

# Becoming Phonemic

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## READING MEETINGS

with Mark and Molly  
Conversations Bridging



Made possible by support from the  
Deinlein Language and Literacy Fund,  
University of Wisconsin-Madison



Children need to develop the **sense** that spoken words consist of discrete segments, called “phonemes”.

Why phonemes?

Because alphabets **represent** spoken words as sequences of phonemes.

That is **not** how words are pronounced.

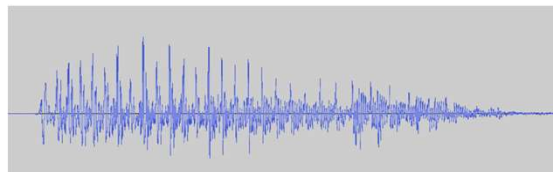
It is an **abstraction**: treating spoken words **as if** they consist of discrete sounds.

That abstraction makes reading an alphabetic system possible.

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Speech



/b/ /æ/ /t/

Phonemes

*Abstract!*

Can't see or hear  
because they're *in  
your head!*



B A T

Spelling

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## Phonemes are like having letters for speech.

Big step: Aligns print and speech, creates learnable mappings.

Reader must **fill in** how to go from three discrete phonemes /b/ /a/ /t/ to one integrated syllable /bat/.

## Conclusion:

Alphabetic writing is the **source** of the illusion that spoken words consist of discrete sounds.

That is why becoming phonemic **depends on** exposure to print.

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## Proof?

**We'll do an experiment:**

Raise children in an environment that is normal in all respects, but withhold exposure to an alphabet.

**Will children develop "phonemic awareness"?**

The world has done this experiment for us.

1. Illiterates. 2. Readers of non-alphabetic writing.

**Answer is the same: they have minimal knowledge of phonemes.**

**Very limited ability to perform phonemic awareness tasks.**

**Far less than people who read alphabets. (Morais et al. and many others.)**

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## How does this knowledge develop?

Early spoken language experience prepares the way for phonemes.

children learn that syllables consist of parts, onset and rime

soap hope rope  
s- h- r-

hearing contrasts between these words, child starts to isolate initial sounds

children hear words with simple rimes:

ma pa da  
-a -a -a

hearing contrasts between these words, child starts to isolate vowels  
(also hearing vowels in isolation, like "oh" "ooh" "eye" "ai")

This is the level of phonemic awareness seen in illiterates. Minimal.

Big increase comes with linking sounds of words with print.

## Is this confusing? It could be. Common view:

1. Every textbook says "Phonemes are the minimal units of spoken language"

Illustrated by words such as BATH PATH COOK TOOK

They differ in meaning because their initial phonemes are different.

2. Since phonemes are units of spoken language, they can be learned by using spoken language.

3. Pre-readers who learn the phonemes are then ready to learn about print and mappings between print and sound.

This reasoning has led to adoption of curricula and instruction that emphasize learning phonemes as the prerequisite for learning about print and phonics

Each step in this reasoning is flawed, as known from reading research. Let's look.

1. Every textbook says "Phonemes are the minimal units of spoken language"

*This is true if you read an alphabetic system.  
But not if you don't.*

"Phonemes are minimal units of spoken language" makes sense to us because we read an alphabet!

A little Western-alphabetic bias here, folks.

1. Every textbook says "Phonemes are the minimal units of spoken language"

2. Since phonemes are units of spoken language, they can be learned by using spoken language.

**But, they aren't units of spoken language and therefore they can't.  
Spoken language only provides a foundation to build on.**

1. Every textbook says “Phonemes are the minimal units of spoken language”
2. IF phonemes are units of spoken language, then they should be learnable from using spoken language.  
  
But, they aren’t. Spoken language provides a foundation to build on.
3. Pre-readers who learn the phonemes are then ready to learn about print and mappings between print and sound.

No. “Phonemic awareness” isn’t the prerequisite to reading.  
It develops in conjunction with learning about print.

### The Important Idea:

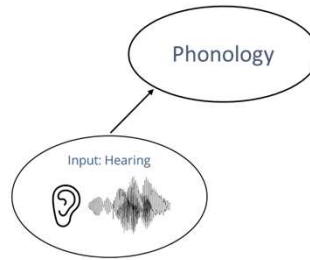
“Phonemic awareness” is both  
necessary for reading alphabetic writing *and*  
a product of reading alphabetic writing

*How can this be? Chicken-egg problem!*

The Answer: Learning is interactive, reciprocal, interdependent.  
Learning one thing influences learning another—and vice versa.

The opposite of: learn phonemes, then print, then phonics.

A child before formal reading instruction

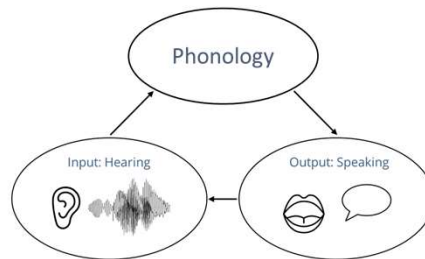


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A child before formal reading instruction

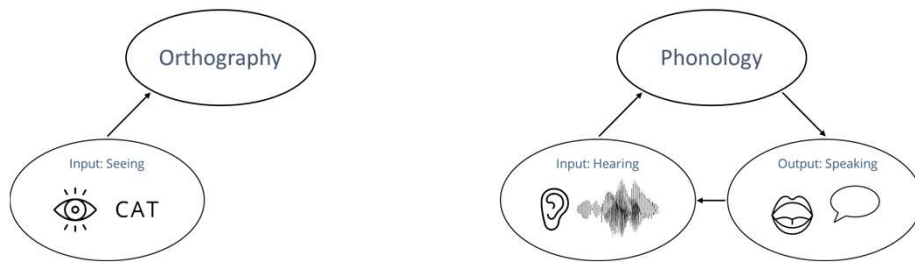


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A child before formal reading instruction

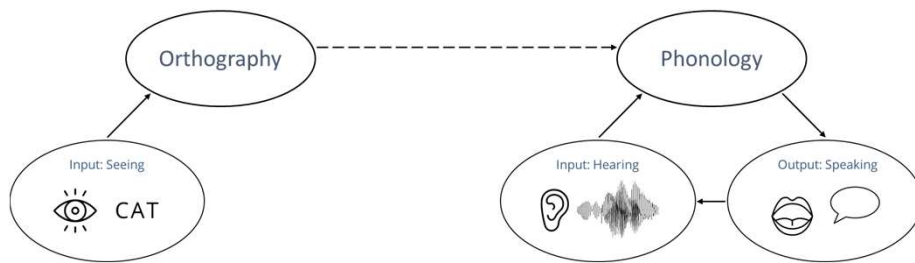


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A child before formal reading instruction



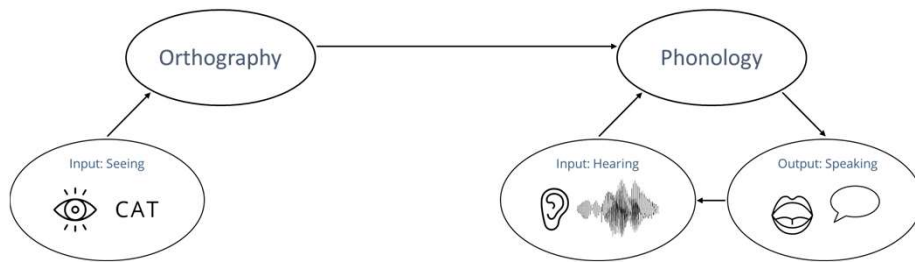
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A child after formal reading instruction begins

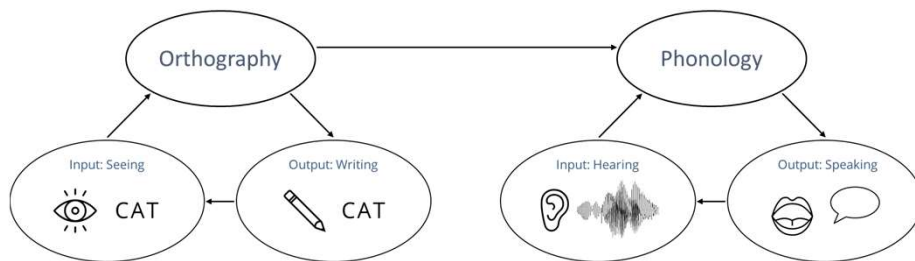


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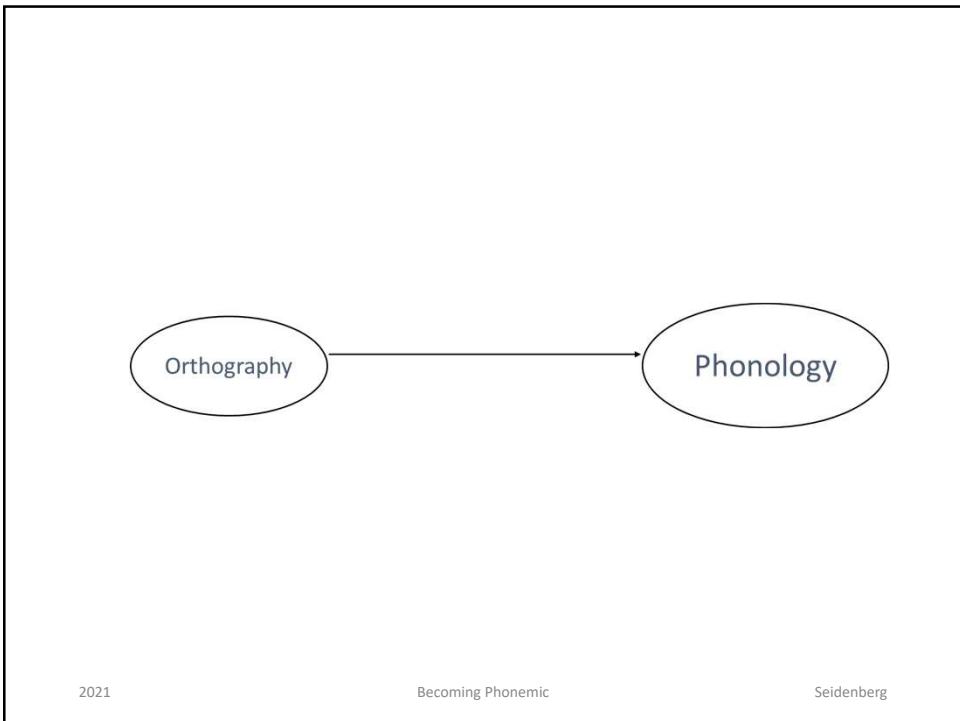
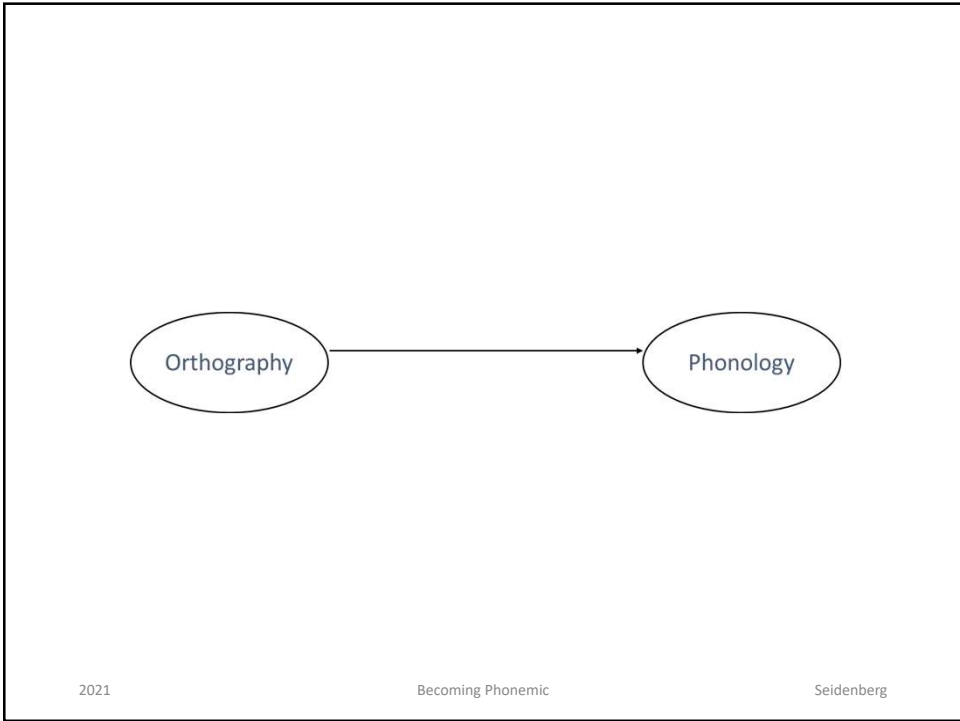
A child after formal reading instruction begins

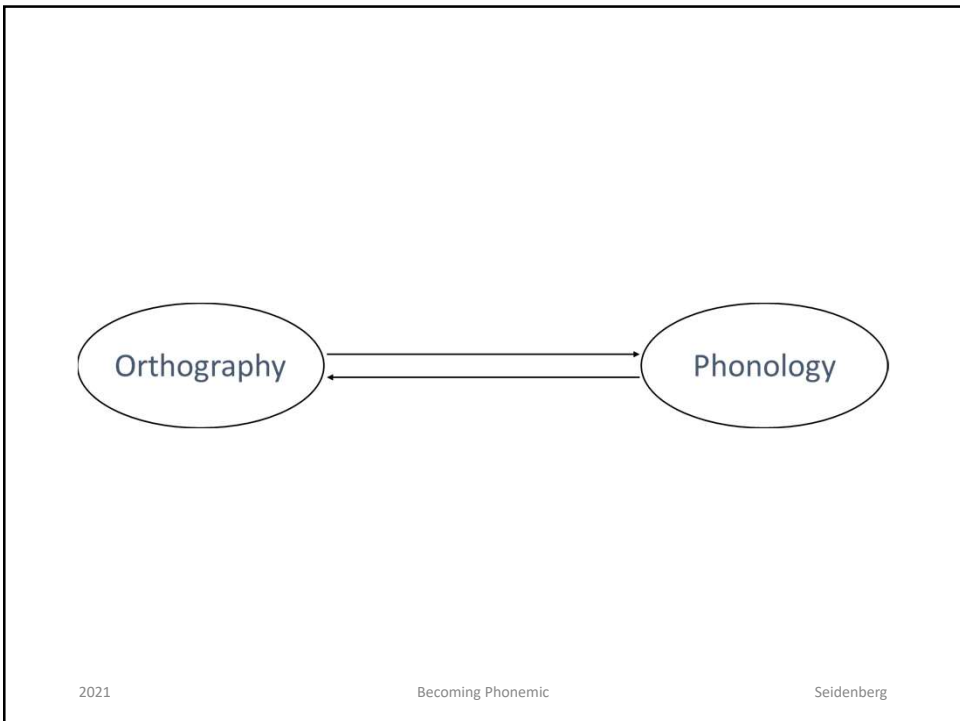
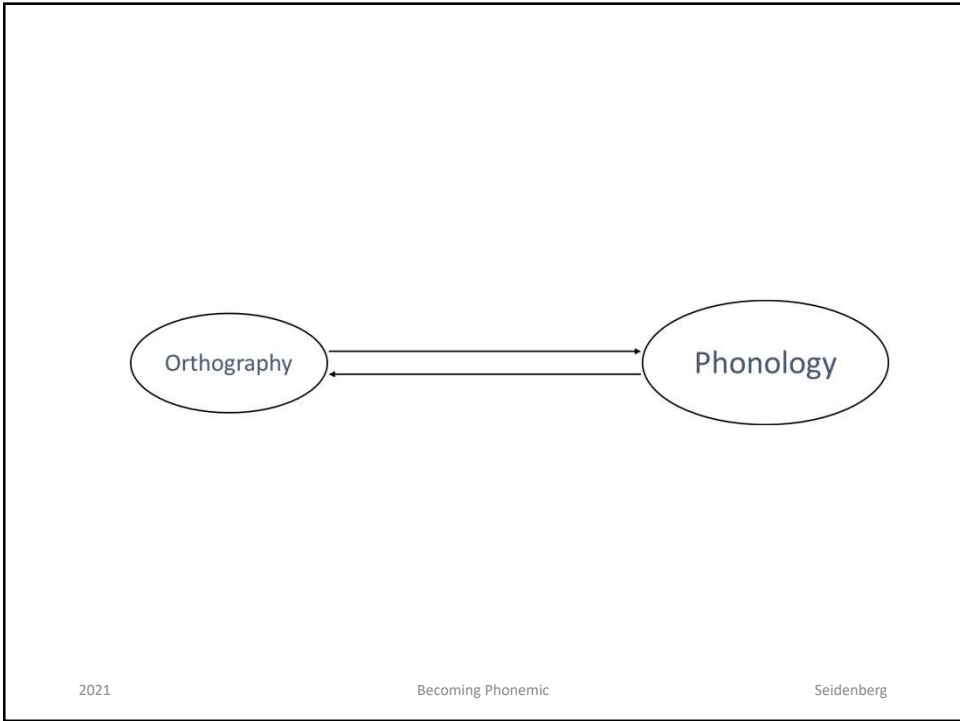


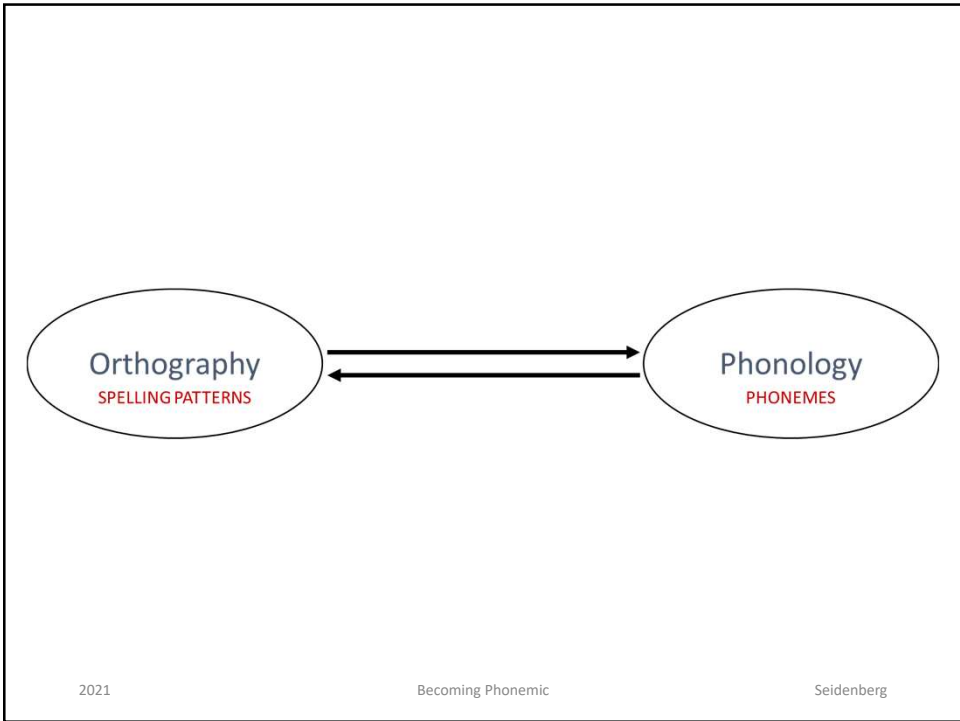
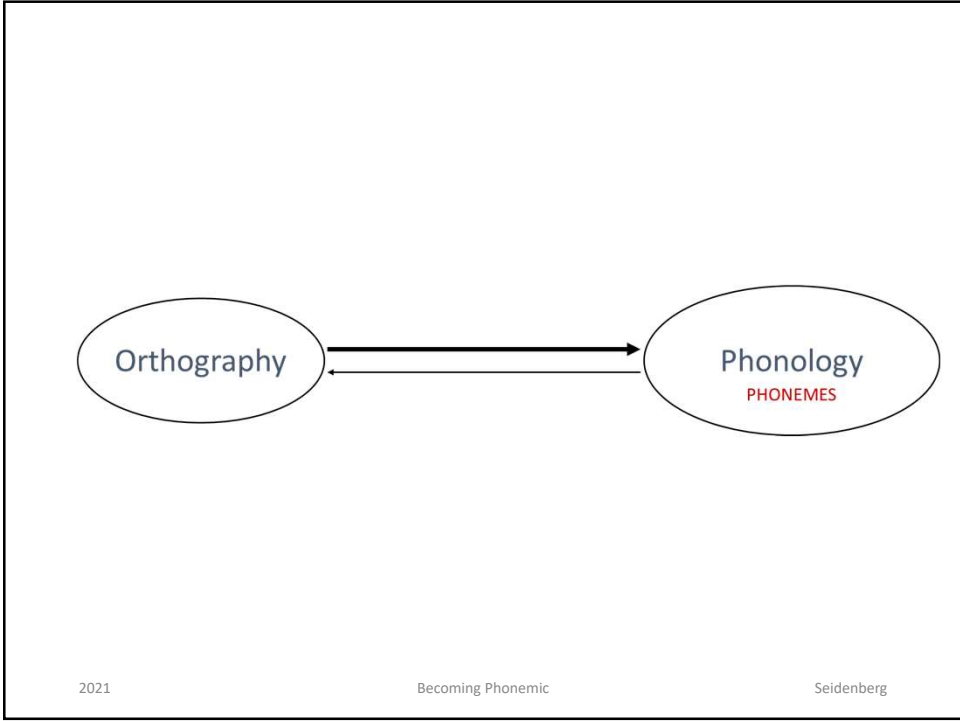
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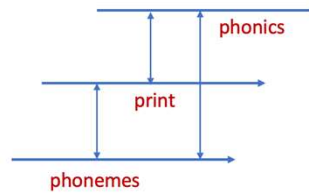
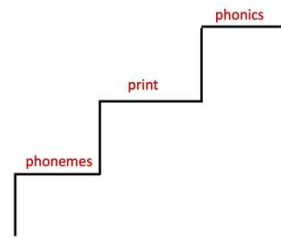






*Mark, remind us why this matters!*

Because this science has important implications for instruction.  
What to teach when.



No. Each of these depends on the others.

More like this.

To be effective, instruction must be congruent with basic facts about how reading and learning work.

*How do we know you're correct?*

We've already provided two types of evidence about the dependence of phonemic knowledge on exposure to alphabet. Illiterates, non-alphabet writing.

Here is more evidence that is closer to home. It's called

**Follow the Tasks.**

"Phonemic awareness" is assessed using several standard activities or "tasks". The tasks *differ in difficulty*, what the child needs to know to perform them.

Looking at *performance on these tasks* at different ages provides important evidence about how children become phonemic.

“Phonemic Awareness Tasks”

Isolation	Segmentation
Identity	Deletion
Categorization	Addition
Blending	Substitution

Very good discussion in “Put Reading First”, a summary of the NRP findings “designed by teachers for teachers.” (downloadable from our web site.)



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These are all called “phonemic awareness tasks”.

The name isn’t important.

What is the child asked to do?

What do they need to know?

How is the knowledge acquired?

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## Familiar PA tasks from “Put Reading First” (NRP for teachers)

### Phoneme isolation

Children recognize individual sounds in a word.

Teacher: What is the first sound in **van**?

Children: The first sound in **van** is /v/.

### Phoneme identity

Children recognize the same sounds in different words.

Teacher: What sound is the same in **fix**, **fall**, and **fun**?

Children: The first sound, /f/, is the same.

### Phoneme categorization

Children recognize the word in a set of three or four words that has the “odd” sound.

Teacher: Which word doesn't belong? **bus**, **bun**, **rug**.

Children: **Rug** does not belong. It doesn't begin with /b/.

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### Phoneme blending

Children listen to a sequence of separately spoken phonemes, and then combine the phonemes to form a word. Then they write and read the word.

Teacher: What word is /b/ /i/ /g/?

Children: /b/ /i/ /g/ is **big**.

Teacher: Now let's write the sounds in **big**: /b/, write **b**; /i/, write **i**; /g/, write **g**.

Teacher: (Writes **big** on the board.) Now we're going to read the word **big**.

### Phoneme segmentation

Children break a word into its separate sounds, saying each sound as they tap out or count it. Then they write and read the word.

Teacher: How many sounds are in **grab**?

Children: /g/ /r/ /a/ /b/. Four sounds.

Teacher: Now let's write the sounds in **grab**: /g/, write **g**; /r/, write **r**; /a/, write **a**; /b/, write **b**.

Teacher: (Writes **grab** on the board.) Now we're going to read the word **grab**.

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### Phoneme deletion

Children recognize the word that remains when a phoneme is removed from another word.

Teacher: What is **smile** without the /s/?

Children: **Smile** without the /s/ is **mile**.

### Phoneme addition

Children make a new word by adding a phoneme to an existing word.

Teacher: What word do you have if you add /s/ to the beginning of **park**?

Children: **Spark**.

### Phoneme substitution

Children substitute one phoneme for another to make a new word.

Teacher: The word is **bug**. Change /g/ to /n/. What's the new word?

Children: **Bun**.

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### Three levels of difficulty

Isolation  
Identity  
Categorization

Simplest.  
Need labels for sounds like  
/f/ in fix, fall, fun.  
No further operations.

Segmentation  
Blending

More difficult.  
**Decompose** spoken word into segments.  
**Combine** segments to form spoken word.

Deletion  
Addition  
Substitution

Most difficult.  
Identify segments AND remove one  
Identify segments AND add one  
Identify segments AND remove one AND replace it

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At what ages do children typically learn to perform these tasks?  
Moats and Tolman, LETRS:

Isolation  
Identity  
Categorization

Ages 5-5½

With learning letters  
and associated sounds

Segmentation  
Blending

Ages 6-9

After onset of reading instruction.  
Spelling, phonics. Activities that  
combine spelling, sound.

Deletion  
Addition  
Substitution

All of these tasks are influenced by exposure to print, to differing degrees.  
Tasks involving segmentation depend on actual spelling.

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6	Blending of two and three phonemes	/z/ /ū/ ( <b>zoo</b> ) /sh/ /ō/ /p/ ( <b>shop</b> ) /h/ /ou/ /s/ ( <b>house</b> )
	Phoneme segmentation of words that have simple syllables with two or three phonemes (no blends)	"Say the word as you move a chip for each sound." <b>sh-e</b> <b>m-a-n</b> <b>l-e-g</b>
6½	Phoneme segmentation of words that have up to three or four phonemes (include blends)	"Say the word slowly while you tap the sounds." <b>b-a-ck</b> <b>ch-ee-se</b> <b>c-l-ou-d</b>
	Phoneme substitution to build new words that have simple syllables (no blends)	"Change the /j/ in <b>cake</b> to /n/. Change the /ā/ in <b>cane</b> to /ō/."
7	Sound deletion (initial and final positions)	"Say <b>meat</b> . Say it again, without the /m/. "Say <b>safe</b> . Say it again, without the /f/."
8	Sound deletion (initial position, include blends)	"Say <b>prank</b> . Say it again, without the /p/."
9	Sound deletion (medial and final blend positions)	"Say <b>snail</b> . Say it again, without the /n/. "Say <b>fork</b> . Say it again, without the /k/."

Look at how late these tasks are typically learned.

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The NRP authors recognized that segmentation depends on coupling print and sound:

### Phoneme blending

Children listen to a sequence of separately spoken phonemes, and then combine the phonemes to form a word. Then they write and read the word.

Teacher: What word is /b/ /i/ /g/?

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Teacher: (Writes **grab** on the board.) Now we're going to read the word **grab**.

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### Phoneme substitution

Children substitute one phoneme for another to make a new word.

Teacher: The word is **bug**. Change /g/ to /n/. What's the new word?

Children: **Bun**.

They don't mention spelling here. But performance is highly dependent on knowledge of spelling.

Children can perform these tasks if they **have already had** instruction coupling print and sound.

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**Phonemic awareness instruction is most effective when children are taught to manipulate phonemes by using the letters of the alphabet.**

Phonemic awareness instruction makes a stronger contribution to the improvement of reading and spelling when children are taught to use letters as they manipulate phonemes than when instruction is limited to phonemes alone. Teaching sounds along with the letters of the alphabet is important because it helps children to see how phonemic awareness relates to their reading and writing. Learning to blend phonemes with letters helps children read words. Learning to segment sounds with letters helps them spell words.

If children do not know letter names and shapes, they need to be taught them along with phonemic awareness.

Relating sounds to letters is, of course, the heart of phonics instruction, which is the subject of the next section of this booklet.

Conclusion? “Phonemic awareness” tasks are not alike.

Infants can perform simplest ones such as detecting that “bin” and “din” start with different sounds. Aslin, Swingley.

**The harder ones involve segmentation: treating words as consisting of discrete sounds.**

This is the type of “phoneme awareness” relevant to reading.

Here, performance depends heavily on knowledge of print.

Children gain proficiency while learning about print.

The conclusion that the development of segments—the level of “phonemic awareness” relevant to reading an alphabet—depends on and develops with knowledge of print follows from a large body of compelling research.

It’s not new. But, it’s also not well known.

1. Reviews
2. Experiments: behavioral, neuroimaging
3. Intervention/training studies
4. Correlational studies
5. Computational and quantitative models

Here are [some](#) examples. References, other sources posted.

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## HOW PSYCHOLOGICAL SCIENCE INFORMS THE TEACHING OF READING

Keith Rayner,<sup>1</sup> Barbara R. Foorman,<sup>2</sup> Charles A. Perfetti,<sup>3</sup> David Pesetsky,<sup>4</sup>  
and Mark S. Seidenberg<sup>5</sup>

2001

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: Although they have begun to discover aspects of the internal structure of spoken words, they typically have not converged on explicit representations of phonemic segments. These partially structured phonological representations are sufficient to support the use of spoken language. Exposure to orthography and explicit instruction in the mappings between spelling and sound lead to further refinement of children’s phonological representations, in the direction of more explicit representations of segments and other units such as onsets and rimes. Learning to spell also contributes to this process (Shankweiler & Lundquist, 1992). These refinements in turn facilitate further development of reading skill.

A review article with about 150 references.

These observations suggest that the child’s development of phonemic representations is more closely tied to reading than to speech. No child ready to read has trouble hearing that *bad* and *pad* are different forms with different meanings. Making such distinctions does not require the use of phonemes; they can be based on acoustic phonetic information (such as the difference in voice onset time, the lag between the release of the consonant and the onset of the vowel, that differentiates /b/ from /p/) to which even infants are sensitive, or on the basis of whole syllabic representations. In fact relatively few preschool children demonstrate an awareness of phonemes despite showing awareness of syllables (I.Y. Liberman, Shankweiler, Fischer, & Carter, 1974). The alphabetic writing system both builds upon and facilitates the development of phonemic representations. It is in keeping with the alphabetic principle that a single letter *d*, for example, is used to represent the category of sounds called the phoneme /d/. Thus, the alphabetic principle was a unique discovery in the evolution of writing systems (Gelb, 1952), and it is a discovery not made by all children on their own.

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Gail Gillon (2008) summary of principles governing instruction for 5-7 year olds

1. Phonological awareness training should focus on the development of skills at the phoneme level (Brady, Fowler, Stone, Winbury, 1994; Brennan & Ireson, 1997; Cary & Verhaeghe, 1994; Lundberg, Frost, & Petersen, 1988; Yopp, 1988).
2. Phonological awareness activities should be integrated with letter sound knowledge training (Cunningham, 1990; Hatcher, Hulme, & Ellis, 1994).
3. A range of phoneme analysis and synthesis activities should be incorporated with particular attention given to phoneme segmentation skills (Ayres, 1995; O'Connor, Jenkins, Leicester, & Slocum, 1993; Schneider Kuspert, Roth, & Vise, 1997; Torgesen, Morgan, & Davis, 1992).
4. The integration of letter sound knowledge with phonological awareness activities should include manipulative materials and should engage the children in reflecting upon the phonological awareness task (Alexander, Andersen, Heilman, Voeller, & Torgesen, 1991; Clarke-Klein, 1994; Cunningham, 1990; Defrrior & Tudela, 1994; Gillon & Dodd, 1995, 1997; Truch, 1994).
5. Flexibility in programme implementation is required (Brady et al., 1994).
6. A direct approach to phonological awareness training has greater benefits for literacy development than an indirect approach (Ayres, 1995).
7. An intensive individual or small group model of service delivery is necessary for children with severe deficits (Brady et al., 1994; Byrne & Fielding-Barnsley, 1995; Torgesen, Wagner, & Rashotte, 1994).

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CURRENT DIRECTIONS IN PSYCHOLOGICAL SCIENCE

2005

## Development of Phonological Awareness

Jason L. Anthony<sup>1</sup> and David J. Francis<sup>2</sup>

### WRITTEN-LANGUAGE EFFECTS ON PHONOLOGICAL AWARENESS DEVELOPMENT

Children's experiences with written language dramatically influence phonological awareness development, especially the development of phoneme awareness. Most children achieve minimal levels of phoneme awareness prior to literacy instruction. Learning the names of letters and the sounds they represent provides a concrete way to attend to phonemes, given that phonemes do not have physical reality independent of each other. That is, phonemes produced in speech are acoustically inseparable because adjacent phonemes are coarticulated.

Phonological awareness typically develops quickly once literacy instruction begins. This is especially true for children

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## Ending the Reading Wars: Reading Acquisition From Novice to Expert

Anne Castles<sup>1,2</sup>, Kathleen Rastle<sup>3</sup>, and Kate Nation<sup>2,4</sup>

<sup>1</sup>Department of Cognitive Science, Macquarie University; <sup>2</sup>Australian Research Council Centre of Excellence in Cognition and its Disorders; <sup>3</sup>Department of Psychology, Royal Holloway, University of London; and <sup>4</sup>Department of Experimental Psychology, University of Oxford

Hulme, 2012). This group proposed that to crack the alphabetic code, children must be able to abstract the relevant phonemic units from the stream of the speech they hear. This is a nontrivial task, because the segmentation of an acoustic signal does not correspond in any straightforward way with segmentation at the phoneme level: In continuous speech, phonemes overlap and run together. A large body of research is also consistent with Byrne et al.'s second finding—that acquiring the alphabetic principle requires children to learn the visual symbols of the writing system that correspond to phonemes. An intimate and reciprocal association exists among children's letter knowledge, their phonemic awareness, and their skill in alphabetic decoding (see, e.g., Castles & Coltheart, 2004; Castles, Coltheart, Wilson, Valpied, & Wedgwood, 2009; Hulme, Bowyer-Crane, Carroll, Duff, & Snowling, 2012).

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THE QUARTERLY JOURNAL OF EXPERIMENTAL PSYCHOLOGY, 2003, 56A(3), 445–467

2003

### How does orthographic knowledge influence performance on phonological awareness tasks?

Anne Castles

*University of Melbourne, Australia, and Macquarie Centre for Cognitive Science, Sydney, Australia*

V. M. Holmes and Joanna Neath

*University of Melbourne, Australia*

Sachiko Kinoshita

*Macquarie Centre for Cognitive Science, Sydney, Australia*

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Wonderful Landerl, Wimmer, Frith (1997) study.

8 year old good readers.

Phoneme deletion task

Say "crab" without the "b"

Say "tub" without the "t"

Say "lamb" without the "m"    people often say "lab"

Say "sword" without the "s"    people often say "word"



"Take Away The A", M. Escoffier

Children who are better readers/spellers make more of these errors.  
Because phonemes are intertwined with spelling.

Studies of brain structure, function

## How Does Learning to Read Affect Speech Perception?

Chotiga Pattamadilok,<sup>1</sup> Iris N. Knierim,<sup>2</sup> Keith J. Kawabata Duncan,<sup>3</sup> and Joseph T. Devlin<sup>3</sup>

<sup>1</sup>Unité de Recherche en Neurosciences Cognitives, Université Libre de Bruxelles, B-1050 Brussels, Belgium, <sup>2</sup>Max Planck Institute for Human Cognitive and Brain Sciences, Research Group "Neurocognition of Rhythm in Communication," 1A 04103 Leipzig, Germany, and <sup>3</sup>Cognitive, Perceptual and Brain Sciences and Institute of Cognitive Neuroscience, University College London, London WC1E 6BT, United Kingdom

Knowledge of spelling changes neural representation of spoken language.

## Reading Differences and Brain: Cortical Integration of Speech and Print in Sentence Processing Varies With Reader Skill

Donald Shankweiler  
*Haskins Laboratories*  
*Department of Psychology*  
*University of Connecticut*

Shankweiler et al., *Developmental Neuropsychology*, 2008

Integration of print and speech is greater for more skilled readers

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OK, Mark, so remind us why you're explaining all of this?

If the research is so obvious why are we repeating it?

1. Popular curricula and practices based on "the science of reading"  
are not consistent with this body of work.

Poor translation of research to practice.

Need to stop. Examine validity. Develop alternatives.

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2. Discussions of the “science of reading” on social media are not informed by this body of work. People are improvising new answers to questions that have **already been answered.**

Should phonemic awareness be taught as a prerequisite or in conjunction with phonics?

Should I move a student on in learning letters, phonics practice etc... Even if their Phonemic Awareness is low?

Meaning should I do a 2-3 minute PA activity first and continue with my phonics lesson or spend all my group time on PA? My school has Heggerty that is used in k-1 classrooms.

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?

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3. People have complained for a long time that educational theories, practices, and curricula have failed to incorporate highly relevant research on reading, language, development, and learning.

**It's still a problem.**

The version of the “science of reading” that's popular on social media and among major interest groups is not adequate.

**We need to do better.**

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Next time: Let's look at learning.

How do children acquire knowledge relevant to reading?

What is the role of explicit instruction?

What about implicit "statistical" learning?

What activities promote interactive learning? Bootstrapping?

What to teach, when, how much?

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Bye for now.



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MEETINGS**

with Mark and Molly  
Conversations Bridging



Made possible by support from the  
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