In the brain, one area sees familiar words as pictures, another sounds out words

June 9 2016

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Skilled readers can quickly recognize words when they read because the word has been placed in a visual dictionary of sorts which functions separately from an area that processes the sounds of written words, say Georgetown University Medical Center (GUMC) neuroscientists. The visual dictionary idea rebuts a common theory that our brain needs to "sound out" words each time we see them.

This finding, published online today in *NeuroImage*, matters because

unraveling how the brain solves the complex task of reading can help in uncovering the brain basis of reading disorders, such as dyslexia, say the scientists.

"Beginning readers have to sound out words as they read, which makes reading a very long and laborious process," says the study's lead investigator, Laurie Glezer, PhD, a postdoctoral research fellow. The research was conducted in the Laboratory for Computational Cognitive Neuroscience at GUMC, led by Maximilian Riesenhuber, PhD.

"Even skilled readers occasionally have to sound out words they do not know. But once you become a fluent, skilled reader you no longer have to sound out words you are familiar with, you can read them instantly," Glezer explains. "We show that the brain has regions that specialize in doing each of the components of reading. The area that is processing the visual piece is different from the area that is doing the sounding out piece."

Glezer and her co-authors tested word recognition in 27 volunteers in two different experiments using fMRI. They were able to see that words that were different, but sound the same, like "hare" and "hair" activate different neurons, akin to accessing different entries in a dictionary's catalogue.

"If the sounds of the word had influence in this part of the brain we would expect to see that they activate the same or similar neurons, but this was not the case—'hair' and 'hare' looked just as different as 'hair' and 'soup.'"

Glezer says that this suggests that in this region of the brain all that is used is the visual information of a word and not the sounds. In addition, the researchers found a different distinct region that was sensitive to the sounds, where 'hair' and 'hare' did look the same.

"This suggests that one region is doing the visual piece and the other is doing the sound piece," explains Riesenhuber.

"One camp of neuroscientists believe that we access both the phonology and the visual perception of a word as we read them, and that the area or areas of the brain that do one, also do the other, but our study suggests this isn't the case," says Glezer.

Riesenhuber says that these findings might help explain why people with dyslexia have slower, more labored reading. "Because of phonological processing problems in dyslexia, establishing a finely tuned system that can quickly and efficiently learn and recognize words might be difficult or impossible," he says.

More information: Laurie S. Glezer et al, Uncovering phonological and orthographic selectivity across the reading network using fMRI-RA, *NeuroImage* (2016). DOI: 10.1016/j.neuroimage.2016.05.072

Provided by Georgetown University Medical Center