

Introductory notes on the Study of Language by Ear and by Eye,
as part of the early emerging rise of researchers in cognitive psychology.
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As stated in above postings, The Science of Reading had its origins in the 1960s and 70s. From there, the number of scientific studies and research reviews expanded exponentially each decade, almost every year. This increase was largely due to the rise of cognitive psychology. Its timing coincided with several events. It contributed to a deepened understanding of the mysteries of reading, upon which teaching practices are based. Even with this foundation, (as mentioned in the Lyon introduction) the search for best teaching practices continues to this time. The scientific study of reading is needed at both levels, theory and practice. However, as stated earlier, the Science of Reading is long on theory and short on practice.

As background, what is cognitive psychology? The on-line source, [IMOTIONS](https://imotions.com/blog/cognitive-psychology/), has provided a succinct answer.

“Starting as a discipline in the 1950’s, the field was in some sense a reaction to the dominant psychology research approach at the time – behavioral psychology. Cognitive psychology assumes that thoughts and feelings are active in the process of behavior and can be the subject of scientific study. Behaviorism, a study of human behavior that can be observed and measured, largely avoided, or downplayed, the importance of the process and impact of inner thoughts. (What is Cognitive Psychology, Bryn Farnsworth, <https://imotions.com/blog/cognitive-psychology/>”)

A dictionary definition may have been sufficient.

Cognitive psychology, the study of intellectual activity, as in thinking, remembering, reasoning or using language. (Merriam-Webster Dictionary)

The theoretical base for the first half of the century for reading came from a few studies conducted by James Cattell in 1886 and reported by Huey, 1908. These were experiments conducted in the very first psychological laboratory, established in Leipzig, Germany. As reported by Huey in 1908, these experiments, with crude instruments, found “that skilled readers read four connected words as quickly as two unconnected words (in a list) and it took longer to name letters than it did words.” (Chall, 1967) These studies continue to be discussed by cognitive scientists. The question isn’t that the finding was untrue. Readers do read words fast. The question is, how is it done? How is it explained. It was assumed that because the reader reads words fast, s/he couldn’t possibly think about the spellings and their phonetic function. The tasks for cognitive psychologists was to replicate this and then explain why. According to Perfetti, in a current publication on the Progress in Reading Science: Word Identification, Comprehension, and Universal Perspectives, “Cattell’s explanation stood unchallenged until the independent publications of experiments by” by scientists in 1969 and 1970.

Chall noted the lack of a theoretical base for teaching reading that existed prior to her study. However, some qualifications from the Gage 1963 [Handbook of Research on Teaching](#), should be noted. Although the prevailing theory was not without questions, the Cattell study still provided the scientific bases for teaching children to read by a whole-word, look-say method. The conclusions about how this was done seem reasonable to many. It was a perfect example of how theory can determine practice. The conclusion was, if skilled readers read words this

fast, there was no point in learning the phonics of the words. It would be a waste of time. There would not be time to pay any attention to the spelling constituents of words. Good readers, from this basis, apparently don't use them. According to Chall, this led to meaning-emphasis methods of teaching beginning reading. With whole-word memorization of lists and assistance from contexts and other clues, rather than a word-for-word analysis of the phonics. In spite of the reasonableness and popularity of the theory, many persisted in teaching phonics. According to Chall's analysis, they were more successful than the prevailing theory. Sorting out this question on how words are recognized in a running text, their importance in reading, and their role in comprehension, became a major objective in the new field of cognitive psychology.

Cognitive psychologists added much needed scientific evidence in the new search for answers. As a cognitive psychologist and long-time researcher, R.G. Lyon had posed the question that had puzzled scientists in his 1998 report, "How do children learn word recognition skills?" ([chapter, p. 4, see earlier posting on this website](#)) Lyon credited the scientists at Haskins Laboratory for leading the way in finding answers to this question. "In the late 1960s and early 1970s, investigators at the Haskins Laboratories were studying the relationship of speech and language, (how they worked together, if they did.) Through a series of experiments, they discovered how speech articulation influences the relationship between spoken and written language. This relationship involves how the sound structures of language are represented in speech."

As an example of this early interest, four conferences were held in the late 60's on "Communicating by Language": the first two on speech and language, the last two included reading.

The proceedings of the last of these conferences were published in 1972 under the title, Language by Ear and by Ear. It explored, "The Relationships between Speech and Learning to Reading." Its Title Page, Table of Contents and Preface are posted on this website. Two articles from the book have also been posted, one by Savin and another by Gough. The proceedings were co-edited by J. D. Kavanagh, of the National Institute for Child Health and Development (NICHD), which contributed funding, and I.G. Mattingly, of the Haskins Laboratory. Alvin Liberman, of Haskins, helped organize and plan the conference. Six of the participants were connected to the Haskins Laboratory. The list of participants in the Preface illustrates how much the field had grown. They all puzzled over the reason for the "contrast between the ease with which most children acquire speech and the difficulty they generally have with reading". Why is learning speech so easy and reading so hard? This was a new way of posing the question. (the answer should have been obvious, we were born with one, but not the other, but how was it to be explained?)

What is notable about these conferences were that they were funded by the NICHD in stimulating, developing, supporting and organizing conferences of this kind, well before Reid Lyon's time. The NICHD had only recently been established in 1963. (The same year as the publishing of the Gage Handbook) Also, the leadership and participation by members of The Haskins Laboratory, is notable, which supports Lyon's statement years later. As noted above by Lyon, Haskins had been deep in research on speech since the 40's and 50's. Interests had begun to turn towards issues that related speech to reading in the 60's. Studying the proceedings of this conference reveals how scientists first began studying reading more on a scientific basis. (See the posting of excerpts of the 2020 Haskins Laboratory Pamphlet.)

As Background for the Conference, organizers James Jenkins and Alvin Liberman puzzled over the broader question of which channel of information for language is more prominent, the ear

or the eye. Given the strength of the eye, “Surely the eye is superior to the ear by almost any general standard we can apply.” (So,) why is it easier to learn to talk and listen by ear than it is to learn to read by sight? “Perception (listening) of the spoken language presents no such problem.” So why aren’t “the sounds of speech better signals (for reading) than the printed characters”? **Letters in words are easier to see than the sounds they represent in speech.** “Printed characters are much clearer signals than the sounds of speech and bear a much simpler relation to the linguistic message they convey”. So, **why isn’t the eye an equally adequate channel for learning to read as the ear is for learning to talk and listen?** The eye’s dominant channel for reading has always been assumed, but it does not performed for reading as well as the ear performs for speaking and listening. Thus, the “paradox”. Why? - **an important and revolutionary question that led to a deeper understanding of reading.**

Did the conference answer this question? Not completely, However, posing this question would soon create a revolution in understanding reading in which the eye plays less and the ear plays more. The knowledge, gained by cognitive psychologists, went beyond what previous researchers noted in the Gage Handbook had attempted. Researchers would begin to understand why learning to read is harder than learning to speak and listen. It would also lead to a better understanding of why some had difficulty learning to read. Scientists have also learned more about the origins of language, both oral and written. (See two postings, Ancient Clicks and Egyptologists find..) Alvin Liberman would eventually become the recognized authority on the subject of the relationship between speech and reading. He will be featured in a later series of posts of his 1990’s publications on this website. (see his quote by Lyon, page 2, on the above link. He clearly understood what had been learned.)

The Conference of 1971

The proceedings of this conference were organized around three aspects of this paradox.

- One, “how sounds of speech in the one case and the visible characters (letters that represent these sounds) in the other might relate to the language in significantly different ways.” (e.g., How speech and print related to language in different ways.)
- Two, considering the “fact that the child normally learns to read after he has acquired the spoken language, ... how and where (does) this newly acquired skill (of reading) converge on the old.” (with an alphabet)
- Third, because “speech perception (listening) is more natural, hence an easier task for the child,... what (does) reading require of the child beyond his already developed ability to speak and listen?” (this comes closer to the answer. One is natural the other is not. Alphabetic language requires something from speech and cannot stand alone. This is a very significant discovery. **It changed everything** in our understanding of reading and what should be taught for reading.)

This last question assumes that reading builds on a child’s “already developed ability to speak and listen”. (Interesting, how was this arrived at?) This relationship had yet to be completely confirmed, although many scientists may have believed it by then. These themes and questions carried throughout the history of The Science of Reading, which eventually came to understand reading as more of an action of the ear than of the eye. (or at least equal) **This was a major switch.** This conference, through this book, tells how cognitive scientists began studying reading. It sets the scene for future research on this question and sets the scene for the rapid growth of the Science of Reading. Many similar conferences and publications rapidly followed in carrying out these questions. (This book has been out of print for some time and probably is

lost somewhere in college libraries. However, I found two old copies through an Amazon search.)

The last three chapters of the book are devoted to reading. Donald Shankweiler and Isabell Liberman, who became prolific writers, reported on their early study of the causes of misreading. (Their subsequent works are the focus of the following group of postings.) Robert Savins reported on what the beginning child knows about speech in learning to read. He eliminate all the false leads and identified where children have the most difficulty in learning to read. Phillip Gough analyzes how reading is performed at the word level within the first second of reading. The chapters by Savin and Gough are posted.

Misreading?

The authors of the Misreading chapter state that, “In an attempt to understand the problems encountered by the beginning reader and children who fail to learn, we have investigated the child’s misreadings and how they relate to speech.”

Studies so far had found that “there are strong reasons for believing that the principal barriers for most children are not at the point of visual identification of letter shapes.” In seeking to understand the problem, “we need to look closely at the misreadings ... and ask how these differ from errors in speech perceived by ear. In this way, we may begin to grasp **why the link between alphabet and speech is difficult.**” (is this part of the answer of why learning to speak and listen is easier than learning to read? The way they are linked makes reading more difficult?)

A major question was: “whether the major barrier to reading acquisition is indeed in reading connected text (whole-language, Goodman 1965, 1968) or whether instead it may be in dealing with words and their components” (as separate units). The authors chose to focus on the latter. **“Having concluded from our own findings and the research of others that the word and its components are of the primary importance, we then looked more closely at the error patterns in reading words....** This led to asking “which constituents of words tend to be misread, and whether the same ones tend to be misheard (in speech)”.

In their study, it was found “that good and poor readers among young children differ not in their scanning rate or strategy, but in their ability to deal with individual words and syllables. A slow rate of reading contributes to “poor performance on paragraphs”. A possible explanation is: “If it takes too long to read a given word, the preceding words will have been forgotten before a phrase of sentence is completed” (Gough, this volume).

“We found, as others have, that medial and final segments in the word are more often misread than initial ones and vowels more often than consonants. .. we concluded that children in the early stages of learning to read tend to get the initial segment correct and fail on subsequent ones **because they do not have the conscious awareness of phonemic segmentation needed specifically in reading but not in speaking and listening.**”

It was noted that vowels in speech carry the strongest portion of a word. “In reading, the situation is different: alphabetic representations of the vowels (letters) possess no such special distinctiveness.” They all are the same size as consonants. Vowels also have more complex spelling patterns to increase their errors in the early reader. “We believe that the comparative study of reading and speech is of greater importance for understanding how the problems of perceiving language by eye differ from the problems of perceiving it by ear, and for discovering

why learning to read, unlike speaking and listening, is a difficult accomplishment.” (Thus, it takes longer to learn. There’s the answer.)

What the Child Knows about Speech.

Savin seeks to pin this down, more accurately. What is the source of difficulty uniquely involved in learning to read?

“Both Savin’s paper and Shankweiler and I. Y. Liberman’s paper spotted the possible cause of the difficulty that poor readers have is phonemic segmentation.” P. 327

Savin reasons: “The prevailing theory of the skill of reading (predominantly by sight) fails to account satisfactorily for the observed pattern of difficulties. This theory fails to identify a component of the skill that is demonstrably lacking in each child who does not learn to read. ... It is worth reexamining the account of the nature of what the child has to learn.”

“The mere fact that a child understands what is said to him tells us little about what speech segments he perceives. (hears) ... It is as yet an unresolved empirical question: which of the levels of representation of speech can children easily become aware of?”

“In the present author’s experience everyone (that he has seen) who has failed to learn to read even the simplest prose by the end of the first grade has been unable to analyze syllables into phonemes... What is important for the teaching of reading, **is not** whether phonemes play any part at all in speech,... but (whether) **the child can become aware of enough of them** to make any sense of the things his teacher tells him about the sounds of the letters.” (And the pronunciation of the words.)

Related skills with “blending of letters into words (the opposite of analyzing words into parts) are also problematic, even when the sounds for the letters are well known.” This is referred to as synthesizing constituent parts (letters or sounds) into words. It is not obvious to many children “whether the ... parts can be pronounced in isolation or not.” (They frequently cannot form words from the parts. They see parts but do not know how to combined them (blend) into one sound, that their ears hear, for the word.)

The opposite to the combining skill is the act of segmenting, through an analysis, whole syllables into phonemic parts. “There is no training program that is known to help these children.... Research on the causes and cure of children’s inability to segment syllables should be pursued.” (This whole subject eventually became a target of many, many studies in the future, known as phonemic awareness training and decoding.)

In the general discussion of these two articles, several participants suggested that the cause of these difficulties in Slavin’s group of children could be that they had been taught with too much drill or that they had come from disadvantaged conditions. Liberman interjected into the discussion, “that reading teachers often complain about the inability of pupils to “blend”: the pupils can identify the individual characters in, for example, bag, as b-a-g, but when asked to pronounce the word (from the characters) will say /bah/ /aa/ /ge/. The teacher then urges the child to blend, by which she means, say it faster. But the

child cannot do this unless s/he is aware that the spoken word bag, which s/he already knows, “consists of three individual sounds”. (They need to know more than that, they need the skill to blend. See the next section of postings.) **The child sees three letters but only hears one sound for the word.** This became the common crux of all of beginning reading studies that seek to clearly explain difficulties. Some children have great difficulty in becoming sufficiently conscious of these separate sounds embedded in the spoken word and then to blend the parts into a pronounced word. These scientists fore-saw the future. Carroll remarked, in the discussion, that some recent work by Chall, Roswell et al. (1963) and by Roswell and Chall (1956-58) suggested that the ability to blend is maturational. Cooper said that artificially slowed speech makes one very aware of the motor machinery of articulation, and he wondered if such speech might help children. Kavanagh said he found that adults in a phonetics class who were not able easily to associate sounds and phonemes had been helped by stretching speech and also by immediate feedback. (These questions and ideas are the beginnings of The Science of Reading. Their discussion also notes how little they knew about teaching. I.Y. Liberman came the closest. Her work will be the future focus.)

Gough, One Second Reading.

As Jeanne Chall noted in her book, The Great Debate, very little research on the reading process had taken place. In the Language by Ear and by Eye conference of 1971, Philip Gough, a leading scientific thinker, presented an early attempt to create a model for the reading process from what had been learned thus far. It was based partially on recent eye movement experiments and speech research.

In 1984, Gough started his comprehensive review in the encyclopedic Volume I of The Handbook of Reading Research on word recognition with the bold statement, “**Word recognition is the foundation of the reading process.** ... A reader must recognize that a sentence contains words that must to be recognized correctly or the sentence will be misunderstood.”

Gough noted that word recognition research had virtually ceased with the Cattell study and not resumed for roughly 60 years later. It then returned in a rush of activity. He referred to a 1982 publication by Henderson on word recognition to illustrate the rapid increase in scientific study of reading words. It contained 27 pages of references from just within the previous decade. Gough describes some of the mystery.

“Routine as it may seem, each instance of word recognition is an amazing feat. It begins with a pattern of light and dark cast onto the retina by reflection from the printed page; for the skilled reader, it ends less than a quarter of a second later and almost always with the correct word. In this time, the reader must find the word’s meaning in memory, for only there is a word form associated with meaning; it must locate a single item in a mental lexicon containing tens of thousands of entries. How this lexical search is accomplished remains essentially a mystery after nearly a century of research.”(Gough 1975, 1984)

He added, "It behooves the student of reading, then, to understand something of word recognition."

In the paper presented to the conference, *One Second of Reading*, Gough seeks to illustrate how complicated the reading process likely is, given what was known thus far. He seeks to show the possible "sequence of events that transpire in one second of reading." Charles Perfetti, many years later, comments, "During this second, Gough's estimations from various visual and coding processes implied that 9 words were read. This is the rapid current of 'online' reading observable by the tools of reading science, which have supported much of its progress." Perfetti outlines the technical advances made since Gough's paper that provided "tools that reveal the intricate and interleaved processes and knowledge interactions that occur rapidly in reading." This includes eye tracking and brain imaging tools that "detect the processes that constitute the rapid stream of reading" that seek to explain the mystery.

The ABSTRACT states, "Reading involves a rapid succession of intricate events..... carried out with amazing rapidity and coordination in our complex information processing system. ... Specification of the mechanism by which letters are mapped onto entries in our mental lexicon is the fundamental problem of reading research (then and now)."

Gough's writing is a dense analysis (hard to read) that predates brain imaging, almost 30 years, and more advanced studies of eye movement during reading, reported by Keith Rayner (1998). Gough characterizes the writing.

"The description of the chain of events is intended to be exhaustive in the conviction that the complexity of the reading process cannot otherwise be fully appreciated. Thus, it is detailed by choice, speculative by necessity, and almost certainly flawed."

Given its complexity and density I have not attempted to summarize and analyze it. Sections from the presentations are posted. In spite of details that may have become dated, this writing illustrates the state of the science in understanding reading at this early date of *The Science of Reading*. It therefore remains important and frequently cited in the literature for years later. It's historic as well as informative. Gough became an important thinker in this process of learning about the science. His view of "The Simple View of Reading" remains in use to the present time.

Perfetti' brings this up to date in chapter One of the 2022 publication, [The Science of Reading: A Handbook](#), Second Edition. Edited by Margaret J. Snowling, Charles Hulme, and Kate Nation. Stay tuned.