Culture shapes dyslexic brains

Dyslexia may be distinct brain disorders in English and Chinese speaking cultures, according to researchers who found different neurological deficits between the two.

The difference may stem from the fact that English uses a letter alphabet while Chinese languages use characters, the researchers write online today in the *Proceedings of the National Academy of Sciences*.

The researchers found that English speakers with the reading disability typically have functional abnormalities in posterior parts of the brain associated with reading and possibly also less grey matter in these areas.

But in Chinese speakers with dyslexia, the functional and structural brain abnormalities related to reading correspond with the left middle frontal region of the brain.

The research is based on brain scans performed on 16 Chinese speakers with dyslexia and 16 of their peers with normal reading ability during the course of a couple of tests.

Researchers first asked the 32 Beijing primary school students to look at two Chinese characters in a different sized font to see if they could identify the difference in size.

Having used this question to establish which part of their brains was involved with reading, the investigators then presented the students with two more Chinese characters and asked them if the two characters rhymed.

The second question was designed to test the students' phonological awareness, their sensitivity to the sound structure of language, which is considered an important and reliable predictor of reading ability.

The scans revealed that the students with the reading disability had less activity in the left middle frontal gyrus on the second task than the children without the disability.

They also had less grey matter in this brain region than the children with normal reading skills.

Further, the Chinese children with dyslexia did not have any abnormalities in the parts of the brain that have been shown to be problematic in alphabetic-language dyslexics.

**Characters versus letter alphabet**

While surprising, the contrast can be explained by the fact that the Chinese language uses characters, while English uses a letter alphabet, one of the researchers says.

"At the functional level, it's easy to understand why Chinese and English speakers use different parts of the brain to read language," says Li-Hai Tan, a professor of linguistics and neuroscience at the University of Hong Kong, and author on the paper.

"The different brain networks accommodate the different features of English and Chinese. The two systems are dramatically different. Chinese is pictographic and English is more phonological, or sound-based."

But he says that it is striking that the Chinese children with dyslexia had less grey matter in the middle frontal gyrus, and that was probably a function of genetics, since this phenomenon is thought to be largely genetic.

This would suggest that the genetic make-up of Chinese speaking children with dyslexia is different from
that of English speakers with the same disorder since they have reductions of grey matter in different sites of the brain.

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