# WHERE RESEARCH HAS FAILED

IN THE STUDY OF TEACHING PHONEMIC AWARENESS AND DECODING

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## Preface

Learning to read at the age of 5 or 6 is truly a remarkable feat of cognitive achievement. "Few cultural requirements are as important to a child's life as that of becoming a reader." (Adams 1994) This paper concerns the question of how this achievement can be accomplished as a result of a good beginning that enables children to read words in meaningful texts as early as kindergarten.

After working with reading interventions for more than 25 years, I decided to focus my interests in prevention. Although this interest had been growing over the years, it finally came to a head while finally being able to teach first grade. This shortly led to establishing charter schools that started with kindergarten. In this focus, my first concern was on how reading gets started, at the point of entry. My experience and studies up to this time had convinced me that there was a weakness in the way mainstream research on beginning reading was reporting on this topic. If not corrected, many children will have a tough time learning to read.

Research on this aspect of reading has exceeded all other aspects of education since its inception in modern studies in the late 1960s early 1970s. Yet , repeatedly a weakness has been over-looked. As a consequence, it has set practices into place that has hampered the search for the most successful way of teaching beginning reading. Traditionally, the trend has been to teach readiness skills in kindergarten and wait until 1st grade to formally start teaching the mechanics of reading words. Modern research has replaced traditional readiness with instruction in phonemic awareness as a new kind of readiness. This was an improvement but still results in a rough and delayed beginning for most children.

This can be corrected. It would mean that kindergarten can be a time for a head-start in learning, not just a readiness to get started. It can be a time of building a reading vocabulary of at least 400 words in kindergarten, and not wait until first grade for a troubling beginning.

It all hinges on how instruction in phonemic awareness is taught and used as a preparation for formal instruction of a decoding strategy, which is commonly known as a major challenge for all children and a fatal one for many. A break-through in early research did establish the importance of phonemic awareness but failed to establish the most effective and efficient way of teaching it and connecting it to formal instruction. This break-through included remaining difficulties. This includes how decoding and phonemic awareness is taught. The decision about decoding comes first. An analysis of it will determine how phonemic awareness will be taught. The failure to find the best combination of the two, phonemic awareness and decoding, weakens the new promise that phonemic awareness brings to teaching.

This paper will argue that research chose a faulty model for deciding on the best way to teach. It chose a model after the printed word, with spaces between each letter. The correction of this choice would be simple, just model it after continuous streams of sounds in speech as a means of getting learning started and sustaining this early phase.

My case is this: With a simpler and more effective start, modeled after speech, with its corresponding way of teaching decoding and phonemic awareness, learning to read can begin sooner and will be successful with more children. This applies to all children as young as kindergarten and with learning difficulties. Missing this possibility and opportunity is Where Research has Failed. Correcting this omission can prevent failure for many children and create an earlier beginning for all. The charter schools that I set up, beginning in 2002, have demonstrated how this correction can be made.

WHERE RESEARCH HAS FAILED

## Part I
## Learning to read in Kindergarten as a Cognitive Achievement

*"If the light were not so gradual in dawning, the relationship between speech and print might count as one of the most remarkable discoveries of childhood."* **The Threshold of Reading**. (Linnea Ehri, 1979)

"*Learning to read is strikingly different from other sorts of learning…* It requires merging two forms of language, speech and print… *The beginning reader must learn how a given writing system relates to spoken units in his or her language… that letters and letter strings correspond to speech segments."* (Keith Rayner, Barbara Foorman, Charles Perfetti, David Pesetsky and Mark Seidenberg, 2001)

### Introduction

Any beginning reading program that is successful and appropriate for teaching kindergarten children starts without any assumptions about what the children might know about reading. It assumes that the children know nothing and begins from there. Yet, early-on, amidst this threshold, within the first few weeks, sometime in October in the school year, children are asked, this early, to start to begin tackling "*one of the hardest parts of learning to read*." At this point, they begin learning how to decode words, translating print to speech, starting way before other methods of teaching get started.

Teaching decoding this early in the program, a rare occurrence in kindergarten, is made possible by the uniquely pre-taught phonemic awareness task, "Say the sounds without stopping". Taking this pre-taught oral tool, from speech, and applying it to, and then co-teaching it along with decoding, for the first two months of the year, eases children into this critical phase and makes decoding teachable for kindergarteners. Thus, the children are given an early and successful start at learning to read. *

Learning the oral-only technique of "Saying the sounds without stopping" accomplishes two objectives: 1) it takes a child's limited awareness of the sounds in words from learning to talk to the next level, called phonemic awareness, and 2) it directly prepares for the start of learning the more difficult task of decoding words, which is fraught with hazards. (See Part II.) Decoding can then be taught with the same continuous sounding out technique, only with letters. If taught well, it can avoid the many hazards along the way and make the difference in learning to decode words a full year early.

Learning to decode words, in this manner, at this level, begins to set-up a valuable foundation for reading more advanced words. It prepares for essential advanced phonemic knowledge, beyond a speech form, to a form from print, with segmented units. (see further explanation of "reciprocal interaction" in Part III, One hitch)

In a modern program like Reading Mastery, this kind of decoding of words is taught in lessons for two-thirds of the year, to about lesson 110. At this point, it is fully replaced by an early form of fluent reading, with some over-lapping and use with new or troubling words. Preparing for this, children have been taught how to transition from out-loud decoding to instant "sight word" reading words without sounding out. How this is performed remains a mystery. (Ehri, 1992)

This approach enables children, who finish the program, to have a reading vocabulary of at least 400 decodable words, containing 40 possible phonemes spelled with 41 possible letter combinations, (eventually reaching 60 spelling/sound correspondences) all read at a fluency rate of at least 40 words per minute. This is a **remarkable achievement**. Kindergarten children can read as well as the typical 1st grader at the end of the year, who doesn't get this kind of careful tightly sequenced instruction until 1st grade, even if then.

There have been volumes of research on this topic over the last fifty years, yet, very little mention is given to **this particular key to a smooth and early entrance into reading, without obstacles. This early entrance makes it possible for kindergarten children to learn to read**.

This is the failure in research. (See parts IV-VI)

(*In a recent study by Linnea Ehri et al, this oral tool from speech, is applied to decoding only without phonemic awareness preparation and was named "continuous phonation". Regrettably, it was not applied to phonemic awareness teaching and thus failed to reap the earlier results.)

Accomplishing this remarkable cognitive achievement involves learning how the alphabetic print code works in representing speech, i.e. the principle on how it spells out words from speech into print. This knowledge is then applied to changing any printed words back into their original spoken form for reading. This exchange is accomplished by cognitively matching letters to sounds, from which the words and their meanings are recognized from speech. It's a process that requires a knowledge of letters and how they represent particular speech sounds. (Liberman, I. 1974) After learning the spelling/sound matchings, the two become tightly bonded, magically, almost automatic. Strategically, using this learned matching enables a new reader to learn how to decode printed words and learn their structure and identity. With this learning, if a word is in a reader's spoken vocabulary, (i.e. mental lexicon) thousands of words in print can be instantly recognized and changed into spoken language. i.e. reading. This is possibly the most remarkable learning in a child's lifetime that takes place in a few years' time. It is called decoding. (Adams, 1990, ch. 10-11; 1994, ch. 1)

**First steps for translating printed words to speech.**

| | |
|---|---|
| 1. Identify and pronounce the sound for selected letters: i.e. s m a n t<br>2. In a given printed word, identify and pronounce the sounds for each letter. /s/ / a/ /m/<br>3. Sound out the letters in a word. /s/a/m/<br>4. Recognize and pronounce the word. /sam/<br>5. Apply this process to a collection of words: me man at ran | 6. Practice this process with fewer prompts.<br>7. Add new words with new letters.<br>8. Read words in a list in mixed order.<br>9. Read same words in a passage of varying length.<br>10. Increase reading vocabulary without sounding out. |

Decoding is the strategy for both learning the alphabetic principle and for reading words. In learning to decode words, both their oral and print structure become exposed and learned. This also contributes to strengthening the awareness of phonemes and their bond to letters. The skills acquired become a self-teaching tool for continued learning of the spelling and identity of new words. The alphabetic principle can and must be generalized and applied, beyond the first words taught, to more advanced spellings of words and a large volume of words through self-teaching (Share, David, 1995). Eventually, through learning, the analytic decoding of words fades and words are mysteriously identified instantly through the hidden and mysterious used of the same principle. The learned alphabetic link to speech makes fluent reading possible, automatically, almost like breathing. Even in kindergarten, this fading process and early, emerging, fluent reading can be observed, putting the mystery of reading on early display.

The alphabetic code (cipher) does get complicated, especially in English. At the simplest starting point, spelling/sound matchings in small words can be easily seen in words like: *me, am, see, mad, sad, ram*, in which each letter represents one phoneme. Adding words with consonant digraphs or blends increases the complication slightly: slip, *ship, that, chop, when, stop*. Adding long vowels that say their name is a major step up because they require added spellings, either with vowel digraphs or with the silent letter e. As seen in the chart below and in the linked word lists, the long vowels have diacritical markings and the silent letters are smaller to help the new learner. These modest adjustments assist in this initial learning and add to the variety of decodable words that can be learned from the start in kindergarten.

Kindergarteners, in an appropriate program with carefully sequenced teaching, are able to learn and apply this level of alphabet knowledge to decode at least 400 regular and slightly variably spelled words, with up to 60 spelling/sound correspondences. (Sample word list for kindergarten, Sample word list for 1st grade )

Forty-two letters or letter combinations to teach in kindergarten

Vowels: *a e i o u* = 5 short and 6 long, including y. (long vowels with diacritical markings) = 11
*er, ar* (r controlled) *oo* = 3
Consonants: at least two kinds from an instructional point of view.
Slow, continuously voiced or non-voiced sounds: *c f l m n r s v w z* = 10
Fast sounding stop sounds: *b c d g h j k q p t x* = 11
Consonant digraphs. *sh, th* (voiced), *th* (non-voiced), *ch, ck, wh, ng* = 7 (3 fast, 4 slow)

This is a level of reading, that exceeds the new Common Core standards for kindergarten, is thus **rarely seen in kindergarten classrooms**. From this foundation, decoding strategies advance beyond the overt letter-by-letter "sounding-out" procedure, even within kindergarten, where the mystery of fluent reading begins to be displayed. (see Arthur, C., and Stockard, J., 2014)

**Simple, but not so easy to learn.** Although words with these simple common spelling/sound correspondences are a good place to start teaching the alphabetic principle, and can eventually be applied to reading at least 80% of the English language, they definitely are still not easy. (Castle, K. et al. Ending the Reading Wars, 2018, p. 9; Grossen & Carnine, 1993) For most children, learning how an alphabet works at the start, is very difficult. It doesn't come naturally. It places higher demands on cognitive activities of the young child, beyond what they needed for spoken language. Psychologists refer to this as possible "Cognitive Overload" if instruction is not done carefully. (Knight, B.A., et al. 2017)

The next two parts of this series of papers give additional background towards explaining the nature of the failure that has occurred in researching the subject of beginning reading. It describes the common built-in difficulties that children face in learning to read and how research has made break-through contributions toward solving these problems. However, parts IV-VI explain how these contributions have come up just short of a final solution. Part VII seeks to show how these attempts can be brought to completion at the kindergarten level.

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## Part II
## The intractable impasse at the point of entry.

Herein lies a paradox in learning to read.

*"Reading seems so natural to the literate adult that he could easily imagine that it must rank among the simplest skills for a child to acquire. Yet nothing could be further from the truth. For many children, learning to read is an extraordinary effortful task, a long and complicated process that can last for years. That is the essence of the paradox. How can a skill that feels so easy to the adult be so difficult for the child to acquire? The paradox is interesting to the scientist because* ***learning to read is strikingly different from other sorts of learning."***
(Rayner et al., 2001 p. 1)

Researcher, Linnea Ehri, called learning to read words, at the start,

*"one of the hardest parts of learning to read. It's a part that consumes substantial learning time."* ( Ehri, L. 2005)

Learning to read is the most heavily researched subject in all of education.

"*Indeed, no area of instruction has received more scrutiny or provoked more controversy*." (Lehr & Osborn, 1994)

**Marilyn Adams**, a prominent scholar on this subject, in her 1990 landmark book on **Beginning Reading**, has sought to described and explain this difficulty with learning at the threshold.

She argues….

"*that the basic phonic curriculum* ***is inherently intractable****, slow, inefficient, and worse:* ***likely to be ineffective***."

In a later 1998 publication**,** she writes,

*"...alphabetic instruction has been* ***bogged down*** *by one problem: Many students find it extremely difficult to* ***induce the words from the code****, no matter how they are drilled on the individual letters and sounds".*

Adams suggests that the difficulty, at the start, lies with the alphabet itself**.** She sees, in this representation, serious built-in barriers to learning. **The system impedes learning and acts as an "impasse"** in learning basic foundational skills that must be overcome at the entry point.

(Adams, M., 1990, ch. 12, p. 292 and 1998a, p. 18) (scroll to pgs 11 and 16 of the link.)

*Y*et, as illustrated in Part I, learning to read must be accomplished in a relatively short time period. The question asked and examined in this paper is: What makes it so hard at the start, what's the best solution that research has offered in surmounting this difficulty or "impasse", how adequate is this and how is it possible to do a better job early in kindergarten.

**Where is the "impasse" first seen?**

The impasse is apparent early in teaching. It shows up in child's initial attempts to "induce the words from the code", that is: identifying the word from the print. This is a decoding problem, which is inducing the identity of words with a decoding strategy, whatever strategy is used. The impasse is due to a child's difficulty word decoding. This is where the impasse resides. Decoding is the problem.

What are the sources of this problem? Why do children, almost universally, have trouble with this spot of learning? Charles Perffetti (1985), a leading researcher, refers to this as the "bottle-neck". It shows up with simple words. Guessing words without decoding them would avoid this dilemma but only temporarily.

**The "impasse**" is commonly observed by teachers. They have seen how children, even after learning the letter sounds and names, still can't translate (induce) them into the easiest words. Their attempts to decode the words by sounding out the letters, in their order, even then, often fail to produce the word. They may first say each sound separately but, from this, still not be able to say the word. *"Some children we worked with could not identify the word if they sounded it out in the traditional way – with pauses between each sound…*" (Engelmann, 2004 pg 3) They

may attempt to decode a word like *bat* that sounds like three syllables, *buhatuh or buh- a- tuh with a swah sound in-between letters*. Sometimes, they may say the last two sounds aaaat without the first.

It's not obvious to a child that this is a word that they know. This is a chronic problem that children have with decoding. They often can't identify words from decoding attempts. This kind of difficulty can discourage many teachers from teaching phonics, at all, at the start.

It all seems "inherently intractable". The impasse must be identified and surmounted or removed somehow so that the child can begin to meet the normal increase in the cognitive demand of reading.

In an early research report, Isabell Liberman, of the Haskins Laboratories, describes this difficulty.

> *"Indeed, children can generally make appropriate sounds in response to single letters but are often unable to proceed when they encounter the same letters in the context of words. ….. Somehow , they cannot relate the three letters of the printed word* ***bat*** *to the three* ***phonemic segments*** *[or speech sounds] of the spoken word. It is as if they were not aware of the fact that the mono-syllabic spoken word has these segments." (1973,pg 5, )*

**What is it about the alphabet that creates the impasse?**

**Three sources of difficulty create this impasse**:

They come from…

the nature of speech, the nature of an invented alphabetic and the nature of English spellings.

1. Due to the nature of speech, young children have difficulty hearing all the small bits of sounds in speech, called phonemes, in the order they are pronounced in words. Because reading an alphabetic language requires matching the letters to the sounds, knowledge of the sounds is more necessary for reading than for speech.
2. Yet, due to the nature of print, children have difficulty attaching an alphabet to the elusive speech sounds, even if the sounds become known. This difficulty concerns how well the alphabet represents speech for making the match.
3. On top of all of this, English has its contribution. It is referred to as a "deep" alphabetic system to the degree it approximates spoken words, apposed to other shallow alphabetic languages. English adds even additional hazards.

These three sources identify how the start of learning to read places a high cognitive demand on the new learner that can result in possible overload, frustration and resistance at the beginning. (Rayner et at. 2001, pp. 3 and 8)

**The First Source, speech,** concerns the structure of speech at it most basic level, made up of the smallest bits of speech sounds, i.e. phonemes, within syllables, and its knowledge for reading.

A technical definition of a phoneme.

> *"For our purposes the phoneme is the shortest segment that makes a significant difference between utterances. It lies in the lowest layer of language, has no meaning in itself, and is, within limits, commutable. …. As commonly defined, a phoneme is an abstract and general type of segment."*
> (Liberman, A. 1967)

> ***At its most fundamental level, the basic awareness of the nature and existence of phonemes seems to qualify as a genuine insight of our times****. (Adams, 1994)*

So why is its knowledge so important?

> "*Measures of schoolchildren's ability to attend to and manipulate phonemes strongly correlate with their reading success all the way through the 12th grade. [a snowballing effect)*
> *Indeed, among readers of alphabetic languages, those who are successful invariably have phonemic awareness, whereas those who lack phonemic awareness are invariably struggling.*" (Adams 1994)

The science indicates that phonemic awareness pervades all of reading. It is a hidden part of what the reader thinks about when reading, silently or out loud. Kieth Stanovich, a leading thinker on this has stated the following in a major report.

*"Phonemic awareness is ubiquitous in reading."*

There is nothing in reading that phonemic awareness doesn't touch. It drives reading from the hidden under side, as much as , or more than, what is seen from the visual side. It's that important. Learning about phonemic

awareness was eye opening, "a genuine insight", in understanding what reading is, and how phonemic awareness is involved in teaching.

A landmark report, published by the National Reading Panel on phonemic awareness and phonics, (2000) stated that phonemic awareness is the first of five essential components of teaching reading. See Part IV for a detailed account of this report on phonemic awareness.

Adams summarizes why this phonemic awareness is so important. Phonemes make sense of the alphabet. The alphabet has two sides: the printed spellings (visual) and the hidden phonemes that they represent. (Auditory)

> "*The value of phonemes lies in their linkages with spellings*." (Adams 1994)

But the phonemes are elusive, partially hidden, in speech.

In her analysis, Adams identifies the small bits of speech sounds that are represented by the alphabet as one source of the impasse. *"**The impasse** lies in the perceptual and conceptual **elusiveness of the phonemes**"* in the hidden under side of reading that young children are asked to learn. For a non-reader, many of these sounds are hard to hear and to distinguish from one another. Non readers barely know about these sounds. **Why**? Knowledge of the sounds is not necessary for speech, so they remain elusive to the natural ear.

Adams asks:

> *"What makes these sounds so elusive (so hidden) and how do they create such difficulties?...*
> *Why do they block the doorway to reading for large numbers of children?"* (Adams, 1998)

In speech, phonemes are not like letters in print. They are not neatly arranged. They are rapidly spoken and tend to be bunched up into bundles of over-lapping sounds that sound like a single pulse to the child, in which some phonemes remain hidden. (Liberman, 1977) Technically, many do lie hidden within each syllable. Adams notes that phonemes are "*acoustical sloppy entities*". There are wide variants in their pronunciations.

Isabelle Liberman, the primary researcher on this subject at Haskins Laboratories at the time, explains how phonemes hide in speech. She begins by asking:

> (Given that alphabets represent the same string of sounds in speaking,) "Why can (young children) not quickly begin to read and write as well and as easily as they can already speak and listen?"
>
> "Consider how you and I produce a word like 'bag', or more to the point, how we do not produce it. We do not say B - A - G; we say 'bag'. That is, we fold three phonological segments (bits of sounds) – two consonants and one vowel – into a single (sound) segment of sound. This we do by a process called 'coarticulation'. In the case of 'bag', we overlap the lip movement appropriate for the initial consonant B with the tongue movement appropriate for the medial vowel A, and then smoothly merge that with the tongue movement appropriate for the final consonant G. Such coarticulation, it should be emphasized, is not careless speech. It is the very essence of speech, the only basis on which phonological structures can be produced at the rapid rates that make words, phrases, and sentences feasible."
>
> "The vowel is not limited to a medial position but covers the entire length of the syllable. Information about the initial consonant continues well beyond the middle of the signal. Moreover, the center portion of the acoustic signal is providing information not just about the vowel, but about all three perceptual segments at once."(Liberman, 1989, p. 10)

As early Haskins' experiments demonstrated, the ear receives a syllable as a single burst, or cluster, of sounds. The small bits are all produced at once, as a single acoustic sound for one-syllable words or a syllable in multi-syllabic words. This enables speech to keep pace with thinking. The ear of a non-reader is not naturally tuned, or sensitized sufficiently, to hear all these individual phonemes produced so quickly and bunched together. They come and go rapidly, lost in memory. (Liberman, et al, 1973,1974,1977, 1979 pgs 5-8)

In normal speech, the component sounds are not individually pronounced, one at a time, in neat order, from first to last, in neatly separate pieces, like the letters seen in printed words, from left to right.

> "*The spoken word is not a merging of a string of consecutive sounds. (like in print) In speech, information about the three segments of the word cat is encoded into a single sound, the syllable*." (Liberman, 1977, p 125 see Annotated REFERENCES: Pgs 5-8) (For a more detailed analysis, see the above reference, Alvin Liberman et al, Perception of the Speech Code. 1967)

### How Speech Works to Produce this Elusiveness.

In speech, the sounds in words are first aurally encoded (spoken) by the speaker, from a particular number of phonemes (43 for English) and then aurally decoded back into a word (understood) by the listener. Words from the original speech code have been evolving for thousands of years and have been split into various languages. They have been more recently translated or encoded (spelled out) into ancient alphabetic texts (4 to 5 thousand years ago). This ability took about a thousand years to develop into ancient documents, Greek and Hebrew for example. Once manually printed, they were ready to be decoded back (read) into the speech code by readers. In spite of most people's intuitive understanding of how speech is performed from the speaker to the listener, knowledge of

this process is only recently been available. It is now known that the brain rapidly and automatically does this work. This is an evolved capacity. The listener hears the speech, containing a quick continuous stream of phonemes, and through a miraculous feat, the brain translates it into understandable spoken words. This enables the listener and speaker to pay attention to meanings in speech without having to slow it down and pay much attention to the smallest pieces of the code in speech.

> (In listening) "all of this is automatically carried out below the level of conscious awareness. (All the speakers and listeners) have only to think of the word. The "phonetic specialization" in effect spells it for them. … On hearing the sound 'bag', they need not consciously analyze it into its three constituent elements. The phonetic specialization [or phonological module] does it all; …the listeners are none the wiser about the very complex process that has been carried out." ( Liberman, I. 1989)

Brain imaging has confirmed this understanding of speech. (Sally Shaywitz. 2005)

> *"At the lowest level of the hierarchy (of spoken language) is the* ***phonologic module****, which is dedicated to processing the distinctive sound elements of language. …* ***(In hearing words), before they can be identified, understood, stored in memory, or retrieved from it, they must first be broken down into phonemes by the neural machinery of the brain. …. Words must be broken down into their underlying phonemes before they can be processed by the language system. Language is a code, and the only code that can be recognized by the language system and activate its machinery is the phonologic code. "***
>
> ***"Through neural circuitry deep within our brains, a genetically determined phonological module automatically assembles the phonemes into words for the speaker and disassembles the spoken word back into its underlying phonemes for the listener. Thus, spoken language, which takes place at a preconscious level, is effortless.*** *…. If a baby is neurologically healthy, there is almost no way she can avoid learning to speak."*

A child's ear, before learning to read, is not sufficiently tuned to pick-up and identify all the component phonemes in words, as they are spoken or heard, as well as the brain. (For that matter, the adult illiterate ear is not naturally and sufficiently tuned to hear them either.) This level of "tuning" is only necessary and appropriate for speech. Individually parsing out of each sound in slow speech, to make them more noticeable to the ear in speech, would make communication impossible. Speech does not work that way. It must keep up pace with thinking. If speech was this slow, sustaining the listener's and the speaker's attention to meaning would be hampered.

### Reading needs awareness of phonemes.

Although speech does not require a high degree of awareness of phonemes, (The brain takes care of that knowledge automatically.) unfortunately, reading does require a higher degree of awareness. Because of the nature of an alphabet, an alphabetic written language requires it. The brain has not been evolved to "read" the printed codes the way it has for "reading" the speech code. The alphabetic link to phonemes must be learned first. Then the brain begins to kick in, leading to when automaticity is achieved. (More on this later)

As it turns out, reading not only needs a greater awareness of the phonemes. It, in turn, in reverse order, helps gain awareness. Reading calls attention to the elusive phonemes and, through the alphabetic principle, increases phonemic awareness, what is called a reciprocal relationship. (More on this later as well)

Pre-readers are not much aware of phonemic interaction in speech. Their "attention is necessarily trained to the meanings" not the sounds in speech.

> ( In order to read, Children) "must be quite consciously aware of the phonological structure the letters represent".
> (But none of their experience with speech has) "revealed to them that words have internal phonological structures."
> (This realization) "led us to consider the hypothesis …. That awareness of phonological structure (phonemic awareness) might be a problem for preliterate children." (Liberman, 1979 p. 8)

### How awareness was first studied

As Adams has cited above, "*the basic awareness of the nature and existence of phonemes seems to qualify as a genuine insight"*. The study of phonemic awareness is a relative recent development. The Haskins' team, in a pioneering study, studied the problem of children's difficulty with phonemes in the late 60s and early 70s.

Their study of 135, four, five and six year-old children, pre-schoolers, kindergarteners and first graders, attempted to determine the difficulty in identifying phonemes and syllables in words. The children were asked to **tap a stick** for every syllable or phoneme they could hear in a word. They were given as many trails as necessary on each item to successfully tap the correct number of phonemes. Some children were never successful after as many as seven trials. It was found that they were more successful in identifying syllables than phonemes.

The authors of the study, at that time, considered the simple tapping ability an adequate way of indicating a child's ability to identify "phoneme segments". Yet, as simple as it was, it was not an easy task. Even the first graders took many trials before being successful in each item. (More on this point later)

There was not much difference between the pre-schooler's and kindergartener's performance on either test. Nearly half of the pre-schoolers could identify syllables, but none could identify any phonemes. The kindergarteners were equally successful with syllables, but only 17% could identify phonemes. The first graders were vastly better. (after some learning to read?) They were 90% successful with syllables and 70% with phonemes.

For kindergarteners, this level of success makes it difficult to learn to read. Letters must be cognitively connected in memory to the sounds that exist in speech. Learning the letters for reading is not enough.

"*We read with our eyes, but the starting point for reading is speech."* (Seidenberg, M. 2017)

"*The value of phonemes lies in their linkages with spellings*." (Adams 1994)

And, this is not an easy connection to make.

In learning to read an alphabetic language, phoneme identity is necessary. Phonemes must be uncovered, exposed from hiding from the new learner, so they can be aligned and bonded to assigned letters according to the alphabetic principle, i.e. phonemes matched with letters according to the alphabetic code or principle.

A new reader must somehow learn how to uncover and hear the phonemes, within their clusters, in order to learn the printed code. However, at this point, when children hear syllables or single-syllable words, they sound like **one sound to the ear, making learning to decode words very difficult.** The phonemes are quickly spoken and hidden in the syllables.

> "To skilled readers, this insight seems trivially easy, yet research at the Labs proved otherwise. Young children focus on the meanings of words and find it much more difficult to become aware of the phonemes making up those words."
> (see Haskin Laboratory, The Science of the Spoken and Written Word, pg 1)

Linnea Ehri wrote it in about the same time.

> *"If the light were not so gradual in dawning, the relationship between speech and print might count as one of the most remarkable discoveries of childhood. At the point when the youngster has achieved substantial competence with spoken language, he learns that this highly traveled terrain contains parts he never noticed before. This insight comes as a consequence of learning how it is that language can be represented in an entirely different modality [form], one designed for eyes rather than ears." (L. Ehri, 1979)*

Not being able to clearly identify sounds is fine for speech, but not so fine for reading an alphabetic language. Difficulty with phonemes inhibits a clear and firm match of letter/sounds in the transition of print to speech. This becomes a hazard that must be navigated by the new reader. How well it is done will determine how well reading is learned. (Liberman, A.M. 1998)

**A Second Source, print,** concerns how well the alphabet represent speech.

The work of Isabelle and Alvin Liberman and Donald Shankweiler ( pg 5&6, 1977) , at the Haskins Laboratories at Yale University, have also uncovered how print interferes with a clear and firm match of letter/sounds. The printed alphabet itself is an added source of difficulty in learning to read. The question here is: how well can it represent the phonemes, given their unique structure within pronunciations. Any imprecision in the matchup can create an elusiveness between the eye and the ear and makes this "insight" for spelling/sound relationships difficult at the start.

**An alphabet, as a human invention, seeks to match letters in human speech sounds that have evolved in nature over thousands of years.** An alphabetic writing system, invented and developed over a much shorter time, attempts to graphically represent the smallest bits of sounds in words. This is often not a perfect match of the evolved sounds in nature. The nature of phonemes in speech, as described in the previous paragraphs, makes this match problematic. Alphabets have difficulty graphically displaying the structure or arrangement of sounds in nature, as well as getting the distinction of the sounds exactly right.

For example, a child looks at a word like cat and sees a string of letters, one after the other, and hears one sound for the word. These do not match up. The child sees printed words with letters, with spaces, lined in straight rows. This is not how they hear or experience speech sounds. The spaces that separate each letter in print, are obvious to a new reader's eyes, but do not match, what is heard.

As described above, spoken words do not exist in speech this way. The small bits of sounds are rapidly pronounced, hidden within syllables, as one "acoustic" sound. Words, heard by a child are not produced in the same order or clarity as print. Phonemes do not have distinct "acoustic" signals, with starts and stops, like

syllables. They tend to overlap and therefore are difficult to hear and match up with print. Print does not represent this overlapping of sounds.

**For print to precisely represent speech, as it exists in nature, some letters would need to be piled on top of each other.** This would make learning to read impossible. Thus, there is a disconnect between speech and print that must be overcome in some way.

This is an "impasse" that Adams wrote about.

One attempt to resolve this difficulty is to teach awareness of phonemes as broken segments from the start. Phonemes as segments have spaces in a word. They are not a continuous stream. Nor are they overlapping. It is assumed that this kind of training would help the new learner see the match easier. It is widely acknowledged that this perception of the letter/sounds match-up in words is important. Phonemes must eventually be learned as abstraction, as segments to match print, because what is seen in print is dominant in the child's eyes. However, this is a more advanced skill for decoding lengthier and more complex words. Introducing phonemes as segments creates an extra leap in learning at the start. Is this necessary? (See Part III and IV for more detail. )

The point here is to identify how learning the matching of letters with sounds, this as a source of difficulty. The question about this practice, based on this model, is its appropriateness at the start, as a way of approaching the start of learning. Because of its difficulty, this practice can exacerbate learning at the start. This model came about because the original researchers wanted to explain the relationship between print and speech. This model is based on fixed printed words, with spaces, rather than a fluid stream of speech. In so doing, phonemes become identified as segmented "abstract hypothetical entities" rather than how they physically exist in speech. . "young children often have an imperfect idea of what phonemes are because they are abstractions rather than natural physical segments of speech…" (Gough 1984) Here the question is: is there a way at the start to represent phonemes that is closer to their natural physical state and easier to learn at the start? This anticipates the major failure being argued. It will be discussed in more detail in Parts III and IV.

Even once the phonemes get sorted out and in line with the print by the reader, due to nuances of speech, the invention of print cannot exactly represent what has been evolved in nature and culture. Some aspects of speech is missing. The alphabet is only a close approximation. Once the matches are learned, the child must "induce" or recognize the word. It's the difference between human invention and nature's evolution. Children in becoming beginning and more advanced readers must figure out this match regardless of the difficulties.

### Both Sources together, Speech and Print

Thus, the elusiveness of the phonemes in speech, plus their matching nuances to letters, combined can be a major source of difficulty for the beginning reader to overcome. The differences between the structure of phonemes and the structure of letters in words create an **obstacle** and a potential cognitive overload in attempting to learn how to decode words. This explains why Ehri calls learning to read words *"one of the hardest parts of learning to read. It is a part that consumes substantial learning time."*

To become a reader, the child must eventually learn the connection between speech and print at the finer points of the letter/sound level. For speech, the close identity of each phoneme was not necessary, but for reading, because of this new alphabetic written language, more clarity of the phonemes is needed. In speech, the human ear doesn't naturally hear phonemes imbedded and hidden within a **fast, continuous flow of vocal sounds, not arranged with spaces like in print.** The child must learn this connection. The problem seems to lie equally with the nature of speech, its hidden phonemes, and with the nature of an alphabet, with its imprecise representation. It is difficult for a young child to figure out how the system works at first.

The problem is less with learning the visual representation with the alphabet than with making the match with speech sounds and recognizing the word. Children have difficulty "inducing" the words from all of this.

These two sources are at work even with the simplest spelled words like *sat* or *in*. Each word sounds like one sound to a child, not two or three sounds. How letters represent spoken words is not visually obvious to them. They are not aware that single syllable words even contain small sounds. They, therefore, don't hear all the sounds that they see in the spellings of words. They only hear one "acoustic" sound per syllable, as a single spirt, and see three letters. This makes the initial learning of the alphabetic principle problematic. **It is the impasse** that, for all the above reasons, must seem "inherently intractable" to a child at first. This accounts for why children tend to want to learn words as whole symbols rather than alphabetically spelled words. Some kind of learning must take place to make this match more obvious in learning to read. There is one more source of difficulty closely related to the second source.

**A Third Source**, **the English language**, concerns additional complications in the application of the alphabetic principle in the system of an alphabetic written language. The Rayner team called this their second hazard. It refers to the difficulties the English language contributes to learn to read.

> "… **American English, has more than a dozen vowel sounds but only five standard vowel letters."**
> (Keith Rayner, Barbara Foorman, Charles Perfetti, David Pesetsky and Mark Siedenberg. 2001)

The English language is often considered an outlier among alphabetic written language systems. (Venesky, R. L., **English orthography** 1967) Written English only has 26 letters, not enough for the 43+ phonemes in the language. Many phonemes can be spelled a variety of ways in matching the 43+ phonemes. For vowels, there are more than a dozen sounds but only five vowel letters to represent those sounds. There are many spelling variations to be learned.

However, in spite of the fact that English is more complicated than other alphabetic writing systems, it is not as irregular as is often implied. In spite of complications,

> "*approximately 80% of English monosyllables could be pronounced using a relatively small set of rules relating graphemes to phonemes. In the remaining 20% of cases, typically only one grapheme deviates from its most frequent pronunciation." (e.g., pint, have, chef)* (Castle, Rastle and Nation, , 2018. p. 9.)

Keith Stanovich notes that;

> "*all analyses of the orthography indicate that there is considerable regularity when groups of letters are considered.*" (1991) (also Louisa Moats, **Speech to Print**. Chapter, 4, the Structure of English Orthography. 2011)

The complicated alphabet system of English, with its irregularities, adds even more to the elusiveness of the hidden phonemes in speech. Reading for meaning requires a rapid recognition of words, similar to speech, in spite of the English language complications. (See the Introduction to the Science of Reading Words, (page 3) ,

The brain doesn't naturally decode the print code as it does the speech code. (it must be learned.)

The key question is how to get the reading started, without experiencing obstacles and cognitive overload, so that the basic letter/sound bonding and mapping of words can be learned to initiate the progression towards full alphabetic fluent reading of words in texts. Research has made a break-though in discovering how this challenge can be met more successfully, which has greatly improved the situation, but there is more to be done. The failure was in not going far enough.

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## Part III
## The Solution is in the Instruction

**A restatement of the problem:**

*"...alphabetic instruction has been **bogged down** by one problem: Many students find it extremely difficult to **induce the words** from the code, no matter how they are drilled on the individual letters and sounds". (Adams, 1998)*

Part III seeks to explain how it became evident that instruction in phonemic awareness is where the solution lies. It discuses in general terms how and why this instruction can accomplish this.

In seeking a way through these hazards at the beginning of learning, Adams et al in 1998, in The Elusive Phoneme, (pg 16) turned, once again, to the early research of the Haskins Laboratory on phonemic awareness. Their researchers first focused their studies on identifying the various difficulties beginning readers had with phonemic awareness.

As noted earlier, they found that more than 80% of 135 kindergarteners could not perform a simple tapping test for identifying phonemes in words. In time, it became apparent that these difficulties coincided with difficulties in learning to read. Those who had difficulties with one typically had difficulties with the other. Correlation studies eventually confirmed this relationship.

However, before instruction could have been consider as a plausible way of reducing these difficulties, a more direct causal relationship had to be established.

When a link to causation was made, a hypothesis for instruction soon followed, ie, If weaknesses with phonemic awareness are strengthened through instruction, a corresponding improved ability in learning to read could be expected. Put more clearly, if children improved their ability to detect (hear) and manage (vocalize) the elusive pieces of speech sounds through instruction, their chances of learning to read would improve.

Could instruction in phonemic awareness be the opening for over coming the impasses described in Part II?

Adams reports,

(phonemic awareness) "*is clearly a dormant (hidden) that begs instruction support. Happily, a number of studies have demonstrated the children's awareness of phonemics can be effectively awakened and refined through instruction." (Adams, 1994)*

Researcher, Steven Stahl, acknowledged the value of phonemic awareness instruction as early as 1994 in his review, "Defining phonological awareness and its relationship to early reading p. 11**".**

> *"The general relationships between phonological awareness and early reading are well established… the correlations between phonological awareness and beginning reading are robust and much replicated….. Further evidence that phonological awareness underlies beginning reading skill comes from training studies. …" (Steven Stahl, et al, 1994)*

But, what would this instruction in phonemic awareness look like? What particular tasks could be used to assist children in increasing awareness? The early interest in the study of phonemic awareness first focused on finding reliable tasks that indicated various levels of awareness. They looked for particular tasks, in addition to tapping, that could be used. The higher the level on the tests, the higher the expected success in learning to read. However, this was still assessment through correlation, not instruction based on causation.

The earliest formal review of tasks for this testing purpose was by Lewkowicz (1980). It categorized various types of tasks that had been used in research. Based on this analysis, Keith Stanovich (1984) conducted a study of 10 of these tasks with kindergarten children."The tasks were of several different types, (according to the Lewkowicz' classifications)….

The order of presentation was …..

*rhyme supply,*
*rhyme choice,*
*initial consonant same,*
*final consonant same,*
*(strip initial consonant,)*
*substitute initial consonant,*
*initial consonant different,*
*initial consonant not the same, (asked differently)*
*final consonant different,*
*supply initial consonant."*

In this evaluation, it was found that rhyming provided low to no correlation to reading ability in the first grade. Of the remaining, the "strip initial consonant" task was the most difficult for all students. The other seven tasks reliably distinguished and predicted between high and low performers. They "correlated with first-grade reading more strongly than standardized IQ test,… **(especially) when sets of these measures are used together.**" These tasks were deemed reliable predictors of reading ability in first grade. This would help determine which kindergarteners would need extra help. They could be used as screeners.

No follow-up training was made in this study to investigate whether or not training in these tasks would improve this relationship in learning to read.

A similar study was conducted in 1983 by a British group. Their tasks were easier: identifying a three-letter word with a different first, middle or final sound. They found very similar predictive results as Stanovich just with these easier tasks. They also followed up with training in these same tasks to evaluate the question of causation and instruction. The training involved teaching the same tasks with pictures, e.g., using a picture of a hen and a hat to teach the beginning sounds in words and so forth with middle and ending sounds. Letters were also included. As a result of the training, children were more successful in learning to read. This was one of the first demonstrations that showed support for causation between improved phonemic awareness from simple instruction and learning to read (Bradly & Bryant 1983).

Some formal tests for correlation used the difficult tasks. In 1988, Hallie Kay Yopp conducted a similar kind of study as Stanovich. She administered a collection of 10 phonemic tests to a large number of kindergarten children. Some were more predictive than others. Her own test, The Yopp-Singer Test of Phoneme Segmentation, was included in the ten. It involved the single, very difficult task of segmenting words into their phonemes, (Yopp, 1988) e.g. "Tell me the sounds you hear in the word, old." The test included 22 single-syllable words with various spellings .

The oral exercises, or tasks, in these studies went beyond the "stick tapping" in the original Haskins studies. (See Part II, How the elusiveness was first studied.) If the Haskins studies found that children had difficulty with the simple tapping technique, the difficulties with these new tasks would be even more so. They went far beyond the tapping practice. Oral exercises eventually involved a range of skills in pronouncing the phonemes and orally manipulating them in various ways in words. For example:("Take away the /t/ sound in task and what do you get. Substitute the /g/ sound in go with the /n/ sound.")

Most of the tests for diagnosis used the harder segmental form for assessment: beginning, middle, ending sounds, the segmental form of blending and segmenting words, (see below) because of their predictive value. The most currently used examples can be found in **DIBLES,** the most widely used tests.

By 1991, Stanovich reported that in "the last 20 years" researchers had identified "a major determinant" of learning to read. It provided "keys to the prevention of reading disability."(Stanovich 1991) "A large number of studies have demonstrated that phonological abilities stand out as the most potent specific predictor" of learning to read. Most importantly, in addition to correlations, they established "the existence of a causal link running from phonological abilities to reading skill". Over a dozen studies were cited.

The causal link between increased phonemic awareness and learning to read was confirmed. The assumption was a matter of principle: if increased phonemic awareness, through instruction or training, is attain, learning to decode words would be easier. It would reduce the impasse at the start. Instruction in phonemic awareness would be the key to unlocking the code to enable new learners to better "induce the words" from the decoding.

By the end of the century, 52 studies on training or teaching phonemic awareness were identified in the National Reading Panel report of 2000. The report summarized the kinds of tasks that were used to enhance phonemic awareness in six tasks. These studies served to further confirm the causal link between instruction in phonemic awareness and learning to read.

The tasks helped expose the elusive phonemes, described in Part II, from their hidden structure in speech to the ears of children. They provided practice in orally identifying and manipulating the phonemes so that their ears would get used to hearing those hidden sounds in reading words e.g. "How many sounds are in the word /fish/?"

However, these studies did not thoroughly examine all the possible ways of teaching increased awareness to determine the most effective and efficient way to teach phonemic awareness as a preparation for formal instruction. The tasks used in instruction drew from the tasks used in research. The same oral exercises used for researching causation were then used for training and instruction. Researchers seemed to assume that these were the only possible tasks that could be used. No further investigation for other possibilities was conducted. (See a more detailed discussion in Part IV)

Assuming that the tasks for research would be most effective for instruction is a false assumption. The tasks may be useful for research, but they are not necessarily appropriate, or sufficient for training. Training is an instructional issue with its own concerns. The objective for a task is to increase a child's ability in awareness of the small bits of speech sounds. …*just because tasks are valuable in research and testing in individuals, doesn't mean that they are the most appropriate way of improving this ability, especially in the practical preparation for teaching beginning skills of decoding.*

The instructional training is intended to strengthen cognitive abilities in speech awareness of the hidden auditory side of the alphabet link to print. Initially, this means learning how to hear and think of spoken words independent of their meaning in order to attend to individual speech sounds. In order to increase this ability of detecting speech sounds in spoken words, which became a pre-reading necessity , "*the child must adopt an analytic attitude toward both written words and the spoken words they represent; that is, the child must discover and exploit the fact that the mapping takes place at the level of letters and phonemes.*" (Adams)

One of Stahl's concerns was: "*How much phonological awareness is needed to learn to read*?"
He was interested in particular tasks for teaching phonemic awareness that are related to learning to read. The kinds of tasks that Stahl found that related to reading most strongly were:

1. The ability to manipulate onsets and rimes, once an adequate level of letter recognition is achieved.
2. The ability to isolate (pronounce)a phoneme from either the beginning or the ending of a word.

Thus, though a causal relationship has been established, there is much to learn about the best kind of training in phonemic awareness that facilitates the beginning reading. At some point, there is the question about what kind and when a particular oral training is necessary and best in leading to a "full development of phonological representations".

**An attempt to resolve this question through an analysis of the oral tasks.**

As a result, two kinds of oral tasks are observed.

1. Continuous oral blending of streams of sounds that expose the partially hidden sounds in words.
2. Segmented disconnected sounds in words, with clear beginnings and endings, abstracted from speech.

The first kind is easier than tapping sticks. The second kind is much more difficult than tapping sticks.

**The first kind** of oral task uses continuous blending. This means pronouncing a series of continuous phonemes as they exist in speech but slowly stretched out so that all phonemes can be heard, not hidden. The tasks moves from sound to sound without making any stops between the sounds. Every sound is part of a continuous stream.

For example,

What word is this? mmmmmmaaaaaannnnn.
What sounds are in the word, sam? Sssssaaaaammmm

These are easier, early developmental forms of phonemic awareness that are closest to speech. They have proven to be useful in teaching children at the start, before their awareness has developed into segments from reading and other training. (See below)

**The second kind** uses segmented sounds. This means performing various kinds of oral tasks with phonemes as abstracted segments, with clear beginnings and endings. They are a slightly more developmentally advanced skill than the continuous forms. They take longer to learn, but they are useful with decoding slightly more difficult words. If used as a preparation for beginning decoding, they prepare for a decoding strategy with pauses between letters. This takes more training than the continuous sounds.

For example:

What word is this? /m/ /a/ /n/ = man
What sounds are in the words, sam? = /s/ /a/ /m/

Segmenting tasks are much harder to learn because they don't exist in speech as such, but they are useful and necessary for learning decoding slightly more complicated words. Stahl has provided a sample of these tasks:

Does fish rhyme with dish? Does fish begin with the /f/ sound? What is the first sound in fish?
What does /f/ /i/ /sh/ say? Say fish without the /f/. Say the sounds in fish.

As explained above in Part II, the early research on this topic used a model based on print. This model ended up representing phonemes as segments, with spaces to match printed letters. The work of Liberman, and team, tended to set this practice in place for future studies and programs, ignoring the possibility of using continuous

sounds for beginning instruction. They used the abstract form of segmenting tasks instead. This was intended to help the child understand how print represents speech. The print model has been been the predominant method used in instruction. However, in getting reading started, it has unique difficulties for the beginners. (See above Alvin Liberman's definition of segmentation from 1967, Part II and Part IV for more detail)

The difference between the two kinds of oral tasks is a matter of difficulty. This difficulty was not beyond the range of kindergarten ability to learn, however, it is a matter of efficiency, ie how much time was required. The two kinds of oral tasks don't need to be seen as opposites. They can be seen as two developmental levels of phonemic awareness, one closer to speech of the pre-reading child and one more advanced and closer to reading printed words as growth begins to accumulate. This concept of developmental levels was advanced by the Rayner group.

> A "full phonological representation" in learning to read, "suggests that segmental representations are closely tied to (or model after) knowledge of orthography (print) rather than speech." (Rayner, et al., 2001)
>
> "Pre-readers' knowledge of phonemic structure, is causally related to success in learning to read; **at the same time**, learning to read changes the nature of phonological representations, [from what pre-readers bring] making them more segmental." Connectionists models show how the "mechanism of the underlying interactions between phonological knowledge and reading" make this change in phonemic awareness. [It becomes more segmented, like print.] "What was crucial in the model was not having full phonemic representation **prior to reading** but rather **having the capacity to develop such representations with reading experience.**"….

In spite of their pioneering work, the Liberman studies did not recognize these possible levels of phonemic awareness in children at the start. (Liberman, 1973) From the start of their studies, they identified phonemes as segments. Other studies followed suit.

> "We have noted elsewhere that the need to do explicit segmentation may be one of the important differences between speaking and listening, on the one hand, and reading and writing, on the other." (1974)

As Stahl has pointed out, it all depends on how useful the task is in getting reading started and/or for carrying learning along from there.

Question: Does each kind of oral task have a different function for the kindergarten child?

Answer: Much of it depends on the decoding strategy used to follow the particular oral task. An easier decoding strategy only requires the easier kind of oral preparation, closest to the speech of the child. A harder strategy will require the harder kind of preparation, closest to print. But in the end, it all depends on how successful the tasks are in teaching at various levels of progress.

This goes to the heart of where research has failed on this very small, but special aspect of teaching beginning reading. These distinctions have only been referred, not researched. Something has been missed in this decision, a nuance, at this point in the history and development of thinking about phonemic awareness and beginning reading. Decisions at this point in the history have had consequences.

### Research on these two kinds of oral tasks

*S*tudies on oral tasks with continuous sounds are much less prevalent than on oral tasks with segmentation. The clearest studies in support of continuous oral blending were done by a team of researchers led by Weisberg, published in 1989 and 1993. They report that…

"*The likelihood that school-age children (kindergarten and first grade) will have difficulty blending CVC words when the successive spoken sounds are broken by silent pauses is supported by the present findings and is consistent with their poor blending performance reported elsewhere"* (Chall et al. 1963 and Williams, 1980)

*" The effect of pausing between sounds was much more deleterious for the kindergarten children, whose overall correct performance was 14%, than for first graders whose comparable performance was 49%. ..Without any intervening pause (continuous blending), both age groups responded at much higher levels, although first graders still did better at 73% than the kindergartener at 60%." (Weisberg, 1989)*

The practice of the use of continuous sounds is first described in an early published book by Sigfried Engelmann, Preventing Failure in the Primary Grades (1969). A few of his tasks are referred to in the Liberman reports. Over time, all five editions of Carnine & Jerry Silbert's textbook, Direct Teaching Reading (1979-2011) have included a section on this practice of continuous blending of sounds. In the first edition, the authors cite two studies, Helgott, 1976 and Roberts 1975 that include an analysis of both segmenting and continuous blending. They "found that 5 and 6 year olds learned 'continuous blending' more rapidly, then segmenting." (1979)

As a result, a **simpler speech model** is posed in these studies as a more effective way of getting reading started. This model is closer to speech, with no spaces. A continuous oral task for phonemic awareness eases the new reader into a similar decoding strategy that facilitates"inducing the words" from print and speech. A speech model, with phonemes as continuous streams of sounds, as they exist in speech of the child, is an easier place to begin teaching a decoding strategy. With this at the start, letters are added to the continuous stream of sounds in speech for decoding the words. This way the letter/sound match is made in speech, a reverse order to the print

model. It works from the sounds in a stream to the letters, rather than from fixed letters to abstracted sounds. At least for the start, it avoids having to break up phonemes into segments, out of their natural state in nature, which, as reported, is difficult for a child. This is precisely the contention of where the misdirection was made in the early stages of research.

This issue relates to the question of how much of phonemic awareness is needed to get reading started verses what is needed for its following growth and progress. And, what particular oral exercise could best accomplish this at the start. Instructional tasks should be chosen on his basis, not from their use in research on correlation *and* causation. Finding the most effective and easier task remains unsettled and incomplete.

**The promise of phonemic awareness training remains true,** regardless of the question on best instruction**.**

***"****In the course of 30 years or so, the idea that reading words requires phonology has ascended from a minority view to one with such a substantial majority that it now amounts to a conventional wisdom. This sweeping change of opinion can be celebrated as a triumph of reading science." (P. 153, Perfetti, 2011)*

*"The ascendancy of phonology came about through research that discovered phonological effects in word reading across a variety of tasks (with significant task difference.) ….three line of research that, at about the same time, made a strong case for phonology, specifically the role of phonemes in word identification. …phonemic effects can be observed within the first 40 ms of word identification." (P. 154)*

*"The evidence across orthographies, including English, was persuasive enough to support… the strong phonological hypothesis: that all word reading requires the engagement of phonological representations." (p. 155, Perfetti, 2011)*

## One hitch, regarding training.

It should be noted that early observations showed that some children could learn to read without prior oral training, yet they had higher levels of phonemic awareness. It became evident that learning to read, itself, contributes to phonemic awareness. The conclusion was that phonemic awareness is both a cause and an effect in reading due to a reciprocal interaction between *"… letters and words, letters and phonemes, and phonemes and words [that] permit reciprocal activation*." (Perfetti, 1992) .

*"Reading and phonemic awareness are mutually reinforcing: Phonemic awareness is necessary for reading, and reading, in turn, improves phonemic awareness still further." (Shaywitz, 2003, Overcoming…)*

The opposite is true for those who read a non-alphabetic language. For example, Chinese scholars, with reading skills in a non-alphabetic language, are said to be unable to identify the phonemes in their language.

Therefore, in addition to direct oral exercises before, and possibly during, formal reading, learning to read words progressively and continuously also contributes to readers' skills with phonemes. This interaction strengthens both visual and auditory learning, letters and sounds. Each strengthens the other. Reciprocal interaction becomes most beneficial in learning the more advanced complicated words in English. The Rayner group describe how this works.

> "The alphabetic writing system both builds upon and facilitates the development of phonemic representations. The relationship between knowledge of phonological structure and ability to read is reciprocal. At the start of reading instruction, **children's knowledge of phonological structure is partial**. ….
> Exposure to orthography and explicit instruction in the mapping between spelling and sound **lead to further refinement** of children's phonological representations. … These refinements in turn facilitate further development of reading skill. …
> **Thus, experience with an alphabetic orthography draws conscious attention to the underlying phonological representation of words.** … **The implication is that experience with an alphabetic orthography may be necessary for an individual to develop full phonological representations."** (Rayner, et al, 2001)

Thus, increasing phonemic skills and sensitivity involves more than just oral exercises. However, coordination of oral exercises with the reciprocal interaction process in reading texts becomes a critical consideration in teaching early learning. The studies reported on in the Rayner monograph affirm that phonemic awareness is a matter of growth in clarity and strength in the process of learning to read. Teaching could initially start from an easier task, modeled after speech that children bring to reading with continuous sounds, and evolve into a more advanced form. This critical growth is enhanced through the reciprocal interaction between letters and sounds within words learned and read in texts. (Perfetti, et al. 1987 and 1992) See **Addendum** below.

Stahl states, *"It may be that certain levels of phonological awareness…..precede learning to read, whereas more advanced levels may result from learning to read."* (Stahl, 1994) The ability to reflect on spoken words for their phonemes may come more after rather than before learning to read.

Adams states that she is *"not suggesting that either phonemic awareness or letter knowledge be developed to perfection before moving on. Given sensitive support, both will refine themselves through experience with reading and writing."*

Thus, if phonemic awareness continues to play a role in reading beyond just as a preparation for decoding, it will be due to the reciprocal dynamics going on between letters and sounds in the growth of reading. Stanovich states that " the activation of phonological information (phonemic awareness) is a **ubiquitous feature of skilled word recognition**" (1995) More on this in Parts IV-VI

## A New Model for Reading.

**Thus, reading is more than a visual activity. This makes the teaching of the alphabetic principle more feasible, teachable and critically important, especially at the beginning. The"inherently intractable impasse" at the beginning can be eliminated with instruction in phonemic awareness**. This is most promising for the new reader. Finding the most effective exercises and ways of accomplishing this remains critical.

This conclusion has led to a distinct change in the way reading is understood.
Perfetti notes that,….

*"In the 1970s, skilled reading was seen mainly as a matter of visually recognizing a familiar letter string as a word, whose access was said to be "direct". (Not requiring any phonological translation for word recognition)P, 153*

Learning to read through the use of the alphabetic principle, was only considered necessary for unfamiliar words and maybe for young children just learning. Frank Smith (1979), an early whole-language advocate, has stated*: "We (fluent readers of English)… recognize words in the same way that fluent Chinese readers recognize the words of their non alphabetic written language." (P. 103 of second edition, 1985)*

The new model conveyed a deeper and more comprehensive understanding of reading. It shifted the understanding from a visual activity and gave the sounds in language a larger role. (Stanovich, K. 1991) As Stanovich was cited above: " the activation of phonological information (phonemic awareness) is a **ubiquitous feature of skilled word recognition**" (1995) This provided a broader theoretical framework for teaching that included phonemic awareness. It also helped to explain the increased cognitive demand that reading brings to the young readers beyond what was thought of as primarily a visual task of memory. Adams, as well as a large body of researchers, sees this insight into reading as a "genuine discovery of our time".

Perfetti concluded that

*"Research leading to the ascendancy of phonology as the critical component in learning to read and the major factor in dyslexia is one of the major achievements in reading science." (P. 167)*

The Rayner group has made this remark.

"There is now a large body of evidence that phonological information plays an important role in word reading, even among highly skilled readers"….. "This is among the most important findings in contemporary research on reading, and it strongly suggests the achievement of reading skill depends in part on learning to use phonological information efficiently." (Rayner et al. 2001)

Perfetti summarizes how the importance of phonemic awareness has been confirmed.

"The ascendancy of phonology came about through research that discovered phonological effects in word reading across a variety of tasks…. 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." (Perfetti, 2011 **Phonology Is Critical in Reading**)

The appearance of this new model of reading coincided with the re-emergence of cognitive psychology in the 1950s and 60s. Cognitive psychology is defined as "the study of intellectual activity, as in thinking, remembering, reasoning or using language," (Merriam-Webster Dictionary) Its rise was in reaction to behavioral psychology that dominated the early half of the 20th century. It is the science of how we think. The new model of reading was essentially the work of cognitive psychologist studying the act of reading.

The new model of reading gives insight into how reading can become automatic. Learning the alphabetic principle enables reading to go beyond the visual and to tap into the natural speech process. **(**see Alvin Liberman reference above pp. 1 & 17**)** Skilled reading is more than a massive visual memory. This means that reading words, must latch onto speech for a free ride. This enables reading to be performed as well, or better than, speaking and listening. It has the driving force of the evolved speech process. It also provides the reader with a much larger

storage of words in memory. Just as the brain decodes the speech code automatically for speech, learning to read enables the brain to do the same to the printed code for reading as efficiently as speech. i.e., reading piggy-backs onto speech. The alphabet enables reading to tap into oral store house of words, which enables the human brain to automatically decode by using the same mechanism for reading that is used for speech. Alvin Liberman. **Why Is Speech So Much Easier Than Reading and Writing?** 1998 pg 17

(see The Science of Reading, Part II, Brain Imaging, The Phonological Code in Speech, page 8)

This underlying concept of reading explains why firmly matched and bonded spelling/sound relationships, according to the alphabetic principle, are necessary for accurate and fluent word reading. (Ehri, L. 1992) Subsequent brain imaging has shown how this learning links reading to the natural process of speech and makes reading as efficient as speech. Experimenters have recorded that "phonemic effects can be observed within the first 40 ms of word identification." (Perfetti, 2011. p. 154)

This link to the innate speech process makes it possible for readers to devote their thinking to comprehension as they read words, at an appropriate pace, as efficient as speech. As David Share has stated: reading fluently is the "*Sine qua non of reading acquisition.*" (Share, 1995)

This level of reading begins with the new learner learning to clearly hear the inner sounds of spoken words in order to link up with the alphabetic print in words. As the learner develops this skill and applies it to a large sample of words, words can be read accurately and quickly so that reading with meaning can follow. (A strict visual memory explanation falls short of this.) The importance of phonological learning should not imply that visual learning of words, in detail, is any less important, otherwise letter/sound connections and word identifications are weak. Tying all of this learning to comprehension creates a serious increase in cognitive demand in reading.

Understanding this process has improved insights in understanding the causes of reading difficulties like dyslexia. Whatever difficulty is normally found in learning in this linkage of speech and print, will be further exacerbated in children with dyslexia. They bring innate weaknesses in phonological aspects to this cognitive demand. They are in greater need of finding a solution to meeting this added demand in reading. The question remains: how can beginning reading overcome potential obstacles and overloads and become a smooth and easy beginning?

This new model helps explain why training in phonemic awareness would reduce the impasse and makes the start of decoding, whenever and however it is taught, with whatever kind of task, smooth and easier. An emphasis in the phonological aspects of reading would lead towards solving the impasse problem, at least partially. It would help make the difficulty of translating printed words to speech easier to overcome and also meet the challenges of the varied orthography of the English language. However, it would only make it easier. Learning still requires carefully planned and executed teaching to assure that the child can make this momentous achievement. The 2017 dated paragraph below, by a team of international researchers, clearly outlines, in broad terms, the kind of instruction needed. It could have been written by authors from decades earlier.

> Managing cognitive load using effective sequenced instruction is likely to be a critical issue in seeking to optimize reading and literacy instruction. When children master earliest literacy skills, these become well- developed sub-skills for next steps of learning. Effective learning of complex skills uses this sequence of new skills being learned, then automized to become sub-skills for subsequent stages of learning. Cognitive load challenges are likely to occur more often when sub-skills are insufficiently mastered and automized. (cited above, Knight, 2017)

**In summary**

Because of the power of the alphabet, much of the need to expose the phonemes to the readers has historically been forced onto their consciousness, without awareness, by the invention of an alphabetic written language. It forces humans to become more aware of the details of their speech sounds, beyond what is normally needed for speech, so that the alphabetic principle can be put to use in writing and reading. For many, over history, this dynamic has been enough to get started and, largely, learned, on their own, with little assistance. Tracking the development of literacy through history traces the experience of how an alphabet has made a major break-through in the acceleration of literacy because of its invention. An alphabet enabled a larger portion of societies to gradually become literate.

The discovery of the importance and usefulness of phonemic awareness in the later part of the twentieth century did the same in advancing this potential in literacy growth. It has enhanced the understanding of reading and made it possible to once again make a leap in increased literacy. This has enabled a larger portion of the child population to be able to read without obstacles or cognitive overload. Considering all that a young child must learn in order to read within a short period of time is truly a remarkable cognitive achievement on their part.

Yet with all of this knowledge acquired where is the failure? What has been left undone?

# Phonemic Knowledge and Learning to Read are Reciprocal: A Longitudinal Study of First Grade Children

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Explicit knowledge of the phonemic structure of spoken words, or *phonemic awareness*, has sometimes been seen as necessary for learning to read. But it is suggested that although some phonemic knowledge is important for beginning reading, the relationship between phonemic knowledge and learning to read is reciprocal. The results of a longitudinal study of first grade readers support this claim. Children were tested at four points throughout the year on tasks of synthesis (phoneme blending) and analysis (deletion and tapping). Analyses of the tasks emphasize the differing cognitive demands of phoneme synthesis and phoneme deletion. According to the results of partial time-lag correlations, the deletion task in particular taps a phonemic knowledge that is truly reciprocal in its relation to reading. Gains in reading enable gains in deletion which enable further gains in reading. The synthesis task taps a more primitive phonemic knowledge that has a simple (nonreciprocal) enabling relationship to reading gains.

Knowing explicitly about the phonemic structure of language is a curious and apparently important skill. To know, in some sufficiently deep sense of *know*, that the word *cat* contains exactly three phonemes and that these phonemes are /k/ /æ/ and /t/, is a skill useful to a professor giving a lecture on phonemes and perhaps to a child playing Pig Latin. However, it is actually quite remarkable that ordinary persons should acquire such arcane knowledge. And anyone who has ever asked, as one of us has, a class of bright undergraduate students, "How many phonemes are in the word *ship*?" and noted the large number who answer "four," realizes that such knowledge does not necessarily come easily even to adults.

Given such experiences, we have always been a bit surprised that anyone would expect children to routinely acquire such knowledge, and even more surprised that only children who exhibit such knowledge would be expected to learn to read. Yet, along with Gough and Hillinger (1980), Mattingly (1972), Liberman and Shank-

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*Merrill-Palmer Quarterly*, July 1987, Vol. 33, No. 3, pp. 283–319.



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