Dyslexic diversity

Chinese and English dyslexias stem from different brain abnormalities.

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Children with dyslexia have trouble learning to read, but the cause of their difficulties depends on what language they are attempting to learn, according to a study published today in the 

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In 2004, Li Hai Tan at the University of Hong Kong and his colleagues examined patterns of activity in the brain as English and Chinese speakers — some dyslexic, some not — worked on various reading-related tests while inside a magnetic resonance imaging (MRI) machine. Results from this study suggest that the brain areas involved in dyslexia vary between languages. In English, reading involves translating letters into sounds and putting them together. In Chinese, the key skill is memorizing a huge number of characters, each one mapping to a whole word. So different brain areas are probably needed to accomplish the slightly different task of reading across the two languages.

But patterns of brain activity are a bit ambiguous as data. The researchers couldn’t be sure that what they were seeing — a less-than-lively left middle frontal gyrus in Chinese dyslexics, as compared with the temporo-parietal and occipito-temporal regions in their English-speaking counterparts — was the cause or the result of the disorder.

The new study used MRI plus a technique called voxel-based morphometry to measure the actual volume of the brain’s grey matter at the key sites. And sure enough, Chinese children with dyslexia had a significantly smaller left middle frontal gyrus than did Chinese children without the disorder, even though both groups had the same overall volume of grey matter.

"It is surprising for us because we didn't think the structural abnormalities would be different," says Tan.

Higher consciousness

John Gabrieli, a neuroscientist at the Massachusetts Institute of Technology in Cambridge who also works on dyslexia, is especially intrigued by the region that the researchers fingered as the culprit in Chinese dyslexia. It isn't the part associated with symbol recognition, he says. Instead, the area is associated with working memory — a higher stage of processing.

The differences between the two languages suggests that dyslexia could be two separate disorders. "That's the most provocative possibility, that you could be fine in one language and struggling in the other," says Gabrieli.

Gabrieli's lab hopes to one day be able to screen children when they first start to learn to read, or even at birth, for dyslexia. Furthermore, work done by Elise Temple's lab at Dartmouth, UK, suggests that behavioural therapy can help modify the brains of children with dyslexia such that they become more like those of their peers who do not have the disorder.

Temple is interested to know whether such recovery occurs in Chinese children with dyslexia as well. "Can these kid's brains respond to treatment and rewire?" she asks.

The work also suggests an alternative. If a child is likely to have severe dyslexia in English, maybe he or she could be taught to recognize whole words as units in the Chinese manner.

Tan's group is working on therapies specific to Chinese children with dyslexia. At the same time, they intend to examine whether the brain differences behind dyslexia have different genetic causes. "Previous genetic studies suggest that malformations of the brain are associated with different genes," he says. "Our finding may assist in the search for candidate genes."

References