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Dyslexia linked to brain communication breakdown

Language centres struggle to access phonetic information.

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Dyslexic people have trouble linking written symbols with corresponding speech sounds.

Dyslexia may be caused by impaired connections between auditory and speech centres of the brain, according to a study published today in *Science*[1]. The research could help to resolve conflicting theories about the root causes of the disorder, and lead to targeted interventions.

When people learn to read, their brains make connections between written symbols and components of spoken words. But people with dyslexia seem to have difficulty identifying and manipulating the speech sounds to be linked to written symbols. Researchers have long debated whether the underlying representations of these sounds are disrupted in the dyslexic brain, or whether they are intact but language-processing centres are simply unable to access them properly.

A team led by Bart Boets, a clinical psychologist at the Catholic University of Leuven in Belgium, analysed brain scans and found that phonetic representations of language remain intact in adults with dyslexia, but may be less accessible than in controls because of deficits in brain connectivity.

"The authors took a really inventive and thoughtful approach," says John Gabrieli, a neuroscientist at the Massachusetts Institute of Technology in Cambridge, Massachusetts. "They got a pretty clear answer."

Communication channels

Boets and his team used a technique called multivoxel pattern analysis to study fine-scale brain signals as people listened to a battery of linguistic fragments such as 'ba' and 'da'. To the researchers' surprise, neural activity in the primary and secondary auditory cortices of participants with dyslexia showed consistently distinct signals for different sounds.

But images of dyslexic people's brains revealed reduced structural integrity of the white-matter tracts linking the auditory cortices and the left inferior frontal gyrus — a brain area involved in language processing, including speech production. Even when the study participants were not doing any tasks, activity in these areas was less correlated in the brains of the dyslexic people than in the controls, suggesting that they had weaker communication between their auditory and speech centres.

Together, these findings suggest that dyslexic people do not have distorted neural representations of speech sounds; rather, "the problem seems to be in pathways down the road that help us assemble those sounds and produce those sounds when we read out loud", explains Guinevere Eden, a neuroscientist at Georgetown University in Washington DC.

Boets cautions that studying adults can reveal only the end result of atypical development; dyslexic people could have distorted phonetic representations early in life. But, he says, the results argue that weakened connections between specific brain regions have an important role. Ultimately, Boets hopes that the insights could lead to improvements to treatments and exercises for dyslexia, which historically have focused on strengthening phonetic representations.

"It should be possible to design strategies to specifically improve the connections," says Boets.

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References

1. Boets, B. *et al*. *Science* **342**, 1251–1254 (2013).