# Reading, Learning, and Instruction

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READING MEETINGS
with Mark and Molly
Conversations Bridging Science & Practice

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This is the third of our explainers about phonology, phonemic awareness, and learning to read

Why dwell on these issues? There's more to reading than phonology.
Because they are the main focus of the "Science of Reading". And it's getting out of hand.

"Science of Reading" = recent attempts to apply research to practice.
A simplified version of some findings from reading research.
Leading to practices that may be an improvement over what came before.
But also incorporate assumptions that aren't supported by research.
Which make it harder for children to learn and for teachers to succeed.

Our view: We need to take the "Science of Reading" to the next level.
Better understanding of research will lead to more effective practices, better outcomes.

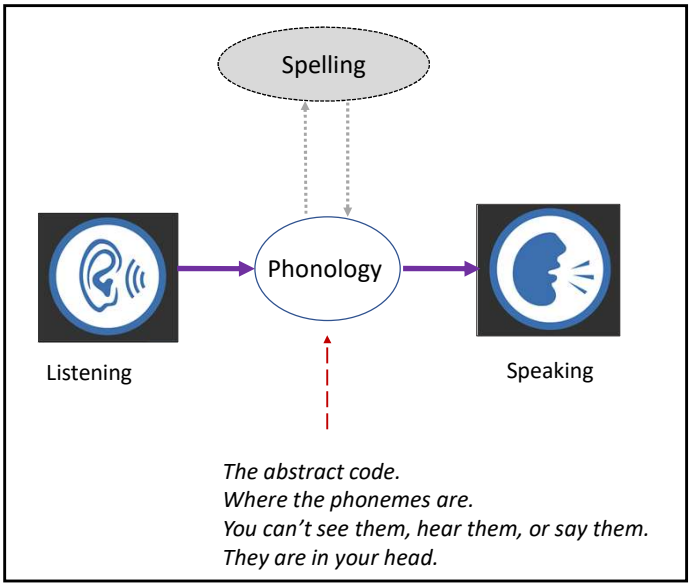
First session: What are phonemes, why are they important, where do they come from?
Short summary:

Learning to treat spoken words as if they are composed of discrete segments—phonemes—is important for reading.

You might call this "phonemic awareness".

Researchers call it "developing a phonemic level of representation". An abstract type of knowledge. Something we learn and use, mostly without awareness.






Phonemic abstraction develops

Spoken language experience gets the learner part way.

But alphabet is necessary to get to the phonemic knowledge relevant to reading: segments.

Requires instruction, about letters, letter names, associated sounds, spelling. Activities that couple spoken, written codes.

## Second session: Evidence?

We started by looking at a popular view:

1. Phonemic awareness is important for reading
2. Phonemes are properties of spoken words
3. Therefore children can acquire phonemic knowledge via spoken language activities
4. They are then ready for introduction of print.

Based on flawed assumptions about what phonemes are, how they are learned.

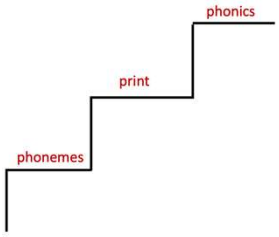


Better:

1. Phonemes are a product of spoken language and print
2. "Phonemic awareness" is both
   - necessary for reading alphabetic writing *and*
   - a product of reading (and spelling) alphabetically
3. How can it be both? Because they are learned over time in a reciprocal, interactive manner.
   - Knowledge of print bootstraps development of phonemic knowledge.
   - Phonemic knowledge bootstraps learning about print.
   - Each influences the other.

Learner converges on knowledge that supports reading.

"Teach the components" approach

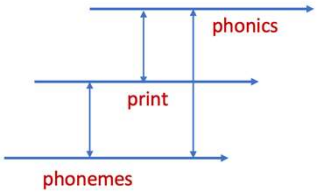



Wrong about

what is learned:
"components" are not independent.

how learning occurs:
not like a lesson plan with units that build in complexity.

Interactive account




Each "component" depends on, contains elements of the others. Learning about one affects learning about others. Instruction can emphasize these interconnections.



## The differences between these views matter.

Important implications for instruction.

Children need to learn to treat spoken words as consisting of phonemic segments. How?

> Harder: Treat phonemes as properties of spoken language, taught via spoken language activities, "in the dark". Could take several years of instruction, even. Opportunity costs.

> Easier: incorporate print knowledge because phonemes result from print + sound.

How history repeats itself:

Then:
teaching children to read words while withholding phonics instruction makes it harder to learn.

Now:
teaching children about phonemic awareness while withholding print information makes it harder to learn.

Talk 2 also emphasized the importance of looking at the tasks (activities) used to assess, teach "phonemic awareness".

What is PA? It's whatever PA tasks measure. But, these tasks measure different things.

PA tasks differ in

- the types and amount of knowledge that are required
- task difficulty: memory demands, mental operations
- ages at which they can be performed
- how relevant they are to reading

Some are simple enough for infants to perform.
Some aren't learned until grade 2 or 3.

The PA tasks that matter for reading involve using discrete segments:

- segmentation
- blending
- deletion, addition, substitution

Performance on these tasks is highly dependent on knowledge of print.
Many studies. This is settled science: answer is known.

PA Tasks
Isolation
Identity
Categorization
Blending
Segmentation
Deletion
Addition
Substitution
others



Bottom line:

The term "phonemic awareness" is too broad.

Treating spoken words as consisting of discrete sound segments is essential for reading alphabetic writing.
Only some "PA" tasks require this knowledge.
The ones that depend on exposure to print!

Since segmentation depends on print knowledge, it would be quite weird to use segmentation tasks to develop phonemic awareness decoupled from print

Despite current interest in the "science of reading," this research is largely unrecognized.

As seen in discussions on social media, popular websites:

> I'm sorry if this is a stupid question. I've been reading so much that things are a bit of a jumble. I think I read that letters are not introduced until phoneme awareness is solidified but I'm not sure. When would you introduce letters?

Popular curricula emphasize extensive phonemic awareness training as a precursor to reading, contrary to this research.

This is a poor translation of research to practice.
It's not because scientists haven't done relevant research.
The research exists but isn't widely known.
Results in ad hoc "science of reading" that overlooks a lot of the most important findings.

Which undermines our efforts to use research to improve literacy outcomes.



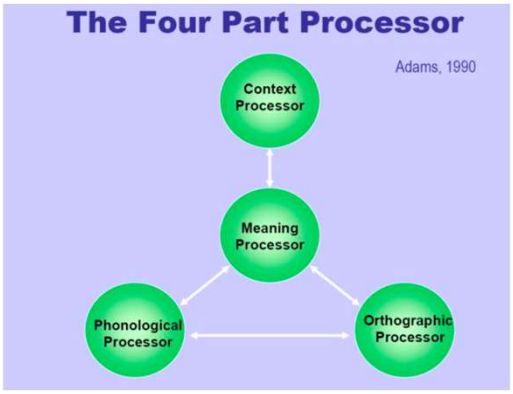
## Let's move on. We need to look at LEARNING.

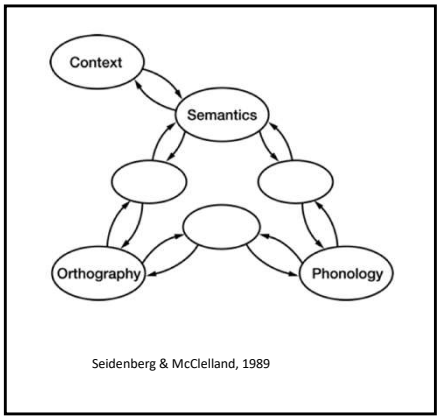
We talk a lot about what beginning readers need to learn.
There's a lot: Phonemic representation, yes, but so much more.
Now we want to look at how they learn.

This is obviously relevant to instruction.
We want how we teach to align with how they learn.

How people learn is a general question that applies to all types of knowledge, not just reading.
This too is part of the science relevant to reading.

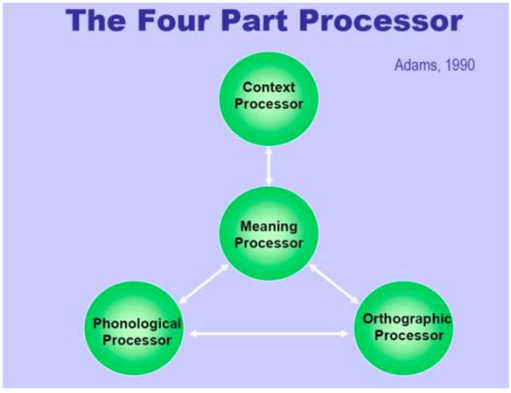
Let's start here:




Seidenberg & McClelland, 1989






We can tell a lot from this.

What people know about words:

spellings how words relate to contexts
sounds
meanings

How various tasks are performed:

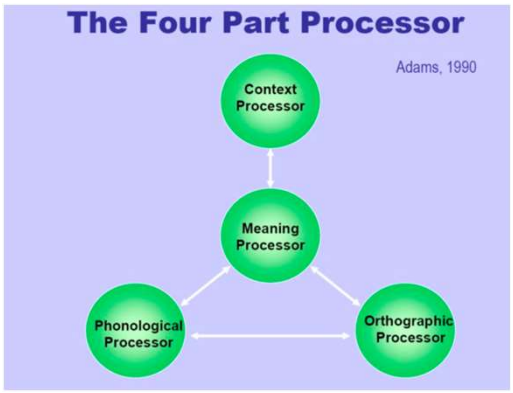
Reading aloud
Computing meaning
Spelling to dictation
Writing a word

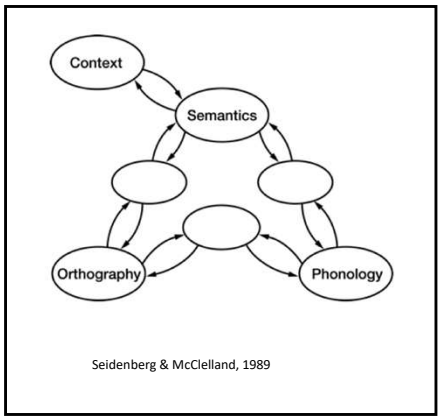
"Context": The linguistic context in which a word occurs
The environment/situation in which a word is used
World knowledge
more

What you can't tell from this: What is in the circles? What do the arrows represent? How do the parts work together? How is this knowledge acquired? What develops when and how?

(Seidenberg & McClelland addressed these issues.)

To start, let's focus on one part of this system:
The mappings between spelling (orthography) and sound (phonology).
AKA "phonics".



Seidenberg & McClelland, 1989



We know that children need to learn correspondences between print (spelling) and sound.
We also know that this requires instruction. To know what to teach we need to determine
What this knowledge involves, how it is learned.

There is one nearly universal intuition about how the correspondences work in English:
The system is rule-governed, but has a lot of exceptions

Evidence for rules: we can sound out novel words. SAVE GAVE PAVE MAVE
This means we don't just memorize words.
But: rules have exceptions, such as HAVE. These do have to be memorized.
Therefore: Reading requires two types of knowledge. Core idea in "dual-route" models.

Instructional implications:
Teach the rules: phonics. Leftover ("sight", "snap") words: provide opportunities to memorize.

This was the only theory for several hundred years of instruction.

Is this correct?

The problem with phonics rules:

- What are they? No agreement. Estimates vary wildly.

  Not like the rules of chess.

- Any way you slice it, there are a lot of them. Takes a lot of time to teach. Too much to learn, too little time.
- Using rules to pronounce letter strings is slow, laborious for beginning readers.

How would this turn into fluent, automatic reading?

- Little evidence that skilled readers use rules.

What about memorizing the leftovers? Rote learning, lots of repetition.
Little agreement about rules → little agreement about how many sight words are left over.
Here too curricula vary enormously.
definition of sight words
which words are included



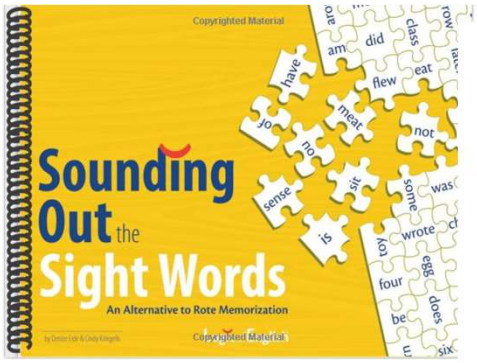
Despite these concerns, emphasis on teaching rules is increasing.

Curricula vary in how many rules, order in which they are taught, other details.
Typically include dozens of rules of varying complexity.

Goal is to reduce the number of words to memorize.
Because that is rote learning.

Here is one recent attempt to reduce the number of "sight words" by creating additional rules. Described as "an alternative to rote memorization."

An example:

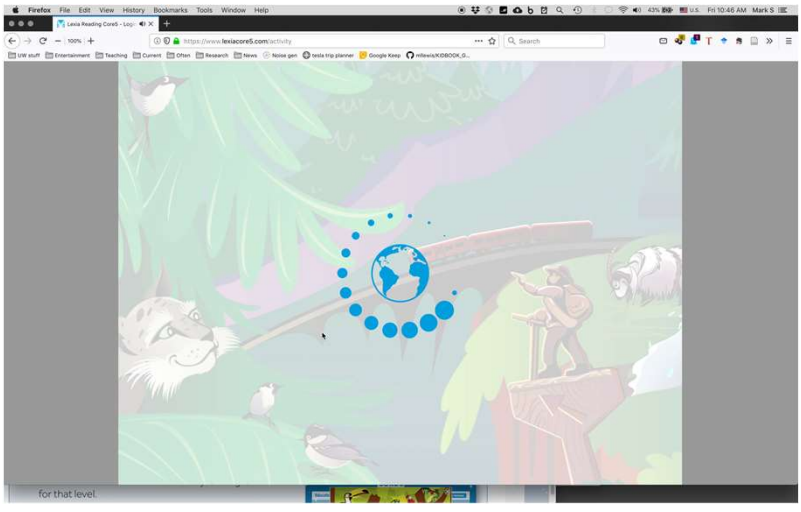




These rules also have to be memorized! And complicated, too.



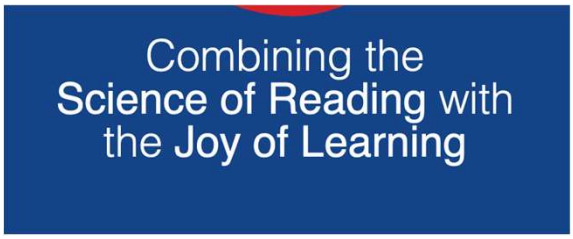
There are spelling rules to memorize, too. From Lexia Learning, Core 5:




Can you repeat that accurately?

**Rule 14** Double the last consonant when adding a vowel suffix to words ending in one vowel followed by one consonant only if the syllable before the suffix is stressed.*
*This is always true for one-syllable words.

From a commercial program advertised as




What science? How joyful?



You all know that some programs include syllabification rules.
And recently, morphological rules.

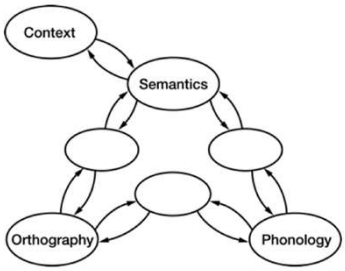
(These rules all have exceptions, too.)

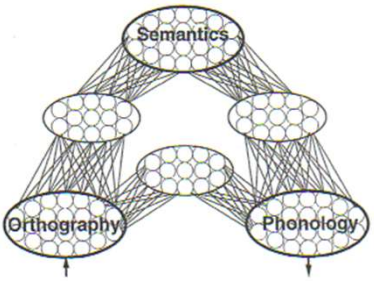
Some years ago, McClelland and I developed a different view.

English spelling-sound correspondences aren't rule governed.
(nor are syllables, morphology, grammar)

The correspondences are statistical, probabilistic.
That means: they vary in predictability and consistency.
Continuum includes "rule-governed" words, "exceptions", and everything in-between.

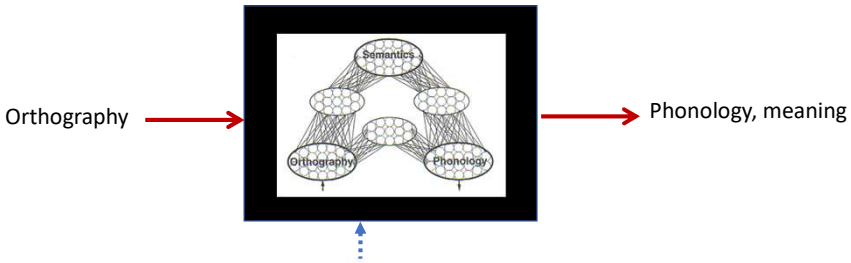
People pick up on the many patterns and subpatterns that exist across words.
These patterns are encoded in large neural networks.






This account is based on how brains learn, function.
For a long time, we didn't know what was inside the black box.
Rules + exceptions: the story we told about it, based on behavior.




Neural network
Statistical dependencies

Modern theory:

1. Orthography, phonology, morphology, semantics: statistical, degrees of consistency
2. ”Rule-governed,” “sight words”, generalization: products of the same network.
3. Most of this complex system is learned implicitly.
   Unlike chess, no one has explicit knowledge of all the “rules”.
4. We learn, adjust networks every time we use them: reading, speaking, writing, etc.
   This goes on in the background as we pursue our communicative goals.



Modern theory:

5. HOWEVER: Explicit instruction is also necessary.

   For learning arbitrary facts, such as identities of letters, their names and pronunciations

   For the child to learn about the nature of the system:

   visual patterns that represent spoken language.
   arbitrary associations between letters and sounds
   other properties of text (spaces, pictures, etc.)
   what a morpheme or syllable is

Only a small fraction of this system can be explicitly taught.

But from the examples, children learn how to learn on their own. Without explicit instruction.
Jorm’s self-teaching mechanism is one of the ways. (There are others.)

This is a modern account of “breaking the code”.

Does this mean that explicit phonics instruction is unnecessary?

NO. It is essential. It's the starting point. It draws attention to properties of the system. It sets up the learner's task. And gets them started along the path.

Does this mean that explicit phonics instruction is the sole way to learn this system?

NO. In fact, very little of the system is learned this way. Mostly at the outset, less as knowledge develops. Most learning is implicit. Occurs through language use: reading, speaking, listening, writing.

How does learning occur without explicit instruction?
Based on other signals: does this word look right? Does it sound right? How other people respond. Whether we achieve communicative goals.

Does this mean that children will learn "implicitly" if you hand them books and clap enthusiastically?

NO. Learner needs foundational word recognition skills to build from.



Human learning involves both explicit and implicit systems.
"Complementary learning systems".

The processes that underlie skilled reading are almost entirely implicit. Unconscious. Can't be put into words. We are aware of the results, such as comprehending a text, not how they were produced.

BUT, we can see why explicit instruction is also necessary, especially at the start.

Approaches to reading instruction differ in reliance on these systems as child develops.

Ideal:

Explicit: necessary early in development
Enables increasing reliance on implicit.
Balance reverses over time.

Explicit → Implicit

Whole language error:
Phonics learned implicitly from the start.
Extreme avoidance of explicit instruction at the point when it is most important.

Implicit → Explicit

Explicit only comes in later, with language arts instruction, grammar, morphology. Grade 4 and after.

Some current "science of reading" curricula:
Excessive reliance on explicit instruction, beyond initial functions, extending into grades 3-4.

Explicit → Implicit



Ideal: Explicit → Implicit

Whole language: Implicit → Explicit

SoR curricula: Explicit → Implicit

Goal is appropriate mix of implicit, explicit.
Which change as child gains skills.

Balanced learning, not "balanced literacy"

Why are we seeing so much emphasis on rules, memorization, other types of explicit instruction?
Part of it is an overcorrection to extreme antipathy to basic skills instruction in whole language/balanced literacy.

But blame part of it on Chomsky and Gough

Chomsky: spoken language is unique, innate, learned automatically without instruction or feedback.
Gough: that makes reading "an unnatural act".

Implication: unlike speech, reading has to be taught.
If it isn't taught, it won't be learned.
Creates emphasis on explicit instruction.

Unfortunately, this only half right.



Spoken language is mainly learned implicitly. Child does not need to be taught that there is something called language or how it works. Very little explicit instruction.

The underlying mechanism is statistical learning, beginning in infancy. Infants/toddlers pick up on patterns in spoken language. Unconscious, automatic. That is how they learn language so rapidly.

Amount and variety of language in the environment affects how much is learned (Hart & Risley, Fernald, Snow, others).

Reading definitely requires instruction to initiate learning. Child has to be taught what writing is, learn how the symbols work, etc. That is the "unnatural" part.

But, most of what children subsequently learn about written code—how words are spelled, how spelling relates to sound and meaning—occurs implicitly. It cannot all be taught explicitly. This too occurs via statistical learning: same procedure. It's a continuation of what started with speech.

This is effective IF the child has benefitted from initial instruction, and learned about how the code works, and learned enough bits to see what else is there to learn.

We're almost done. Here are the major points of our talks.

1. Development: reading builds on spoken language but then reciprocal effects. Integration of print and sound is goal. In behavior, brain.

2. Interdependencies of different types of knowledge. Reading doesn't consist of a set of independent skills, types of knowledge. Many pieces working together, influencing each other. Allows child to learn about more than one thing at a time: e.g., vocabulary is also about spelling and phonics.

3. Roles of implicit, explicit systems. Explicit is essential at the outset. Enables transition to more implicit/self-generated learning.

4. Reading instruction is about learning to read.

   Instructional decisions need to be conditionalized on child's progress.
   Instruction in specific skills is relevant only to the extent that it advances the child's reading.
   There's no required level of performance on phoneme deletion/substitution tasks!
   If the child's reading is advancing, there's no reason to grind away on the component skills.



Thanks for listening and participating.

We will be announcing a roundtable discussion of these issues.

And we can answer questions posted to our website.

We will do another on-line Q&A if there is sufficient interest.