Orthographic mapping, first proposed by Ehri (1998b; Ehri & Wilce, 1985), and substantiated by later neuroimaging studies (Halerman, Ashby, & Perfetti, 2012; Dehaene & Cohen, 2011; Frost et al., 2009), is a theory to explain how humans store words for effortless and automatic retrieval. The theory is used to explain how skilled readers have an expansive sight word vocabulary, a large number of words they recognize automatically. The theory disproves the popular theory that words are stored in visual memory. Instead, orthographic mapping asserts that words are stored in long-term memory when the reader associates the sequence of phonemes (the phonological quality) with the letter order in the written word.

Note: Popular curriculums, unfortunately, conflate ***sight, high-frequency,*** and ***irregular*** words. For the purposes of this document, the following commonly accepted definition of sight word will be used:

Sight word
"a word that is instantly and effortlessly recalled from memory, regardless of whether it is phonetically regular or irregular" (Kilpatrick, 2016). "Sight word vocabulary" refers to the pool of words that a reader can effortlessly recognize.

A popular theory about how humans store words:

Prior to Ehri's theory of orthographic mapping, scientists believed that humans stored sight words by having a "visual image" of every word. In other words, they believed that words were stored in visual memory similar to the way faces and objects are stored. With this theory, students are expected to memorize the visual attributes of letters and words. While several scientific studies (Adams, 1979, 1990; McLelland, 1976) have since disproved this theory, many teaching practices still presume it. Teaching practices assume that students will learn words solely through repeated exposure.

Instead, researchers have used neuroimaging to discover that typically developing readers follow a progression (see below) of reading words in which they use letter-sound knowledge to decode words and, eventually, these words become sight words after several opportunities to commit the words' phonological properties to long-term memory.

Sounding Out	→	Saying the Whole Word	→	Sight Word Reading	→	Automatic Whole Word Reading
(saying each individual sound out loud)		(saying each individual sound and pronouncing the whole word)		(sounding out the word in your head, if needed, and saying the whole word)		(reading the word without sounding it out)

*Graphic taken directly from University of Oregon, Center on Teaching and Learning (2020)

What is orthographic mapping?

Orthographic mapping helps us understand how students achieve the last step in the progression: automatic whole word reading. First, orthography refers to how phonemes are represented in print. Orthographic *mapping* is the unconscious, mental process used to permanently store printed words in long-term memory (Kilpatrick, 2016). While skilled readers develop orthographic mapping naturally, struggling readers do not. Efficient orthographic mapping requires (1) advanced phoneme awareness, (2) letter-sound knowledge, and (3) phonological long-term memory. These three interact to produce long-term orthographic memory of all words that are read.

Term	Definition
advanced phoneme awareness	ability to add, delete, and substitute phonemes in words automatically
letter-sound knowledge	knowledge of sound(s) of letters
phonological long-term memory	memory for pronunciations of words and word parts

How does orthographic mapping work?

As a reader decodes an unfamiliar word (using letter-sound knowledge), the process of orthographic mapping begins to turn the unfamiliar word into one that is instantly recognized. In orthographic mapping, a reader connects the letters in a written word to the phonemes in the word's spoken form. For example, if a reader decodes "tip," he can align each letter with the phonemes in the spoken word (/t/i/p/). This alignment allows the printed word to become familiar. In typically developing readers, a word is "mapped," or recognized automatically, after just a few exposures to the word (usually one to five exposures). Struggling readers often require many more exposures.

In addition to mapping phonetically regular and irregular words, readers can also map parts of words. For example, when a student sees *ip* in *lip, sip*, or *trip*, thanks to orthographic mapping, the student will have mapped the sounds and letters of "*ip*," even though it is not a word.

Efficient orthographic mapping only occurs with adequate phonemic awareness. If a reader cannot accurately segment a word into phonemes, she cannot align the phonemes to the order of letters.

Essentially, a word is stored in long-term memory when the reader associates the sequence of phonemes (the **phonological** quality) with the letter order in the written word.

How is it useful to us?

Inefficient orthographic mapping explains why 1) struggling readers do not develop large sight word vocabularies, 2) forget words page-to-page or seem to always have to sound them out, and 3) demonstrate difficulty with fluent reading.

Teachers can support more efficient orthographic mapping by teaching and practicing 2 of the foundational requirements for orthographic mapping: advanced phoneme awareness and letter-sound knowledge. The third requirement (phonological long-term memory) cannot be taught.

Questions to consider:

- Think about the Simple View of Reading. Does inefficient orthographic mapping impact listening comprehension or decoding?
- How, then, does inefficient orthographic mapping affect reading comprehension?
- What foundational requirements are essential to develop strong orthographic mapping?
- Can you think of students in your class who may have inefficient orthographic mapping?

Significant acknowledgments to David Kilpatrick (2015 & 2016).