

# Orthographic mapping and literacy development revisited

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Orthographic mapping (OM) involves the formation of letter-sound connections to bond the spellings to the pronunciations and meanings of specific words in memory. It explains how children learn to read words by sight, to spell words from memory, and to acquire vocabulary words from print. This development is portrayed by Ehri (2005a) as a sequence of overlapping phases, each characterized by the predominant type of connection linking spellings of words to their pronunciations in memory. During development, the connections improve in quality and word-learning value, from visual non-alphabetic, to partial alphabetic, to full grapho-phonemic, to consolidated grapho-syllabic and grapho-morphemic. OM is enabled by phonemic awareness and grapheme-phoneme knowledge. Recent findings indicate that sight word reading is facilitated by OM when beginners are taught about articulatory features of phonemes and when grapheme-phoneme relations are taught with letter-embedded picture mnemonics. Vocabulary learning is facilitated when spellings accompany pronunciations and meanings of new words to activate OM. Teaching students the strategy of pronouncing novel words aloud as they read text silently activates OM and helps them build their vocabularies. Because spelling-sound connections are retained in memory, they impact the processing of phonological constituents and phonological memory for words.

## Orthographic mapping in the acquisition of sight word reading, spelling memory, and vocabulary learning

A major hurdle for beginning readers is learning to read words from memory accurately and automatically in or out of text. Sight of the word activates its pronunciation and meaning immediately in memory and allows readers to focus their attention on comprehension rather than word recognition. Other ways of reading words serve as tools that transform unfamiliar words into familiar sight words. For example, decoding letters into blended sounds helps readers figure out words they have not read before. Rereading them a few times moves the words into memory so they can be

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read by sight. People used to regard sight words as limited to high frequency or irregularly spelled words, but it turns out that all words when practiced become read from memory by sight.

The focus of this chapter is to review how sight words are retained in memory as children learn to read, to clarify the central role played by letter-sound connections and orthographic mapping, and to consider recent findings that extend our understanding of these processes. Orthographic mapping occurs when, in the course of reading specific words, readers form connections between written units, either single graphemes or larger spelling patterns, and spoken units, either phonemes, syllables or morphemes. These connections are retained in memory along with meanings and enable readers to recognize the words by sight. An important consequence of orthographic mapping is that the spellings of words enter memory and influence vocabulary learning, analyses of phonological constituents in words, and phonological memory.

### Word reading strategies and orthographic mapping

Children are taught to read words in multiple ways, by applying strategies to read words that are unfamiliar in print, and by retrieving from memory words that have been read before and stored in memory. Several strategies might be used to read unfamiliar words. Readers might use their knowledge of the writing system to apply a *decoding strategy*. The writing system consists of graphemes that are single letters or digraphs that represent the smallest sounds or phonemes in words, for example, B represents /b/, PH represents /f/. It also includes larger grapho-syllabic and morphemic spelling-sound units (e.g., *-ump*, *-tion*, *-ed*, *-ing*) (Moats, 2010). Decoding involves transforming graphemes into a blend of phonemes, or transforming spelling patterns into a blend of syllabic units and then searching the mental lexicon (word memory) for a familiar spoken word that matches the blend and fits the context. In languages with regular grapheme-phoneme relations, such as Spanish, decoding is straightforward. However, the English writing system includes multiple ways to pronounce letters and to spell sounds in words as well as spelling irregularities, so readers must be flexible and expect variability when they blend letters to form recognizable words. For example, if they decode *stomach* as “stow – match,” they must try other pronunciations to figure out the real word (Tunmer & Chapman, 2012). This is helped by a meaningful context.

Another strategy for reading unfamiliar words is by *analogy*. This involves finding in memory the parallel spelling of a known word and adjusting its pronunciation to match letters in the unknown word (e.g., reading *thump* by analogy to *jump*). As beginners accumulate a larger store of written words in memory, this strategy becomes more useful.

The third strategy for reading unfamiliar words is by *prediction*. Readers use initial letters plus context cues in the sentence, the passage, or pictures to anticipate what the word might be. Once a word is predicted, then its pronunciation is matched to the spelling on the page to verify that the sounds fit the letters.

Whereas unfamiliar words are read by the application of print strategies, words that have been read before are read from memory. Ehri (1992, 1998, 2005a,b) referred to these as *sight words* because sight of the word immediately activates its pronunciation and meaning in memory. To build sight words in memory, orthographic mapping is required. Readers must form connections between the spellings and pronunciations of specific words by applying knowledge of the general writing system. When readers see a new word and say or hear its pronunciation, its spelling becomes mapped onto its pronunciation and meaning. These mapping connections serve to “glue” spellings to their pronunciation in memory. For example, if a reader knows that the graphemes T and OW commonly symbolize the phonemes /t/ and /o/, respectively, then when the word TOW is seen and pronounced, two connections are formed linking T and OW to their phonemes, and the spelling is bonded to its pronunciation in memory. If a reader knows grapho-syllabic spellings as letter-sound units, then when a word such as *excellent* is seen, three connections are formed between the spelling units, *ex*, *cell*, *ent*, and their sounds to retain the word in memory. Processing the meanings of words bonds semantic connections to the word units as well. This enables readers to read words immediately from memory, thus precluding the need to apply word reading strategies to figure out the words.

To form connections and retain words in memory, readers need some requisite abilities. They must possess *phonemic awareness* (i.e., the ability to focus on and manipulate phonemes in speech), particularly segmentation and blending. They must know the major grapheme-phoneme correspondences of the writing system. At a more advanced level, they need to know grapho-syllabic spelling-sound patterns. Then they need to be able to read unfamiliar words on their own, by applying a decoding, analogy or prediction strategy. Application of these strategies activates orthographic mappings to retain the words’ spellings, pronunciations, and meanings in memory. Share (2004b, 2008) referred to this decoding as a self-teaching mechanism whereby a reader can learn words independently. With repeated readings that activate orthographic mapping, written words are retained in memory to support reading and spelling.

When readers can read words from memory rather than by decoding, analogy or prediction, text reading is greatly facilitated. Readers are able to read and comprehend more rapidly and to focus their attention on meanings while word recognition happens automatically. Although word reading strategies are no longer needed to identify words once they can be read from memory, decoding and prediction may still be activated as backup to confirm that the words identified fit the spelling and the context or to signal a mismatch needing repair (Perfetti, 1985). ←

Readers differ in the connections that are activated to bond the identities of words in memory. Perfetti (2007) proposed the concept of *lexical quality* to capture variation in the representations of words that are formed in memory to support reading and spelling. Words that are high in lexical quality (LQ) consist of complete spellings that are fully connected to their pronunciations at grapho-phonemic or syllabic levels in memory. High LQ also includes knowing the meanings of words in various contexts as well as pragmatic uses of the words. Possession of high LQ representations of words facilitates not only accurate word recognition but also reading comprehension.