasks — an addition task and a quantity comparison task. The so-called mathematical loading of the comparison task is thought to be heavier than that of the addition task, which in turn is heavier than that of viewing the numeric symbols. As the mathematical loading increased, there was a trend for increased PMA area activation in NCS but not in NES. Interestingly, a similar trend was observed in the perisylvian area, which is crucial for language processing, in NES but not NCS. Further fMRI connectivity analysis confirmed that NCS and NES engaged different neural networks in addition and comparison tasks.

Therefore, our mother tongue might influence the development of the brain circuits involved in processing numbers and arithmetic. The researchers emphasize that it is possible that different teaching methods across cultures, or variations in genetic disposition, could also prime the brains of Chinese and English speakers to solve mathematical equations in different ways.

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