The Reading Room:
Reading & the Brain
October 2024

We are going to explore the fascinating and complex processes of what our brain does when we read. For skilled readers, it seems simple. We look at the text, "read" it and understand what it's telling us, all this happening in a nanosecond. If any of you have ever worked with struggling readers, you have experienced the heart-breaking challenges these individuals face every day. These processes in the brain are anything but simple and anything but instantaneous. I must admit that I am totally captivated by what our brains can do, particularly when it comes to reading. In this article, we will be looking at what areas of the brain are involved in reading and how they integrate with one another. The evidence is very strong and overwhelmingly clear. Because of all this brain research, we know what to do to help our struggling readers learn to read.

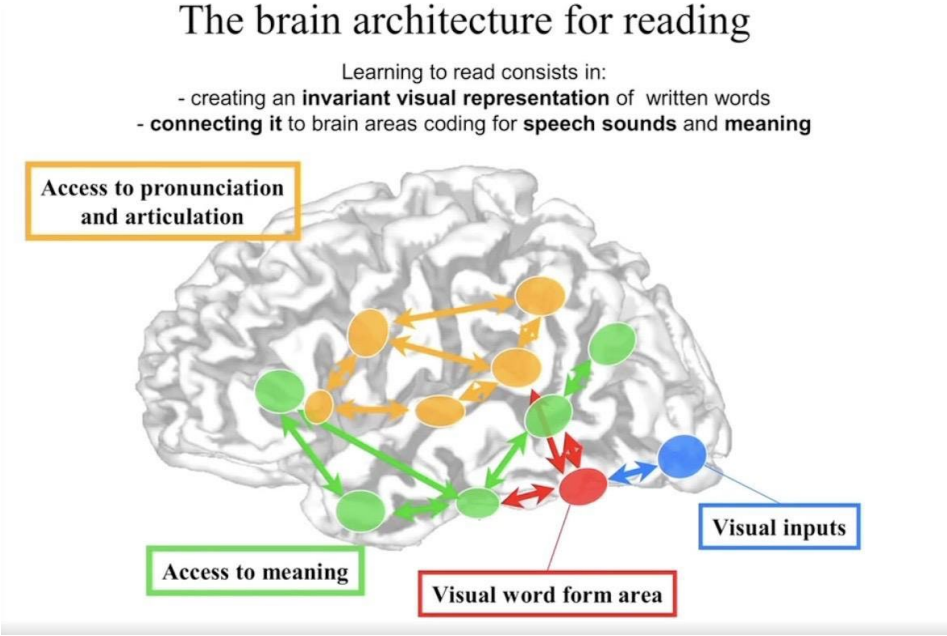
We know so much about reading and the brain because of the amount of research conducted in the last 30 plus years using FMRIs (Functional MRIs) that show us in real time, the areas of the brain that are activated during the task of reading. One of the pioneers in this type of brain research is Dr. Sally Shaywitz who is a professor at Yale Medical School. She has written over three hundred and fifty scientific articles and chapters as well as a very well received book, "Overcoming Dyslexia". She and her husband, Dr. Bennett Shaywitz co-founded *The Yale Center for Dyslexia and Creativity.* Her early FMRI research compared the brain scans of skilled readers to those of struggling readers, and the findings were quite remarkable. What they showed was that skilled readers use several areas in the left hemisphere of the brain that work in conjunction with each other using neural pathways called white matter tracts. In contrast, the struggling readers' brains showed much less activation in those areas as well as weaker white matter tracts, thus causing them to be much less efficient and unable to connect to these essential areas. Dr. Shaywitz found that the primary underlying difficulty was weakness

in the phonological processor where we hear and manipulate sounds and, in many cases, orthographic mapping.

Keep in mind that our brains are not hardwired to read. We are not born knowing how to read. We are hardwired to speak and understand spoken language. Reading the written word is a relatively new skill that has developed in the human brain. The Sumerian Language is the oldest written language in existence. First attested about 3100 BCE in southern Mesopotamia, it flourished during the 3rd millennium BCE. Modern Humans have been around about 200,000 years and our early ancestors, about six million years. Our brains had to adapt to learn this new skill.

Enter French neuroscientist, Dr. Stanislas Dehaene, who is the director of *NeuroSpin*, a research center in France which now has the largest FMRI magnet in the world. His work has been centered around how the brain reads as well as how the brain learns, and he has written books on both subjects.

Dr. Dehaene explains that we use the same areas in the left hemisphere of the brain, that we use to understand spoken language and to recognize faces, to read the written word. He calls this neuro recycling. We access words and text visually, but from there, that input travels to the brain's "letterbox" or visual word form area. This area is called the fusiform gyrus (gyrus refers to a ridge or fold between two clefts of cerebral matter). This is where orthographic mapping occurs and where we map familiar sound strings onto the letters and words. Once the words are mapped, they will be stored permanently. There is another part of the brain called the primary auditory cortex which is where we process auditory input, including sounds. The angular supramarginal gyri helps us to manipulate the sounds. Meaning is attached in the inferior frontal gyrus. All of these processes work together instantaneously so that we are not conscious of them. The image below is of the left hemisphere of the brain.



As I mentioned before, all these areas are connected by white matter tracts. Remember that in struggling readers all these areas do not activate, and the white matter tracts are not as strong as in skilled readers. The good news is, that with proper instruction, brain activation can be changed, and neural pathways can be strengthened.

The overwhelming majority of top-notch world researchers agree that Structured Literacy, based on the Science of Reading, is the way to teach students who struggle with reading, students who have been diagnosed with Dyslexia, and most would also agree that this kind of instruction benefits all students.

Resources:

Eyes on Reading: Dr. Stanislas Dehaene with Emily Hanford

How We Learn to Read

https://www.apmreports.org/episode/2023/03/30/rerelease-at-a-loss-for-words

Dr Stanislas Deheane
Dr. Sally Shaywitz - “Overcoming Dyslexia”
Dr. Nadine Gaab
Harvard Medical School
Planet Word
Emily Hanford - “Hard Words”

For questions, please contact:

Chris Fox - cfox@ces.org, Jessica Powell - jpowell@ces.org