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Odyssey

THE SIGHT-SPEECH GAP

BY RICHARD J. DAVIDSON

We've all known that "tip-of-the-tongue" frustration. We recognize the man coming down the street toward us, or the tune we hear over the radio, but we can't come up with the name. About one-third of the children who suffer from dyslexia—reading difficulty unrelated to intelligence—demonstrate a persistent effect, called anomia, similar to the tip-of-the-tongue phenomenon. If you point to your elbow and ask what it is, they frequently struggle for the word.

Whether the "word frustration" of normal adults and these dyslexic children has the same roots, we don't know, although the effect is strikingly similar. But research with the children suggests that for them, at least, there is a time-lag problem: They may have difficulty moving sensory information quickly enough from the right hemisphere to the speech center in the left hemisphere, an area in which we categorize and express what we experience.

Most of the brain centers that register sensory impressions are present in both hemispheres, with each receiving information from the opposite side of the body. One center that is not duplicated is the speech area, which in nearly all right-handed people and some left-handers is located in the left hemisphere. My colleagues and I took advantage of this specialization to compare the reactions of 26 normal boys with those of 26 dyslexic boys in a series of tests that required them to transfer sensory information either within the same hemisphere or from one to the other. We blindfolded each boy and gave him an odd-shaped cutout or a common object such as a spoon to feel with one hand, then had him feel among four other shapes or objects to find the one that matched. The boys did this in four ways: feeling the object with the left hand and using the same hand to find its match; feeling both with the right hand; feeling the object with the left hand and matching it with the right; and vice versa.

The normal boys had no problem with the task. The dyslexics, however, were less accurate and took longer when they felt the object with one hand and matched it with the other. They did worst of all when they felt the object with the left hand (which connects to the right hemisphere)

and tried to find its match with the right hand. This required the ability to transfer information easily between hemispheres, and to equate information supplied by the two sides — the same transfer needed to see a word with the left visual field and say it with instructions from the speech center in the left hemisphere.

To test this theory more directly, we conducted two experiments using words rather than objects. In one we presented different words to each ear simultaneously, and then, a second later, presented another pair of words, one to each ear. The boys had to tell whether one of the words in the second pair was the same as in the first, and if so, what it was. In the other study, we did this visually, using an apparatus that allowed us to present each word in a pair to different halves of the visual field.

The normal boys had little trouble giving the correct answers. The dyslexics also did well, if both matching words were presented to the same hemisphere. But when the match required them to cross from one side to the other, they did poorly — particularly when they had to transfer information from the right hemisphere to the left, where the speech center is.

These results suggest that the reading problems that plague these dyslexics may be due, at least in part, to a lag in the time it takes information to get to the left hemisphere from the right. Apparently, the right hemisphere's message of what words have been seen continually arrives later than the message from the left hemisphere. This produces confusion that interferes with understanding.

Work by other researchers supports this theory. Rita Rudel and Martha Denkla at New York's Columbia Presbyterian Medical Center asked dyslexic children to identify pictures in rapid succession. The children had the same sort of difficulty in saying the right word as when they tried to read aloud. Often their errors were close to the tip-of-the-tongue effect: They came up with a "semantic shadow," a word that was wrong but related in meaning, like "cup" for "glass." Yet when the children were given more time to name the pictures, they had little trouble doing so.

We are now designing a special apparatus to test the theory further. It will enable us to divert a dyslexic's right hemisphere with another task (such as listening to music with the left ear), while he reads with his right visual field (which sends information to the left hemisphere). If our theory is correct, this will improve reading ability by blocking late input from the right side.

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Illustration by Andrea Baruffi