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Development of Sight Word Reading: Phases and Findings

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The hallmark of skilled reading is the ability to read individual words accurately and quickly in isolation as well as in text, referred to as "context free" word reading skill (Stanovich, 1980). For a skilled reader, even a quick glance at a word activates its pronunciation and meaning. Being able to read words from memory by sight is valuable because it allows readers to focus their attention on constructing the meaning of the text while their eyes recognize individual words automatically. If readers have to stop and decode words, their reading is slowed down and their train of thought disrupted. This chapter examines theories and findings on the development of sight word reading.

Sight word reading is not limited to high-frequency or irregularly spelled words, contrary to the beliefs of some, but includes all words that readers can read from memory. Also sight word reading is not a strategy for reading words, contrary to some views. Being strategic involves choosing procedures to optimize outcomes, such as figuring out unfamiliar words by decoding (Gough, 1972) or analogizing (Goswami, 1986, 1988) or prediction (Goodman, 1970; Tunmer & Chapman, 1998). By contrast, sight word reading happens automatically without the influence of intention or choice. Reading words from memory by sight is especially important in English because the alphabetic system is variable and open to decoding errors.

Ways to Assess Sight Word Reading

There are various ways of assessing sight word reading. One approach is to test readers' ability to read irregularly spelled words under the assumption that, if these are not known, they will be decoded phonically, resulting in errors. A second approach is to give students a sight word learning task in which they practice reading a set of unfamiliar words. Their performance over trials is tracked as well as their memory for words at the end of learn-

ing. This approach has been used to study whether readers retain specific words in memory. Readers are taught one of two phonetically equivalent spellings (e.g., cake vs. caik) and then their memory for the particular form taught is tested. Readers might be asked to recall the spelling or to choose among alternative spellings. Although the test is of spelling rather than reading, the correlation between the two skills is very high, supporting the validity of spelling as an indicator. Finally, another approach is to assess word reading speed. This works because readers take less time to read words by sight than to decode them or read them by analogy. Reading words within one second of seeing them is taken to indicate sight word reading.

Automatic word recognition has been assessed with interference tasks. Written words and pseudowords are each imposed on drawings of objects; for example, *cow* or *cos* written on a picture of a horse. Students are told to name the pictures and *ignore* the print. If the words are read automatically, readers will name pictures labeled with words more *slowly* than those with pseudowords (Rosinski, Golinkoff, & Kukish, 1975). This happens because the familiar sight words are activated in memory and readers trip over these competing words as they access the names of the pictures. Tasks involving color words have shown the same effects (e.g., word *red* written in blue ink). Researchers infer that words are known automatically if they create interference.

Memory Processes That Enable Sight Word Reading

Growth of reading skill requires the accumulation of a huge vocabulary of sight words in memory. The magnitude of the task in English is suggested by Harris and Jacobson (1982) who tallied words that were common to at least half of eight basal series. This yielded a core list of basic words that did not count inflected forms such as *stop* and *stopped* separately. The list included 94 words from preprimers, with 175 from primer, 246 from first grade, and 908 from second-grade books. Thereafter, the numbers added at each grade level through eighth grade varied from 1,395 to 1,661 words, for a sum total of 10,240 basic words. Thus, sight word learning makes a big demand on memory.

Research findings reveal that sight words are established quickly in memory and are lasting. Reitsma (1983) gave Dutch first graders practice reading a set of words and then three days later measured their speed to read the original words as well as alternative spellings that were pronounced the same but never read (e.g., plezier vs. plesier). A minimum of four trials reading the original words was sufficient to enable students to read the familiar forms faster than the unfamiliar forms. More recently, Share (2004) found that even one exposure to words enabled Israeli third graders to retain specific information about their spellings in memory, and this memory persisted a month later. To learn sight words this rapidly requires a powerful mnemonic system.

When a reader's eyes land on a familiar written word, its pronunciation, meaning, and syntactic role are all activated in memory. Theories to explain how such memories are built involve specifying the nature of the *connections* that are formed in memory to link visual properties of the word to its other identities. Two types of connections have been proposed.

According to one approach, connections are established between visual features of words and their *meanings*. These grapho-semantic connections are arbitrary rather than

systematic. They are learned by rote. They do not involve letter-sound relations, so substantial practice is required to remember the words. The visuospatial features stored in memory might be letters, letter patterns, word configurations, or length. However, no phonological information contributes to the associations. Rather pronunciations of words are activated only after the meanings of words have been retrieved. This explanation is advanced by dual-route models of word reading with decoding as the other route (Baron, 1979; Barron, 1986).

According to another approach, spellings of specific words are connected to their *pronunciations* in memory. Readers use their knowledge of the alphabetic system to create these connections. They know how to distinguish separate phonemes in pronunciations and separate graphemes in spellings. They know grapheme–phoneme correspondences. More advanced readers know larger graphosyllabic units as well (e.g., *-ing*). When readers encounter a new written word and recognize its pronunciation and meaning, they use their alphabetic knowledge to compute connections between graphemes and phonemes. Reading the word just once or a few times serves to bond the spelling to its pronunciation along with its other identities in memory. This is Ehri's (1992) theory of sight word reading. Others too have proposed visuophonological connectionist theories of word reading (Harm & Seidenberg, 1999; Perfetti, 1992; Rack, Hulme, Snowling, & Wightman, 1994; Share, 1995).

Visuophonological connections constitute a more powerful mnemonic system that better explains the rapid learning of sight words than visuosemantic connections. However, both types appear in developmental theories. Grapho-semantic connections explain the earliest forms of sight word reading. Once beginners acquire knowledge of the alphabetic system, graphophonemic connections take over.

Developmental Theories

The development of word reading skill is portrayed as a succession of qualitatively distinct stages or phases in several theories. Use of the term "stage" denotes a strict view of development in which one type of word reading occurs at each stage, and mastery is a prerequisite for movement to the next stage. However, none of the theories is this rigid. Some theories refer to "phases" rather than "stages" of development to be explicit about relaxing these constraints. Earlier phases may occur by default because more advanced processes have not yet been acquired, so mastery is not necessarily a prerequisite for later phases.

These theories portray the succession of key processes and skills that emerge, change, and develop. Labels characterize the types of processes or skills that are acquired and predominate at each stage or phase. Theories may identify the causes producing movement from one phase to the next. Two types of causes can be distinguished, internal and external. Internal causes operate when specific cognitive or linguistic capabilities facilitate or place constraints on the acquisition of other capabilities. Internal causes include capabilities specific to reading; for example, the facilitation produced by acquiring letter knowledge. Internal causes also include general capabilities that serve purposes other than reading as well; for example, mechanisms involving vision, language, and memory (Rack,

Hulme, & Snowling, 1993). External causes include informal teaching, formal instructional programs, and reading practice. Theories provide a basis for assessing developmental levels, for predicting what students can be expected to learn at each level, for differentiating the types of instruction and feedback that are most effective at each level, and for explaining why some students do not make adequate progress.

Synopsis of the Theories

The different stage and phase theories vary in scope and in the attention paid to sight word reading but there are also many similarities between them. There is not space in this chapter to go into the different theories in detail. Table 8.1 represents an attempt to highlight the synergies between the models as a backdrop to the discussion of sight word reading.

One of the first stage models was proposed by Philip Gough (Gough & Hillinger, 1980; Gough, Juel, & Griffith, 1992) who distinguishes two ways to read words. Cue reading is an immature form of sight word reading. Students read words by selecting a salient visual cue in or around the word and associating it with the word in memory. Cipher reading replaces cue reading when students acquire decoding skill.

Jana Mason (1980) divides Gough's cue reading period into two stages labeled to portray the written cues that beginners use to identify written words: (1) contextual dependency, (2) visual recognition, and (3) letter-sound analysis. Context dependent learners use the same learning process to recognize words as to identify pictures, by treating the words as unique visual patterns. Learners at the visual recognition stage use letters to read words but they lack decoding skill. Learners at the letter-sound analysis stage have mastered letter-sound correspondences and can use them to decode unfamiliar words.

Marsh, Friedman, Welch, and Desberg (1981) distinguish four stages characterized by changes in the strategies to read words. During the earliest stage, known words are read by rote association between unanalyzed visual forms and their pronunciations. Unknown words are read by linguistic guessing. During Stage 2, graphemic features, particularly initial letters, influence the reading of words. In learning to read words, readers remember the minimum graphemic cues necessary to distinguish among words. Stage 3 involves sequential decoding between letters and sounds. Stage 4 involves hierarchical decoding based on more complex context-dependent rules. In addition, analogizing is considered as a strategy for reading unknown words.

Jeanne Chall (1983) differentiates the process of reading acquisition into five stages from birth (Stage 0) through adulthood. Most relevant here are Stage 1 Decoding, and Stage 2 Fluency. Stage 1 is further analyzed into phases. Initially children rely on memory or contextual guessing to read. To make progress, they need to abandon these habits and become "glued to print" by processing letters and sounds. According to Chall this is facilitated by systematic phonics instruction.

Uta Frith (1985) also noted that the transition between a visual and an alphabetic stage depends on awareness of relationships between sounds and letters. Her proposal is a three-phase theory characterized by different word reading strategies: (1) a logographic phase

Table 8.1 A Schematic Summary of the Approximate Relationships between Different Stage/Phase Theories of Learning to Read

Proponents	*Gough & Hillinger (1980)*	*Mason (1980)*	*Marsh et al. (1981)*	*Chall (1983)*	*Frith (1985)*	*Ehri (1998, 1999, 2002)*	*Stuart & Coltheart (1988)*	*Seymour & Duncan (2001)*
Number of Developmental Periods	2	3	4	5	3	4	2	4
1. Pre-reading	Cue reading ↑	Contextual dependency	Rote, linguistic guessing	Stage 0: Letters/Book exposure	Logographic	Pre-alphabetic	Partial orthographic ↑	Pre-literacy
2. Early reading	↓	Visual recognition	Discrimination net guessing	Memory and contextual guessing		Partial alphabetic	↓	Dual Foundation
3. Decoding	Cipher reading ↑	Letter-sound analysis	Sequential decoding	Stage 1: Decoding, attending to letters/sounds	Alphabetic	Full alphabetic	Complete orthographic	Logographic / Alphabetic
4. Fluent reading	↓	Mason (1980)	Hierarchical decoding	Stage 2: Fluency, Consolidation	Orthographic	Consolidated alphabetic, Automaticity	↓	Orthographic / Morphographic

when readers recognize words on the basis of distinctive visual or contextual features; (2) an alphabetic phase when readers use spelling-sound rules to read words; (3) an orthographic phase when words are recognized by larger spelling patterns, especially morphemic units.

Building on Frith's model, Philip Seymour (Seymour & Duncan, 2001) proposes the dual-foundation model consisting of several phases of literacy development: pre-literacy, foundation, orthographic, and morphographic. In the foundation phase, two processes are acquired. The logographic process entails the accumulation of sight words in memory. In contrast to Frith's (1985) nonalphabetic logographic phase, grapheme–phoneme units are used to connect words in memory. The alphabetic process refers to decoding skill. Later phases involve the use of larger spelling units, including onsets and rimes, whole syllables, and morphemes to read words (Seymour, Aro, & Erskine, 2003).

In a rather different formulation, Morag Stuart (Stuart & Coltheart, 1988) rejects the idea of an initial logographic or visual cue stage, arguing that neither visual nor contextual cues enable children to read. When children read successfully, they use phonological processes. Her developmental theory distinguishes two important changes in the representations of sight words in memory: an early point when children acquire phonemic segmentation and letter-sound knowledge sufficient to form partial representations consisting of beginning and ending letters, and a later point when knowledge of vowel spellings provides the basis for forming more complete representations of sight words in memory. During the latter period, children also acquire decoding skill that supports the reading of new words.

In general, there is substantial agreement among theories in the periods that are distinguished to portray the development of word reading. With a few exceptions, they are consistent with my four-phase theory of sight word reading. In this view (Ehri, 1998, 1999, 2002), each phase of reading development is characterized by the predominant type of connection that bonds written words to their other identities in memory: (1) pre-alphabetic, involving visual and contextual connections, (2) partial alphabetic, involving connections between more salient letters and sounds, (3) full alphabetic, involving complete connections between all the graphemes in spellings and phonemes in pronunciations, and (4) consolidated alphabetic, involving connections formed out of syllabic units. Whereas connections during Phase 1 are linked to the meanings of words, connections in subsequent phases are grounded in pronunciations. Decoding skill emerges in Phase 3 and enhances the quality of memory for sight words. This phase theory will be used as a framework in the remainder of the chapter to explain how word reading changes during development to become fluent and automatic.

Phase Theory of Sight Word Reading

Pre-alphabetic phase

During the pre-alphabetic phase, children read words by remembering visual or contextual cues. Gough et al. (1992) taught preschoolers to read four words, one accompanied

by a thumbprint. Children mastered this word first. When the thumbprint was removed, fewer than half could identify the word. When the thumbprint was shown alone, nearly all pronounced the word. When the thumbprint appeared next to another word, nearly all gave the "thumbprint" word. Gough et al. also covered up parts of the words. They reasoned that if students were selecting cues rather than remembering whole words, they should not recognize the words when critical parts were covered. This is what they found. If children could not read the word when the first half was covered, then they were twice as likely to read it when the second half was covered. Gough's findings indicate that the earliest form of sight word reading consists of children selecting a salient visual cue around or in part of a word to remember how to read it.

Studies have examined the cues used by pre-alphabetic readers to read words appearing in their everyday environments, such as the names of restaurants, brands of candy, their own or friends' names printed on cubbies at school. Results showed they used salient visual features in or around the written words rather than alphabet letters. For example, Masonheimer, Drum, and Ehri (1984) studied preschoolers who read few if any common words but could read several common signs and labels in the environment, for example, *McDonalds*. The children were asked to read the same signs but with one letter altered; for example, *Pepsi* changed to *Xepsi*. Most children failed to detect the changes, even when they were prompted to look for mistakes. Although they knew about 60% of the letter names, these results show they did not use them to read environmental print.

One criticism of the use of environmental print to assess sight word reading is that signs and labels are rich in other visual cues that are more salient than letters. This reduces any need to notice letters. A form of print more likely to elicit letter processing is that of personal names. Bloodgood (1999) studied 3–5-year-olds. Although the youngest children knew only a few letters and could read few if any preprimer words, they could recognize their own names in isolation and sometimes names of their classmates. Children's comments suggested that initial letters were the salient cues remembered. Also, knowledge of the letters in their own names accounted for most of the letters they could identify. This was confirmed by Treiman and Broderick (1998). Some children could write their own names yet could not name the letters they wrote, showing that letters were remembered as visual shapes rather than as symbols for sounds. This was evident in the comments of one child, Robert, who referred to 't' as "the cross thing."

Share and Gur (1999) studied personal name recognition in pre-alphabetic children. They distinguished two types of connections to read personal names during this period: contextual and visuographic. Contextual cues are those lying outside the printed word, such as stickers on personal lockers next to personal names. Visuographic cues are nonphonetic graphic features in the printed word itself, such as the two sticks in *William* or the shape of K in *Jack*. These pre-alphabetic, Hebrew-speaking 4–5-year-olds knew few letters, had poor phonemic awareness, and could not read any common words. Their ability to read personal names declined when the names were removed from personal lockers and shown in isolation, with contextual readers losing all ability. Visuographic readers were able to read two or three names in isolation, but they recognized the names regardless of whether first or final letters were covered, indicating they did not select limited visual cues as Gough and Hillinger (1980) would expect, but rather they had memory for the whole name. Full names may have been remembered because they were

overlearned visual forms, or because Hebrew names do not have distinctive initial and final letters attracting attention to this part of the name.

Studies reveal that children's memory for words is very limited during this early phase. Mason (1980) used a sight word learning task that provided several practice trials to examine how easily children at different phases of development learned to identify printed words. The least mature readers who only knew some alphabet letters learned a few of the words, but could not recognize them if the letters were changed from upper to lower case, and they forgot most of the words after 15 minutes. Other studies show that at this stage, children's learning of new words depends on how meaningful they are (Ehri & Wilce, 1987b) rather than their orthographic features. As a result, they frequently make semantic errors when reading familiar words (Goodman & Altwerger, 1981; Harste, Burke, & Woodward, 1982; Seymour & Elder, 1986).

Consistent with this finding, Byrne (1992) showed that pre-alphabetic children attend to print–meaning correspondences but not to print–sound correspondences. He gave preschoolers two word learning tasks followed by a transfer task. In his print–meaning task, children learned to say "little boy" when they saw a triangle and square and "big boy" when they saw a circle and square. Then they were shown the triangle combined with a new symbol, a cross, and were asked, "Does this say 'little fish' or 'big fish?' " In his print–sound task, the same symbols and procedures were used, but children learned to say "fat" to the triangle-square and "bat" to the circle-square. When shown the triangle-cross, they were asked, "Does this say 'fun' or 'bun?' " Byrne found that children succeeded on transfer items like "little fish," indicating that they had learned the semantic connections between the triangle and "little," but not on items like "fun," indicating they had not formed connections at a phonemic level between the triangle and /f/.

In summary, pre-alphabetic readers adopt a visual cue approach by default because they lack the knowledge or ability to use letter names or sounds to form alphabetic connections; hence the name pre-alphabetic. The lack of an alphabetic mnemonic system makes it difficult for children to learn to read words accurately.

Transition from the pre-alphabetic to partial alphabetic phase

The partial alphabetic phase emerges when beginners acquire letter knowledge and can use it to remember how to read words by forming partial connections in memory. In a longitudinal study, letter knowledge and phonemic segmentation measured at entry to kindergarten were found to be the strongest predictors of reading one and two years later (Share, Jorm, Maclean, & Matthews, 1984), so learning letters is critical. Also personal name writing, which may provide a special incentive for children to learn the shapes and names of alphabet letters, but not personal name reading, was a strong predictor of future reading. This observation supports a proposal made by Frith (1985) that writing rather than reading may be the entrée into the partial alphabetic phase.

Gough and Hillinger (1980) claim that children use cue reading to learn their first 40 or so words, but the approach breaks down because there are not enough visual cues to distinguish among all the words they encounter. At this point, Gough and Hillinger argued, readers move into the cipher stage and use letter-sound relations to decode words.

However, Ehri and Wilce (1985) present evidence for an intermediate type of word reading between the cue and cipher stage. They showed that beginners shift from visual cue reading to a rudimentary form of alphabetic reading as soon as they can read even a few words. Stuart and Coltheart (1988) proposed that the acquisition of phonic skills, rather than problems of memory load cause children to shift from cue to cipher reading and that thereafter they show rapid growth in sight vocabulary.

According to Frith (1985), the shift from pre-alphabetic to alphabetic strategies may be promoted by writing, not by reading. Whereas pre-alphabetic reading is not analytic and does not involve letters, writing by inventing spellings draws attention to the sequence of sounds in words and their connection to letters. Findings of several experiments provide some support. In these studies, novice beginners who were taught to invent phonetic spellings of words exhibited superior ability to read words by sight or by decoding compared to novices receiving other forms of instruction (Clarke, 1988; Ehri & Wilce, 1987b; Uhry & Shepard, 1993).

Frith (1985) draws attention to the dissociation between the processes used to read and to write during this early period. Bradley and Bryant (1979) observed that children were able to invent semiphonetic spellings of words, but they were unable to read back their own spellings, indicating that they did not use the same cues for writing as for reading words. Cardoso-Martins, Rodriguez, and Ehri (2003) also observed a dissociation between spelling and reading in illiterate adults who knew some letter names and sounds and produced partially phonetic spellings of words. However, they did not use letters when reading labels and signs in their environment. This was evident when they failed to notice errors, for example, *LOCA-COLA* for *COCA-COLA*, even when prompted to check for mistakes. These findings support the idea that writing may become alphabetic before reading does.

Partial alphabetic phase

Mason's (1980) study of preschoolers at Stage 2 of her theory reveals characteristics of partial alphabetic readers. These students knew most letter names and could read a few words out of context. They used letters in reading words, as evidenced by their misreadings, which often preserved the initial consonant (e.g., misreading *kit* as *key*). After learning to read 10 words in a sight word learning task, they could recognize some of the words when the case of the letters was changed, and they could remember some of the words after 15 minutes.

According to Ehri (1998), the partial alphabetic phase emerges when children can use the sound values of some letters to form connections between spellings and pronunciations to remember how to read words. This requires not only knowing the names or sounds of letters but also being able to detect some constituent sounds in the pronunciations of words (phonemic awareness). For example, children might remember how to read *jail* by connecting the first and final letters *J* and *L* to their letter names heard in the word "jay" and "el." Because the middle letters are ignored, the connections formed are only partial; hence the name of the phase. When different words share boundary letters, children may mix them up. Children lack decoding skill at this phase. To read

new words, they may guess the words using partial phonetic cues plus contextual cues, or they may mistake the words for known sight words sharing similar letters.

Ehri and Wilce (1985) proposed the partial alphabetic phase to challenge Gough and Hillinger's (1980) claim that visual cue reading provides a full account of sight word reading before beginners acquire decoding ability. Ehri and Wilce suggest that a rudimentary alphabetic form of word reading, called phonetic cue reading, precedes decoding. In their study, beginners were given several trials to learn to read two sets of words. One set was composed of visually salient spellings, such as *wBc* taught as the spelling of "giraffe." In this case the spelling had a unique shape and unique letters not occurring in other words, but none of the letters corresponded to any sound in the word. The other set of words was spelled with phonetically salient letters, such as *JRF* for "giraffe." In this case the spellings displayed letters whose names contained sounds found in the pronunciations of the words. It was predicted that pre-alphabetic readers would learn to read the visually salient spellings more easily than the phonetic spellings, whereas partial alphabetic readers would learn to read the phonetic spellings more easily than the visual spellings. This is what was found. These results have been replicated by others and show that phonetic cue reading replaces visual cue reading when alphabetic knowledge is acquired (Bowman & Treiman, 2002; De Abreu & Cardoso-Martins, 1998; Roberts, 2003; Scott & Ehri, 1989; Treiman & Rodriguez, 1999).

Even children who have not yet become readers are capable of using phonetic cues to learn to read words if they possess some knowledge of the alphabet. Scott and Ehri (1989) selected preschoolers who read few if any words out of context but knew most letter names. In a sight word learning task, these children learned to read phonetic spellings more readily than nonphonetic visual spellings. Interestingly, their learning of phonetic spellings was not influenced by whether they named or simply counted letters as they practiced reading the words, very likely because letter name knowledge was activated spontaneously during the sight word learning task.

Sight word learning is easiest when entire letter names are heard in the words. Treiman, Sotak, and Bowman (2001) used a word learning task to compare words containing letter names (e.g., TM to spell *team*) to words containing only letter-sound relations (such as TM for *time*). Preschool nonreaders learned letter-name words faster than letter-sound words. Bowman and Treiman (2002) studied whether the two positions of the letter name, at the beginning or end of words (e.g., ND for *end* vs. DN for *den*) were equally useful for forming connections. Among nonreaders who knew letters, only the initial position improved word learning compared to a visual control condition, whereas among novice beginners who knew letters and could read a few simple words, letter names in final position improved word learning over a visual control condition. These findings reveal that when children first become able to use letter names as phonetic cues in reading words from memory, before they have begun building a sight vocabulary, only letter name cues at the beginnings of words provide effective connections. However, once children begin reading simple words by sight, letter name cues in both positions can be used.

Roberts (2003) provides experimental evidence that teaching children letter names facilitates sight word learning. She selected preschoolers who knew few if any letters and could not read. She taught letter names to one group and she read stories to the control group. In a sight word learning task given at the end of training, she found that the letter

group learned to read simplified phonetic spellings more readily than visual spellings, whereas the control group showed the opposite pattern. Most of the phonetic spellings contained sounds from the letter names (i.e., LN for *lunch*) rather than full letter names. This study confirms that the relationship between letter name knowledge and sight word learning is causal.

The claim that phonetic cues provide the connections that facilitate sight word learning was pursued by Rack et al. (1994). They selected partial alphabetic phase readers, those who knew letter-sound correspondences and could read some words but had little decoding skill. Children learned to read simplified spellings that contained two phonetically plausible letters combined with one target letter that was not as phonetic. In half of the words, these target letters were articulated in the same place in the mouth and hence were close phonetic neighbors of the correct letter; for example, Z in *Z*MR to spell *summer*, or V in R*V*L to spell *rifle*. In the other half of the words, the target letters were more distant phonetically, for example, V in *V*MR to spell *summer*, or Z in R*Z*L to spell *rifle*. Children learned to read phonetically close spellings such as ZMR more easily than phonetically distant spellings such as VMR. Thus, even though the target letters in both spellings were off the mark, the letter that provided a phonetic connection to the word's pronunciation was the one that facilitated sight word learning. Rack et al. interpret their findings to support the direct mapping hypothesis, that spellings are linked to phonological forms of words when they are stored in memory. This is also evidence for Ehri and Wilce's (1985) concept of phonetic cue reading.

In sum, these findings indicate that as soon as children learn to name letters, they become capable of remembering how to read words by forming phonetic connections in memory. Alphabetically based sight word learning processes are thus available to learners sooner than Gough and Hillinger (1980) proposed, before children have learned to decode novel words. Phonetic cue reading identifies a way of reading sight words that is more advanced than visual cue or context dependent reading but less advanced than cipher reading.

Although the capability for sight word reading is present once children have mastered letters, this still may not be sufficient to build a sight vocabulary. In some of the experiments above, preschoolers benefited from phonetic cues in learning sight words yet they had not learned to read any words in isolation outside of the laboratory. In another study (Cardoso-Martins et al., 2003), illiterate Brazilian adults displayed characteristics of partial alphabetic phase readers. They knew the names of some alphabet letters, they invented partial phonetic spellings of words, and they learned to read phonetic spellings more readily than visual spellings in a sight word learning task. However, they were unable to read any common words, indicating they had not yet moved into reading. The lack of formal instruction and practice using alphabetic knowledge to read may explain the halt in their development as readers.

It is important to note that sight word reading during the partial alphabetic phase is an imperfect process that occurs among beginners who lack full knowledge of the alphabetic system and phonemic segmentation skill. There are no expectations about how long this phase will last. If beginners quickly acquire the skills necessary for the next phase, they may not exhibit phonetic cue reading. This issue was raised by Wimmer and Hummer (1990) who found that German-speaking Austrian children showed little

evidence of using visual or partial alphabetic cues to read words. This may have occurred because German is a transparent writing system, so decoding is relatively easy to learn. In addition, from Day 1 in school, Austrian children receive systematic phonics instruction that teaches them the alphabetic system.

Wimmer and Hummer (1990) suggest that the partial alphabetic phase may not apply to children who are learning to read in transparent writing systems. However, Cardoso-Martins (2001) studied beginners reading in Portuguese, a relatively transparent system. She found that those taught with a whole-word method did exhibit phonetic cue reading and did not start out decoding words, in contrast to those taught with a phonics method. Her findings indicate that the instructional method influences how long beginners show evidence of the partial alphabetic phase and how quickly they acquire use of full grapho-phonemic connections.

Transition from the Partial Alphabetic to Full Alphabetic Phase

The full alphabetic phase emerges when beginners acquire decoding skill and grapho-phonemic knowledge that is used to bond spellings fully to their pronunciations in memory. In a longitudinal study following students from first to second grades, Juel, Griffith, and Gough (1986) showed the importance of several capabilities for this transition (with tasks in parentheses): phonemic awareness (segmentation, blending, substitution), exposure to print (level of texts being read in classrooms), cipher knowledge (nonword decoding), and sight word knowledge (recognition of misspellings). A path analysis suggested that phonemic awareness and exposure to print helped children acquire the cipher. Cipher reading when combined with sight word knowledge was found to improve word reading, which in turn influenced text comprehension. Interestingly, correlations between reading measures were much higher, typically above .60, than correlations involving IQ, typically below $r = .40$. These findings suggest that internal causal relations among reading capabilities promote movement from the partial to the full alphabetic phase.

Stuart and Coltheart (1988) are critical of claims that phonological awareness is *the* necessary precursor for learning to read. Rather, they propose phonological awareness combined with letter-sound knowledge initiates reading acquisition (see Bowey, this volume). Studies show that even adults may lack much phonemic awareness unless they have learned to read an alphabetic writing system (Morais, Cary, Alegria, & Bertelson, 1979; Read, Zhang, Nie, & Ding, 1986). Also studies show that teaching beginners both phonemic awareness and letter-sound correspondences produces larger effects on word reading than teaching beginners only phonemic awareness (Bradley & Bryant, 1983; Ehri et al., 2001).

In a longitudinal study, Stuart and Coltheart (1988) had beginners read a list of common words several times during the first grade. Two types of errors were distinguished, errors that preserved beginning or beginning and ending letters (e.g., *cat–car*, *bir–bad*) and errors that showed less resemblance to the written words (e.g., *look–baby*, *milk–like*). Students were grouped by the point in time during the year when they attained phonemic segmentation and letter-sound knowledge. The proportions of different error

types that they produced before and after this point in time were analyzed. Results revealed that prior to the targeted point, readers produced more errors lacking resemblance to words than errors sharing beginning and end letters. However, after the targeted point, the pattern reversed and errors sharing letters with the target words rose. Furthermore, most of the errors produced by children who had reached the targeted point early were of this type. These findings support Stuart and Coltheart's claim that acquisition of phonemic awareness and letter knowledge change the quality of word reading processes and move students to a new level of development.

In a subsequent study, Savage, Stuart, and Hill (2001) examined the predictive relationship between word reading at age 6 and 8 years. Word reading errors preserving beginning and ending letters, called scaffolding errors, were strongly correlated with reading two years later, whereas word reading errors that preserved only beginning or only ending letters showed negative correlations. Scaffolding errors are claimed to play an important role in building word reading skill. Readers who can construct scaffolds of words in memory may find it easier to remember the middles of words and to learn letter-sound consistencies that recur across words.

Chall (1967) emphasizes the contribution of instruction. In her review of studies, she found that early systematic instruction in phonics led to better achievement in reading than later less systematic phonics instruction. More recently, Ehri, Nunes, Stahl, and Willows (2001) conducted a meta-analysis of experimental studies. They found that systematic phonics instruction boosted sight word reading, decoding, and reading comprehension more than other kinds of instruction including whole-word and whole-language instruction. Effects were especially pronounced in kindergarten and first grade.

The impact of phonics and whole-word instruction on students' miscues (misreadings of words) during oral text reading has been examined (Barr, 1974–1975; Carnine, Carnine, & Gersten, 1984; Cohen, 1975). Results indicate that whole-word trained beginners are more apt to guess words based on partial letter cues or context cues or resemblance to known sight words than phonics trained students. Phonically trained students are more likely to stop reading when words are unknown and to generate a nonword when they try unsuccessfully to decode the word. Barr (1974–1975) inferred use of sight word reading if students substituted only real words drawn from their reading vocabularies. She inferred use of a decoding strategy if students produced nonwords and real words that did not come from their reading vocabularies. Midway through first grade, phonics-trained students exhibited both approaches, but by the end of the year, most had shifted to a decoding strategy. In contrast, whole-word-trained students continued to use sight word reading based on partial cues throughout the year. These findings reveal that phonics instruction promotes more rapid movement from the partial to the full phase than whole-word instruction. This is because sight word reading at the full phase benefits from decoding skill.

Full alphabetic phase

Mason's (1980) longitudinal study reveals characteristics of children in the full alphabetic phase. These children were able to decode new words. In her sight word learning task,

they had no problem learning to read all 10 words and remembering them after a delay. Also they had no problem when the letter case was shifted. Parents were unable to estimate their children's sight word vocabularies because growth was so rapid.

According to Ehri (1999) during the full alphabetic phase, beginners become able to form connections between all of the graphemes in spellings and the phonemes in pronunciations to remember how to read words. This fully secures the words in memory and gives them a unique address that eliminates confusion among similarly spelled words. To learn sight words this well, readers need more complete knowledge of grapheme–phoneme relations, most importantly vowels, and how to use these relations to decode words. They also need phonemic segmentation skill to detect the full array of grapheme–phoneme connections that secure spellings in memory. One or a few reading experiences is sufficient to convert unfamiliar words to familiar sight words.

Ehri and Wilce (1979) showed that knowledge of grapheme–phoneme correspondences provides a mnemonic system that links spellings to pronunciations and enhances memory for words. In one experiment, children practiced saying the pronunciations of four nonwords, each paired with a number; for example, 1-"jad," 2-"wek," 3-"sim," and 4-"lut." During study periods, some children were shown spellings of the words. Other children repeated the words an extra time but never saw spellings. During test periods, each number was presented without any spelling, and children recalled its nonword. Children who had seen spellings remembered the words much better than those who had not. The relationship between children's ability to benefit from spellings in remembering the words and their sight vocabularies was very high, supporting the idea that this mnemonic system provides the "glue" that secures sight words in memory.

This connection-forming process works not only to secure regularly spelled words in memory but also irregularly spelled words, most of which exhibit some regularity. Irregular words can be remembered by forming connections between those letters that correspond to sounds; for example, all but the *S* in *island*. The exceptional letters may be flagged in memory as silent, or remembered as extra letters, or given a spelling pronunciation. Stuart and Masterson (1992) found that the tasks of reading regularly spelled words and reading irregularly spelled words were highly correlated in a group of 10-year-olds ($r = .93$), suggesting use of a common connection-forming process.

Results of several studies of beginners' sight word reading reveal differences that distinguish partial from full alphabetic phase readers. Ehri and Wilce (1987a) selected partial alphabetic kindergartners and randomly assigned them, either to a group that learned to process all the letters in words to read them, the full phase group, or to a group that practiced individual letter-sound relations, the partial phase group. On a sight word learning task that followed training, full alphabetic phase readers learned to read a set of 15 similarly spelled words almost perfectly after three practice trials. In contrast, partial phase readers never learned even half of the words after seven practice trials, one reason being that they mixed up similarly spelled words. On a spelling task given afterwards, full phase readers remembered middle letters better than partial alphabetic readers. However, both groups spelled initial and final letters accurately and equally well, very likely because these were the cues that the partial readers used to remember how to read the words. These findings show that sight word learning is more rapid and accurate during the full phase,

and that spellings of words are better secured in memory among full phase readers than among partial phase readers. In another study, Ehri and Saltmarsh (1995) also showed that full alphabetic phase readers retained complete spellings of sight words in memory, whereas partial alphabetic phase readers retained mainly boundary letters.

Evidence that graphemes are connected to phonemes when sight words are learned comes from two studies by Ehri and Wilce (1980, 1986). They taught children to read words and then examined whether the spellings influenced children's conception of phonemes in pronunciations of the words. For example, the medial consonant in *Gretel*, *meteor*, and *glitter* is a flap pronounced more like /d/ than /t/ in American English. Children who learned to read these words perceived this phoneme as /t/ according to its spelling, whereas children who only practiced saying the words but never read them perceived the phoneme according to its spoken form, as /d/. The explanation is that conceptions of phonemes are shaped by the graphemes connected to them.

Stuart and Coltheart (1988) explain how beginners who possess full phonics skills can retain sight words in memory with minimal experience reading the words. It is because alphabetic knowledge provides learners with a basis for *expecting* specific connections between spoken and written words. For example, students who know how to segment the word *bat* into three phonemes and how to spell each phoneme will expect to see the word written b, a, t, before they ever see it. Such expectations support very rapid acquisition because word learning simply entails confirming an expectation and assimilating its form in memory.

Share (1995, 1999) has studied the contribution of a decoding strategy to the acquisition of sight words. Decoding functions as a self-teaching mechanism. When readers decode new words as they read text, those words are retained in memory. In a study by Cunningham, Perry, Stanovich, and Share (2002), second graders read 10 novel words, each repeated 6 times in a story. One of two identically pronounced spellings of each word was read (e.g., yate vs. yait). Posttests showed that students remembered the spellings of the words they read and did not confuse them with plausible alternative spellings that were not seen. In support of the self-teaching hypothesis, there was a strong correlation between correct decodings of the words and memory for the spellings seen. The relationship was not explained by general cognitive ability. This study shows that decoding helps students build a sight vocabulary.

Although decoding facilitates memory for sight words, beginning readers of English have trouble reconciling these two processes because English includes numerous high-frequency words that are not decodable and can only be read from memory. Seymour and Duncan (2001) suggest that instruction emphasizing only one of the processes may retard the development of the other process. Seymour and Elder (1986) observed the word reading of children taught in a whole-word program. They found that when given a reading task, children produced only words they had been taught and were unable to read unfamiliar words. Typically they would refuse to read or would substitute known words for the unfamiliar words. In contrast, students who received a mixed instructional approach utilized both sight word reading and a decoding strategy. This suggests that growth during the full alphabetic phase requires instruction in both decoding and sight word learning.

Consolidated alphabetic phase

Constituents of the consolidated alphabetic phase begin to form during the full alphabetic phase. These consist of letter sequences that symbolize blends of graphophonemic units, including morphemes (affixes and root words), onsets, and rimes (e.g., in *string*, the onset is *STR* and the rime is *ING*), monosyllabic words that have become sight words, and more frequent spellings of syllables in polysyllabic words. As readers learn to read words that share letter patterns symbolizing the same phoneme blend in different words, for example, *king*, *thing*, *bring*, *sing*, a consolidated unit is formed. Knowing *-ing* as a consolidated unit means that readers can read it as a whole rather than as a sequence of grapheme–phoneme units. Knowing larger blends contributes to the learning of sight words by reducing the memory load. For example, connections to learn the word *interesting* are much easier to form if the four syllabic spellings, *IN*, *TER*, *EST*, *ING*, are known as units than if the word is analyzed as 10 graphophonemic units (Henry, 2003).

According to Ehri's (1998, 1999, 2002) theory, the consolidated alphabetic phase replaces the full alphabetic phase when the predominant type of connection for retaining sight words in memory is graphosyllabic. Among the first letter sequences to consolidate during the full alphabetic phase are common morphemic suffixes, *-ED*, *-ING-*, *-ER-*, *-EST*. Also monosyllabic words that have become sight words provide consolidated units available for forming connections. The most common word constituents of multisyllabic words are *ate*, *in*, *it*, *ant*, and *age*.

Relatively few studies have examined the facilitative effects of consolidated units on sight word learning. Ehri and Robbins (1992) conducted a study with first graders who displayed some decoding skill. In a sight word learning task, children practiced reading one set of words and then were given a second set to learn. The second set consisted of spellings that contained either the same rime endings as first set (e.g., *feed – seed*) or the same letter-sound correspondences but not the same rime patterns. Children learned the words faster when the second set shared rimes with the first set than when the second set shared letter-sounds, indicating that common letter patterns provided the connections facilitating learning.

The value of having students analyze the syllable constituents of words in a sight word learning task was studied by Bhattacharya and Ehri (2004) who worked with adolescent struggling readers reading at a third grade level. Students practiced reading and analyzing four sets of 25 multisyllabic words for 4 trials, each set learned on a different day. Words were pronounced and divided into spoken syllables that matched written syllables. Control groups received either whole-word practice on the same words or no special treatment. Performance on posttests indicated that students who received syllable training retained the spellings of sight words in memory more completely than students who practiced reading the words as wholes. Moreover, syllable students outperformed whole-word students in decoding new words and pseudowords. These findings suggest the value of practice in the consolidation of syllabic units for sight word learning and decoding skill.

Juel (1983) studied the influence of letter patterns on fifth graders' reaction times to read 64 familiar words. She found that they read words faster when they contained more

common two-letter patterns occurring in the same positions in many different words than when they read words containing patterns occurring in fewer words. This shows that spelling patterns facilitate sight word reading. Juel also examined the impact of the frequency of spelling patterns occurring in running text (i.e., *th* occurs very often when counted in running text because of the frequency of *the*, but *th* occurs less often when counted in different words). This way of counting spellings patterns did not influence sight word reading, suggesting that acquisition of consolidated units is governed by the number of different sight words containing them, not by their frequency in running text.

Development of Automaticity, Speed, and Unitization

Two other dimensions of sight word reading that undergo development are automaticity and speed. In the theories presented above, these dimensions receive less attention. Chall (1983) considers word reading speed as part of building fluency during Stage 2. Ehri and McCormick (1998) suggest that automaticity may be a separate phase that follows the consolidated phase during development and characterizes mature readers who recognize most words automatically by sight and who are facile if not automatic in decoding unfamiliar words.

Automaticity is recognizing the pronunciations and meanings of written words immediately upon seeing them without expending any attention or effort decoding the words. Studies using picture-word interference tasks show that readers' minds process the words even when they try to ignore them. Words slow down picture naming more than nonwords. Words in the same semantic category as the pictures, such as names of animals or fruit, slow down picture naming the most. Guttentag and Haith (1978) found that normally developing readers as young as the end of first grade processed familiar words automatically.

LaBerge and Samuels (1974) propose a theory to explain the develoment of automaticity. Two stages are distinguished, involving attention (Samuels & Kamil, 1984). At the beginning stage, readers switch their attention between decoding words and comprehending text, whereas at the fluent stage, no switching is required because words are read automatically. The advantage of automaticity is that readers' attention can be devoted entirely to understanding the text rather than having it divided and distracted by decoding issues.

LaBerge and Samuels (1974) also portray the development of visual memory for words. As a result of practice reading many words, the reader processes increasingly larger units as these units recur, from features to letters to spelling patterns to whole words, referred to as unitization. Not only letters but also other visual features of words such as word length, contour, and internal patterns may be retained in memory to support sight word reading. Visual codes become connected to phonological codes, which in turn activate semantic codes in memory.

In one study, Samuels, LaBerge, and Bremer (1978) presented common words of varying length to students (grades 2 through college) who pressed a button if the word belonged to a targeted semantic category such as "animal." Second graders' latencies

increased as words grew longer from 3 to 5 letters, whereas older students' latencies did not change. The explanation is that older students read the words as single units, whereas younger students processed component letters to read the words.

Further evidence regarding the development of unitization is provided by Ehri and Wilce (1983), who measured the latencies of skilled and less skilled readers (grades 1, 2, and 4) when they read common object words, number words, and CVC nonwords (e.g., *cat*, *six*, *des*) and named single numbers. Words were read faster than nonwords, indicating that words were read by sight rather than decoding. Skilled readers read words as rapidly as they named numbers, indicating that the words were read as whole units rather than sequentially by letters. In contrast, less skilled readers below fourth grade did not show unitization. According to Ehri and Wilce, unitization indicates that spellings of sight words are fully secured to their pronunciations in memory, whereas lack of unitization results from sight words that are only partially secured.

One might question whether sight word reading occurs in transparent writing systems where most words can be decoded. Defior, Cary, and Martos (2002) and Wimmer and Goswami (1994) gave German-, Spanish-, and Portuguese-reading students the task of reading number words and pseudowords and naming digits. First graders took longer to read number words than to name digits. However, second graders identified number words and digits at the same speed, indicating unitization. In addition, all grade levels read number words faster than pseudowords. These findings show that sight word reading does occur in more transparent writing systems, despite the fact that decoding is a viable option.

Concluding Comments

We have seen that several theories portray how word reading develops. Although some theories relegate sight word reading to the earliest stage and view it as an immature process that is replaced by decoding, findings of studies show that this is inaccurate even in transparent languages. The types of connections that secure sight words in memory change with development, but sight word reading exists as a way of reading words from memory throughout development. Some theories include an initial pre-literacy phase to explore possible roots of later phases. Other theories ignore this phase because children make little if any progress learning to read. Theories show agreement regarding the huge advantage to word reading that results when decoding skill is acquired. Theories explain later forms of sight word reading as involving connections that are provided by the alphabetic system and that secure sight words in memory. Some of these theories distinguish a rudimentary alphabetic period before full alphabetic knowledge is acquired. Some theories add later phases that involve syllabic and morphographic spelling patterns to form connections.

There is need for further research to enrich the picture of development. Some studies provide evidence that is exploratory and suggestive rather than definitive. Causal claims may rest on correlational findings rather than controlled experiments, so research is

needed to rule out competing explanations. Especially valuable will be training studies to test causal claims.

Developmental theories of word reading carry implications for instruction. Teachers and curriculum designers are using these theories to guide their work (Brown, 2003). This is illustrated by F. Johnston's testimonial:

> Phases of word recognition have so many implications for developmentally appropriate instruction. Right now I am working to convince teachers that directing students to look at the printed word is so much more important than directing them to use context and picture cues. Also I tell them that the prompts they give children when they encounter words they don't know will depend upon where the children are in their word recognition development. If they are pre-alphabetic, then they will have to use pictures, but if they are moving into the full alphabetic phase, then it is perfectly approriate to ask them to sound out the word. Teachers seem to be very familiar with prompts but only as a generic list that is not differentiated by development. (personal communication, February 26, 2002)

Research is needed to study whether taking account of developmental theories improves instruction. Ehri's phase theory was applied to modify the Benchmark word identification program (Gaskins, Ehri, Cress, O'Hara, & Donnelly, 1996). The original program involved teaching students to read new words by analogy to a set of 93 key words. The program was revised to include teaching students to analyze words into grapheme–phoneme constituents so that the key words became fully secured sight words in memory rather than just words listed on a classroom wordwall. Preliminary data analysis comparing students' performance in the original and revised programs indicates that the new program produced superior performance during first and second grades with diminished differences in third grade.

One topic slighted in the present chapter concerns the impact of building a sight vocabulary on other ways to read words. One contribution involves analogizing. As readers' sight vocabularies grow and provide the analogs, this strategy becomes more common, especially if readers are taught how to analogize. Another contribution of sight word learning is to expand readers' knowledge of spelling-sound regularities. According to Stuart, Masterson, Dixon, and Quinlan (1999), readers hold expectations from their alphabetic knowledge about the way words will be spelled when they see them in print for the first time. When parts of these words deviate from expectations, readers notice the unexpected parts. When the same parts recur in other words, they are learned as alternative spellings for the sounds represented; for example, the *-igh* representing /ay/ in *night*, *light*, *fight*. Thompson and his colleagues (Thompson, Cottrell, & Fletcher-Flinn, 1996; Thompson, Fletcher-Flinn, & Cottrell, 1999) have also studied this learning process. They use it to explain how children who do not receive explicit systematic instruction in phonics nevertheless acquire knowledge of the alphabetic system, by learning to read specific words and remembering letter-sound consistencies across the words.

Another important topic deserving more attention involves students with reading disabilities and how they fit into these developmental schemes (Ehri & Snowling, 2004). Compared to typically developing readers, poor readers have greater difficulty decoding new words, they take longer to learn words by sight, they secure partial rather than full

representations of sight words in memory (see Romani et al., this volume), and they read familiar words more slowly and take longer to unitize them. In short, they look like partial alphabetic readers. Because text reading is supported by much redundancy, deficiencies in sight word reading are compensated by other sources. Word reading is propped up by the surrounding text, by readers' spoken vocabulary and world knowledge, and by the strategy of predicting words based on partial letters and context. These sources allow poor readers to read text albeit less adequately than typical readers.