

How does the Brain Solve the Problem of Reading?

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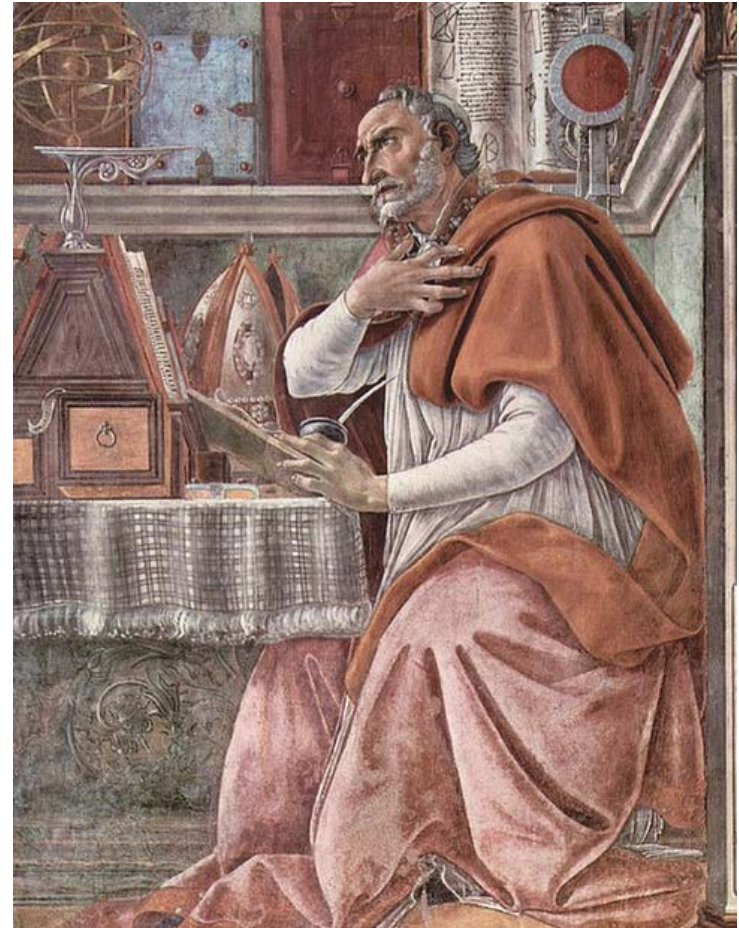


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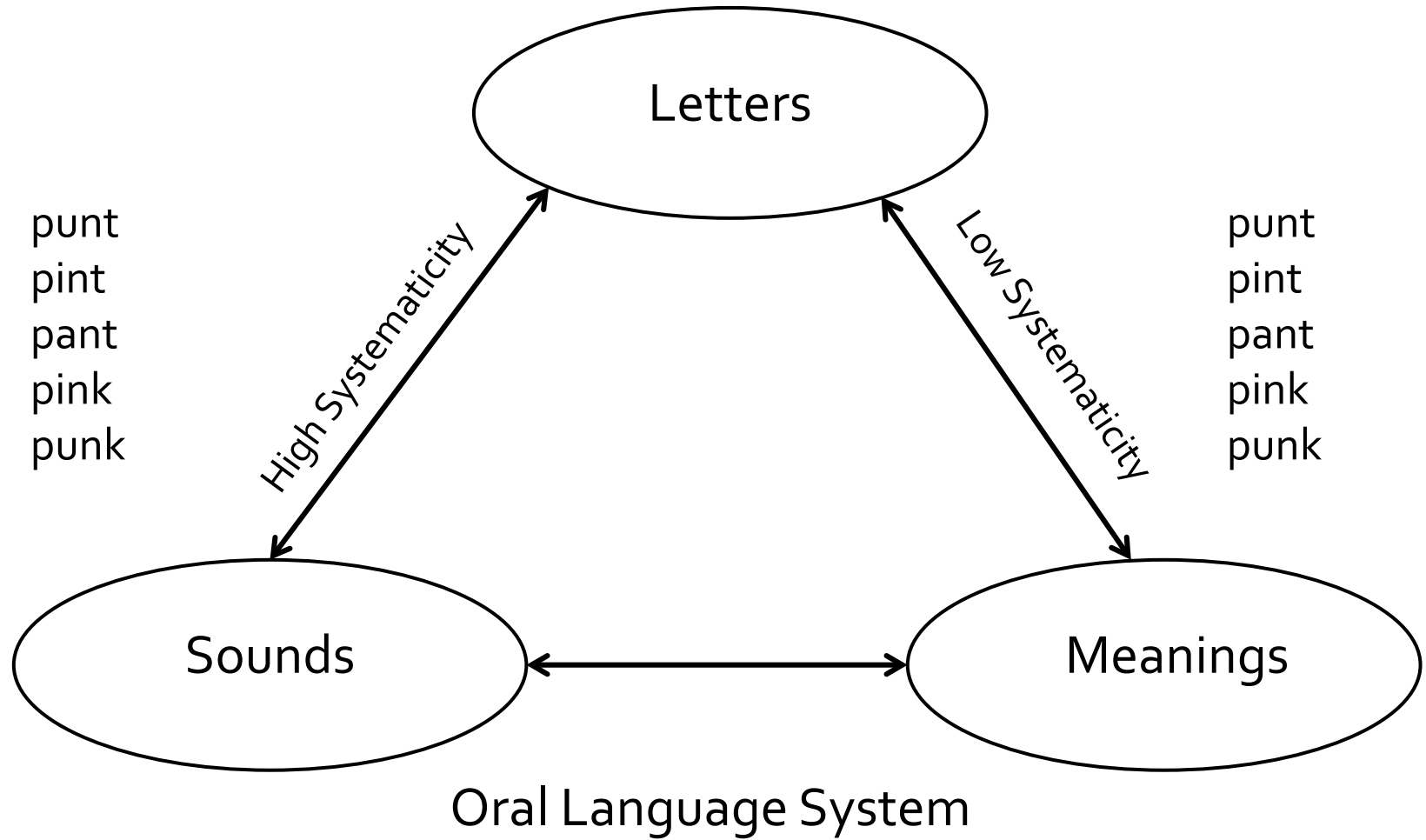


We are not *Meant* to Read

- Unlike spoken language, reading is a cultural invention and a learned skill.
- Evidence for silent reading in antiquity, but reading became an activity enjoyed by the mass public only in the 1800s.
- We are not born with dedicated neural hardware to support reading.
- Immersed in a library of books, a child will not learn to read; reading requires ~10 years of dedication, instruction, and practice.



The Challenge of Reading



The Challenge of Reading



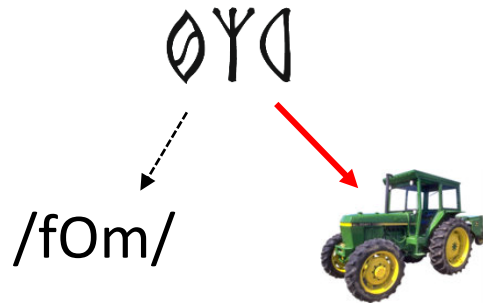
Cracking the Alphabetic Code - Phonics

- Mastery of the alphabetic principle critical for reading development
- Very strong scientific consensus that methods that teach this principle explicitly are most effective
- English spelling-sound relations can be described with a simple set of rules; irregular words rarely deviate by more than one letter-sound combination
- Focus on sounds *enables* access to meaning; it does not discourage it

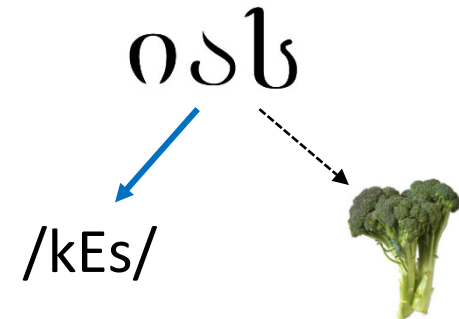


Simulating the Effectiveness of Phonics

Meaning Emphasis

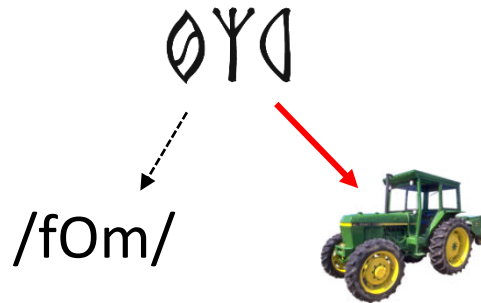


Phonics Emphasis

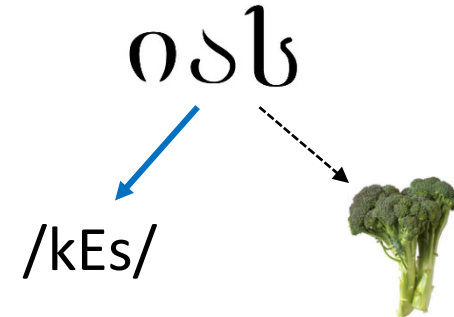


Simulating the Effectiveness of Phonics

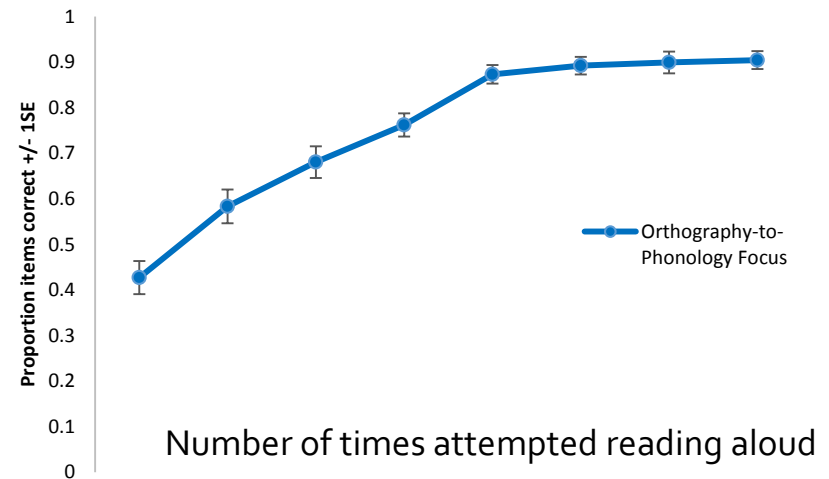
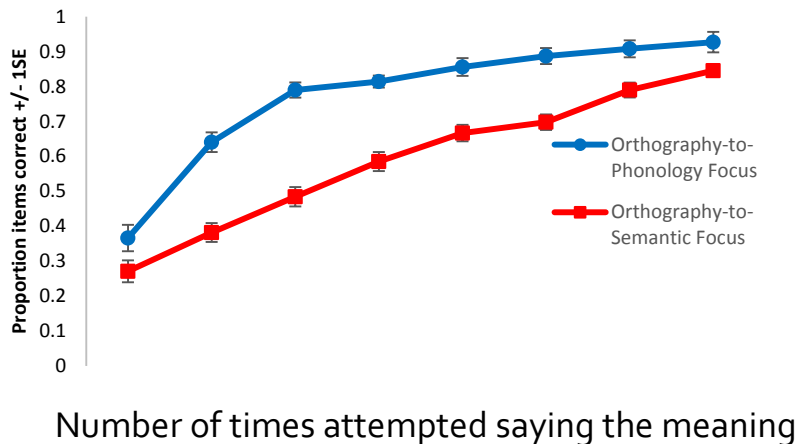
Meaning Emphasis



Phonics Emphasis

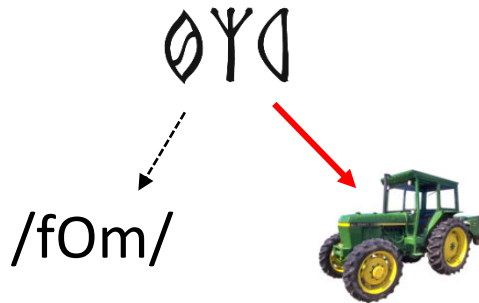


Phonics training helps comprehension

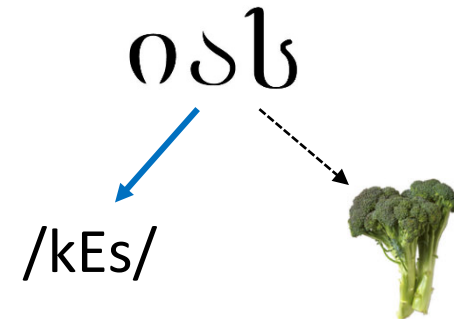


Simulating the Effectiveness of Phonics

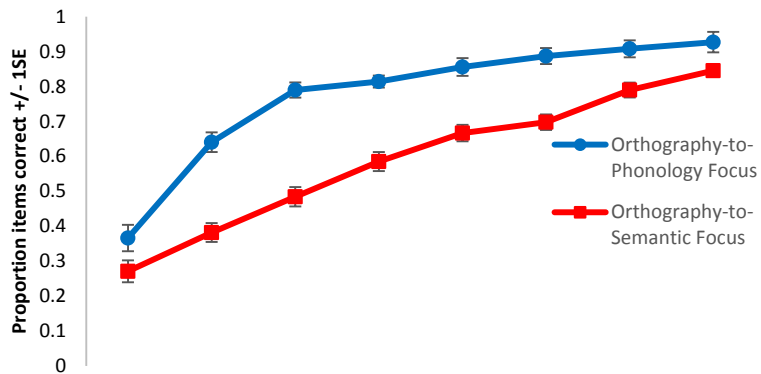
Meaning Emphasis



Phonics Emphasis

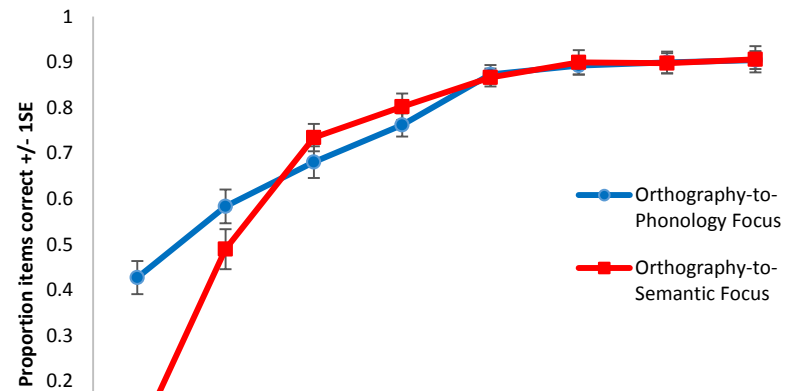


Phonics training helps comprehension



Number of times attempted saying the meaning

Meaning training does not help reading aloud



Number of times attempted reading aloud

Phonic Knowledge is Central to *Skilled* Reading

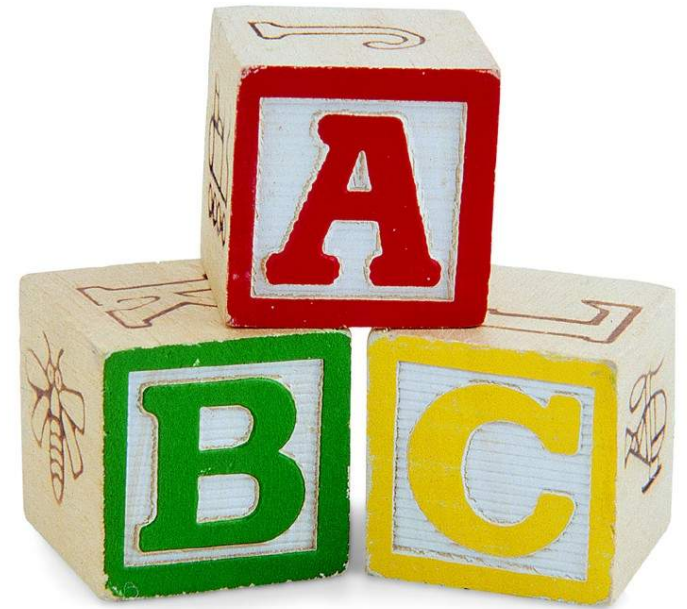


Phonic Knowledge is Central to Skilled Reading

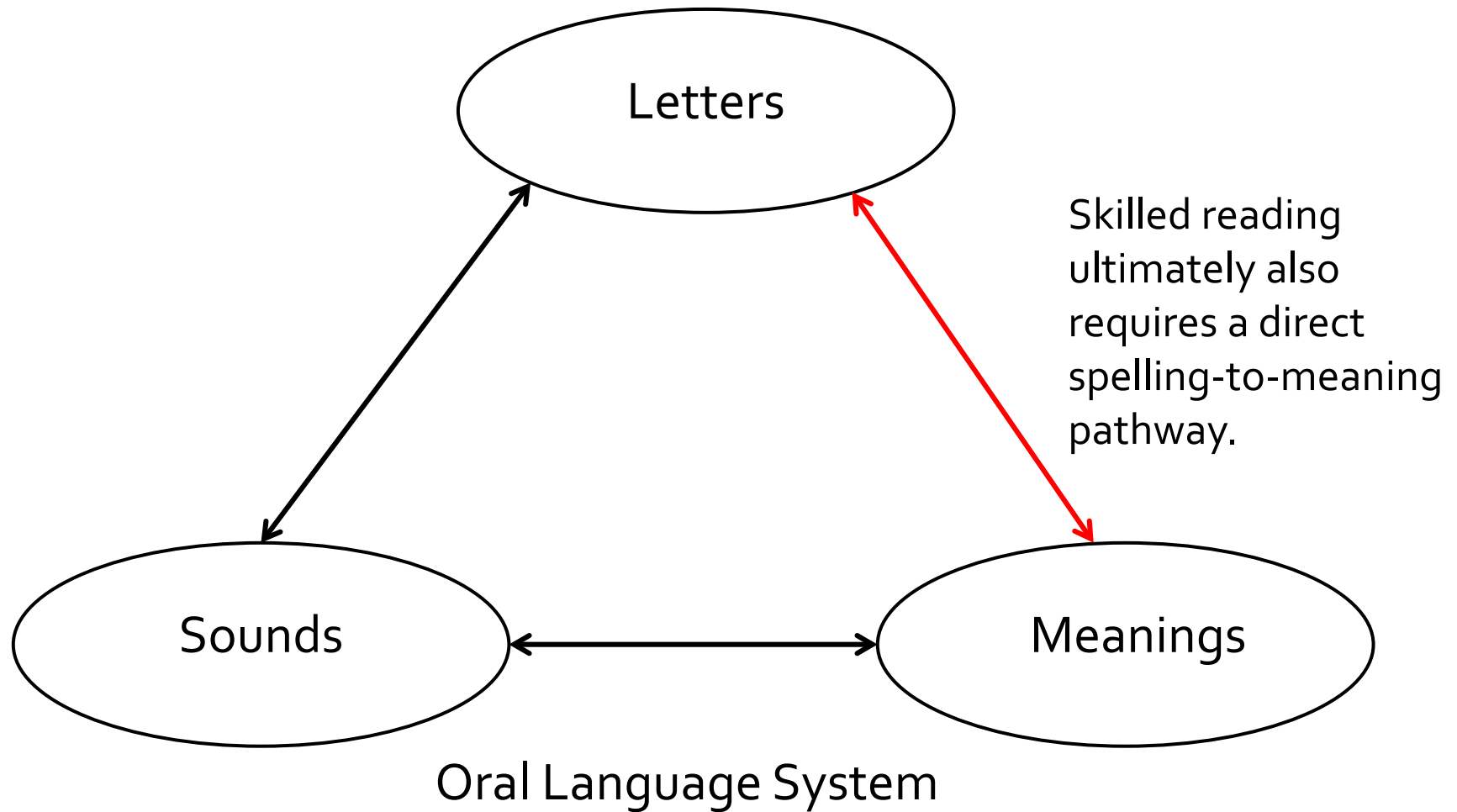


Phonic Knowledge is Central to Skilled Reading

- Skilled readers translate printed words (and nonwords) to sound-based codes as a matter of routine.
- This computation is rapid, and can arise before a reader is even conscious of the stimulus (or when the stimulus is in the visual periphery during text reading).
- Even for skilled readers, using phonic knowledge is necessary for rapid computation of meaning.

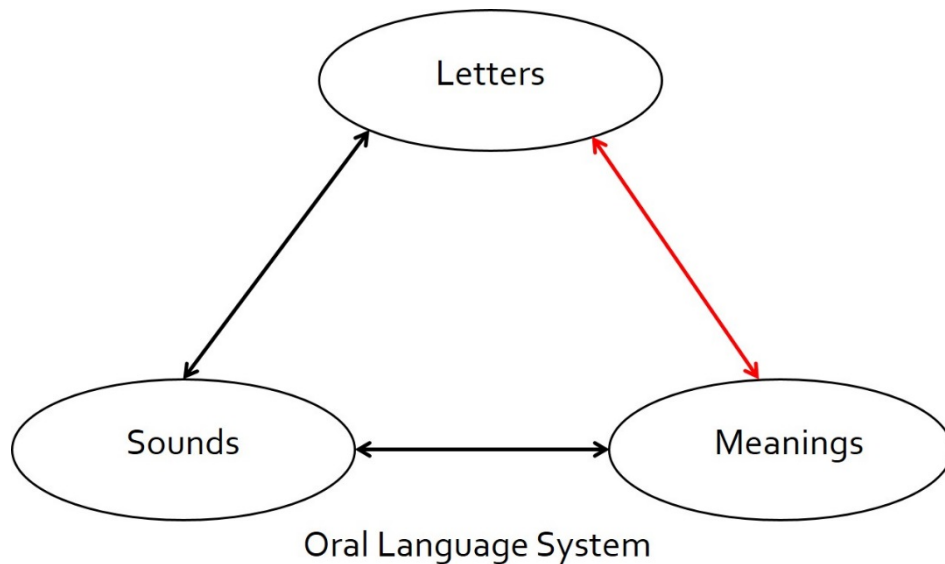


Learning the Spelling-Meaning Mapping



Learning the Spelling-Meaning Mapping

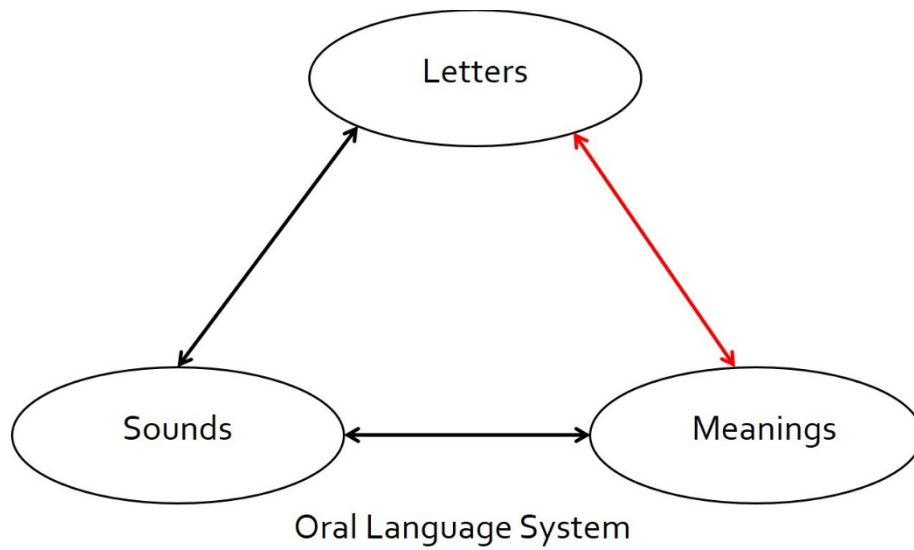
Morphology provides systematicity in the letter-to-meaning mapping



<u>clean</u>	<u>redo</u>
<u>unclean</u>	<u>repaint</u>
<u>cleaner</u>	<u>rewire</u>
<u>cleanliness</u>	<u>remake</u>
<u>cleanly</u>	<u>reheat</u>
<u>preclean</u>	<u>reprint</u>
<u>cleaning</u>	<u>recreate</u>
<u>reclean</u>	<u>reuse</u>

magician, health, two

Learning the Spelling-Meaning Mapping

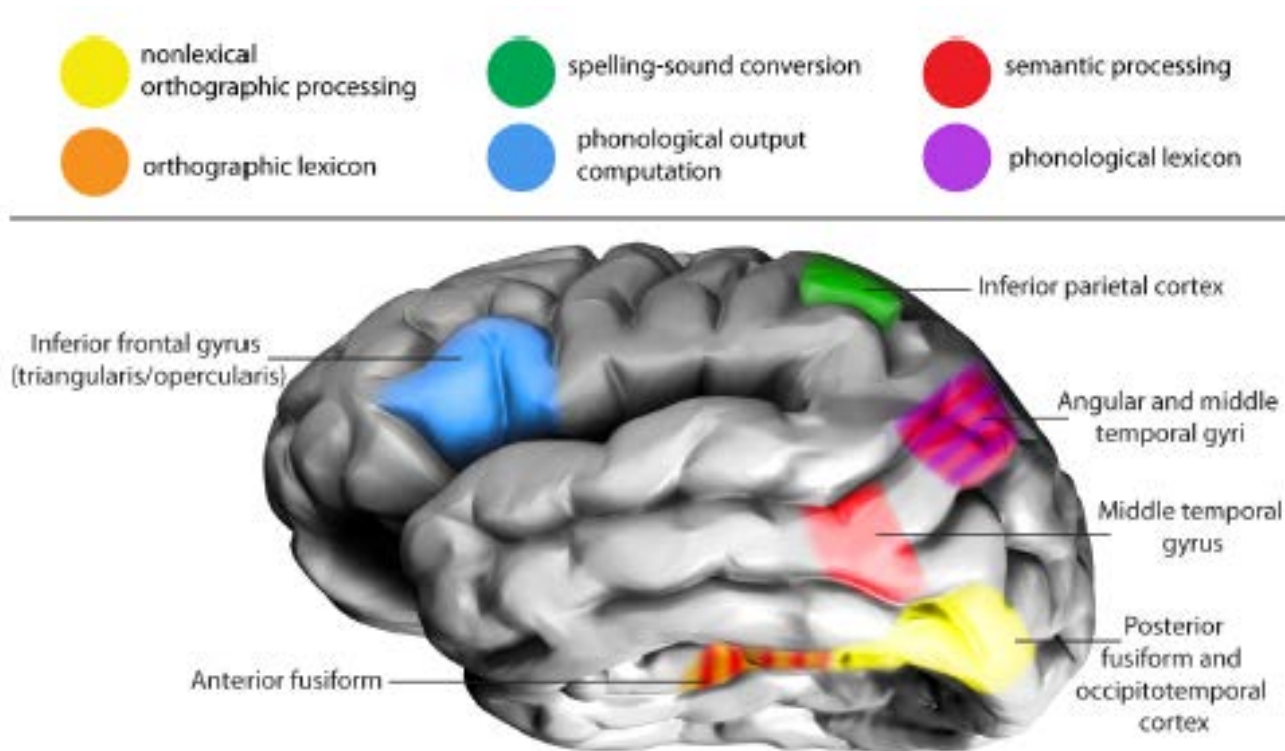


- Skilled readers segment printed words into their morphemes
- This segmentation is rapid, arising before conscious awareness (or when the stimulus is in the visual periphery in text reading).
- No evidence that English readers up to the age of 10 show this rapid segmentation.



*"Actually, I'm not even a real
Modo. I'm only a Quasimodo."*

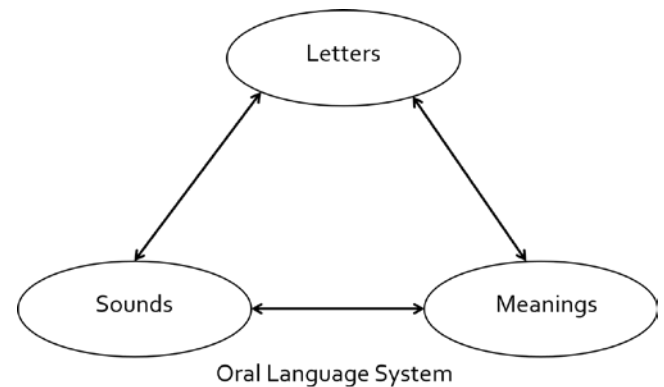
Pathways to Reading in the Brain



- Meta-analysis of 36 neuroimaging studies
- Dorsal (letters-to-sounds) and ventral (letters-to-meanings) pathways
- Evidence that ventral pathway still developing into early adolescence

A Word on Interventions and Treatments

- RCTs aren't always available, and it is challenging for non-experts to evaluate the evidence.
- But reading is simple.
- It should be clear what aspect of the reading system an intervention is affecting.
- If it is not clear, or if complicated language is used to mask the lack of clarity, then that should raise questions; proximal and distal causes.
- e.g. intensive phonics training, intensive balance and coordination exercises, intensive speech and language therapy, playing action video games, wearing coloured glasses ??



Summary

- Reading is a recent invention and a learned skill.
- The brain capitalises on systematicity that exists in the writing system – e.g. phonological and morphological.
- Strong scientific consensus around importance of phonic knowledge in reading acquisition.
- Reading system still developing well into secondary education.
- Interventions should 'make sense' in terms of the theory of reading proposed.

**I'm so smart
because I read!**



Questions?

"The more that you read, the more things you will know. The more that you learn, the more places you'll go." Dr Seuss

