MedicalXpress

Researchers find brain activity related to individual differences in reading comprehension

November 6 2013

What makes a good reader? First, you have to know how to read the words on a page and understand them—but there's a higher-level step to reading comprehension. You have to tie together the words over time, maintaining their order and meaning in your memory, so that you can understand phrases, sentences, paragraphs and extended texts.

Northwestern University researchers were interested in exploring the brain activity underlying this higher-level integration step. Through the use of an EEG to measure brainwaves, they were able to predict reading comprehension with almost 90 percent accuracy based on the brain activity differences between ordered and scrambled story texts.

Participants read two versions of a long text presented one word at a time on a computer monitor. One version was in the original order of the story, the other version was in a scrambled order. In each case, participants read the words in order to perform a word-finding task. However, only in the ordered version of the story were they also asked to comprehend the story in preparation for a comprehension test.

The researchers figured that for people who read each word in the ordered version of the story and tried to tie the words together to form a story but didn't comprehend the story well, their brain activity would not differ much between the two versions of the story. Good comprehenders, on the other hand, should show distinctly different brain

activity when they were successfully tying together and remembering the story in the ordered version versus when the words were scrambled.

"We used a computational algorithm called a random-forest ensemble to identify neural activity that differentiated good from poor reading comprehenders. This activity was focused at EEG electrodes toward the front of the head," said Julia Mossbridge, lead author of the study and research associate in psychology at Northwestern.

Previous research in this area has examined the brain activity surrounding comprehension of sentences and short passages. Consequently, the most significant finding of the study, Mossbridge said, is that she and her colleagues have developed a method, using longer texts, to get to the integration process in reading comprehension.

"Individuals with reading comprehension deficits in the absence of other reading deficits are almost surely lacking in this higher-level integration skill of tying the words together and maintaining the integrated meaning over time," Mossbridge said. "We hope that our novel paradigm and the result showing the neural activity for differentiating good from poor comprehenders could potentially be used to help diagnose and eventually treat reading disorders."

In addition to Mossbridge, co-authors include Marcia Grabowecky, Ken A. Paller and Satoru Suzuki of Northwestern. The article "Neural activity tied to reading predicts individual differences in extended-text comprehension" will appear in *Frontiers in Human Neuroscience*.

Provided by Northwestern University