"Reconceptualizing the Development of Sight Word Reading and Its Relationship to Recoding", (a chapter found in, **Reading Acquisition**, Philip Gough, Linnea Ehri and Rebecca Treiman (eds.) 1992), Third in a series by Linnea Ehri. **Learning to Read Words**.
Highlights of chapter by Charles Arthur

In this earlier publication (earlier than the 2005 and 1998 publications), Ehri provides more details on the distinction between her explanation of sight word reading and a traditional "duel-route" sight word explanation. She also uses slightly different language in describing how this works than she did in her later writing.

Overview
According to duel route theory (of sight word reading), the connections (between the visual forms of words seen in print and their meanings in memory) formed are arbitrary rather than systematic, they are learned by rote (lots of repetition), and they do not involve letter-sound relations.

Few studies (in support of this view) have been conducted with spellings that are totally arbitrary and that lack letter-sound relations to show the visual-semantic connections and not visual-phonological connections form the basis of sight word reading. Furthermore, this view does not explain why it is necessary for beginners to have phonological awareness and phonological recoding (decoding) skill in order to learn to read words, yet this necessity has been demonstrated by research.

An alternative view to decoding and sigh word route.
Readers use their knowledge about letter-sound relations to form these (visual-phonological) connections. (yet), this process (also) differs from phonological recoding (decoding) in that word - specific connections rather than translation rules are used to read words. As a result, the words are accessed directly in memory from their printed forms rather than indirectly from pronunciations (identification goes from visual to pronunciation to identity and meaning), and information about the spellings of specific words is retained in memory and amalgamated(combined) with information about pronunciations and meanings. It is this amalgam(mix) that is accessed directly when sight words are seen.

My conception of sight word reading differs from the sight word route of duel route theory in that the kind of connections enabling readers to find specific words in memory is a systematic connection between spellings and pronunciations rather than an arbitrary connection between spellings and meanings.

Three kinds or phases of word reading.
1. Logographic or visual cue reading: readers know little about the letter-sound system so they read words by rote memorizing connections between visual cues and meanings of words.
2. Phonetic cue reading: readers use their rudimentary knowledge of letter names or sounds to form partial connections between spellings and pronunciations.
3. Cipher reading: readers use their phonemic segmentation and phonological recoding skill to form complete connections that secure the entire spelling of the word in memory as a visual symbol for phonemic units in its pronunciation.

In phonics instructional programs the goal is to teach children to read words by phonological recoding (decoding). This is best accomplished by having children read words that are regularly spelled and that contain letter-sound relations that the children have been taught.

In a whole-word, meaning emphasis program the goal is to teach children to recognize word meanings by sight. This is accomplished by teaching children to read visually distinctive words and by having them read and reread these words in meaningful contexts.

Whether beginning readers read words by sight or by phonological recoding depends not only on how they have been taught to read but also on their skills and strategies. ... Children (can) start out using sight word memory and then add recoding to their repertoires when this skill is acquired. They use sight word memory for words they have read before several times, and they use recoding for words they have never read and words seen infrequently. Phonics-trained readers may acquire superior recoding skill, especially at first, but those children in a whole-word program who make progress in learning to read also acquire recoding skill. Even though they are not taught phonics rules (directly), whole-word trained readers are thought to induce letter-sound relations implicitly as they practice reading and thereby learn how to recode.

Questions: What happens when words that are recoded several times become sight words? Does the prior recoding influence the sight word reading process, or are the two ways of reading words established independently?

Information processing theorist have described the mental processes used to read words by sight memory and by recoding. (The duel-route theory holds that) readers can read words using one of two routes into their mental lexicon. The first is a visual route that leads directly into the lexicon to the word's meaning. The second is a phonological route that leads indirectly into the lexicon; readers first apply letter-sound translation rules to derive the word's pronunciation and then find a word matching this pronunciation in the lexicon. These two routes are considered to operate independently when words are read, with the visual route being faster than the phonological route. (In the visual reading), no sounds or recoding rules are involved in the associations (between word and meaning). Thus, the associations are arbitrary and must be learned by rote. Visual-meaning associations are formed in memory through repetition and practice. (flashcards) Learning them takes substantial time, like learning Chinese characters, because the visual cues in the associations are word-specific and unsystematic.

The other route in the dual route theory is phonological. (Once the words are decoded), the pronunciations are then used to enter the lexicon and retrieve meanings. As readers improve at phonological recoding, they automatically apply letter-sound rules to many different spelling patterns. They execute the process fairly rapidly although never as rapidly as visual word reading. Phonological recoding is used mainly to read unfamiliar words, low frequency words, difficult words, and nonsense words that have not received sufficient exposure to enter memory. Once words become familiar in print, they are read by sight.

The dual-route theory, until recently, has dominated the thinking of many researchers.

Flaws and Sources of Confusion in the Dual Route View
(There are several weaknesses in this theory. For one thing the research is weak.)
A conceptual weakness of dual route theory is its view of how sight words are learned. Dual route theory's claim that rote memory is used in learning to read words by sight appears illogical.

According to dual route theory, rote memory underlies the learning of sight words, particularly irregularly spelled words but also regularly spelled words. ...Although memory is clearly involved, I question whether the memory process is a rote process. Rote memory is used to learn relationships

that are arbitrary and unsystematic. However, few English word spellings are totally arbitrary in the sense that they contain no letters that conform to English letter-sound spelling conventions. Most spellings that are considered irregular are only partially. In using memory processes to read these words, readers are more apt to take advantage of any available systematic relations than to ignore them and rote memorize the entire form. (some decoding skills are almost always used) Irregular spellings as well as regular spellings of words contain letter-sound relations that readers recognize as systematic. It is highly unlikely that these relations are ignored in favor of rote memory.

(Another weakness in this theory concerns phonological recoding of words.) Various studies indicate that phonological recoding is necessary to learn how to read. English is an alphabetic system. Beginners need to learn how the system works in order to succeed in learning to read. Because dual route theory conceptualizes sight word reading(eventually done by all mature readers) as a separate, visually based route that neither involves nor requires phonological recoding, the theory cannot explain why beginning readers need to learn how to phonologically recode words to learn to read. Why not just have them practice reading words by sight from the outset?

(**Comment**: why is there a need to learn how to decode? Why are these skills important? Why is there a need to learn how the alphabetic writing system works?
Most answers to these questions amount to giving the decoding learning process a facilitator role. Yet, are phonological skills no longer used in the act of reading words rapidly and normally?)

However, evidence shows that children who cannot phonologically recode do not become good readers. Phonological awareness along with letter knowledge are the strongest predictors of beginning reading achievement. This evidence suggests that phonological recoding skill is not a mere facilitator but rather is a prerequisite for becoming a successful reader. Dual route theory cannot explain how this could be.

It is possible to devise an alternative explanation of sight word reading that does not eliminate phonological **processes** but rather only omits phonological **recoding** (decoding), which evidence has shown to not be involved (in mature reading). (When learning new words), at some point the reader's memory for that specific word should take over and eliminate the need for phonological recoding. What processes are being used at this point to read the word from memory?

Given that letter-sound relations were used initially to read a new word, why should they drop out of processing when memory takes over? Why should arbitrary, nonphonological, visual-semantic connections form the newly established route into memory? Being arbitrary, the visual cues are much harder to associate with particular words in memory in order to know how to read them. In contrast, letter-sound cues are not arbitrary. They connect the visual form of the word directly to its pronunciation in memory, because readers know how to interpret letters as symbols for sounds.

An alternative conceptualization to the visual-semantic route of dual route theory is a visual route that is paved with phonological information leading into lexical memory. Because letter-sounds were used initially to recode the word, it makes good sense that they would be retained and would participate in the reading-by-memory operation. Setting up a visual-phonological route into memory involves forming specific connections between visual cues seen in the word and its pronunciation stored in memory. The visual cues consist of a sequence of letters. The connections linking the letters to the

pronunciation are formed out of reader's knowledge of letter-sound correspondences and other orthographic regularities linking print to speech. When readers see a word they have never seen before they phonologically recode the word. This begins the process of setting up a visual-phonological route for that word leading from its spelling directly to it pronunciation in memory. Once such routes are set up, readers can look at spellings and immediately retrieve their specific pronunciations without resorting to translation rules and recoding.

The matter of connections is a crucial one, for this is what determines how easy it is for readers to retrieve words I memory from the visual forms that they see. Connections are formed and set up in memory from prior experiences reading words.

Readers who have full knowledge of how the orthographic system symbolizes units in speech form many systematic connections linking visual spelling units seen in print to pronunciations stored in memory. As a result of prior recoding experiences with a word, individual letters are connected to individual phonemes within the word. Knowledge of letter-sound correspondences is used to form these connections. Also, individual letters are connected to the whole pronunciation because each letter-phoneme connection occupies a position within the pronunciation, making it an intrinsic part of the whole.   Moreover, the whole spelling is connected to the whole pronunciation in that the sequence of letters corresponds to the sequence of blended phonemes in the pronunciation.

The critical connections that enable readers to find specific words in lexical memory by means of this visual-phonological route are connections linking spellings to pronunciations rather than to meanings. However, connections between spellings and meanings are easily formed in the process of establishing visual-phonological routes. …. Readers already know connections between pronunciations and meanings from speech. When spellings are connected to pronunciations, the connections extend to meanings as well, perhaps automatically.

The visual-phonological connections that readers have formed for a word make that spelling a visual symbol for its pronunciation. This means in effect that readers "see" the pronunciation when they look at the spelling, and this event creates direct links between the spelling and its meaning. Thus, readers access not only pronunciations but also meanings directly when they learn to read words by means of a visual-phonological route.

What is critical for sight word reading is the quality fo the access route, that is, the kind and number of connections between the spelling and the word in lexical memory. The quality and number of connections between the visual-phonological route and the visual-semantic route differ dramatically. The visual-phonological route consists of many systematic connections, whereas the visual-semantic route consists of one or at most a few arbitrary connections. This makes the visual-phonological route much more stable and well established in memory and subject to much less forgetting.

The visual-phonological route has stronger access in finding the word in lexical memory. Readers need an access route that is highly selective and that clearly targets one word and bypasses all others. Visual-phonological access routes do this easily. Visual-semantic routes do not. In English, spellings systematically symbolize pronunciations of words not meanings. Letters in spellings symbolize a sufficient number of phonemes to distinguish words from even their closest phonological neighbors.

Consider the huge number of words that mature readers are able to recognize by sight. Consider their ability to look at a spelling and access that particular word in memory instantly while bypassing thousands of other words. Consider that words are read by sight after only a few exposures to the

word, and that readers remain able to read words by sight even when the words are read infrequently. An adequate explanation for readers' capabilities with words requires a theory that specifies how many systematic connections are established linking specific printed words to their pronunciations and meanings in lexical memory and how these connections are easily remembered. The visual-phonological route is a much better candidate for this theory than the visual-semantic route of the dual route theory.

Distinction Between Reading Words By Visual-Phonological Connections and By Phonological Recoding.
Once a word has been recoded several times, the rules and the translation (from print to speech) and phonological matching routines drop out to be supplanted by specific connections linking the spelling directly to its pronunciation in memory.

Letters in spellings are processed as symbols for phonemes in the pronunciations of specific words in the course of forming visual-phonological connections. As a result, spellings become amalgamated (combined, attached, stuck, glued, mixed with) to pronunciations and are retained in memory as orthographic "images" of words, that is, visual letter-analyzed representations. These representations also become amalgamated (stuck) to meanings in memory. It is this amalgam that is accessed directly when sight words are read and recognized by means of visual-phonological connections.

Difference Between skilled and less skilled readers (in summarizing the results of a study)
…only the skilled readers possessed adequate recoding skill to form complete connections between spellings and pronunciations in memory. The connections formed by poor readers in learning to read the words by sight were partial and failed to specify the entire word's pronunciation, because poor readers lacked sufficient knowledge of grapheme-phoneme correspondences to form a complete set of connections. In reading words, therefore, they took longer to retrieve the pronunciations from memory. Poor readers' weak recoding skill was evidenced by errors and longer latencies in the nonsense word recoding task.

These results provide support for the distinction between recoding and sight word reading and for the contribution that recoding makes to sight word reading. Moreover, they indicate that readers may differ in their skill at forming visual-phonological connections to read words by sight.

Development of Sight Word Reading
Sight word reading can be analyzed as developing in several phases. Each phase is defined by the kind of connections that are formed…
(in the first phase, the connections formed)are arbitrary. …the link is not phonological. These connections are learned by rote. …. I have called this visual cue reading and also logographic reading. The connections are strictly visual. (This kind of reading is described by the second route in the dual route reading.)

During the second phase when children learn about letter names or sounds, they use their knowledge for form systematic visual-phonological connections between letters seen in words and sounds detected in their pronunciations. However, the connections are incomplete. … I have called this the rudimentary alphabetic phase or phonetic cue reading.

(**Comment: CA** It seems to me that this phase could be defined a little differently for those children that are taught exclusively to read words, from the beginning, that they can recode completely. They would never be asked to read a word that they could not recode completely. Recoding words with

incomplete connections would mean they would be asked to guess the words based on incomplete recoding of words. This would slow the learning process. It would mean that they would need to unlearn a reading process that will eventually not be useful and reliable.

I would suggest that this phase be defined as a time when the novice reader is externally blending all the spellings in words before pronouncing them. In this way, they are forming the connections that Ehir refers to, and that are required for mature reading. Readers at this phase may begin to internalize completely the spellings in some words and begin to build a reading vocabulary that is almost at the full visual-phonological phase of reading. This would be a small and very select collection of words. There are many, many more visual-phonological connections for more complicated words, a great variety of English spellings, that will need to be learned, externally and internally, before they would be able to read in a mature way. This is a gradual two-three year process during which solid and complete connections are learned so that the readers can move into a full sight word reading the way in which Ehri has defined. As Ehri points out in her conclusion, this should be a careful little-by-little process where solid mastery of words with certain spelling combination is attained. Moving too fast into more complicated word would result in poor connections and the use of some guessing based on partial connections and knowledge.)

During the third phase, students continue to use the alphabetic principle to read words by sight but in a more mature way. When readers acquire phonemic segmentation skill and phonological recoding (decoding, sounding out, etc.), they use this knowledge to form complete visual-phonological connections in learning to read sight words. Individual letters are linked to individual phonemes. Also the sequence of letters is connected to the blend of phonemes. I call this type of sight word reading cipher sight word reading to indicate that spellings are fully analyzed as visual symbols for phonemic constituents in pronunciations.

Cipher sight word reading refers to the process of reading sight words by setting up connections to memory between the entire sequence of letters in spellings and phonemic constituents in the word's pronunciation. Not only are individual letters or diagraphs linked to phonemes but also the sequence of letters is connected to the blend of phonemes such that part-whole relations are established leading from print into memory.

(Cipher readers) conceptualize the pronunciation as a sequence of phoneme-size units, and they analyze the "sounds" according to conventional phonemic categories rather than according to phonetic criteria. Cipher readers possess phonological recoding skill and they use this to analyze spellings fully as visual symbols for phonemic constituents of pronunciations. ... Letters in a spelling are connected to the word's pronunciation in a way that fully determines the pronunciation and consequently the meaning and that excludes words with similar pronunciations. Thus sight word reading at this phase becomes an exceedingly reliable process.

Concluding Comments
In this chapter, …. I have tried to show that sight word learning is not a rote memory process but rather involves remembering systematic connections between spellings and pronunciations of words. I have suggested that it is the establishment of systematic connections that enable readers to recognize sight words so rapidly and to remember how to read infrequently seen words.

One of the hallmarks of skilled reading is the ability to read words accurately out of context. This context-free word reading is not carried out by a process of phonological recoding. This conclusion has proved troublesome to researchers…. who would like to regard all word reading as involving

recoding skill. The present view of sight word reading provides a solution by showing how phonological recoding is central. I suggest that context-free word reading skill depends centrally on recoding knowledge because it is this knowledge that allows readers to establish the network of connections leading from a word's spelling to its pronunciation in memory when the word is established as a sight word. One of the weaknesses of dual route theory's view of sight word reading is that it does not explain why beginners must possess phonological recoding skill in order to become skilled sight word readers. In contrast, my view of sight word reading makes letter-sound knowledge a necessity. This knowledge is needed to form a complete network of visual-phonological connections in lexical memory.

Neither a phonics program nor a whole-word instruction program is completely suitable for facilitating the development of sight word reading as I have conceptualized it.

Phonics programs prepare students for independent word reading by teaching them letters and letter-sound relations at the outset. Also, phonics programs teach learners recoding skill that is important for attaining phase 3. However, by having students practice reading many different words sharing a small set of letter-sound correspondences rather than practice fewer words repeatedly, phonics programs may not help students develop strong sight vocabularies.

Moreover, phonics programs may require students to begin recoding word patterns before students have gained much experience as phonetic cue readers. It may be that phonetic cue reading is important preparation for cipher reading.

Whole word instruction programs provide more practice on individual words. However, one weakness is that beginners may be pushed into sight word reading before they have the requisite letter knowledge and phonemic segmentation skill to function as phonetic cue readers. Also, the words that beginners are required to read by sight in whole word programs have spellings that may be quite uninterpretable in terms of reader's letter-sound knowledge, thus precluding their use of phonetic cues in learning to read the words.