**Science of Reading Words and Dyslexia**
**Extension A**
**Eight Experiments**

**Overveiw**

Linnea Ehri's studies are key examples of how the research has been conducted. They help provide a basis for verifying the adequacy and soundness of the theory. These kinds of studies are referred to as "experimental training studies" where children are taught to read particular sets of words, in a particular way, with various kinds of print. In her various publications, Ehri cites and reports on many studies of hers and others. [1.] The following provides more details on how the sampled experiments were conducted, i.e. what were the children asked to do, under what conditions, as well as the results?

It's important to note that other research groups were conducting similar studies on this same theoretical question during the same time, which converged with similar conclusions. Two examples are Kieth Stanovich [2.] and Charles Perfetti. In a recent publication, Charles Perfetti briefly summarized the work that his research group conducted at the University of Pittsburg over a similar period of time.

> "The ascendancy of phonology came about through research that discovered phonological effects in word reading across a variety of tasks (with significant task differences). Among many experiments showing such effects were three lines of research that, at about the same time, made a strong case for phonology, specifically the role of phonemes in word identification: (a) brief exposure identification with masking and priming (Perfetti & Bell, 1991; Perfetti, Bell & Delaney, 1988), (b) semantic category decisions (Van Orden, 1987), and (c) primed lexical decisions (Lukatela, G., Lukatela, K., & Turvey, 1993). **Each of these lines of research produced multiple demonstrations that phonology plays a role in identifying a single word, in deciding whether a word fits a semantic category, or even just in deciding whether a letter string is a word**." [3.]

In Ehri's earliest studies, indications of an "obligatory speech activation" factor from printed words first came from experiments with a Stroop task.[4.] By demonstrating how readers' attention is automatically drawn to printed words, somewhat involuntarily, over pictures of objects, this study sets the scene for subsequent studies that seek to further examine this observation.

In her studies with young children, Ehri found that those who learned letter names and sounds were better able to learn and read words. This was demonstrated with nonsense words spelled phonetically compared to non-sense words spelled non-phonetically. [5.] It was also demonstrated with words spelled with a simplified phonetic spelling (JRF for the word giraffe) vs. words spelled with simplified non-phonetic spellings (WPC for giraffe). Children were able to remember the phonetic "words" easier than words with arbitrary non-phonetic spellings. [6.]

In addition to these critical findings, what is most interesting in these experiments was that, at the very beginning of learning, some children used letters for word recognition before explicit instruction. With just minimum instruction of letter identification and a few memorized words, it was observed that many children on their own, began to "spontaneously" make some connections of letters to sounds they heard in the pronunciation of words. Children didn't even know that the letters were meant for this purpose. This is an astounding discovery, the first indications of some spontaneous, untaught, use of letters- sound connections.

Based on these experiments, many, not all, children appear to have an "inclination" or a "sensitivity", almost natural, for making partial phonetic connections or ties of letters to speech sounds in the pronunciations of the words. **According to Ehri, these partial letter/sound connections in words, made before instruction, are early signs, and evidence, of how spellings of words become connected phonetically to assist in remembering words, which eventually leads to reading all words as phonologically based sight words.**

Ehri stressed that the children, in these studies, did not vocally generate the sounds of the letters as they read the words, as they would in "sounding-out" or decoding. She simply observed that words or nonsense words with phonetic spellings, as cues, were learned easier and quicker before instruction than words with non-phonetic spellings. It was inferred that connections to the speech sounds were made "spontaneously", without being taught and without the child's awareness.

Later experiments by Ehri showed that this partial "incidental"(non direct) phonetic use of letters, found with children in naturalistic classroom settings in which words were initially learned as whole units, would **not automatically extend to include the complete spellings of short real words.** [7]. Other studies demonstrated that, for use in complete words, children needed more instruction, **of some kind**, to learn how it's done with complete words in the English language. [8]. The "innate" inclination for use of letters, first seen with early learners, **for some unknown reason**, (see section on brain-imaging) **undoubtedly assists in getting many children started**, but was insufficient in providing a similar boost in using letters in complete words. This extension to complete words required added assistance of more planned instruction. The initial spontaneity, as mysterious as it is, in a natural setting, may assist at the start, but is not strong enough to work as a self-teaching ability beyond some words.

**This discovery of how some children begin to use letter/sound connections as a result of informal, naturalistic exposure to written words, or more formally planned methods, has led Ehri, and others, to assume that this is the most effective way for children to "move into reading". In time**, as the theory goes, **these initially untaught skills** with letter/sound connections can be **increased,** through extended experiences and instruction, to the point where all the spellings of words would be completely connected to the corresponding sounds in the pronunciations for phonetic sight-word reading, also referred to by Gough as "cipher" reading. [9].


1. **Reconceptualizing the Development of Sight Word Reading and Its Relationship to Recoding**, Chapter 5 in Reading Acquisition, Gough, Ehri and Treiman [Eds] 1992
2. **Stanovich, K., Twenty-five Years of Research on the Reading Process: The Grand Synthesis and What It Means for Our Field, 1998**
3. **Phonology Is Critical in Reading,** But a Phonological Deficit Is Not the Only Source of Low Reading Skill. Charles Perfetti. In Explaining Individual Differences in Reading: Theory and Evidence. P. 153-171. Brady, S. A. , Braze, D., & Fowler, C. A. (Eds.) 2011
4. **Does Word Training Increase or Decrease Interference in a Stroop Task?** Ehri 1979. *Journal of Experimental Child Psychology*, 27, 352-364 (also described in 1987 and 1991)
5. **The Mnemonic Value of Orthography Among Beginning Readers**. Linnea Ehri & Lee Wilce. *Journal of Educational Psychology, 71,*26-40 (1979)
6. **Movement into reading: Is the first stage of printed word learning visual or phonetic?** Ehri, L. and Wilce (1985)
7. **Cipher versus cue reading: An Experiment in decoding acquisition.** Ehri and Wilce 1987a**.** *Journal of Educational Psychology. 79, 3-13*
8. **Does Learning to Spell Help Beginners Learn to Read Words?** Ehri and Wilce 1987b, *Reading Research Quarterly, 18, 47-65.*
9. **Visual Pattern in Fluent Word Identification.** A study by Lee Brooks**,** in **Toward a Psychology of Reading,** A.S. Reber & D. L. Scarborough, (Eds.) (1977)
   **Development of word identification speed in skilled and less skilled beginning readers,** Ehri and Wilce, *Journal of Educational Psychology 75, 3-18 (*1983)

**1. Does Word Training Increase or Decrease Interference in a Stroop Task?**

Ehri 1979. *Journal of Experimental Child Psychology*, 27, 352-364(also described in 1987 and 1991)

To experience what it means to recognize words automatically, try labeling the pictures in Figure 1. Name the pictures as rapidly as you can. Ignore the words

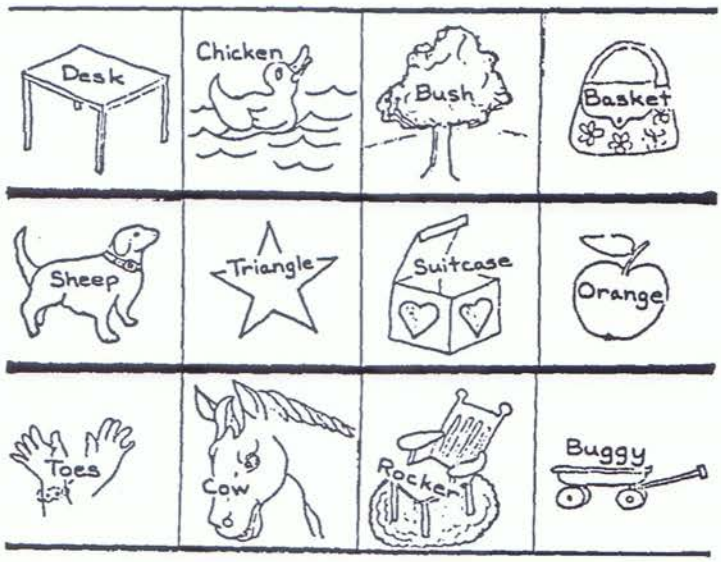



*Figure 1.* Pictures printed with semantically related words that create interference in a task requiring subjects to name the pictures as rapidly as possible and to ignore the printed words.

One of the earliest studies published by Linnea Ehri involved the use of, what is called, a Stroop task. It demonstrates how readers' attention is drawn to printed words over a picture of an object. The Stroop task has a series of pictures of simple objects with a printed word written over the object in each picture. The printed words did not match the object but were closely related, e.g. the word orange on the picture of an apple. The readers were to name the object, not the printed word, as quickly as possible, with and without the print.

The readers were first timed in naming the object in the picture without the printed word, and then they were timed with the printed word over the picture. The test was to see how much the printed words interfered and slowed the time it took to name the objects. Compared to naming the objects without printed words, to naming the objects with an incorrect word printed over it, the second condition was slower in naming the object. This experiment called into question the "distributed attention" concept found in early theories of automaticity, based on practice. It shows that, for some reason, printed words actually have a stronger pull for attention than pictures for readers. This goes beyond practice.

Try naming the objects in each picture to experience what it means to distracted by print. Strangely enough, the words interfere more if the reader knows the words. Attending to the words is involuntary if the words are known.

The Stroop task may indicate the existence of a tendency for automaticity for alphabetic print, but it doesn't show how or why it works. Subsequent studies seek to further show evidence of this tendency in reading words and then explain why. Many more experiments will be needed to solve this mystery.

**2. The Mnemonic Value of Orthography Among Beginning Readers**. Linnea Ehri & Lee Wilce. *Journal of Educational Psychology, 71,*26-40 (1979)
(When three letter, nonsense, or wrong names are given to printed capital letters, the nonsense names are learned better if the spellings are **briefly** shown and phonetically spelled correctly.)

This series of 4 experiments involved the use of CVC nonsense words given as names to capital letters. For example: Name the capital letter V "vap."

The experiments sought to demonstrate that when the nonsense name for a capital letter was **briefly** seen in print (no time to sound out) by early readers in 1st and 2nd grades, as phonetically spelled correctly, they learned and remembered the nonsense names better than by not seeing the name or by seeing it misspelled. In short, phonetic connections, letters to sounds, seen only briefly, assisted in remembering nonsense names for a printed capital letter. The children were not given time to sound out the nonsense words. The letter sound connections were very quick. Sounding out was not taught.

Attempts to demonstrate this point were made by presenting to a group of 1st and 2nd graders four different conditions for learning a nonsense name for a printed capital letter. In each condition, the nonsense word began with the lower case version of the same capital letter. The condition that was most effective would support or refute the claim. Table 1. Shows the four conditions.

Table 1
*Stimuli Employed in the Four Paired-Associate Learning Tasks*

| Task | Test cues | Oral responses[a] | Study aid |
|---|---|---|---|
| 1. Squiggles |  | "jad" | none |
| |  | "wek" | none |
| |  | "sim" | none |
| |  | "lut" | none |
| 2. Initial letters | V | "vap" | none |
| | B | "bem" | none |
| | T | "tib" | none |
| | H | "huk" | none |
| 3. Initial letters plus correct spellings | M | "mav" | Mav |
| | R | "rel" | Rel |
| | K | "kip" | Kip |
| | G | "guz" | Guz |
| 4. Initial letters plus misspellings | P | "pab" | Pes |
| | D | "des" | Dif |
| | N | "nif" | Nug |
| | F | "fug" | Fab |

[a] The four sets of oral responses listed here were employed in all four tasks with assignments counterbalanced across subjects.

The Four Conditions

1. Meaningless squiggly lines for a nonsense word like "jad". (show squiggly line) "This says jad";
2. A capital letter's name, (e.g. V, given the nonsense name, "Vap"), is only pronounced, not seen in print. (point to V) "This says vap"; (don't show the printed nonsense word)
3. A capital letter's name, (e.g. M, given the nonsense name, "Mav"), is briefly shown, correctly spelled. (point to M) "This says mav". (briefly show the nonsense word Mav, correctly spelled. ).*
4. A capital letter's name, (e.g. P, given the nonsense name, "Pab"), is briefly shown, incorrectly spelled. (point to letter P) "This says pab". (briefly show the incorrect spelling of Pes. ).*

* After the non-word was briefly shown, no additional attention was given to the letters of the nonsense words.(the complete list is above.) The test was: (show letter. M) "what does this say?"

After uniform instruction for each condition, each child was tested. After showing sqiggly lines or a capital letter from the list, a child was asked, "What does this say?" After a minimum of trials in practice**, some children** were <u>not</u> able to meet a basic criteria for learning the nonsense word names in any of the conditions. They, therefore, did not complete the exercise. These children were also the poorest readers, according to tests later given. **For those who completed the exercise, the condition that was most successful was condition 3**.

The spellings of the nonsense words, displayed only briefly during the practice, helped them learn the nonsense name for the capital letter on the test, presumably, because the spelling **matched the sounds heard in the pronunciation of the nonsense words** (phonemes). Even with very **little knowledge about how letters can match pronunciations**, the children used the letters in the nonsense words that matched parts of the pronunciation **when correctly spelled in condition 3**. The children did better in condition #3 than in #4, where the children could **only use their visual memory**, no help from phonology of the word, for the spellings because the spellings did not match the pronunciation. They had to remember just the visual information of the middle and last letters.

In Experiment #2, before repeating the same experiment, the children were given a more complete battery of reading skills pretests in order to identify the reading levels of each child before conducting the same procedures. These tests were on letter identification (speed and accuracy), word recognition, phonemic segmentation, CVC spelling production, CVC sounding out and misspelling recognition. The same results were observed for each of the four conditions. The most successful readers did better. (see chart below for reading test results.)

In **Experiment #2**, the children who could read better, according to the pretests, did better than those who were less capable, especially the ones who completely failed to meet the criteria. The better readers were better able to quickly use the letters in the correctly spelled nonsense words to help them remember. This was true even though the correctly spelled nonsense words were only briefly shown to the child, during instruction/practice, too brief to sound out the nonsense words.

The authors concluded: "Sounds accompanied by complete spelling aids **were learned significantly faster** than sounds prompted by single, initial letters without full spellings, and these in turn were recalled significantly better than sounds with squiggle prompts or with misspelling study aids….The result indicates that the ability to **make use of spellings** in remembering oral sounds contributes as an independent factor over and above general learning-memory ability in explaining the variability in beginning readers' knowledge of printed language. " pgs 29 and 30

Table 5
*Scores on the Various Measures of Printed Language for Children Succeeding and Failing to Learn the Sounds in the Spelling-Aided Task*

| | Successful | | Unsuccessful | | |
|---|---|---|---|---|---|
| Measure | *M* | *SD* | *M* | *SD* | Difference |
| Letters | | | | | |
| Accuracy (max = 25) | 24.4 | 1.2 | 22.6 | 2.0 | 1.8* |
| Latency (in sec) | 23.1 | 8.9 | 40.9 | 14.9 | −17.8* |
| Word recognition | | | | | |
| Nouns (max = 27) | 21.5 | 7.5 | 2.8 | 3.7 | 19.7* |
| Sight (max = 30) | 17.8 | 11.0 | 1.2 | 1.8 | 16.6* |
| Phonemic segmentation (max = 18) | 16.1 | 1.9 | 12.2 | 2.3 | 3.9* |
| CVC spelling production (max = 12) | 11.1 | .6 | 5.3 | 4.5 | 5.8* |
| CVC sounding out (max = 8) | 7.4 | 1.0 | 3.2 | 2.6 | 4.2* |
| Misspelling recognition | | | | | |
| CVC (max = 12) | 8.8 | .7 | 5.5 | 2.9 | 3.3* |
| Nonsense (max = 12) | 7.6 | 3.3 | 1.7 | 1.4 | 5.9* |

*Note.* CVC = consonant–vowel–consonant trigram; $n$ = 18 for successful group; $n$ = 12 for unsuccessful group.
* $p < .01$.

DISSCUSION

At the end of Experiment #1, the authors make an astounding statement. Because of the children's performance with little instruction, **they claim that the children spontaneously used the matching letters in condition 3.** They describe the instructional procedures for condition 3 and 4, the correct and incorrect spellings, as "**briefly displaying the single letter and the nonsense word**" (e.g. #3, point to **R**. Quickly show **Rel,** "this says rel". or #4. point to **F**. Quickly show **Fab**, "This says fug".). **No additional attention was given to the spellings**. After these procedures, a test was given by showing the capital letter and asking for the name for it. **When the correct spelling of the nonsense word was used, the children were better able to remember and learn the name for the capital letter better than when it was spelled incorrectly. Why did they use the printed letters of the nonsense word when not taught to do so?**

The author's astounding statement was, "In conclusion, results of Experiment 1 offer support for the view that when children learn to read, they acquire an orthographic mnemonic system. This system is **activated spontaneously** when word sounds are seen mapped in print, and it serves as a means of **gluing print to sound and storing forms in lexical memory**." **This set up the foundation for Ehri's theory.** These results "are at least consistent with the **hypothesis** that when children learn to read, they acquire an orthographic mnemonic system, and **this capability** helps them to build up a repertoire of printed words in lexical memory." p. 31-33

So, what is meant by "spontaneously". This term is use in follow-up studies. It is assumed, in this case, to mean that **the use** of the correct spellings for the sounds in words, by the children, **was done quickly without thinking**. They had not been taught how letters match pronunciations. The children

almost naturally, and quickly, (and mysteriously?) phonetically used these letters **when the letters corresponded to the pronunciation.** This helped them remember the nonsense words better than just trying to remember a nonsense word orally or was given as an incorrectly spelled nonsense word, which couldn't be used phonetically.

However, is this really spontaneous? Or is it the result of children using the knowledge they had so far learned in reading words ? These children, in 1st and 2nd grade, had already received some instruction in reading. The performance on the final test appeared to be spontaneous **for those who were the better readers, even though they were still just beginners.** This was more clearly demonstrated in Experiment #2 where the reading knowledge was tested more. It is important to notice that the difference in knowledge between those who did the test successfully and those who didn't was small for letter identification and phonemic segmentation, but large for word recognition, spelling, **even sounding out and speed of letter identification** on the general tests (Table 5). (pg. 33)

The children "spontaneously" and quickly, without being prompted or given time, may have been "primed" to used their **prior knowledge** to connect the letters phonetically to the sounds, **which helped them remember the nonsense word. The phonetic nonsense words were remembered better than the non-phonetic**. Thus, spontaneous or not, the **phonetic connections were more successful for those children who had learned more by this time, demonstrating phonetic use of letters over visual memory.**

The author's preferred interpretation for this was that the phonetic "spellings provide the children with **orthographic images** to symbolize and store the sounds in memory" i.e. as in a Quality Representation Hypothesis by Perfetti. In the final Experiment #4, these images were not just "inferred". They were "directly induced" and children were taught **how to imagine what the letters looked like** during the instruction. This also helped.

**These experiments demonstrate how easy it is for many children to begin to make some** links between print and speech. It does **reveal** some of the hidden phonological side of the theory. **The question relevant to instruction remains: How strong is this inclination or attraction for putting letters and speech sounds together in assisting in learning to read more advanced reading of words in texts as sight words, for a wide variety of children?** Further evidence is needed to answer this. This study just gives an **initial glimpse of the "propensity" for making phonetic** connections, **if letters have been learned before**. It provides some important clues solving the mystery, i.e**. those who can make letter/sound connections, learn to read words easier**.

There is, of course, **the remaining question**: **how is this "propensity**" or ease for many, not all, young readers for making the necessary connections **accounted for in the first place?** How is this explained? **Where does it come from**? It should also be noted that a significant number of children in these experiments **did not meet the initial criteria** for successfully learning the nonsense words and thus, **had weak "propensity" or difficulty with sounds**? (see Part 3, Brain Images)

**Replication**: to shore up a few outstanding points in this study, it has been replicated by a group of researchers in the UK. See replication by the John Rack group, #4 below.

**3. Movement into reading: Is the first stage of printed word learning visual or phonetic?** Ehri, L. and Wilce, L. S. *Reading Research Quarterly*, Winter, 1985. 163-179.
This experiment seeks to add to the evidence that phonetic matching makes it easier to learn words.

Abstract: "Kindergarteners were placed in three groups according to their ability to read words:
1,) **pre-readers** (no words read), 2,) **novices** ( a few words read), and 3,) **veterans** (several words read).
They were taught to read two kinds of spellings for words: simplified **phonetic spellings** whose letters corresponded to (key) sounds (in real words) (e.g. , JRF for giraffe), and **visual spellings** whose letters bore no phonetic correspondence (made up spellings for same words (e.g. WBC for giraffe, but more distinctive visually).

**"Pre-readers** learned to read the visually distinct spellings, (WBC) **more easily** than the (simplified) phonetic spellings, (JRF) while **novices and veterans** learned to read the (simplified) phonetic spellings (JRF) **more easily**. The results suggest that when children move into reading, they shift from visual cue processing of words (pre-readers) to **phonetic cue processing (novices and veterans)**. Phonetic processing entails recognizing and remembering associations between letters in spellings and sound in pronunciations. **This learning mechanism, rather than visually based sight-word learning or sounding out and blending, is claimed to explain how children first become able to read single words reliably**."

*Table 1* Mean trials to criterion of veterans and novices in the word-learning tasks as a function of words and spellings

| Nouns | Phonetic Spelling | Mean | Visual Spellings | Mean | Difference |
|---|---|---|---|---|---|
| GIRAFFE SET | | | | | |
| knee | NE | 2.1 | Fo | 2.5 | -0.4 |
| giraffe | JRF | 2.6 | WBC | 4.3 | -1.7 |
| balloon | BLUN | 2.9 | xGsT | 5.9 | -3.0 |
| turtle | TRDL | 3.1 | YMP | 6.4 | -3.3 |
| mask | MSK | 3.3 | uHE | 7.3 | -4.0 |
| scissors | SZRS | 3.8 | qDjK | 4.7 | -0.9 |
| Mean | | 3.0 | | 5.2 | |
| ELEPHANT SET | | | | | |
| arm | RM | 2.3 | Fo | 2.4 | -0.1 |
| diaper | DIPR | 2.3 | xGsT | 4.7 | -2.4 |
| elephant | LFT | 3.5 | WBC | 3.1 | +0.4 |
| comb | KOM | 4.7 | uHE | 4.9 | -0.2 |
| pencil | PNSL | 4.7 | qDjK | 5.9 | -1.2 |
| chicken | HKN | 5.5 | YMLP | 6.1 | -0.6 |
| Mean | | 3.8 | | 4.5 | |

**Similar to the earlier experiments, Ehri attempts to demonstrate that children, when first learning how to read, on their own, start using the letters, once learned, to help them remember the words, without being instructed or shown how**. In the earlier experiments for this purpose, nonsense words were used to ensure that the children had never seen the words. In this

experiment, shortened 2-4 letters, simplified phonetic spellings of words whose letters **only match key sounds** in the words were used. Reading words with these kinds of spellings was compared to 3 or 4 letter spellings that had no correspondence to **any sounds** in the same words. (JRF or WBC for giraffe, NE or Fo for knee, etc)

All spellings were capitols. For the phonetic spellings, the sounds for the letters came from the names of letters. For example, this means that the letter J was used instead of the letter G in giraffe, U for oo in balloon and K for comb. For the non-phonetic spellings the size and positioning of the letters varied so that they could be visually catchy. (see list)

The non-phonetic spellings for the words could only be learned from visual rote memory. Presumably the words, with simplified phonetic spellings, could be connected to key parts of the word's pronunciation, remembered from speech.

The test results below show how the three groups were determined. All three groups had similar knowledge of letter names but not letter sounds. The **novices and veterans** had almost identical knowledge of letter sounds. On average, the **veterans** could read 18 of the 40 words on the Primer Word list (see list) and 15 of the 21 words on the Gray Oral Word list. The number of words read by those in the middle, **Novice**, group was considerably less, 4 and 7 respectively. They were still non-readers. Aside from knowing letter names, the **Pre-readers were complete non-readers**.

*Table 2* Characteristics and mean performances of reader ability groups

| | Beginning Reader Groups | | | |
|---|---|---|---|---|
| | Prereaders | Novices | Veterans | $T\sqrt{MS_e}$ [a] |
| Reader Ability Grouping Criterion | | | | |
| Primer Words (40 max) | 0.1 | 4.4 | 17.8 | 3.7 |
| Range | (0-1) | (1-11) | (11-36) | |
| Other Group Characteristics | | | | |
| Sex | 5F, 11M | 10F, 6M | 7F, 9M | |
| Age (months) | 62.6 | 66.9 | 69.8 | 4.3 |
| Letter names (26 max) | 20.1 | 25.1 | 25.4 | 3.8 |
| Letter sounds (26 max) | 6.7 | 20.6 | 21.5 | 4.2 |
| Gray Oral Words (21 max) | 1.9 | 7.2 | 14.8 | 2.3 |
| PA Task Assignments (Number of subjects per condition) | | | | |
| Phonetic First/Giraffe Set | 4 | 7 | 3 | |
| Phonetic First/Elephant Set | 4 | 3 | 3 | |
| Phonetic Second/Giraffe Set | 4 | 3 | 4 | |
| Phonetic Second/Elephant Set | 4 | 3 | 6 | |
| *Total* | 16 | 16 | 16 | |

*Note.* There were 16 subjects in each group.
[a]Tukey pairwise comparison test minimum significant difference, $p < .05$.



As described in the Abstract, the **pre-readers did not use the phonetic letters**. They were better at using the visually distinctive aspects of the words to help them learn by rote. The unexpected part of this experiment, perhaps the most critical aspect, had to do with the results with the **Novice readers**, those who had **some knowledge of letters** but **could read only a few words**.

According to early theories of beginning readers, the only readers that were expected to use the letters phonetically were the **Veterans** who had knowledge of more words **from a bank of words learned by rote**. The theory, proposed by Phillip Gough (1980), asserts that beginning readers need to learn a collection of words visually before they can start learning how to use the letters phonetically. (see part 6, Critical Instructional Implications) It was believed that more knowledge of letters and there use in words, from these memorized words, was necessary before the letters could be put to use in words. This experiment by Ehri proved this to be not true, **much less knowledge can start this learning**.

The evidence showed that the **Novice readers** began to use the phonetic spellings **on their own**, with **no explicit instruction in decoding and with very little experience with reading words**. **They showed no evidence that they knew how the letters were used in words.** Because of the simplified phonetic spellings, the spellings were unconventional, different than anything they might have seen. In spite of this, it was found that **"Among beginning readers, words with spellings with letters that function as symbols for sounds are easier" to learn for Novice learners than non-phonetic spellings**. **The inference was: the words were easier because the Novice beginners made some connections of letters to sounds in the words from what they heard in the pronunciations. They did this on their own, without explicit instruction in how to do it.**

No explanation is given for how the Novice children became capable of using the letters phonetically to this extent, **on their own. "In the present study, it was not possible to determine how novice readers had learned to process letter-sound cues in words since this presumably happened outside the laboratory. The role of instruction in teaching children to make use of their letter-knowledge awaits further study**." Pg 175 If they had learned to use letters phonetically, it did not show up in the simple words in the reading tests.

The 40 word Primer list shows **how many Novice children** could read each word. The authors conclude: **"Apparently, as soon as children become able to read more than a couple of words out of context (in a list), they are capable of deciphering spellings, at least partially**." **This discovery lead support for a Five Phase Theory of instruction discussed in Part 5 of this syllabus that included a non-explicit and unsystematic phase (indirect) for learning to read**.

## APPENDIX

Words included in the 40-item word identification test and number of novices reading each word correctly (Max = 16)

| | | | |
|---|---|---|---|
| up - 7 | see - 3 | eat - 1 | run - 0 |
| no - 6 | stop - 3 | it - 1 | good - 0 |
| yes - 6 | yellow - 2 | boy - 0 | man - 0 |
| you -6 | red - 2 | school - 0 | house - 0 |
| the - 5 | play - 2 | little - 0 | ball - 0 |
| go - 5 | dog - 2 | like - 0 | children - 0 |
| we - 4 | in - 1 | said - 0 | daddy - 0 |
| jump - 4 | come - 1 | big - 0 | blue - 0 |
| is - 4 | green - 1 | girl - 0 | mother - 0 |
| book - 3 | look - 1 | car - 0 | happy - 0 |

What is of greater interest is that these beginning readers were observed using letters as phonetic cues "spontaneously" as in the first experiment. They didn't need instruction. They seemed to have a "natural ability" or "a natural tendency" to use some phonics, **once having been primed somewhat by some knowledge of letters.** If so, why? Where does this ability come from? It seemed natural, unlearned. How much can this "tendency" to use letters as phonetic cues in words can be taken advantage of in learning to read, **even if the "tendency" is only partially, at the beginning**. From these experiments, it appears only possible **if the letter names and sounds have first been taught and the children can read a few words.** (they know what printed words are?) **Does it matter what kind of words are taught by rote at first? (instructional questions for Part 5)**

Ehri and Wilce do pose this possibility, " It may be that if learners possess letter knowledge, then **very little prompting is needed to get them to use it to process and remember associations** between spellings and pronunciations." Pg. 175. So, how far into reading does this "natural tendency" continue to work? **How much prompting and planned instruction will be necessary and useful for reading more complete and advanced words?** Also, does this suggest that this is the most effective way to "move children into reading"? This will be addressed in future studies done or cited by Ehri.

Ehri's answer to the question in the title **(Movement into reading: Is the first stage of printed word learning visual or phonetic?)** is a little bit of both, visual and phonetic, but she does demonstrate how the phonetic connection is persistently and mysteriously there at the beginning, in spite of not being taught. **Another possible answer could be: It depends on how beginning reading is taught, right at the beginning**.

**This anticipates important instructional questions**: When should or can a more directive and explicit instruction in phonics be inserted in this stage, that would include more than just some prompting on how to use part of the spellings phonetically. Would this extend the "natural tendency" to a more complete use of phonetic spellings in words. OR, if this gradual phase is excluded and a more direct/explicit at the beginning is put in its place, would this "natural tendency" facilitate the use of phonetics sooner? This would require a more planned approach in learning to read selected words, early and phonetically, with letters carefully chosen and applied to carefully selected words. This may be a more effective way to move into reading rather than what Ehri suggests with a **partial use of phonetic connections in words that are too difficult for full phonetic connections at the beginning.** She did not attempt to test this approach in comparison to the more informal, gradual phase.

One advantage of a more explicit method, from the beginning, may be that it would not require a "shift" from visual to phonetic reading, which is required in Ehri's partial phases, which would require a correction in the way reading was initially taught to beginners. It means that the final way of reading words, as defined by Ehri's letter/sound connections theory, would be taught from the start with selected transparent words. The shift that would eventually be necessary in a more explicit, planned method would be one that gradually changes from a well practiced slower sounding out decoding procedure into a faster, automatic way of reading words as sight words, a reading of words described by Ehri in the GPC theory. Teaching some use of visual memory of words, without any phonetic use, may prolong learning a more complete use of phonetic spellings. More on this in Part 5, Critical Instructional Implications

Ehri and Wilce did touch on some of these questions in this study.

"Another question is whether beginners need to be given systematic instruction and practice in how to use their letter knowledge to find correspondences between spellings and pronunciations or whether correspondences can be discovered spontaneously during systematic **exposure** to words. A further question is whether, when children first begin reading words, their exposure **should be limited** to words whose **spellings "make sense" in terms of their letter knowledge**. Very likely, sensible spellings are important to insure that children **can detect** a sufficient number of phonetic relationships to **strengthen the habit of attending to phonetic cues**." Pg 177

**(Notice the first, rote words used for non-readers in these studies were difficult)** Does this statement leave open the possibility of a more explicit decoding beginning that would eliminate the "phonetic-cue" phase of reading?

**4. The Role of Phonology in Young Children Learning to Read Words: The Direct-Mapping Hypothesis.** John Rack, Charles Hulme, Margaret Snowling and Joanne Wightman**.** *Journal of Experimental Child Psychology* 57, 42-71 (1994)

The Rack, Hulme et al. group attempted **to strengthen the evidence in support of the same conclusion made by Ehri in her early studies.** The Rack group constructed a new set of spelling cues that eliminated some problems and provided stronger evidence in support of the conclusions that "the acquisition of letter knowledge may be what determines a shift to a sound-based strategy."

The Rack group argued that in the Ehri and Wilce study, the spelling cues were too distinctly different in letter size and were in positions that provided irrelevant clues. Thus, the visual clues could have over road the phonetic cues. Also, the phonetic spellings were not necessarily phonetic. In most cases, the phonological cues were the same as the spellings of the real word. This gave added visual assistance, and less reliance on phonetic relationships, for remembering the words, i.e. R in giraffe and ne in knee. ( see complete list in previous study)

| | | | |
|---|---|---|---|
| JRF | and | WBC | for giraffe |
| NE | and | FO | for knee |

**The Rack group sought to overcome these objections by creating pairs of words with simplified spellings that looked more similar but with only one letter different.** They took out the visual cue that was supposed to act as a phonetic cue. They put the key different letter, phonetic or not, in the same place in each word. Also, this letter was only phonetically close to the correct sound in the word. This made the phonetic connection weaker **but still present**. This would provide a more convincing connection if it was frequently observed being used by readers. It also meant that there would be no visual cues in the simplified spellings that would provide a clue to the real target word.

For example, with the target word hospital, the z was used for the /s/ sound to be closely related phonetically but not identical to the letter sound of s found in the word hospital. For the word rifle, the letter v was used rather than the /f/ sound and the letter f. The control non-phonetic pseudo words used a completely different letter in the same position so that the two were visually similar but incorrect phonetically. Also, the letters were all in lower-case print. (see complete list below)

| | | | |
|---|---|---|---|
| hzpl | and | hfpl | for Hospital |
| rvl | and | rzl | for Rifle |

A 2nd Experiment was conducted to replicate the first to further test whether the position of the key letter would make any difference. It was found the key letter in the first position had a slightly "greater salience" for the young children.

In both Experiments, the child's task was to learn to associate three- or four-letter simplified spellings of a word with its pronunciation. When the children were shown either the phonetic or non-phonetic spellings, they would need to say the correct word. The only difference between the two spellings was one letter that either had a phonetic connection (exact or close) or an incorrect letter in the same position. **It was found that it was easier to learn the spellings that were phonetically correct**. Presumably, the children put together the correct letter and its phoneme (even if only close) to help them learn the word that it represented.

In both experiments, the children's ages ranged from 4 to 6. **They "had not received any direct instruction in using letter-sound decoding to read words, although they had been taught the sound of letters and how to pronounce a number of printed words**. As a result of a standardized word reading test and a test of reading pronounceable nonsense words, it was determined that the children **did not have sufficient letter-sound decoding ability to support the decoding** of unfamiliar words. **The words were also phonetically difficult for new learners to sound out.**

## APPENDIX

TABLE A1
TARGETS AND CUES USED IN EXPERIMENT 1

| Target | Cue type: Phonetic | | Cue type: Control | |
|---|---|---|---|---|
| | Middle letter changed | | | |
| Hospital | hzpl | 46 | hfpl | 39 |
| Basin | bzn | 28 | bfn | 14 |
| Whistle | wzl | 39 | wfl | 32 |
| Daffodil | dvdl | 33 | dzdl | 19 |
| Rifle | rvl | 31 | rzl | 22 |
| Coffee | kvi | 36 | kzi | 25 |
| Supper | sbr | 39 | str | 27 |
| Carpet | kbt | 37 | kgt | 26 |
| Slipper | sbr | 40 | str | 24 |
| Button | bdn | 30 | bpn | 19 |
| Letter | ldr | 23 | lgr | 20 |
| Cotton | kdn | 25 | kbn | 10 |
| Mean | | 33.92 | | 23.08 |
| | Beginning letter changed | | | |
| Silver | zlvr | 28 | flvr | 25 |
| Salad | zld | 29 | vld | 14 |
| Summer | zmr | 36 | vmr | 17 |
| Forest | vrst | 32 | zrst | 12 |
| Farmer | vmr | 36 | zmr | 30 |
| Fairy | vri | 38 | sri | 11 |
| Packet | bkt | 21 | gkt | 21 |
| Party | bti | 24 | dti | 27 |
| Pony | bni | 27 | tni | 23 |
| Tiger | dgr | 26 | kgr | 27 |
| Ticket | dkt | 17 | gkt | 26 |
| Table | dbl | 34 | kbl | 13 |
| Mean | | 29.0 | | 20.5 |

*Note*. Figures following cues are item totals across subjects in Experiment 1 (maximum = 54).

The authors conclude that: **" Children, in the very early stages of learning to read, make use of letter-sound information when learning to recognize word-like items.** ... Our findings show that **children are sensitive to the degree of overlap (connection) between the phonetic features of the phonemes represented by the letters in the (spelling) cues and the phonemes present in the (spoken) words that are to be associated with them .** .... In the phonetic cue condition, this phoneme was (only) phonetically similar (not the exact letter/sound representation) to a phoneme that was present in the (spoken) word. ... The finding that children learn to associate *dbl* with the (spoken) word *table* more easily than *kbl* shows that they are sensitive to the fact there is more similarity between the sound represented by the letter *d* and the sound represented by the letter *t* than there is between the sound represented by the letter *k* and the sound represented by the letter *t*. ...the children were extracting letter-sound information from the cues which enabled the spoken form to be accessed."

To see how this works with real words, the researchers, in a 3rd Experiment, compared a child's ease of learning words termed "transparent" or "opaque". Transparent words are words whose letters all correspond to individual phonemes. Opaque words have letters that are either irregularly spelled or have some silent letters. (see list)

TABLE A4

CHARACTERISTICS OF THE TRANSPARENT AND OPAQUE WORD-SETS USED IN EXPERIMENT 3

| | No. of letters | No. of phonemes | Kucera-Francis Frequency | Concreteness | Imagibility | Age of acquisition | Total recognition (mas = 75) |
|---|---|---|---|---|---|---|---|
| | | | | Transparent | | | |
| March | 5 | 3 | 120 | 440 | 497 | 269 | 41 |
| Forest | 6 | 6 | 37 | 573 | 545 | 297 | 43 |
| Hotel | 5 | 5 | 126 | 591 | 597 | 308 | 35 |
| Garden | 6 | 5 | 60 | 602 | 635 | 186 | 57 |
| Flag | 4 | 4 | 16 | 606 | 607 | 258 | 39 |
| Basket | 6 | 6 | 17 | 606 | 560 | 270 | 39 |
| Elbow | 5 | 4 | 10 | 607 | 602 | 237 | 34 |
| Sand | 4 | 4 | 28 | 616 | 603 | 217 | 49 |
| Snake | 5 | 4 | 44 | 621 | 627 | 289 | 56 |
| Nose | 4 | 3 | 60 | 628 | 605 | 206 | 44 |
| Jacket | 6 | 5 | 33 | 635 | 611 | 224 | 47 |
| Beef | 4 | 3 | 32 | 637 | 625 | 270 | 29 |
| Mean | 5 | 4.33 | 48.6 | 597 | 592.83 | 253 | 42.8 |
| | | | | Opaque | | | |
| Watch | 5 | 3 | 81 | 487 | 525 | 270 | 35 |
| Giant | 6 | 5 | 23 | 515 | 562 | 256 | 33 |
| Dungeon | 7 | 6 | 2 | 562 | 579 | 303 | 33 |
| Biscuit | 7 | 6 | 2 | 574 | 571 | 198 | 40 |
| Knee | 4 | 2 | 35 | 593 | 597 | 231 | 35 |
| Salt | 4 | 4 | 46 | 594 | 570 | 233 | 41 |
| Bomb | 4 | 3 | 36 | 595 | 606 | 303 | 31 |
| Island | 6 | 5 | 167 | 596 | 643 | 289 | 20 |
| Pigeon | 6 | 5 | 3 | 609 | 610 | 325 | 23 |
| Honey | 5 | 4 | 25 | 611 | 608 | 286 | 19 |
| Fruit | 5 | 4 | 35 | 612 | 587 | 219 | 27 |
| Knife | 5 | 3 | 76 | 612 | 633 | 224 | 29 |
| Mean | 5.33 | 4.17 | 44.3 | 580 | 590.92 | 261 | 30.5 |

**"The results of this experiment show that young children, in the very early stages of learning to read, learn to pronounce words with a simple and direct relationship between their spelling pattern and their sound <u>more easily</u> than words where this relationship is less straightforward."** The children were once again able to "generate phonological information from the printed words. The difference between the transparent and opaque words shows that this phonological information is used by children in learning to recognize the printed form of the words."

The difference between learning words by each group was significant, showing that the **transparent words were easier, but not by much.** Transparent words were read only a little more than half the time and opaque words were read a little less, with a large Standard Deviation. **This was done with no or little explicit instruction in decoding the words.** The children were simply asked to read the words the best that they could with a minimal amount of decoding skills.

It is also important to notice that although the transparent words were somewhat easier, **the words used on this list were not easy**. **Comparisons should be made with the list of 400 words taught to kindergarteners in the Reading Mastery program that are also transparent, but significantly easier. These words required careful instruction to kindergarten children and are read in stories, not just in isolation.**

In conclusion, the Rack group state, "In summary, our experiments provide strong support for the idea that **children's phonological skills are brought to bear in the earliest stages of learning to recognize printed words."** "One important and surprising aspect of our findings, … is the evidence that young children are **sensitive to featural properties of speech sounds when learning to recognize the printed forms of words."**

DISCUSSION

It's hard to know what to make of these experiments. They do reveal, and confirm what Ehri found to be true, **the fact that many children can and do easily put together, or match, letters with their corresponding phonemes to some extent** in **some spoken words** more than what is expected, even without much instruction to do so. It's even done without children knowing it. **This behavior of using the phonetic connections generally goes unseen, unless exposed by these kinds of experiments, and is possibly not acknowledged, or taken advantage of, in many beginning reading programs**. However, with the variability in these skills, **how far should this discovery be taken advantage of in teaching so that all children learn these foundational skills, not just for those who were very capable in performing the letter/sound connections or relationships? Also, how extensive is this "inclination" in explaining the mystery of sight-word, fluent reading? And what about those phonetically difficult beginning words? How much phonics can be discovered from them?**

The observations made in these studies are intriguing, almost magical. How are children able to make the correct match of letters to phonemes in speech without knowing they are doing it? How is this ability accounted for and how much does it explain fluent word reading skills?

More specifically, how **is this skill developed to include all words read in print as sight words by good readers**? The findings are critical and insightful for beginning instruction, but it's role in instruction is still debated even by these researchers. The problem is that what is found here is a far cry from "sight-word reading" by advanced readers, which, in some instructional programs, can even be seen in very early instruction. **A deeper question may be the Why question.** Why are young,

pre-readers, able to match letters to sound so easily, without even thinking about it? While these findings provide important clues to solving the puzzle, additional research is necessary to cover this additional ground for a complete solution. How should this initial inclination or tendency toward letters and pronunciations of words be counted on in making full letter/sound connections needed for sight-word reading?

Little by little, Ehri does piece together the rest of the theory in her subsequent studies. **She does go beyond these findings to demonstrate advanced connections made with complete words read as sight-words.**

**5. Cipher versus cue reading: An Experiment in decoding acquisition.** Ehri and Wilce 1987**.**
*Journal of Educational Psychology. 79, 3-13*
**Instruction** in decoding strategies improves beginning reading of partial phonetic readers.
(discussed further in Part III, Some Critical Implications for Instruction)

**Reading words with partial vs complete connections .**
The earlier studies by Ehri and by the Rack group demonstrated how just the knowledge of letters' names and sounds helped pre-readers spontaneously become "novices" in identifying phonetically spelled real words or simple pseudo-words if the spellings are simplified. In Ehri's terminology, Novices, by definition, **only use partial phonetic cues in remembe**ring words. It was concluded that this was the way children "move into reading". This study examines how the Novice, partial phonetic-cue readers are able to move on towards complete phonetic reading. It compared two ways in which this can be done.

In this study, **Ehri challenged a widely held view** of how children best learned to read that held that children learn best if allowed, on their own, to informally extend their knowledge of the alphabet to become phonetically based readers. Gough and Juel (1984) reported on this widely held, two stage theory of learning to read, that involved 1.) visual-cue memory and 2.) alphabetic cipher reading.

In the first stage, the child was taught to learn words by "selecting some distinctive visual aspect of the spelling". They used the most distinctive letters or the "border" letters at the beginning or end of a word to help them learn the words. The letters acted strictly as visual reminders. It was thought that no phonetic information was used at this point.

In the meantime, the child was taught letter names and sounds separately. **As the theory goes, when this visual memory reading proved unreliable, confusing and frustrating, children gradually, and informally, shifted, on their own, to the second stage called cipher reading by applying knowledge of the alphabet to new words**. **From this experience**, children gradually learned how to be cipher readers. **According to Gough, by the time children are in the cipher reading stage, they "understand how spellings systematically correspond to pronunciations**." Becoming this kind of reader was a gradual, and a relatively unplanned, discovery process.

As in her earlier studies, Ehri found that, at some point during this first phase, children do spontaneously learn to use some phonetic connections, not just as visual highlights, in assisting them to learn words. She identified this learning of partial phonetic-cues as a new second phase called **phonetic-cue reading as a natural development that took place even without instruction.** Children learned to use selected letters **to make some phonetic connections to parts of the pronunciation of the words, more than just visual flags.** At this stage, children are not yet able to use the sounds for all of the letters in words. They have limited knowledge of how the alphabet system

works in spelling words with strings of letters. This kind of reading was found in use by children, informally taught with the first of the two stage approach, who were **asked to read difficult words that exceeded their alphabetic skills before being taught** how to read. They had not been taught to read through detailed decoding strategies from the beginning.

This study found that the spontaneous use of letters in parts of words is only a beginning. **It does not get spontaneously extended to include the complete spellings of real words.** This extension required instruction of some kind. **In this Experiment, children were taught decoding skills with pseudo-words to see if these skills would provided better help in learning whole words**.
Two groups of 9 pre-reading, visual-cue kindergarteners were found who could identify some words and knew some letter-sound relations. **Half** of these children were **directly converted into decoding readers** by teaching them decoding skills through the use of **short decodable pseudo-words**. The other **half** were taught **to be better phonetic-cue (partial phonics) readers** by teaching letter sounds and names and beginning sounds in words separately.

After each group had received their training, both groups were tested on their ability to learn the phonetically decodable words in the list below. Each group of children went through the same teaching procedure in attempting to learn these words. The results of how well they learned are displayed in the chart. The decoding group were able to read more of the words than the phonetic-cue group.

Words Taught, Mean Number of Correct Readings per Subject Across Seven Trials,
and Intra-list Intrusions, Produced at Least Two kinds of Cue Readers
M correct

| Word | Decoding Readers | Cue Readers | Intrusion error of cue readers |
|---|---|---|---|
| BEND | 5.4 | 1.0 | blond (4), blast (2) |
| BIB | 6.7 | 6,2 | |
| BLAST | 6.2 | 1.0 | blond (2) |
| BLOND | 6.0 | 1.0 | bend (2), blast (3) |
| DOT | 6.7 | 5.9 | |
| DRIP | 6.3 | 1.1 | dump (4) |
| DRUM | 5.9 | 2.2 | dump (3) |
| DUMP | 5.2 | 1.4 | drip (4), drum (2) |
| LAMP | 6.0 | 4.4 | lap (3) |
| LAP | 6.6 | 3.2 | lamp (6) |
| LIST | 6.1 | 0.9 | lamp (4), lap (2) |
| SPIN | 5.9 | 0.7 | stand (3), stab (2) |
| STAB | 6.1 | 1.2 | stamp (5) |
| STAMP | 5.6 | 1.7 | stand (2) |
| STAND | 5.9 | 2.0 | stamp (2) |
| M | 6.7 or 67% | 2.3 or 25% | |

Note: There was **a maximum of 9 correct responses per w**ord in each group.
Intrusions produced at least once by at least two cue readers are listed with the numbers of cue readers given in parentheses. These accounted for 65% of the intra-list intrusions.

This study demonstrates that for a beginning reader to extend, somewhat innate or spontaneous, phonetic skills for connecting letters to sounds in words, beyond a "partial phase" for reading the words, **they need to be taught, in some way, how it can be done**. Whatever "innate inclination" they may have at the very beginning, as indicated in Ehri's early studies (as well as by Rack's group), **this is not enough**. **Some kind of more direct instruction in these skills is needed for reading**.

From Gough's two stages of learning to read, Ehri eventually identified three new phases: a second partial phase**, a third full decoding phase, and finally, a fourth phases called a consolidation phase before the last more fluent "cipher"**

**phase where all words are phonetically based sight words**. This led to a Five Phase teaching framework, recommended by Ehri in the late 90's, that included the final phonologically based sight-word reading, . (Phases of Word Learning: Implications for Instruction. Reading and Writing Quarterly, 1998)

By teaching decoding skills to half of the "visual cues" group, these children passed from the "phonetic-cues" or partial phonics-cue phase into a "full decoding" phase even though they were only able to read 67 % of the words correctly. The other group remained at the partial phonics phase and were only able to read 25% of the words. Decoding skills helped read more of the words. This leads to the question of how necessary and useful is the second "partial" phase of instruction. It also raises the question about how children move into the more advanced word reading skills identified by Ehri. These concerns are pursued in Part 5, Some Critical Implications for Instruction.

**6. Does Learning to Spell Help Beginners Learn to Read Words?** Ehri and Wilce 1987b, *Reading Research Quarterly, 18, 47-65.*
Teaching spelling skills help but are insufficient for learning to read

Whereas the previous study approached reading through decoding instruction with decodable non-words (from print to speech), this study approached reading instruction through spelling of spoken non-words (from speech to print). **It's main purpose was to explore the extent spelling skills would have in teaching beginning reading**. Because spelling has elements of decoding, it raises the question**: will these elements sufficiently transfer to decoding skills for reading**? This study compared the affects of spelling skills in teaching beginning reading to **not teaching spelling** skills.

**The short answer for each was: Spelling skills helped beginning readers more than not, but were not sufficient for children to learn how to decode words because the elements of decoding skills found in spelling did not always transfer. Decoding skills for reading words need explicit instruction in the decoding strategy**. Therefore, **teaching children to read without explicitly teaching decoding skills, even with spelling skills, results in more phonetic-cue (partial) kinds of reading where young readers use only selected parts of words to connect to pronunciations, plus a reliance on visual memory.** This kind of reading is seen as a phase or stage in learning to read that comes before being able to decode words, **widely observed in schools at the time**.

**Summary of procedures**
A group of kindergarteners with minimal knowledge of the alphabet and spelling of non-words were divided into two groups. One group, the **Training Group**, received oral training in spelling non-words through dictation, some non-words sounded like real words. The second group, the **Control Group**, continued to practice identifying letters that matched sounds, using the same letters used by the Training Group. The need for learning how to write the letters was excluded by using **letter tiles for each letter.** Details of the training sessions were clearly described in the study.

At the end of the sessions, both groups were given several learning trials to read a set of 12 new words shown in the **table below**. The words were printed in capitals and **were given simplified phonetic spellings with the long vowels marked**. The results in **the graph below** show that, on the average, the **Trained group performed better than the Control group**. Therefore, it was concluded that the spelling skills **helped** the children in the Trained group to identify the words. However, as can also be seen, **none of the children in the Training group were able to master the list**. The spelling skills were insufficient for learning all the words.

**Commentary**: Comparing the results of this, **Learning to Spell**, study to the results of the previous, **Cipher vs. Cue Reading**, study should contribute to support the advantages of teaching explicit

decoding skills early so that the phonetic-cue phase can be omitted altogether. This would not conflict with some advantages of also teaching spelling skills early, found in the **Learning to Spell** study.

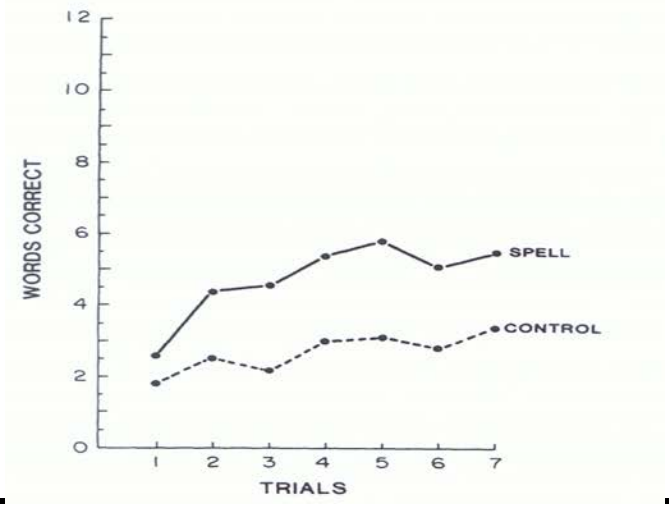
**SEE "Evidence" section of the 1992 chapter, "Reconceptualizing the Development of Sight Word Reading and Its Relationship to Recoding",** pps. 117-137. In this section of the 1992 chapter, Ehri cites several further studies that provide evidence of readers' need to extend visual-phonological reading to whole words. She gives attention to a landmark 1977 study by **Lee Brook, Visual Pattern in Fluent Word Identification, in <u>Toward a Psychology of Reading</u>, A.S. Reber & D. L. Scarborough, described below.**

*Table 1* Characteristics of words in the word learning task and numbers of spelling-trained and untrained subjects who read words correctly

| | | Subjects who read correctly[a] | | | | |
|---|---|---|---|---|---|---|
| Word Taught | Simplified Spelling | Trained Group | Control Group | Difference | % of Letters Shared | Meaningfulness |
| sails | SĀLS | 3 | 4 | -1 | 52 | 9 |
| sake | SĀK | 7 | 1 | +6 | 34 | 12 |
| seal | SĒL | 9 | 9 | 0 | 41 | 3 |
| seats | SĒTS | 4 | 1 | +3 | 50 | 5 |
| signs | SĪNS | 5 | 2 | +3 | 47 | 6 |
| sight | SĪT | 8 | 5 | +3 | 39 | 11 |
| slice | SLĪS | 3 | 2 | +1 | 52 | 7 |
| snake | SNĀK | 6 | 4 | +2 | 41 | 2 |
| soles | SŌLS | 4 | 0 | +4 | 52 | 10 |
| soap | SŌP | 10 | 10 | 0 | 32 | 1 |
| steal | STĒL | 5 | 1 | +4 | 51 | 8 |
| stone | STŌN | 5 | 3 | +2 | 45 | 4 |
| Mean | | 5.8 | 3.5 | +2.3 | 44.6% | |

[a]Number of subjects who read each word correctly at least twice. $n = 10$ for each group.

Mean numbers of words read correctly across trials in the word learning task for subjects given spelling training and for control subjects given sound-letter training



**In these studies she seeks to demonstrate the distinction between two types of sight word reading, visual rote and visual-phonological, and a third kind of word reading, decoding (the term recoding is used in her report.)**

The following last two studies cited and described in this chapter attempt to demonstrate all three kinds of distinctions. In each case, speed is the deciding factor, making the difference between phonologically based sight word reading, visual memorization and decoding, in favor of the first type.

Making these distinctions is difficult because the phonological connections are hidden. Making the phonics connection evident, from strict sight word reading, is the challenge. This requires finding evidence that phonics is at play. Both kinds of "sight-words" sound the same. How is it known if and when phonetic connections are being used? In early teaching, teachers typically have difficulty knowing when children have memorized a word and when they are internally using their learned phonics connections. The speed and accuracy of remembering and reading words in a mixed arrangement or text, can make this distinction more evident under the right conditions. Initially, memorized words are learned faster, but phonetically connected words finally outdoes memorizing for accuracy and speed, even as well as in decoding.

7. To demonstrate these distinctions, Ehri cites an early 1977 study by **Lee Brook, Visual Pattern in Fluent Word Identification, in Toward a Psychology of Reading, A.S. Reber & D. L. Scarborough.** In this study, tests were conducted to see how well adults learned words that were spelled with **artificial alphabets**. With this lettering, words in two lists were spelled in two ways, one phonetically and the other non-phonetically.

Adult participants had to learn the new phonetic alphabet enough to read the first list of words spelled phonetically and then remember the words in the second by rote where the letters didn't give any phonetic help. Participants were given 400 trials or practice activities to learn all the words in both lists. During the first 200 trials, the non-phonetically spelled words were learned quicker. During the second 200 trials, however, the phonetically spelled words were read faster, presumably due to the help the alphabetic connections the spoken words eventually provided. This continued to be true even after all words were eventually learned in the 400 trials, each word read as one of two types of sight words. Yet, the non-phonetically spelled words were read slower by the end of the practices. As the phonetic spellings were learned, they by-passed the visual memory words and became easier and faster to remember during the last 200 trials. Speed and accuracy demonstrated the difference between the two kinds of reading.

Ehri's explanation for this is as follows. P. 118

"This suggests that the **two types of sight words** are not processed similarly. Our explanation of the difference is that the connections linking spellings to lexical memory (of spoken words) are more numerous and of higher quality for phonologically spelled words than for arbitrarily spelled words (that could only be visually memorized). This facilitates memory access in the former case. Also, **word reading speed is greater** because the phonological spellings are linked directly to pronunciations, whereas the arbitrary spellings are linked only indirectly to pronunciations through meanings."

Once the adults learned the new alphabetic letters, their knowledge of how alphabets work enable them to read the words faster. **For some reason, the phonetic learning eventually worked faster than whole word memory**. This study is similar to Ehri's 1985 study in which simplified phonetic spellings and arbitrary spellings of real words were used. ( MSK vs. UHE for the word mask) However, in the Brooks study with adults, whole words were spelled with artificial alphabets where the adult readers had to learn a new alphabet. In both cases, young and adult readers found that making the phonetic connections to the pronunciations in words **eventually** made them easier to learn and read.

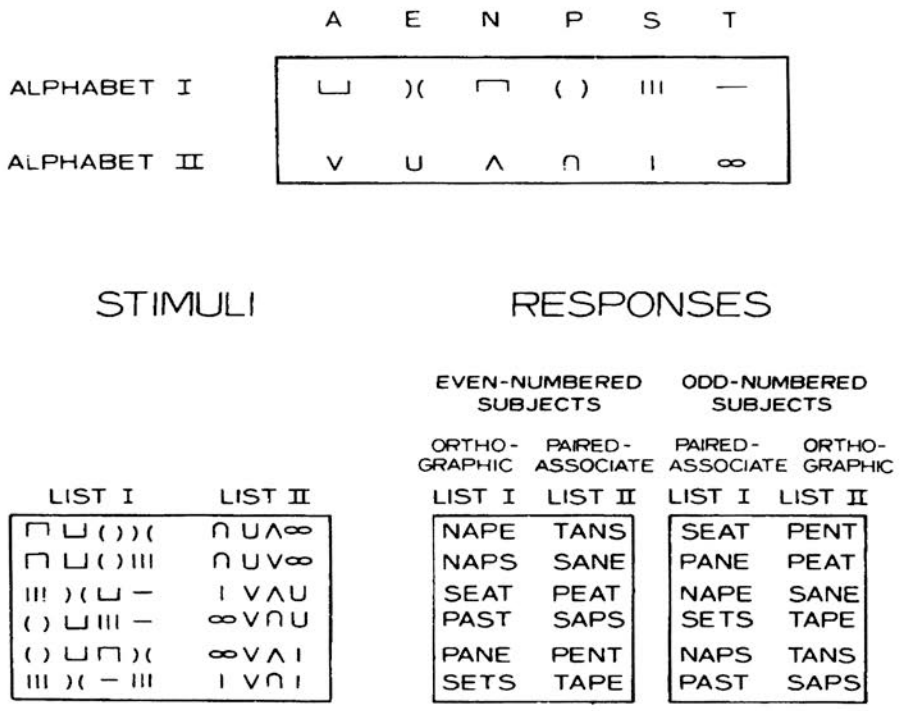



FIG. 5. An experiment to test the importance of an alphabet at fluency. For each subject, one list has a functional alphabet and one does not. Each subject is given 400 trials of practice naming the words in each of the two lists. Which list is orthographic (has a functional alphabet) is counterbalanced across even- and odd-numbered subjects.

**Distinguishing between "sounding out" (recoding) and phonetically based sight word reading**
The Brooks study also illustrates this distinction. The phonetically spelled words were slower at first but got faster during the second half of the practice. The fist half is a time when decoding is slower than phonologically based sight word reading. Ehri claims that recoding (decoding) and phonologically based sight word reading are also different ways of reading. Even fast and fluent recoding is different, slightly slower than sight word reading. If students are taught the recoding or "sounding out" strategy, **they must eventually shift to sight word reading for advanced reading**.

The recoding strategies may help the child, or an adult with a new alphabet, establish the connections and read words more accurately, but they are still too slow for fluent and expressive reading. **Recoding involves too much thinking to enable the reader to simultaneously concentrate on expression and meanings**. The persistent use of recoding skills are an indication of insufficient learning of the words. The shift to sight word reading indicates a completely learned, automatic connection of letters to sounds to meanings of words, with little thinking necessary for these connections. Recall Perfetti's quote: **"phonemic effects can be observed within the first 40 ms of word identification**". Ehri sees the Brooks study as a demonstration of how phonetically based sight word reading is faster than decoding.

The slowness in learning the words during the first 200 trials can be understood as the reader working with the decoding strategies. As they become good at the decoding and **the artificial symbols become connected to speech sounds**, the readers gradually shift to a phonetic sight word reading during the last 200 trials, which enable them to read **faster than decoding and memorization**.

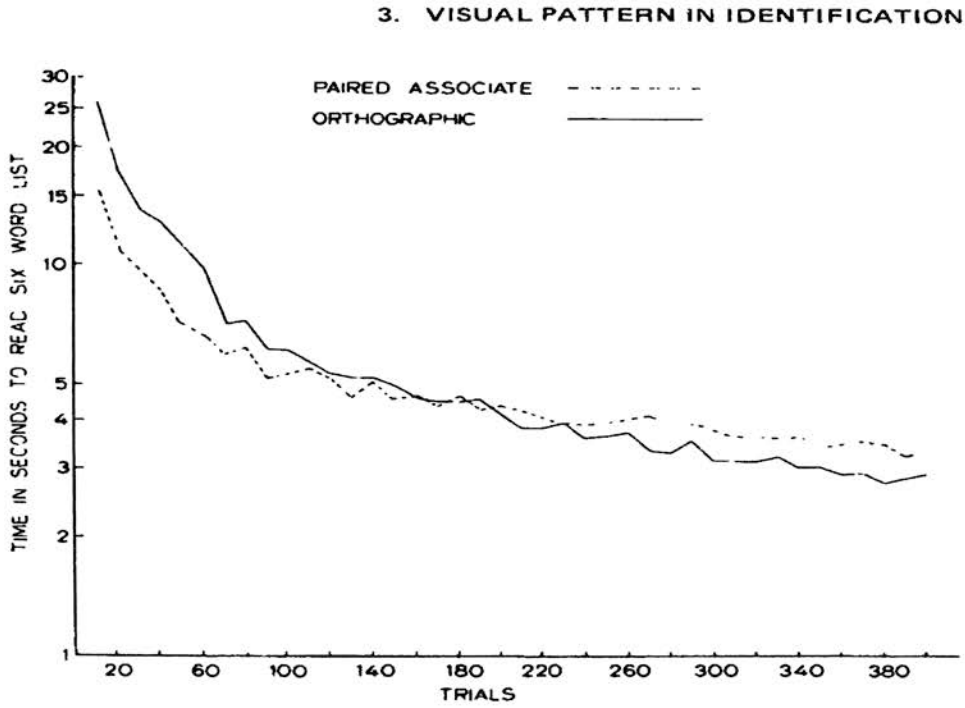



FIG. 6. Time taken in seconds (log scale) to read each of two sets of six words over 400 trials of practice. Rather than converging, as might be expected from a "whole-word" notion of fluency, the set with a functional orthography became faster with practice.

**8. Ehri and Wilce, 1983 in Development of word identification speed in skilled and less skilled beginning readers,** *Journal of Educational Psychology 75, 3-18***,** performed an experiment that studied the **differences between the way skilled and less skilled readers read** in first, second and fourth grades, **to further demonstrate the difference between decoding and sight word reading**. In this study, they used simple, familiar words (e.g. cat, book, see, stop, jump, red), nonsense words (e.g. mel, jad, mig, fup) and single digits. p.121

It was found that only "the skilled readers….**were able to read the words as fast as they name digits**, indicating that only some of the readers had formed complete connections between spellings and pronunciations. (With practice, they were able) to read the nonsense words as fast as the real words and digits, indicating that the non-sense words had become completely connected sight words. …only the skilled readers possessed adequate recoding skills to form complete connections between spellings and pronunciations in memory**. Poor readers' weak recoding skill was evidenced by errors and longer latencies in the nonsense word recoding task."**

Finally: According to Ehri, (As words are learned), skilled readers "shifted from recoding to sight word reading… As the number of connections increased for each word and became more effective in distinguishing one word from another, and as systematic spellings became linked directly to pronunciations in memory, processing speed continued to increase beyond that involved in reading words (just from memory or decoding)."P. 123.

Question: Is this a distinction between full decoding of words and instant sight words or is it a distinction between partial decoding and sight word reading?

"These results provide support for the distinction between recoding and sight word reading and for the contribution that recoding makes for sight word reading. Moreover, they indicate that **readers may differ in their skill at forming visual-phonological connections to read words by sight**." P. 122

**The less skilled readers had not mastered the full decoding of words on this list, in comparison to the more skilled readers. They made errors and were slow**. (written extensively by Perfetti and Stanovich, cited in Part 1. p. 16)

According to Ehri, the poor readers "**differ in their skill at forming visual-phonological connections to read words by sight".** Are these poor readers "full decoders" or "partial phonetic-cue readers", still struggling with reading words? Other than showing that good readers can read words as fast as they can read digits, **this study doesn't compare full decoding of words to her concept of sight word reading?** How to demonstrate the full decoding kind of reading vs. the sight word reading remains to be seen. How is the "shift" from these two kinds of reading made visible? Is it still just a matter of speed? Full decoders still need to think about it too much?

**Some Instructional Implications**

At the kindergarten level, in the Reading Mastery program, in the lesson sequencing, it is possible to observe how children transfer from sounding out loud to sounding out silently, after a pause. As the pauses shorten, the young reader is able to say words, that they've learned, almost instantly -- words that have been learned by connecting letters to sounds, but not memorized. (**"phonemic effects can be observed within the first 40 ms of word identification**") The texts are written so that words, made up of letters previously taught, and sentence patterns, are carefully mixed to discourage memorizing. Guesses produce errors.

In Ehri's experiment, presumably, the more skilled readers had mastered the decoding skills sufficiently to move on to the **final automatic phase of sight word reading**. Knowing this, can the "shift" be taught explicitly, applied to words as they are learned and read in texts, or should this shift come about naturally and all-at-once applied to most of their learning? If it can be specifically taught, with practice, as they go, would this accelerate the learning and also assure that all children progress to the sight word reading level sooner, beyond struggling with, or thinking about, decoding skills? It also pays dividends in the enjoyment of reading by the children.

A lot would depend on the reading vocabulary used in the lessons and programs to "program" this shift as they go, as soon as possible in texts, with carefully selected vocabulary within the learning readers skill level. This kind of careful instruction can result in increase generalization of these skills to new and unfamiliar words, even early by less skilled readers. Because of the way the less skilled readers were taught and the programs used, Ehri's experiment was not able to demonstrate this possibility with less skilled readers. This led to some unfounded conclusions about less skilled readers and how they learn.

It should be noted that, although automaticity can be observed in the reading of advanced readers, these studies do not explain how the reader is able to do this so automatically, even with letter/sound learning. Ehri, and others have demonstrated what skills are necessary for automaticity, but do not explain how these skills are put to use so quickly and easily (**"phonemic effects can be observed within the first 40 ms of word identification**"). The thinking that the answer lies with the innate speech process does point in the right direction for the answer. Yet, how does being able to speak and listen enable rapid reading? See the brain image studies.

Perfetti explains the linkage between reading and speech this way. "Phonology (speech sounds) matters for reading because **reading builds on language**. Phonology (what is spoken and heard) is implicated so strongly because it is the level of language that **provides the surface interface to written words**. **Graphic units map onto phonological**

**units** that can be phonemes (alphabetic writing) or syllables (either simple phonological syllables, as in Japenese Kana, or syllbic morphemes, as in Chinese). In the case of alphabetic writing, whether the orthography is shallow or deep, the basic units of writing are graphemes (consisting of one or more letters) that correspond to phonemes. **Without sensitivity to the phonemic structure of language and without word representations that include phonemes, there is a logical problem in mapping graphemes to phonemes."**

**CONCLUSIONS OF THE EIGHT EXPERIMENTS**: These experiments do strongly support the theory that good reading involves phonetic, alphabetic connections to speech sounds rather than straight memorization. The memorization idea defies reason as well. Memorizing thousands or even hundreds of words at the very beginning is not possible and obviously is not done by good readers. How the "look-say" idea lasted so long is beyond belief. Good readers over the ages did not memorizing thousands of words in spite of what the experts thought.

It does take time to learn decoding skills and apply them to the vast amount of reading vocabulary needed for good reading, but these skills are essential, and are consistent with an alphabetic writing system. All things considered, kindergarten and first grade is a short time to learn how to read at least 2000 words at a good rate. Even children who have serious difficulty with learning decoding skills still end up being able to read more words with these skills than they would through straight memorization, though at a slower rate.

Ehri's attempt to show the difference between decoding skills by good readers and automatic sight word reading was not as strong. Although Perfetti's point of measuring how fast phonemic recognition can take place, 40 mls, and although demonstrating that good readers can read words as fast as they can read digits, it is very hard to demonstrate when a young reader, even a good reader, is using internal decoding skills and when the recognition is more instant and automatic. Just demonstrating that poor readers have difficulty learning decoding skills is not enough evidence to distinguish between how good readers use decoding skills and then shift to automatic reading. It is commonly known that poor decoding is a characteristic of poor readers.

**The Grapho-Phonemic Connection (GPC) theory therefore tells an essential part of the mystery. The rest comes from brain-image studies**.