How to Help Students Who Are Not Good at Remembering Written Words:

Understanding Orthographic Mapping and the Role of Grapho-Phonemic Proficiency

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Today's Objectives

1. Understand how we remember written words
2. Learn why phonemic proficiency is central to efficiently remembering words
3. Consider how this knowledge affects our assessment and instruction

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An Observation and an Intuitive Puzzle

Observation

- What's the most obvious thing about our own reading?
  - We instantly and effortless retrieve all (or nearly all) the words on the page.
  - We are neither sounding out words as we go along, nor guessing at words.
    - We only do those if we see a word we don't already know.

Intuitive Puzzle

What would an "auditory" skill like phonemic awareness have to do with visual word reading?

Unraveling the Mystery

To make sense of the connection, we need to understand

(1) How alphabetic writing works.

(2) How our memory system interacts with alphabetic writing.

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The Nature of Alphabetic Writing

- Chinese writing vs. alphabetic writing
- In alphabetic writing, *we rarely write words!*
  - Normally, we write phoneme characters.
  - Alphabetic characters represent phonemes in speech—alphabetic characters do *not* represent words.
    - Except (1) *a, I, O*, (2) letter names, and (3) single-digit numbers as words
  - Thus, we write sequences of phoneme characters (alphabetic) that line up with the phoneme sequences in spoken words.
- Poor access to phonemes in spoken words makes learning to read alphabetic languages very difficult.
- Phoneme skills are needed for BOTH sounding out new words AND for remembering written words.

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Our Multiple Memory Systems

- Working Memory (limited, temporary storage)
- Long-Term Memory
  - Semantic Memory
  - Episodic memory
  - Motor memory
  - Procedural memory
  - Auditory memory
  - Phonological memory
  - Face memory
  - Orthographic memory
  - Visual memory

Auditory INPUT
yet two different aspects of long-term MEMORY

Visual INPUT
yet three different aspects of long-term MEMORY

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Sight Word Vocabulary is NOT Based on Visual Memory/Visual Skills

- Input and storage are not the same thing.
  - Input is visual, storage is orthographic (via a phonological process).
- Those with dyslexia generally do not have poor visual memory.
  - The correlation between word reading and visual memory is weak and cannot explain reading difficulties.
- Yet word reading correlates strongly with phonemic skills.
- 1960s to 1980s miXeD cAsE sTuDiEs illustrate this.
  - Notice bear vs. BEAR.
- Most students who are deaf struggle with word-level reading.
  - This is difficult to explain if we read by visual memory.
- Neuroimaging studies show different activation patterns for visual memory and orthographic memory.
- It seems generally accepted in the reading research community that we do not read based on visual memory.

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The Intuitive Puzzle Once Again

- What would an "auditory" skill like phonemic awareness have to do with visual word reading?
- For me, this question was resolved in 1997.
  - In Ehri's theory of sight-word learning (orthographic mapping), phoneme analysis and letter-sound skills are central for remembering words.
  - Orthographic mapping has been well established in many direct studies and indirect studies, and explains a multitude of findings.
    - But these findings are primarily known to those familiar with this niche research area of the broader reading research – many have heard of her theory, fewer understand it.
  - Orthographic mapping has been difficult to understand.
  - You need your "aha" moment.
  - Share's theory of orthographic learning (the self-teaching hypothesis) overlaps and is easier to understand.

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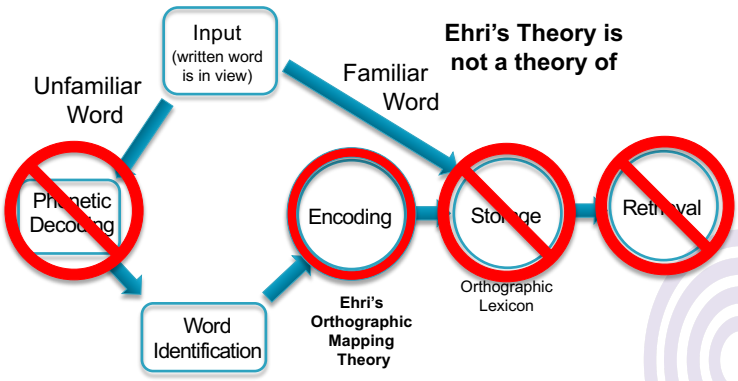
From Visual Input to Written Word Recognition



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Orthographic Mapping

- Orthographic mapping is the *process* involved in remembering words for later, instant and effortless retrieval.
  - It also applies to word parts, not just words.
- Orthographic mapping is the mechanism that builds the sight vocabulary/orthographic lexicon.
- Other than visual input of the letters into the system, it is not a visual memory process.

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Linnea Ehri's Orthographic Mapping Theory

- Sight words are highly familiar spellings (i.e., letter sequences), regardless of the visual look of the word
  - e.g., bear, BEAR, **Bear,** *bear*, **bear**, *BEAR* , **bear**, *bear*, BEAR
- Sight words are anchored in long-term memory (LTM) via a grapho-phonemic connection forming process
- We connect something well established in LTM (the word's pronunciation) to the stimulus that needs to be learned (the letter sequence in the word's spelling)
- Phoneme-level analysis and letter-sound knowledge are central to this connection-forming process

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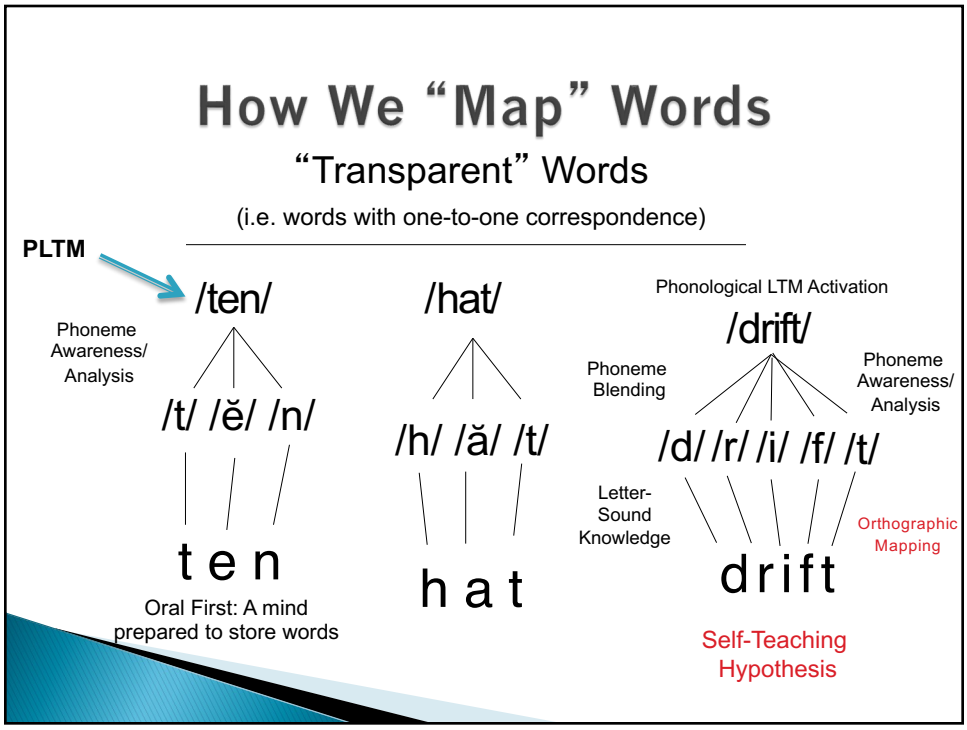
How We "Map" Words
"Transparent" Words
(i.e. words with one-to-one correspondence)
PLTM
/ten/
Phoneme Awareness/ Analysis
/t/ /ĕ/ /n/
t e n
Oral First: A mind prepared to store words
/hat/
/h/ /ă/ /t/
h a t
Phonological LTM Activation
/drift/
Phoneme Blending
Phoneme Awareness/ Analysis
/d/ /r/ /i/ /f/ /t/
Letter-Sound Knowledge
Orthographic Mapping
d r i f t
Self-Teaching Hypothesis

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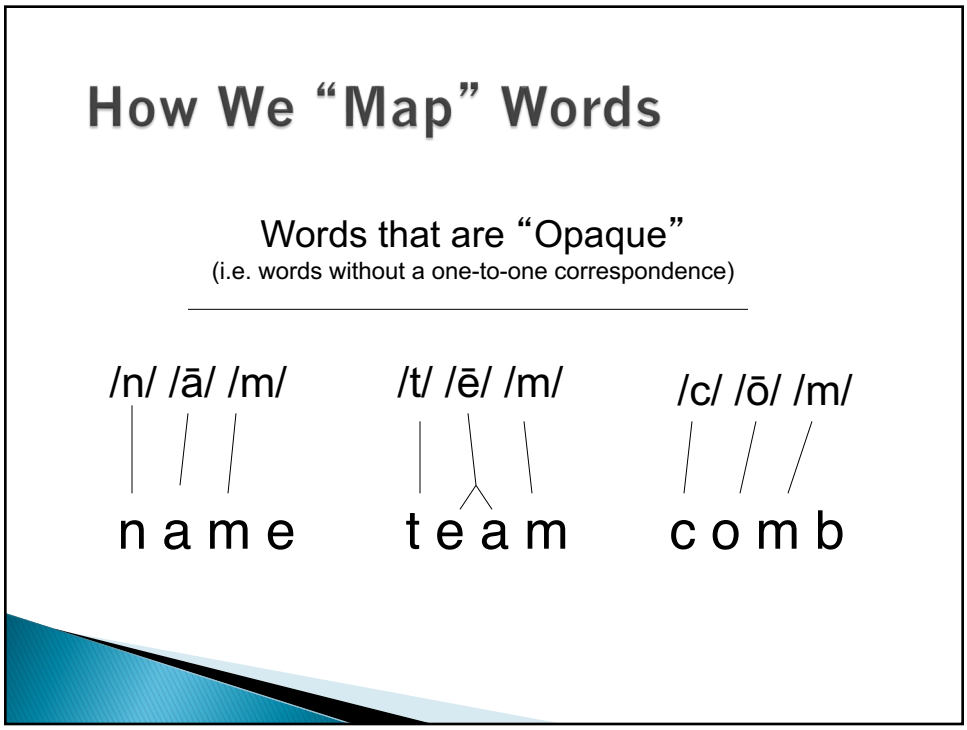
How We "Map" Words
Words that are "Opaque"
(i.e. words without a one-to-one correspondence)
/n/ /ā/ /m/
n a m e
/t/ /ē/ /m/
t e a m
/c/ /ō/ /m/
c o m b

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What about irregular words?

- Most irregular words are off by only one element
  - E.g., *said, put, comb, island*; multiple violations are rare: *of, one, iron*
- Irregular words are not a challenge for orthographic mapping
  - "Exception words are only exceptional when someone tries to read them by applying a [phonetic] decoding strategy. When they are learned as sight words, they are secured in memory by the same connections as regularly spelled words . . ." (Ehri, 2005 p. 171-172)
- Many regular words require mapping "adjustments," just like irregular words
  - Silent e words, vowel digraphs, consonant digraphs are all opaque
  - Multisyllabic "regular" words with vowel reduction require mapping adjustment, much like irregular words (e.g., *holiday, market*)

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Skills Required for Efficient Orthographic Mapping (and thus necessary for skilled reading)

- Orthographic mapping is a grapho-phonemic connection forming process that occurs automatically
- To do this efficiently, readers must have:
  - **Letter-sound proficiency**
  - **Phonemic proficiency**
  - The ability to automatically/unconsciously establish a relationship between phonemes and graphemes while reading
- This helps us understand two things:
  - Why phoneme manipulation tasks are so useful
  - How we can unconsciously encode words so efficiently
- **Letter-sound "knowledge" and phoneme "awareness" are not enough!**
  - Automaticity is essential with both letter sounds and phoneme skills

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Evidence for Phonemic Proficiency:

Simply Having Awareness of Phonemes is Not Enough

(Thank you to Pearson, Inc. for permission to use this information)

Age	Non Instant	Instant	Combined
6	0.12	0.71	0.72
7	0.19	0.68	0.70
8	0.00	0.64	0.67
9	0.02	0.66	0.71
10-11	-0.07	0.66	0.72
12-13	-0.12	0.66	0.70
14-15	-0.08	0.70	0.75
16-17	-0.09	0.50	0.55
18-50	-0.10	0.62	0.68
Overall	-0.10	0.78	0.81

Correlations between the WIAT-4 Word Reading Subtest and the Phonemic Proficiency Subtest

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Ehri's Theory in the Literature

- Ehri's theory has been extensively cited
  - At one point, Ehri (2005) was SSR's most cited article
- But . . . since the late 1990s I realized many (most?) researchers didn't fully understand Ehri's theory or appreciate its explanatory power; here were my clues:
  1. In the PA literature – how the role of PA in reading was described
  2. Many cite Ehri, but only Ehri explains Ehri
  3. Functionally absent from the dyslexia literature and the word-reading intervention literature
     - Yet orthographic mapping helps explain poor memory for words
  4. A few attempts by some researchers to explain the relationship between PA and reading
     - These attempts do not interact with Ehri or say why her solution is incorrect
  5. Then came the explicit comments
     - In feedback from reviewers
     - In conversations with researchers
     - In print and online comments

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Knowledge to Practice:
Assessment and Instruction

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Foundations for Assessment and Instruction

- Reading is based on phonology, given the nature of alphabetic writing.
- For skilled word-level reading, letter-sound knowledge and phonemic awareness are not enough.
- Skilled word-level readers have letter-sound proficiency and phonemic proficiency.
- Older struggling readers who lack either of these skills need to have these skills directly addressed. There is no alternative way to efficiently remember words.

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Assessing Letter-Sound Proficiency and Phonemic Proficiency

Assessing these skills

- **Letter-sound proficiency** can be assessed via commercially available timed nonsense word reading subtests.
  - TOWRE-2, WIAT-4, KTEA-3
- **Phonemic proficiency**, unfortunately, cannot be easily estimated using most currently available PA assessments.
  - The *Phonological Awareness Screening Test* (PAST) and the *Phonemic Proficiency Subtest* from the WIAT-4 are the only current assessments of phoneme proficiency that I am aware of.
- The PAST is free at www.thepasttest.com.

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Instructional Considerations: Letter-Sound Proficiency

- All skilled readers of alphabetic writing systems have phonics skills.
- Not all students need the same amount of phonics.
- Prevention results have been very impressive by teaching phonics and phonemic awareness in K-1.
  - However, some students will require more practice and reinforcement in either or both of those skills.
- Letter-sound skills must become automatic to help facilitate orthographic mapping.

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Instructional Considerations: Phonemic Proficiency

- Phonemic awareness develops without explicit instruction in a large proportion of students.
- However, at-risk and struggling readers will require explicit instruction in phonemic awareness.
- Once they are capable to doing phonemic awareness tasks, continued practice will be needed until that skill becomes effortless and automatic.
  - There is a misconception that the National Reading Panel in the U.S. said that once letters are introduced, no more oral phonemic awareness is needed. They never said that, nor did the studies they reviewed suggest that.

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Phoneme Awareness, Letters, and Social Media Misinformation

- The National Reading Panel (NRP) distinguished between studies that taught PA "with letters" vs. "without letters" *but they never defined what they meant by that.*
  - However they illustrated what they meant by describing seven "with letters" studies, ***all of which used oral PA activities!***
  - Examining the studies they reviewed makes it clear the "without letters" studies taught PA isolated from letters or words. The "with letters" studies most commonly taught PA with oral activities but at some point connected the PA learning to letters and words.
  - Before they discussed this distinction between the "with letters" and "without letters" studies they gave a strong caveat that these conclusions were only "suggestive" and "tentative" (their terms).
    - Their "tentative" suggestions were not based on any experimental findings.
    - Their tentative suggestions must not be confused with their well-established finding, based on experimental studies, that teaching PA provides better results in reading compared to not teaching PA.

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Phoneme Awareness, Letters, and Social Media Misinformation

- The "with letters" studies the NRP reviewed involved 41% more instructional time than the "without letters" studies. Thathat may be responsible for the difference in their tentative outcome. Without an experimental study, we don't know.
- Their suggestion did not apply to students with reading difficulties, the very students who need this the most.
- Contrary to popular misinformation, the NRP (1) never downplayed oral-only PA activities. Most "with letters" studies used oral-only PA activities! (2) never said letters should be in front of students all or most of the time when doing PA activities, (3) never suggested to discontinue oral PA activities once letters are introduced.
- Unfortunately, some academics (i.e., professors and researchers) are passing this along without having checked themselves.
- The misinformation undermines 40+ years of research on the impact of PA instruction and intervention on reading.

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Summary

- Alphabetic writing is phonemic in nature.
- Phonemic skills are important not just for figuring out unfamiliar words, but also for *remembering* words via orthographic mapping.
- Orthographic mapping is an automatic process that happens unconsciously in the background.
- The two skills needed for that process must also be automatic: letter-sound proficiency and phonemic proficiency.
  - Letter-sound knowledge and phonemic awareness are not enough.
- Teaching these skills to all students early on has a strong prevention effect.
- Yet some students will require additional instruction and practice before these skills become automatic.

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