



The **Four Part Processor**, first proposed by Seidenberg and McClelland (1989), and then substantiated by Adams (1990), Moats and Eden (2002), Shaywitz (2003), and Seidenberg (2017), is a model to understand how the brain reads. The theorists first proposed this model before fMRI brain scans could corroborate the model, but we will see how this model is supported by fMRI brain scans during Science of Reading II (Class #2). Currently, Georgetown’s Center for the Study of Learning (led by Dr. Guinevere Eden) is a full-time research study using fMRI scans to study learning, including reading. Concurrent work is being conducted at Boston Children’s Gaab Lab and University of Washington’s Brain Development and Education Lab.

So, what is the model?

There is no “reading center” in the brain. [That makes sense, because considering evolutionary trends, the invention of reading is too new for humans to have adapted to it! ((Dehaene, 2009)]. Rather, four areas – or processors—in the left hemisphere activate when printed language is present. Of course, some processors activate more than others in different students, which we will also discuss in Class #2. The four processors work together and are linked by pathways shuffling information back and forth as every word is read. The four processors and their jobs:

Phonology Processor	This processor is responsible for understanding speech sounds . It recognizes, remembers, analyzes, and produces words within a sentence, syllables within a word, and phonemes within a word. If it has to do with hearing, matching, analyzing, and producing speech sounds, it’s the phonological processor.
Orthography Processor	Orthography is the study of written language . This processor receives visual input: letters, punctuation marks, spaces, pictures, etc. In the orthographic processor, that visual input is matched with the student’s orthographic memory and he/she matches the letter or letters to ones he/she has seen before. Then, the phonological processor is involved in turning those letters into sounds.
Meaning, or Semantic, Processor	This processor makes meaning out of what the phonological processor and orthographic processor have matched. Mostly, the meaning processor stores and organizes our previously learned knowledge and matches new words to that knowledge—or uses it to build new knowledge. So, we match the letters <i>c,a,r,r,o</i> , and <i>t</i> (orthography processor) to the sounds to realize it says “carrot” (phonology processor.) However, it is only if we have heard of, and seen, a carrot before that we are likely to retrieve its meaning (semantic processor.)
Supporting the Meaning Processor: Context Processor	The context processor serves a supporting role to the meaning processor. Often, knowing the word or words on a page is not enough; the context processor helps define those words in context so that we can make meaning out of the entire text. For example, if we had never seen or heard of a carrot, the sentence “Farmers plant carrots along with potatoes and other root vegetables” may help us figure it out.

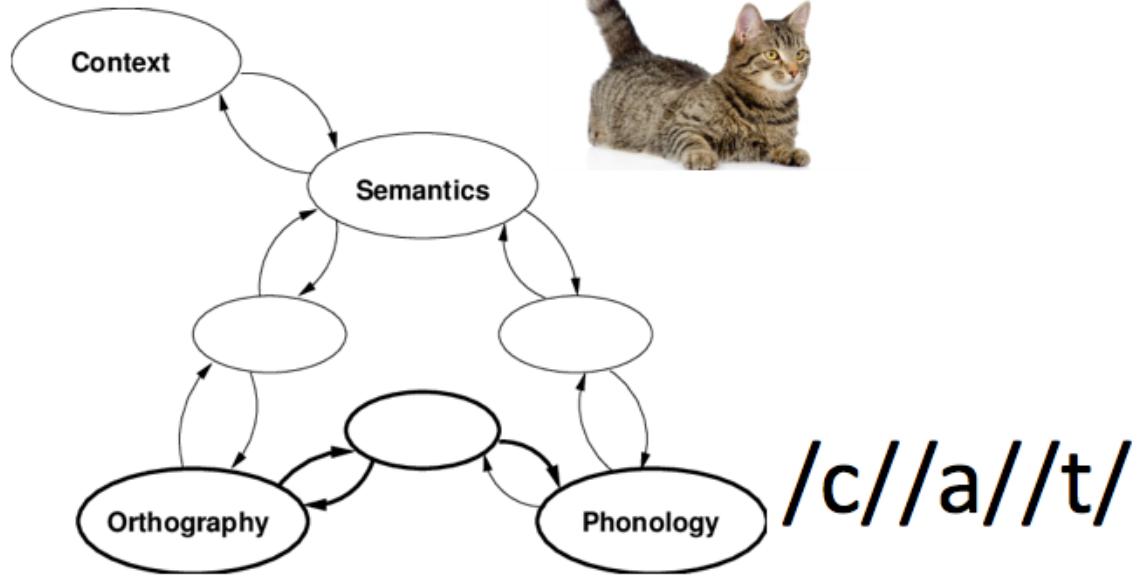


The cat had kittens.

Not "The CAT drove over the sand dune."



cat



How is it useful to us?

The Four Part Processor helps us understand how reading problems may develop and what domains to address when they do develop. Of course, some students struggle with the orthography; they can't see or understand graphemes (letter and letter combinations). Others struggle with the semantics: they just do not have the background knowledge and vocabulary to support the interconnected processing. However, as we will see, "the functional disruption in poor readers relates to phonological awareness" (Shaywitz, 1999). So, we both see how important the phonological processor is (just as important as orthography and semantics) and also that poor readers usually struggle with the processing of individual speech sounds *more often than the other processors*.

Questions to consider:

- How can the Four Part Processor help you think about assessment?
- Think of a child you've recently taught to read. What areas of the four part processor appeared relatively strong and relatively weak in their skill-set?

Significant acknowledgements to Louisa Moat's LETRS Modules (2018) and Seidenberg (2017).