Psychology of Language

21 Acquired dyslexia

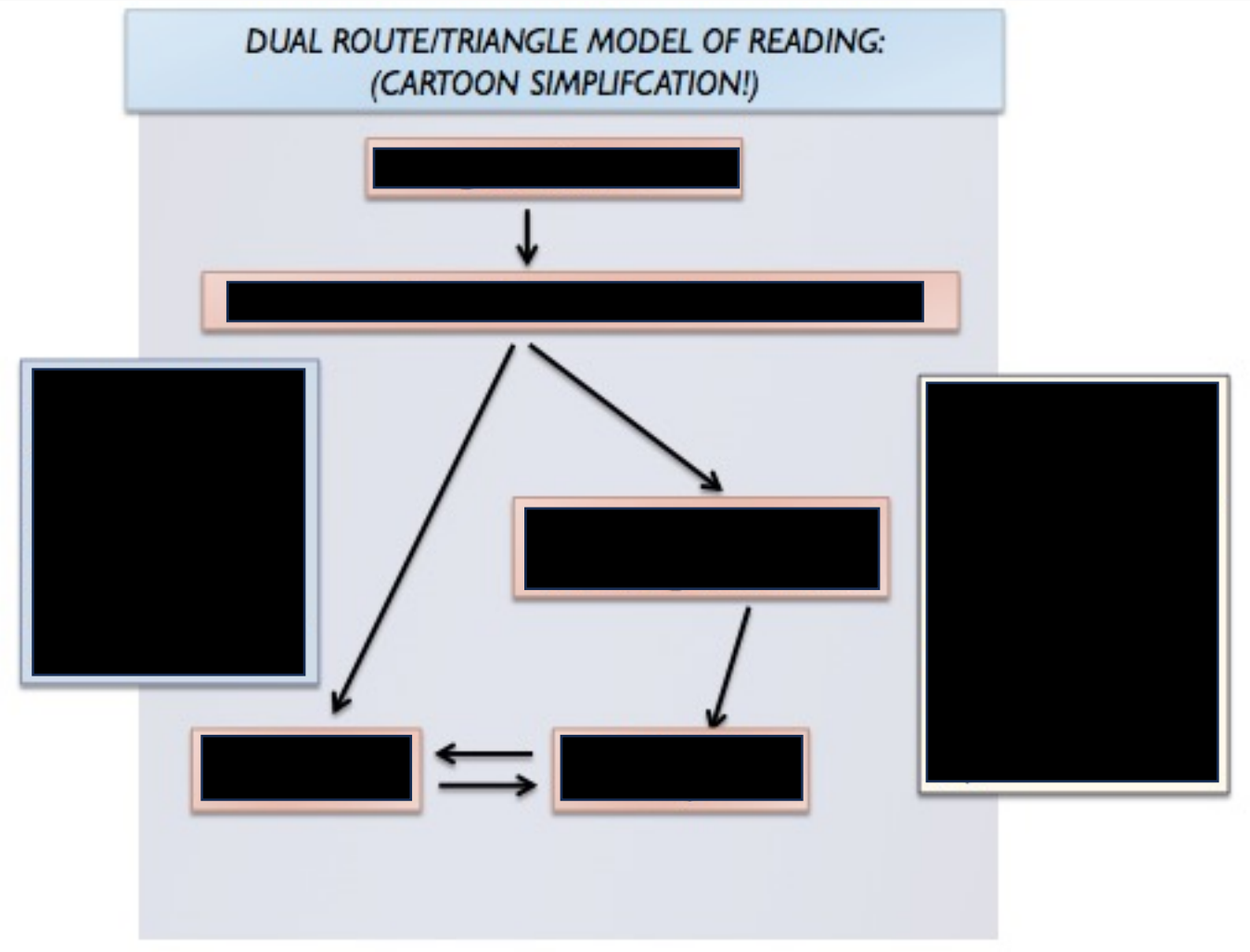
Fall 2023
Tues/Thur 5:00-6:15pm

Emma Wing
Drop-in hours:
Wednesdays 3-4pm
& by appointment
Webex link

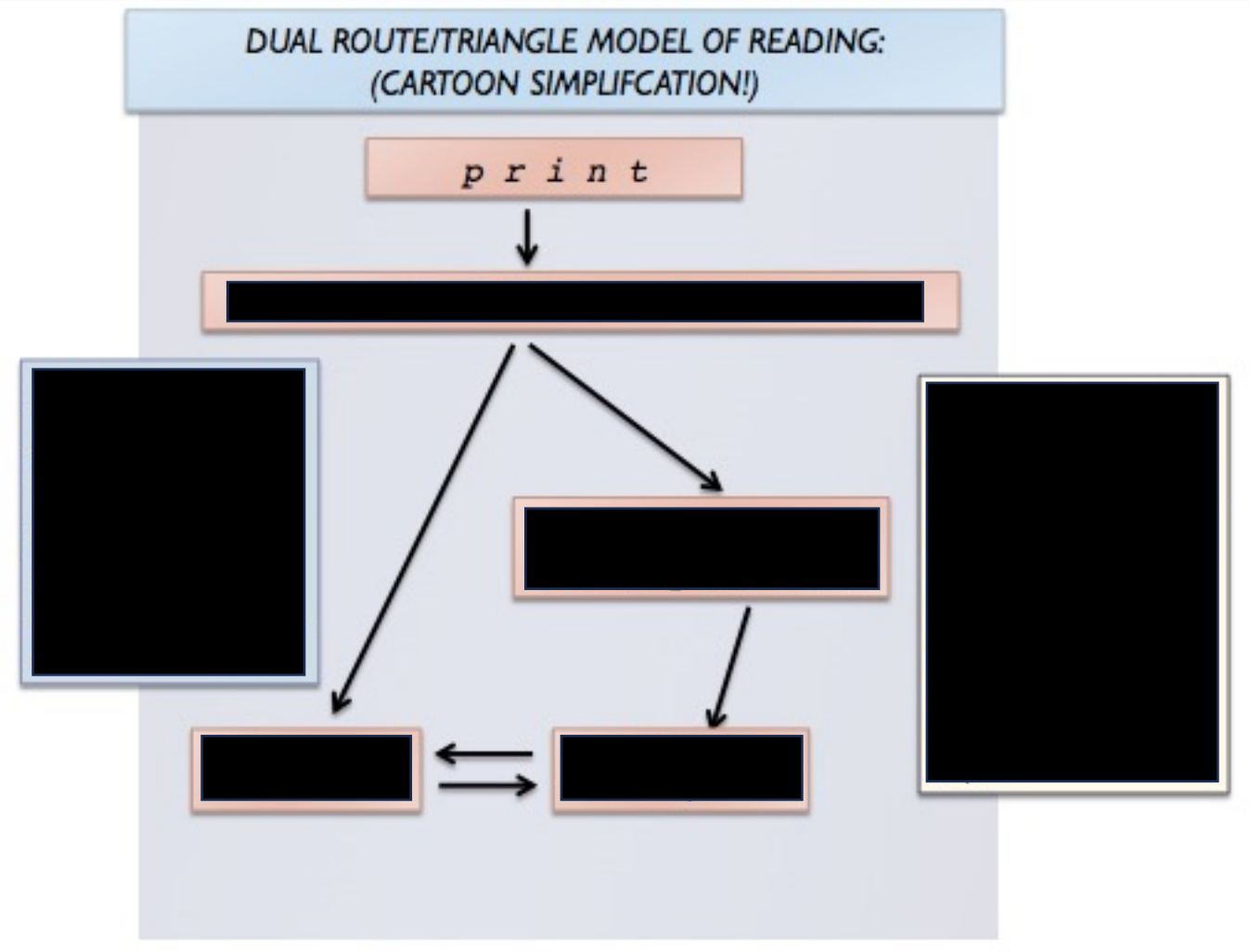
Road map

- Unit 3: Language, Brain, & Diversity
  - 20 Reading (review)
  - 21 Acquired dyslexia

Pure alexia & the dual-route model



Pure alexia & the dual-route model



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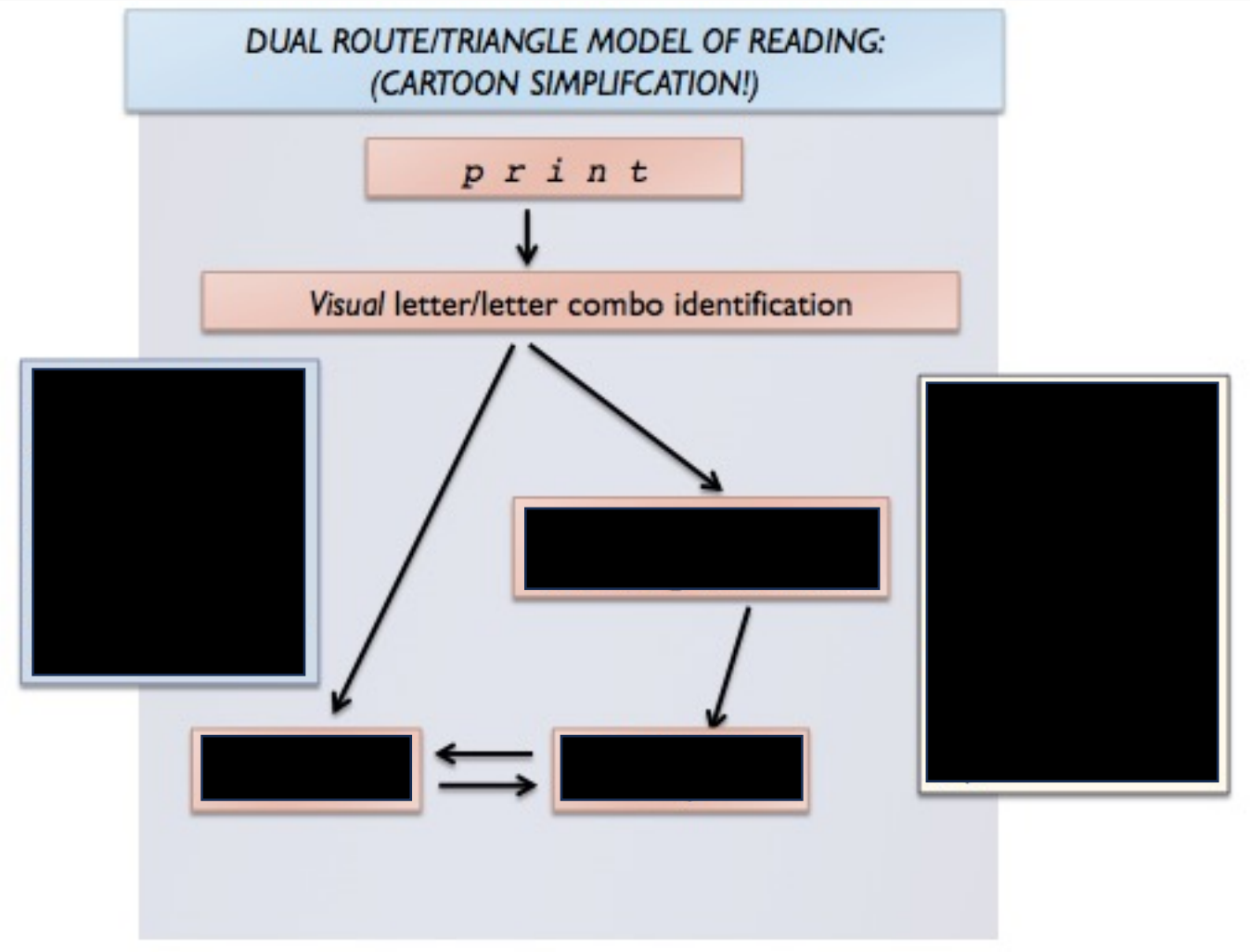

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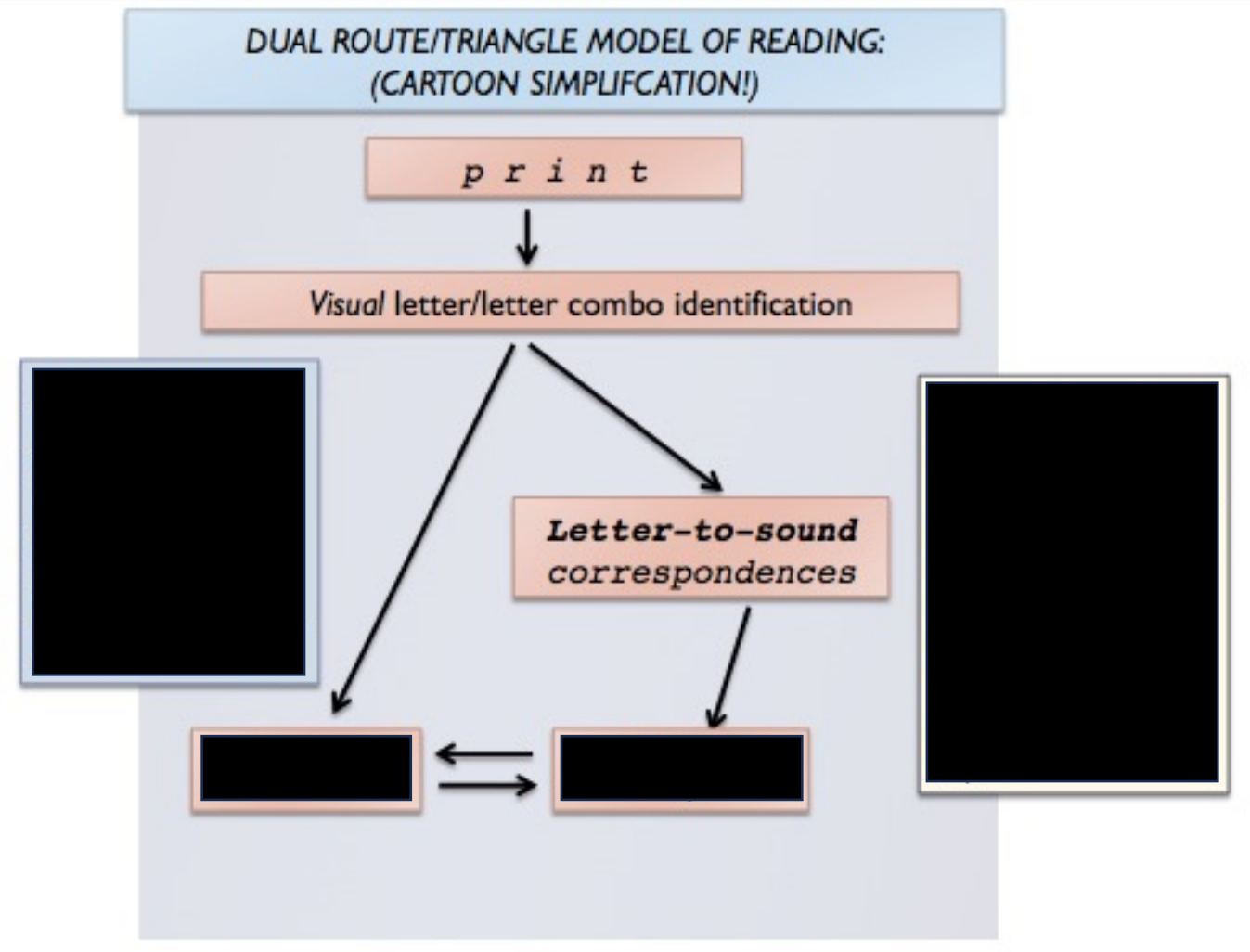

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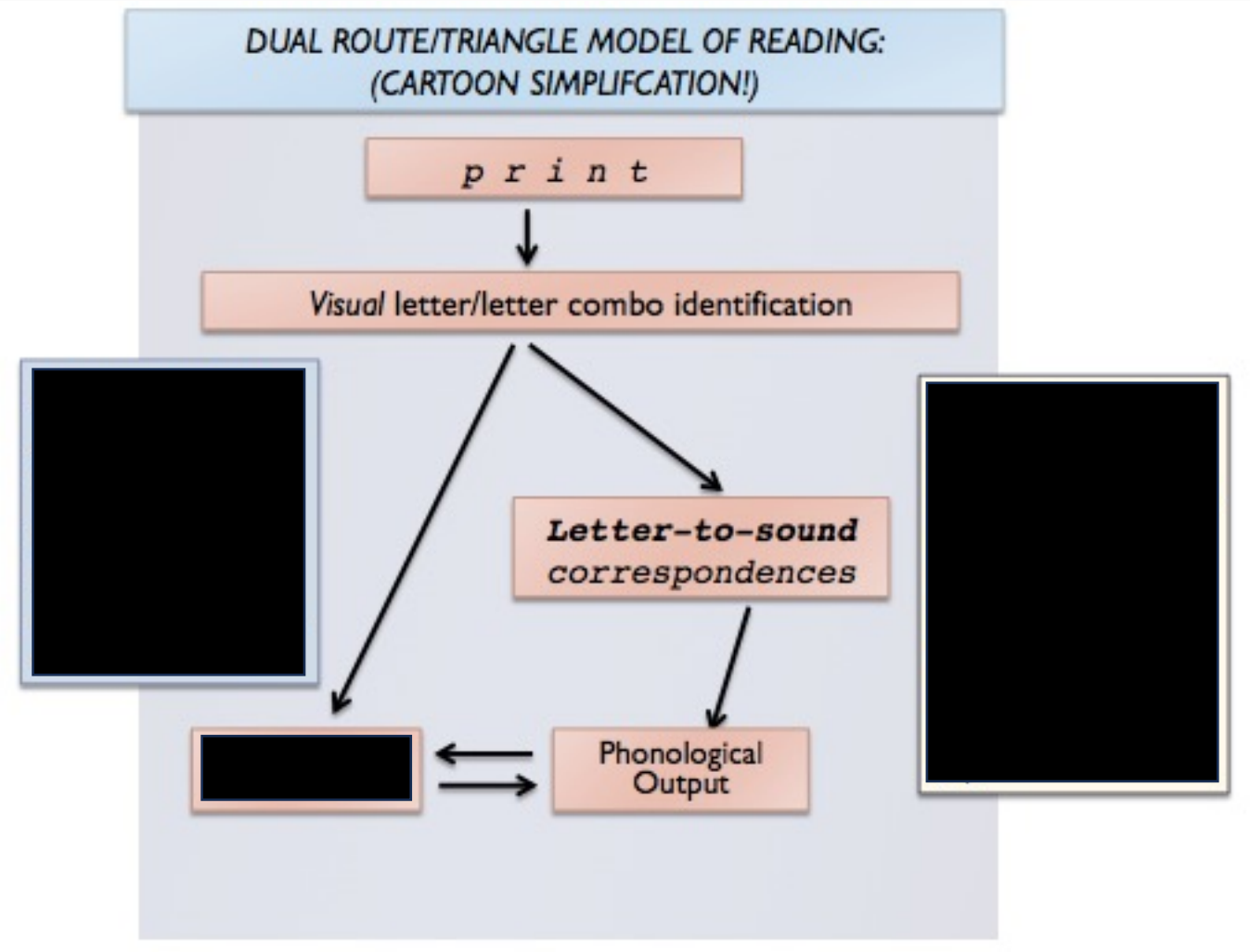

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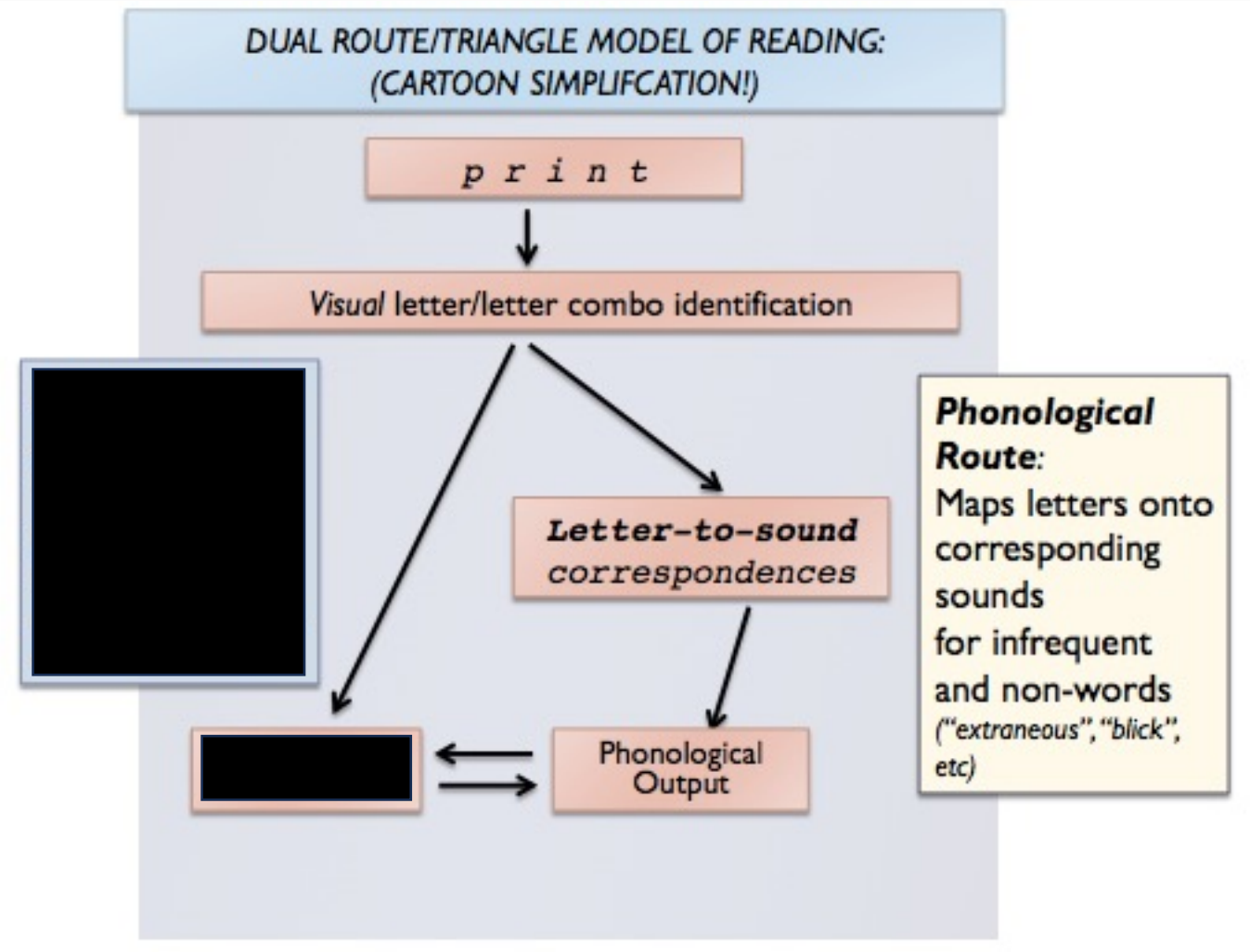

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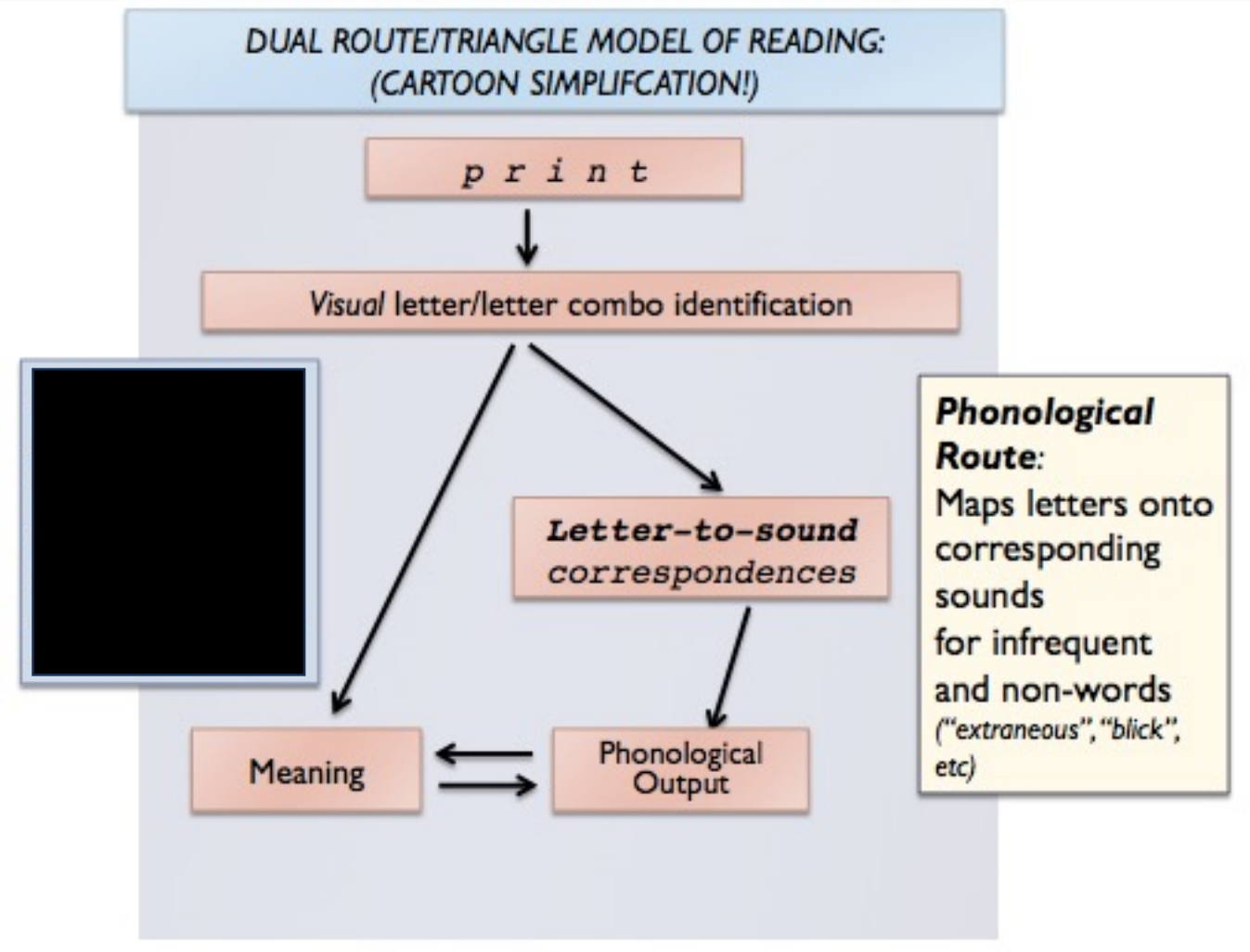

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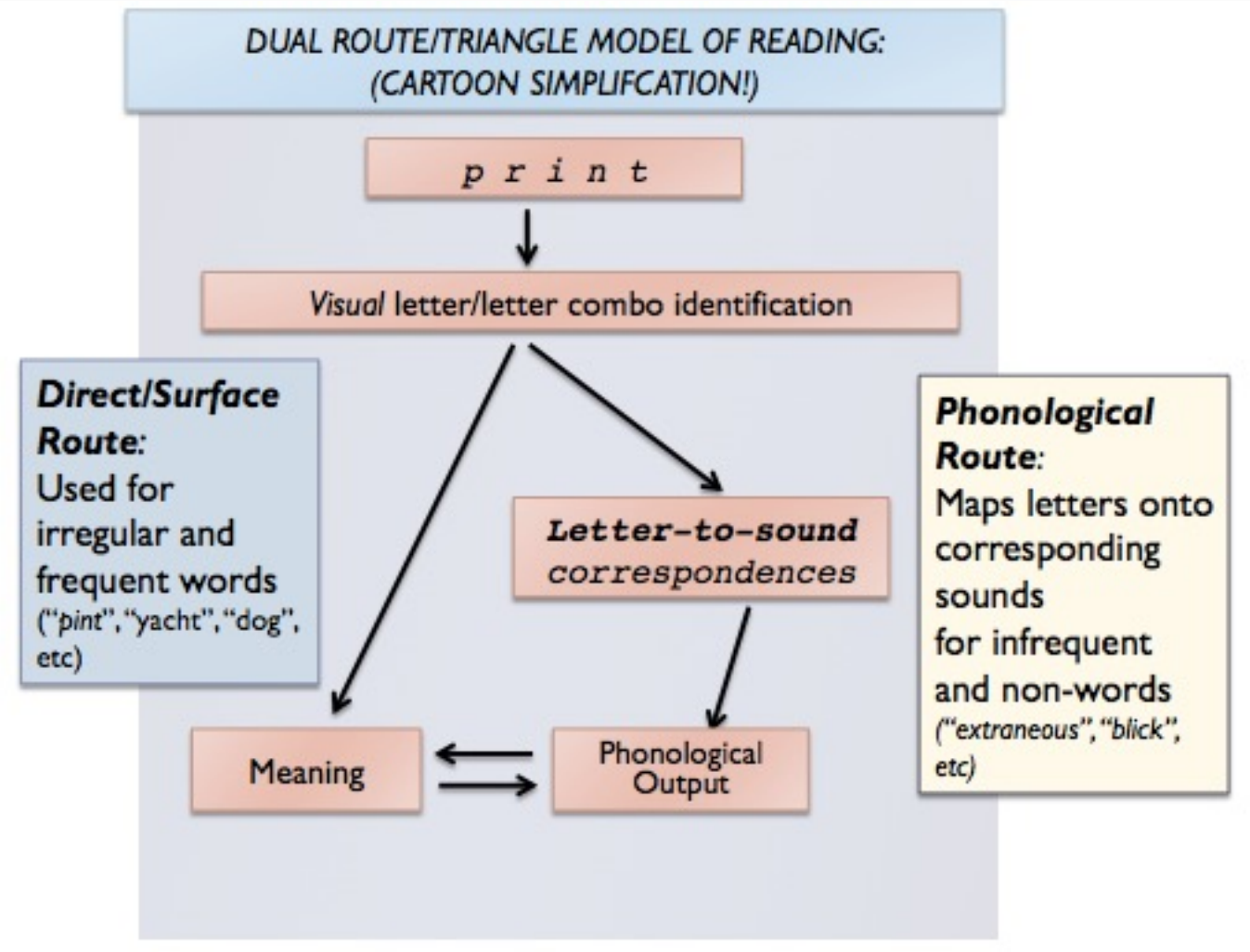
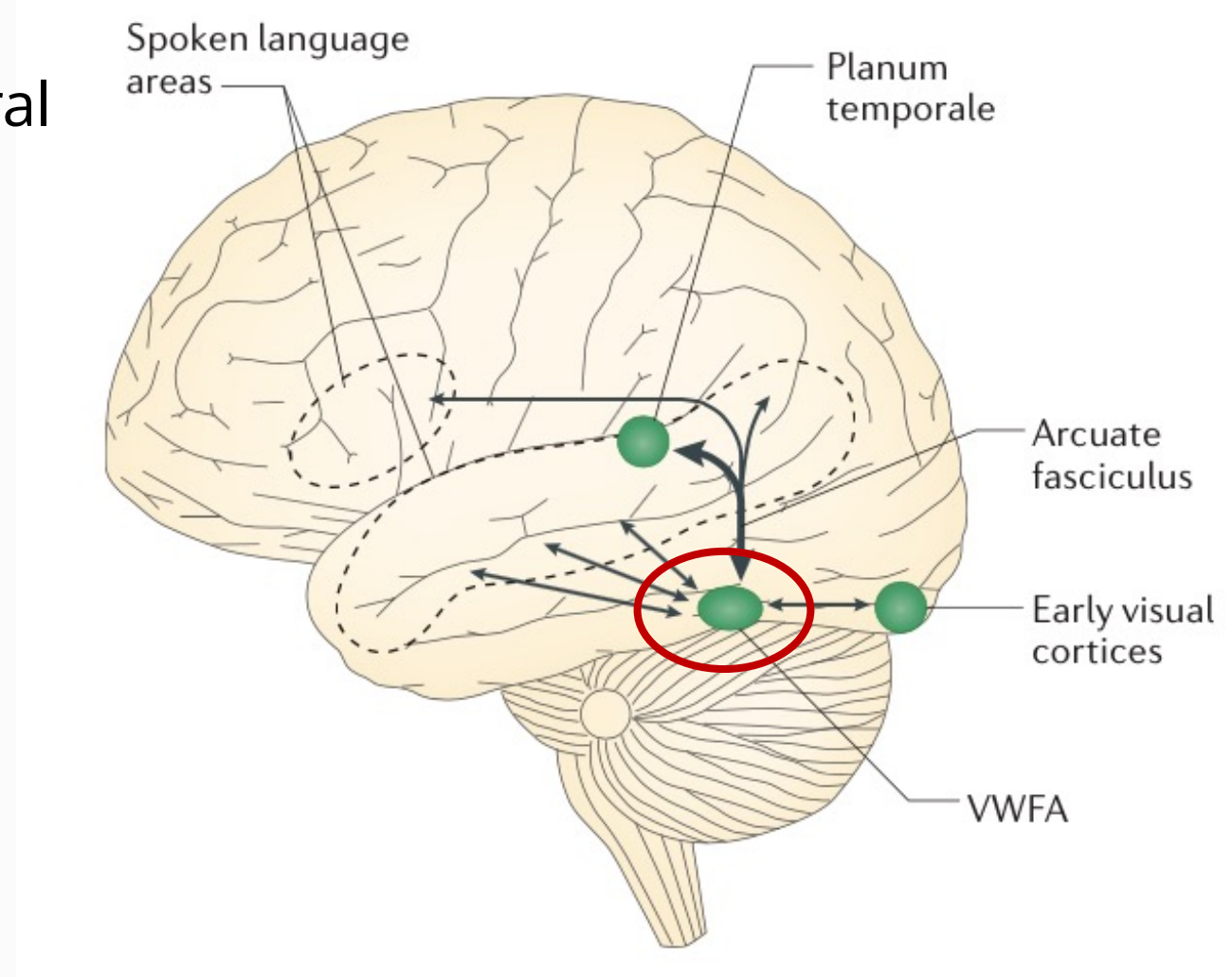


Learning objectives

- Locate the visual word form area (VWFA) and describe what it is for
- Describe how becoming literate changes the VWFA's response to words and faces
- Describe Dehaene's (as described by Sacks) hypothesis about the visual word form area's "evolution"
- Describe the main symptoms of Alexia, and of Phonological, Surface, and Deep dyslexias
- Use the dual route/triangle model of reading to help categorize the acquired dyslexias

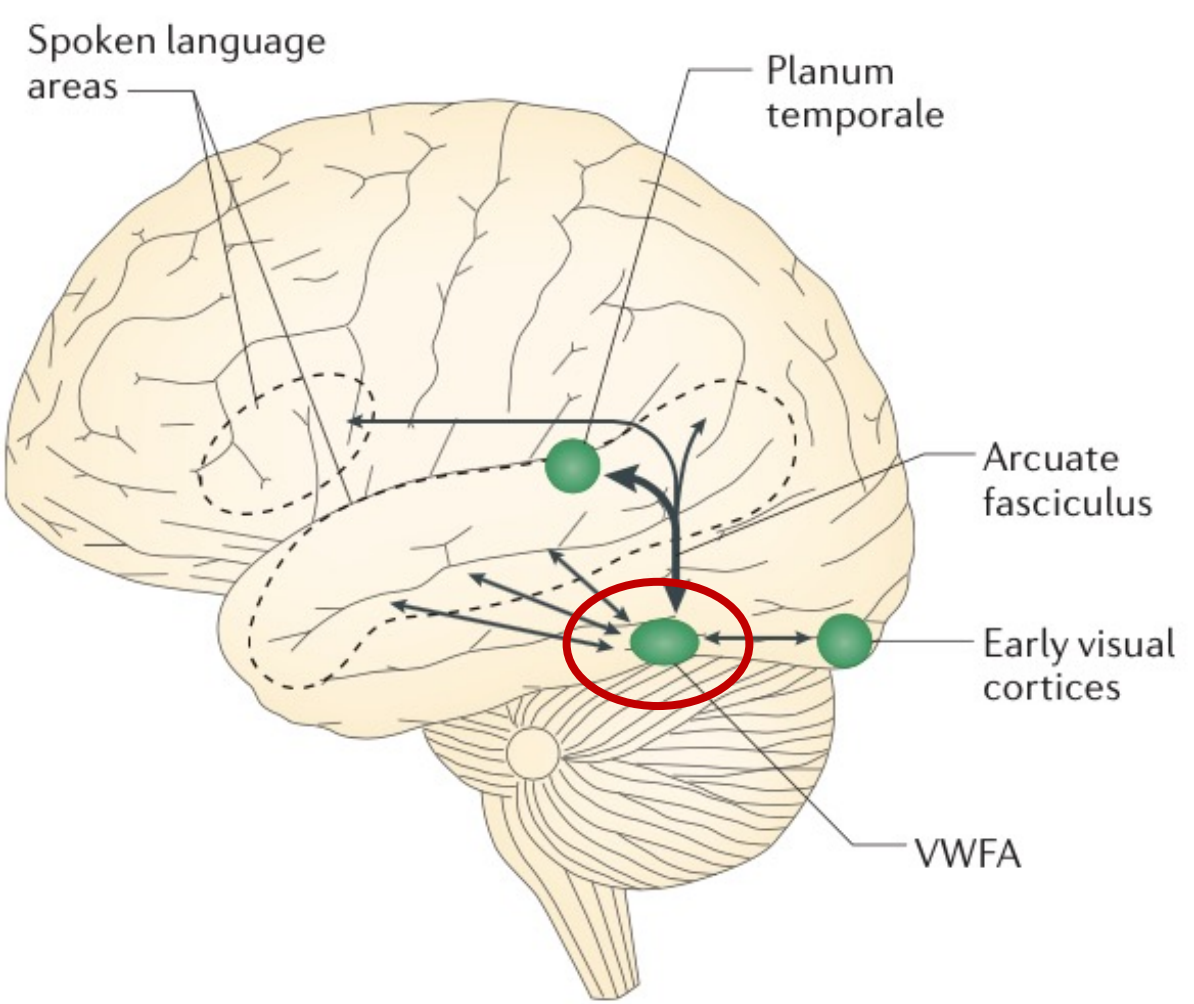
Visual word form area

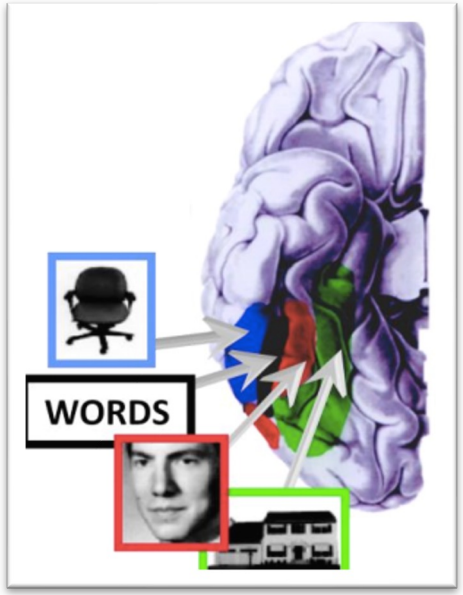
- In ventral occipito-temporal cortex



Visual word form area

- In ventral occipito-temporal cortex
- Activated specifically by acceptable (in the language of the reader) visual words and letter strings
  - E.g. NGTH (as in length) but not TGNH, in English.



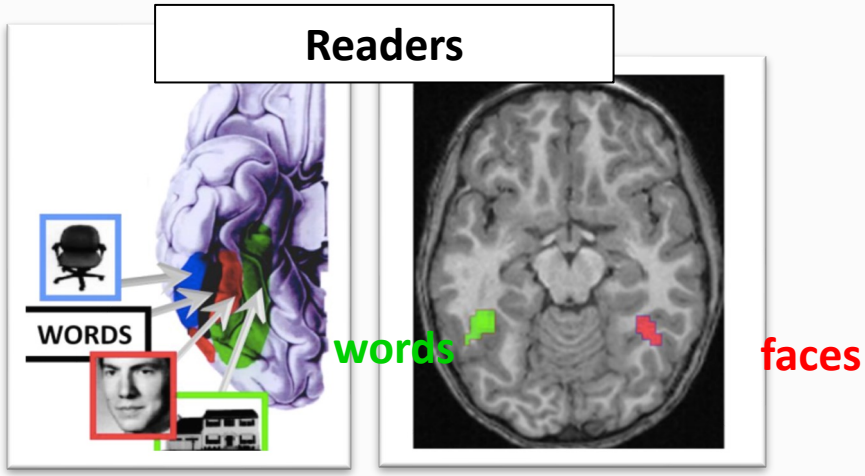


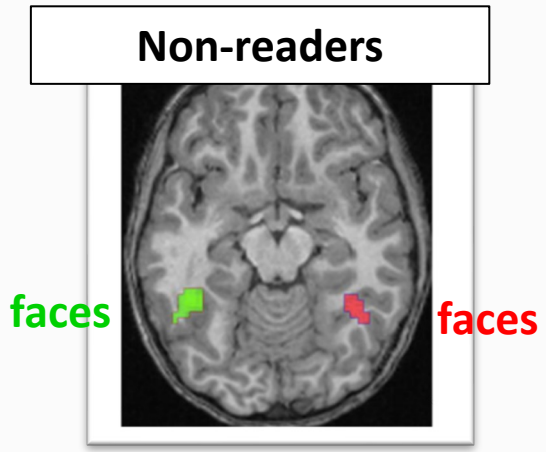
Visual word form area

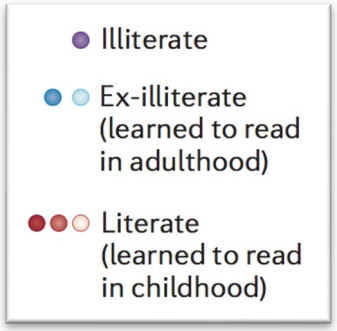
- How did we evolve a brain area that processes written words?
- How could we investigate this?
  - What does this area look like in people who do not read?

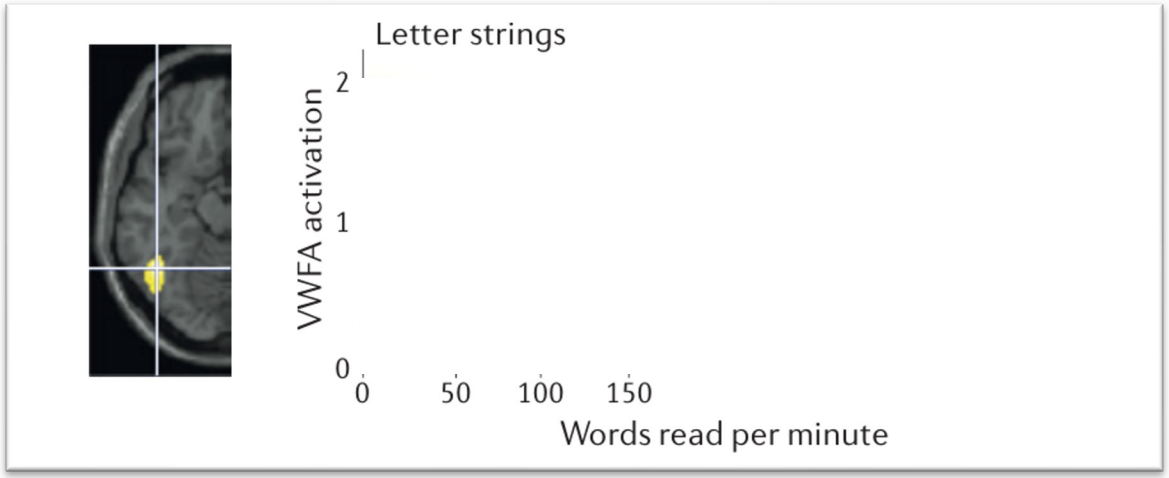
(Deheane et al.)

Visual word form area









(Deheane et al.)

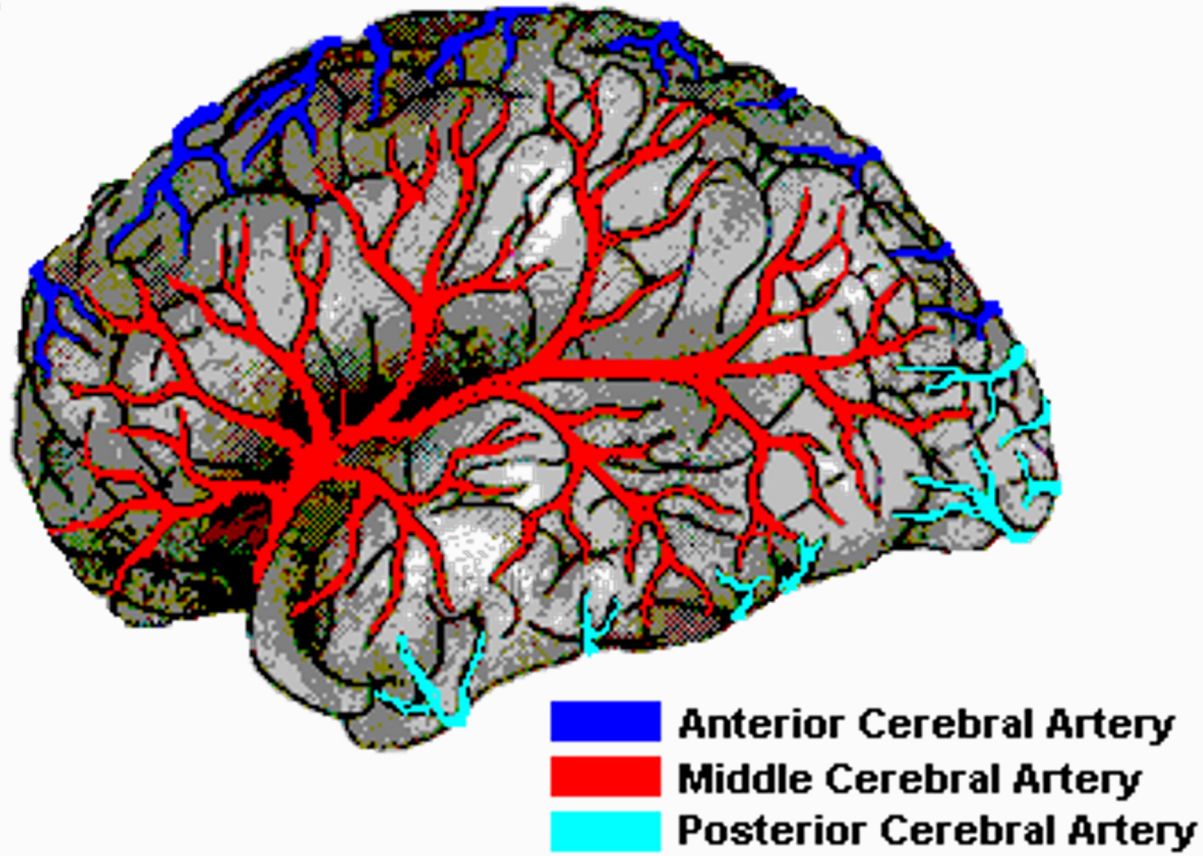
Acquired dyslexias

Video
https://youtu.be/GJZnpd4NQ98

Acquired dyslexias

- Types of dyslexia
  - **Pure alexia** (Déjerine, 1892)
    - AKA alexia without agraphia; letter-by-letter reading
  - **Phonological dyslexia** (Shallice & Warrington, 1975)
  - **Surface dyslexia** (Marshall & Newcombe, 1973)
  - **Deep dyslexia** (Marshall & Newcombe, 1966)

- Commonly caused by stroke

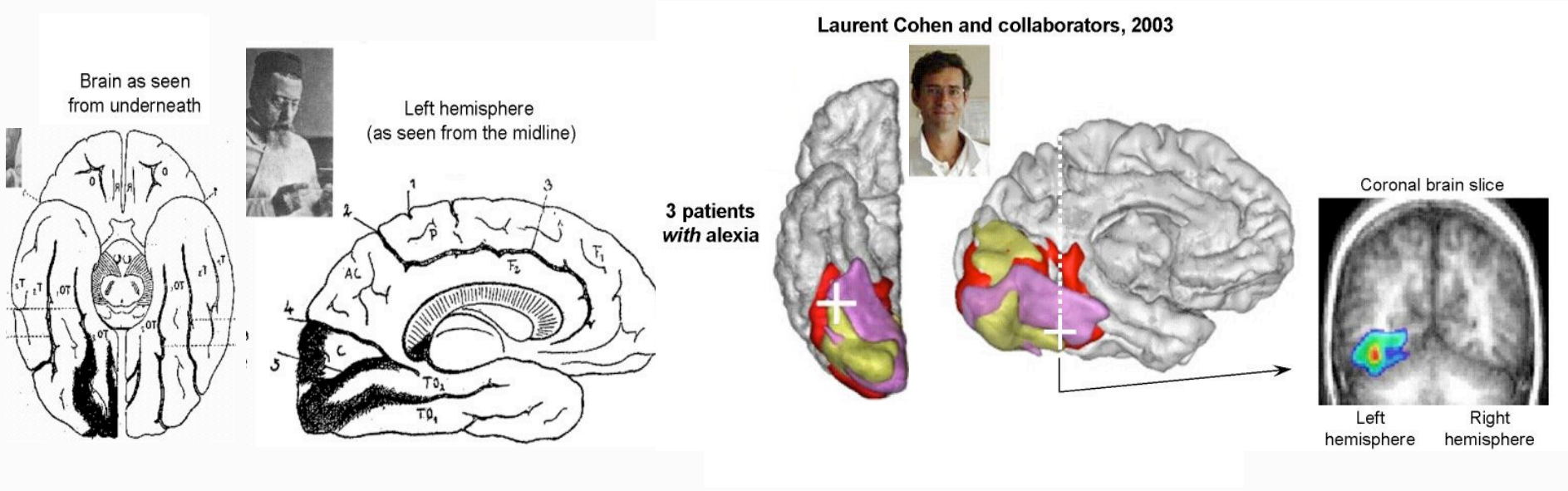


Pure alexia

- French neurologist Joseph-Jules Déjerine and Monsieur C. (1892)
- Mr C: 68 year-old intelligent, cultured, wealthy retired Parisian textile merchant
  - Woke up one day in 1887 after stroke unable to visually recognize words or letters
  - However:
    - Oral language AND oral spelling are intact.
    - Object, face, and drawing recognition are largely preserved.
    - Tactile letter/word recognition remains intact.
  - Mr C. had **pure alexia**

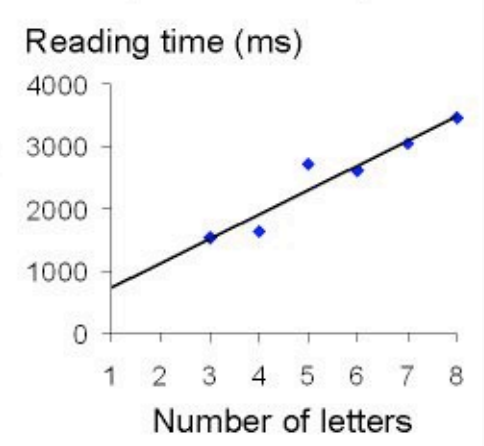
Pure alexia

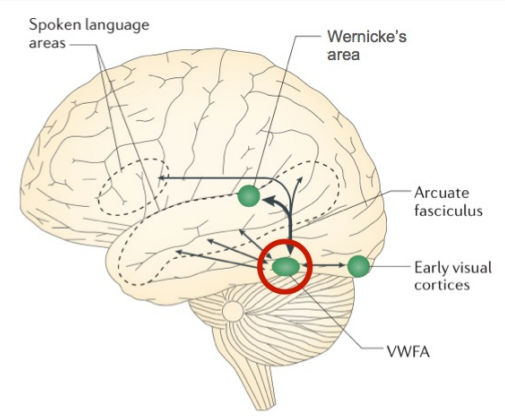
- After death, Déjerine concluded that Mr C.'s pure alexia resulted from disconnection between primary visual areas and other occipital areas dealing specifically with letters and words.



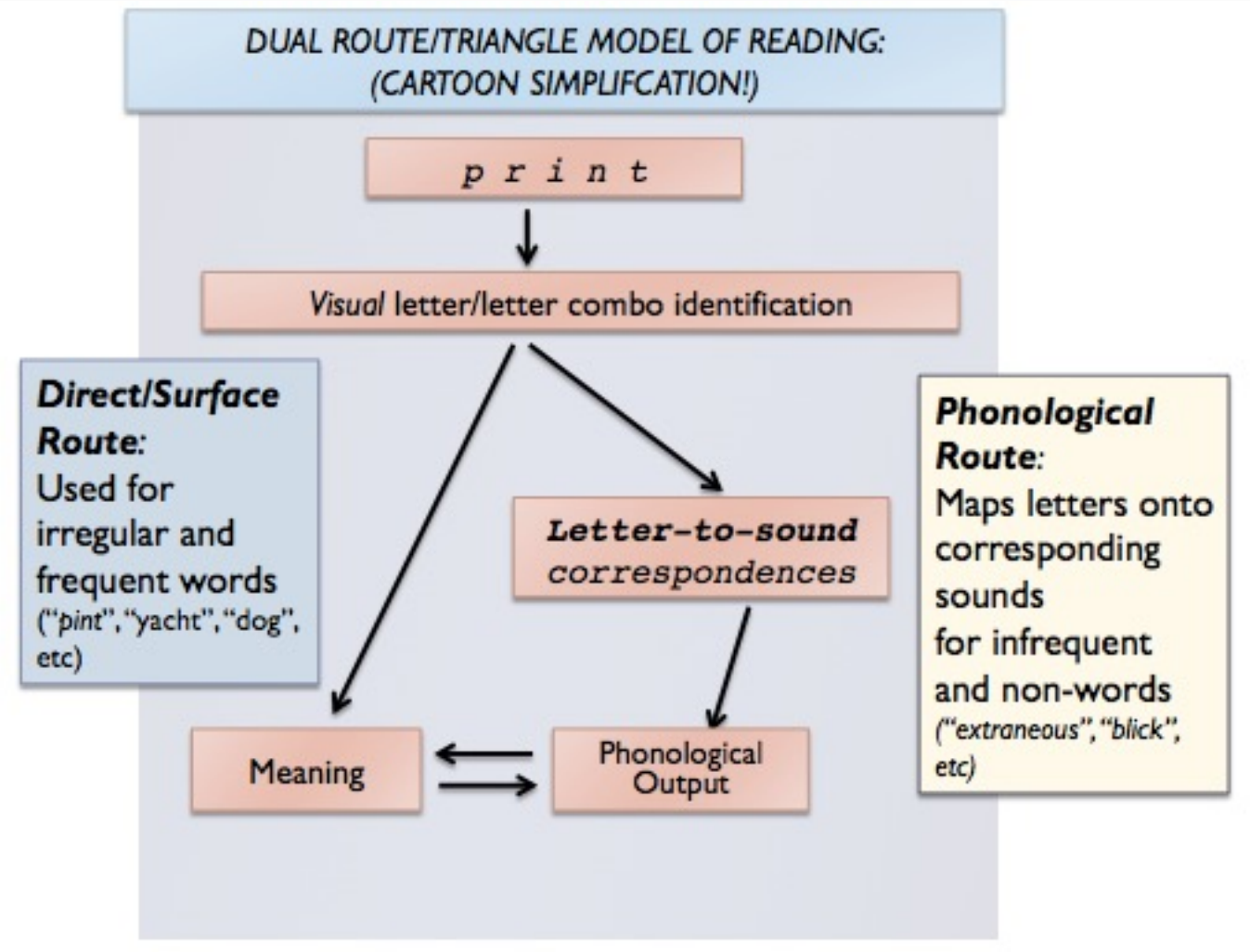
Pure alexia

- Primary Characteristics:
  - Word reading impossible, except via explicit sequential identification of individual letters (slow and effortful).
  - Large length effect and almost a linear relation between length in letters and reading time.
  - Tactile letter/word recognition remains intact.
- Visual word form area (ventral occipito-temporal region) damaged or disconnected





Pure alexia & the dual-route model



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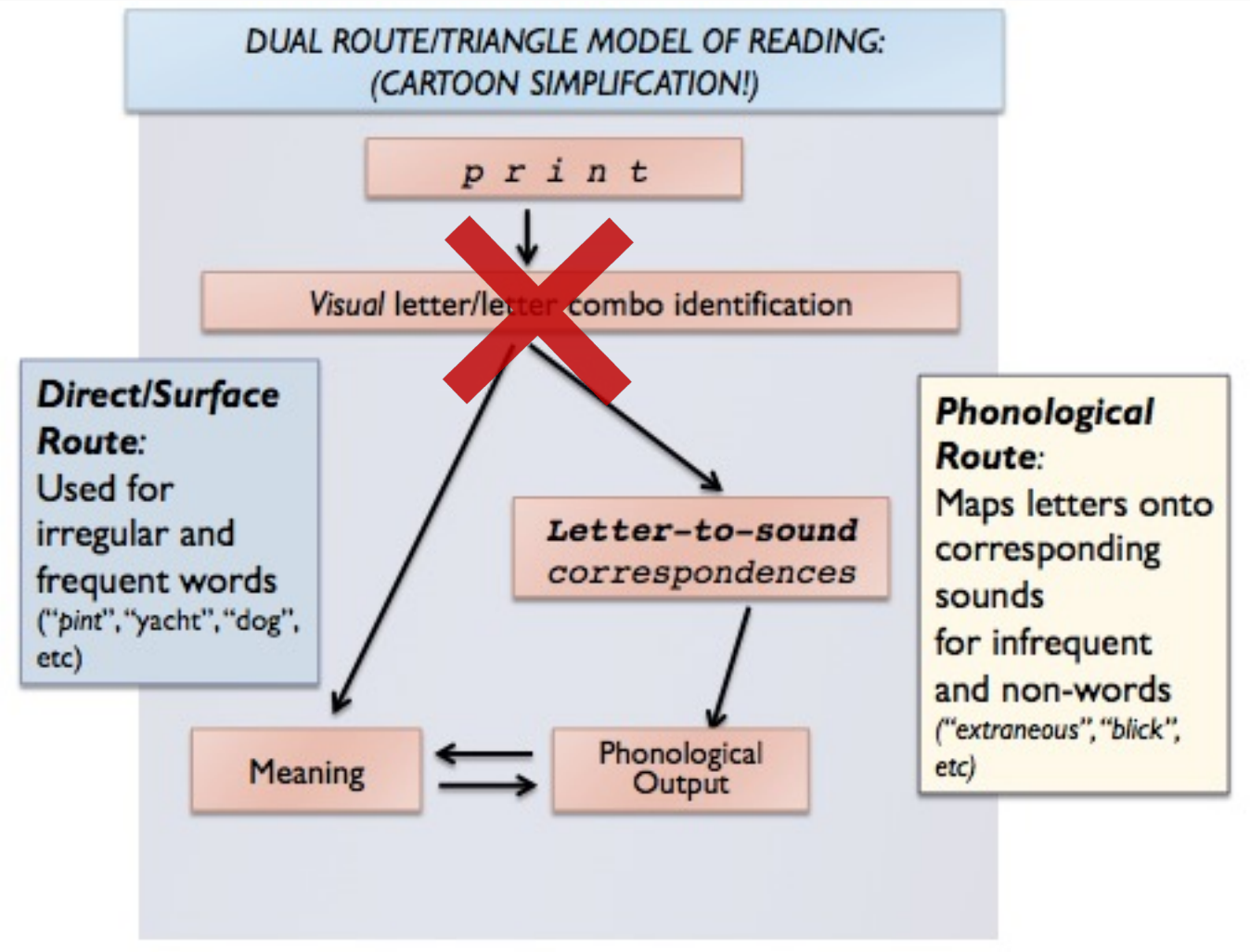
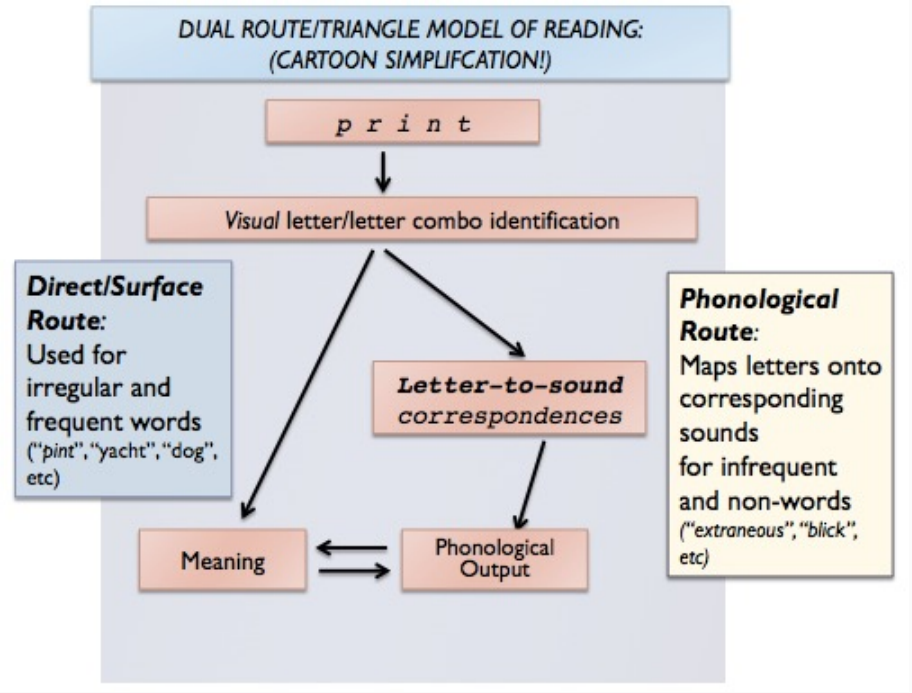


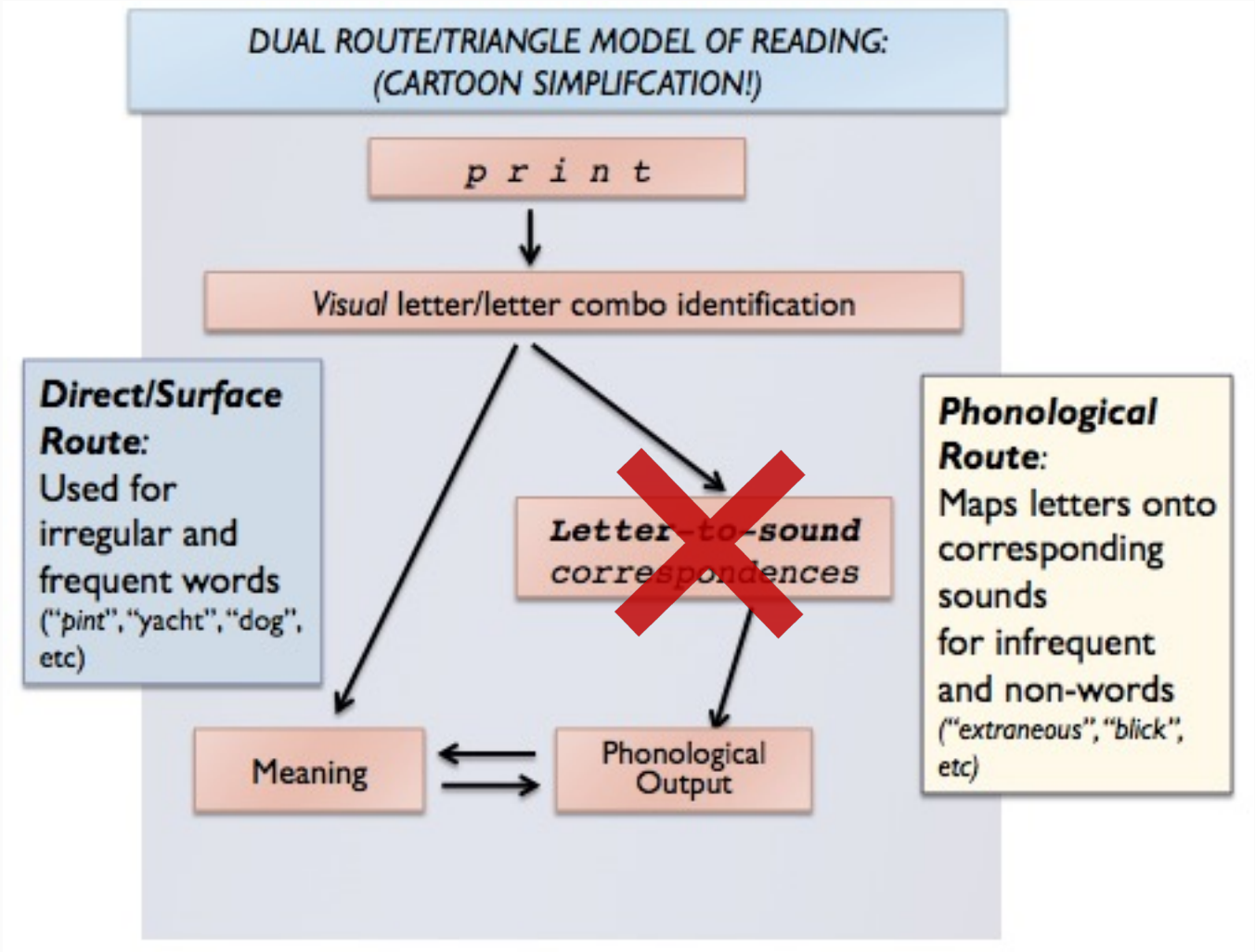
Phonological dyslexia

- Primary characteristics:
  - Impaired ability to read new or made-up words (i.e., non-words)
  - Known word reading is relatively intact, if not perfect
  - Lesions tend to be in temporal lobe of language dominant hemisphere



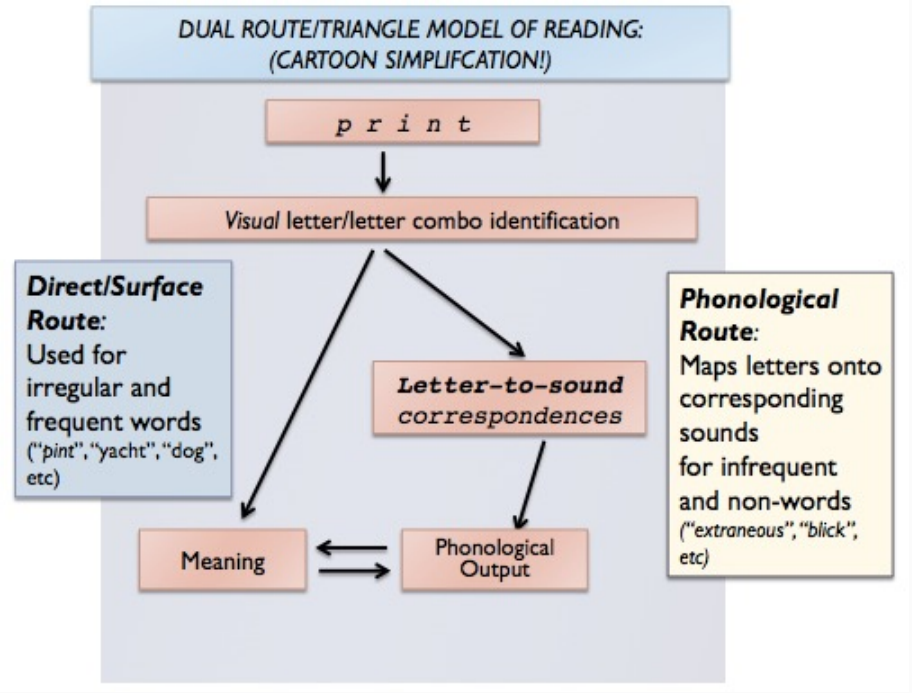
(Shallice & Warrington 1975)

Phonological dyslexia & the dual-route model



(Shallice & Warrington 1975)

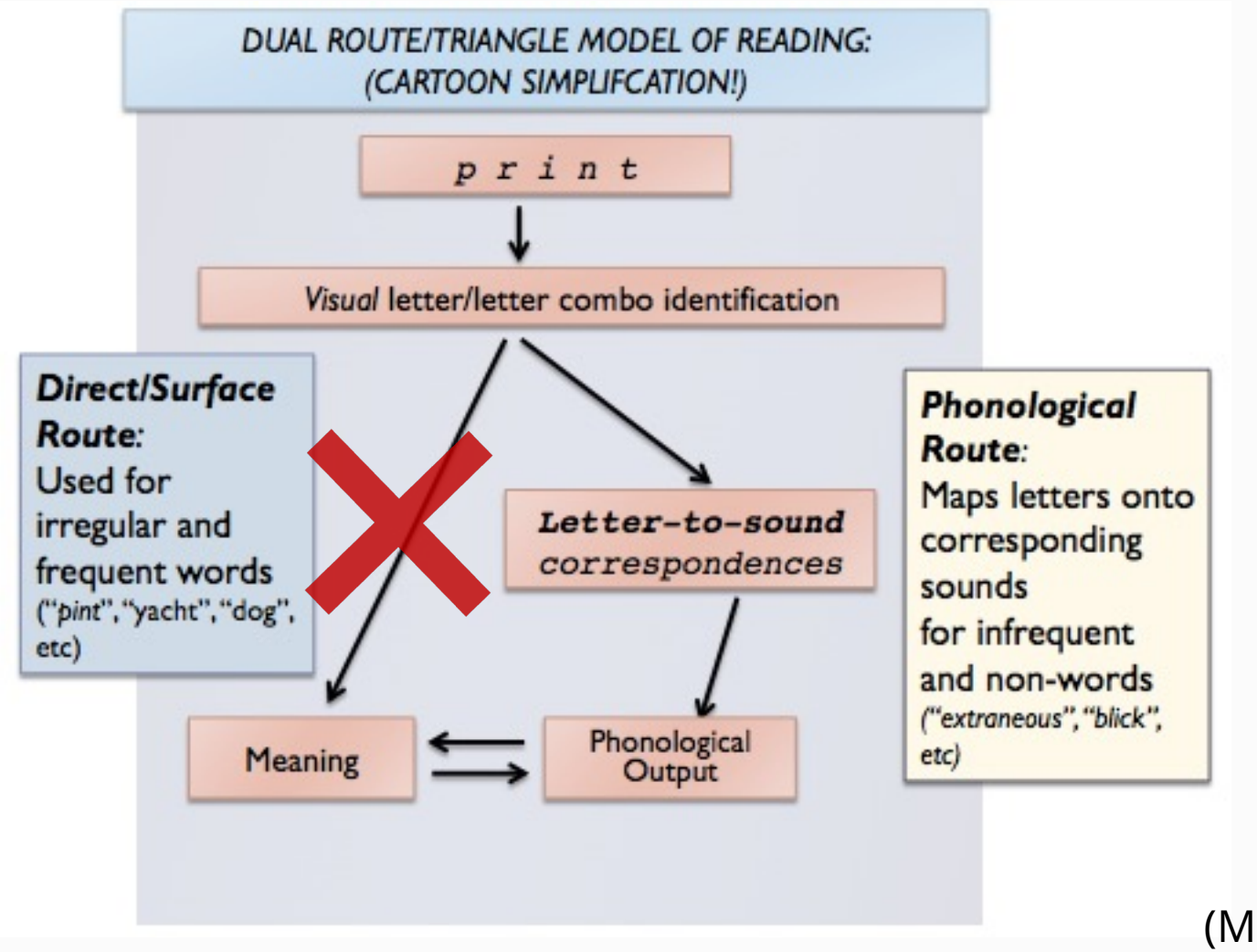
Surface dyslexia



- Primary characteristics:
  - Regularizations:
    - 'pint' > rhyming with mint
    - broad > 'brode'
    - island > 'is-land'
  - Comprehension based on pronunciation, e.g., bear for 'beer'
  - Non-word reading is okay
  - Lesions tend to be in parietal or temporal lobe of language dominant hemisphere

(Marshall & Necombe, 1973)

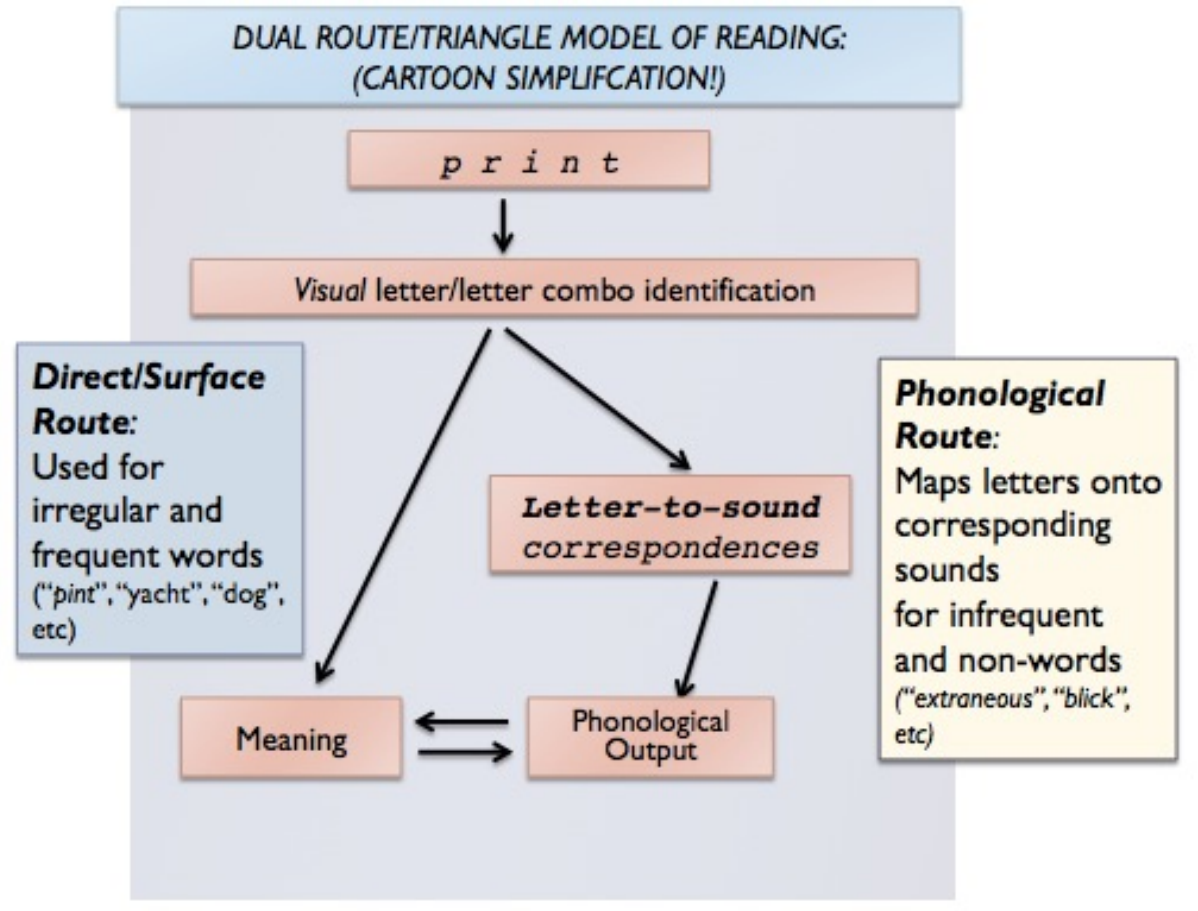
Surface dyslexia & the dual-route model



(Marshall & Necombe, 1973)

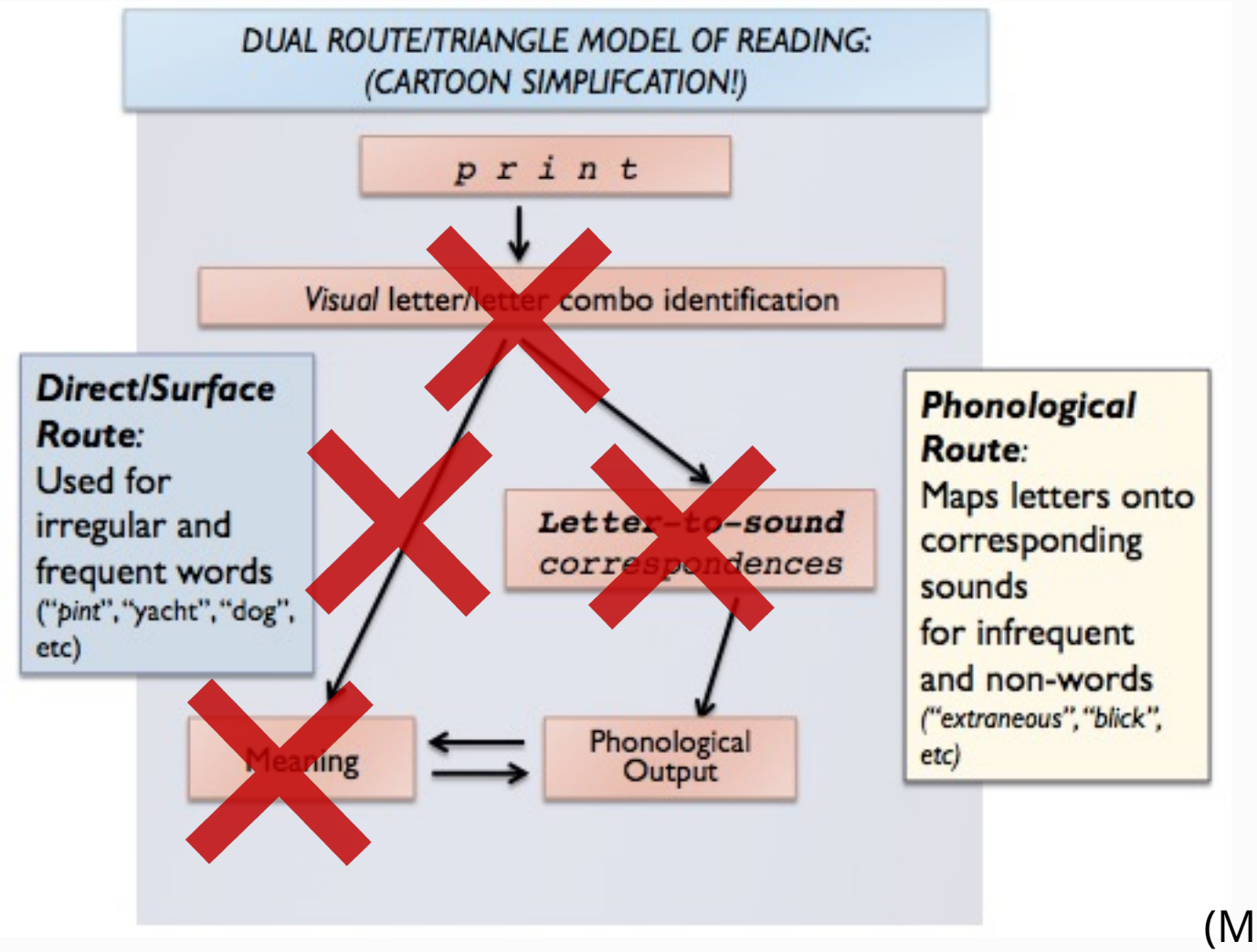
Deep dyslexia

- Primary characteristics:
  - Impaired nonword reading
  - Visual errors:
    - life > 'wife'
    - sword > 'words'
  - Semantic errors:
    - ill > 'sick'
    - bush > 'tree'
    - bad > 'liar'
    - pray > 'chapel'
  - Usually extensive damage to language dominant hemisphere



(Marshall & Necombe, 1973)

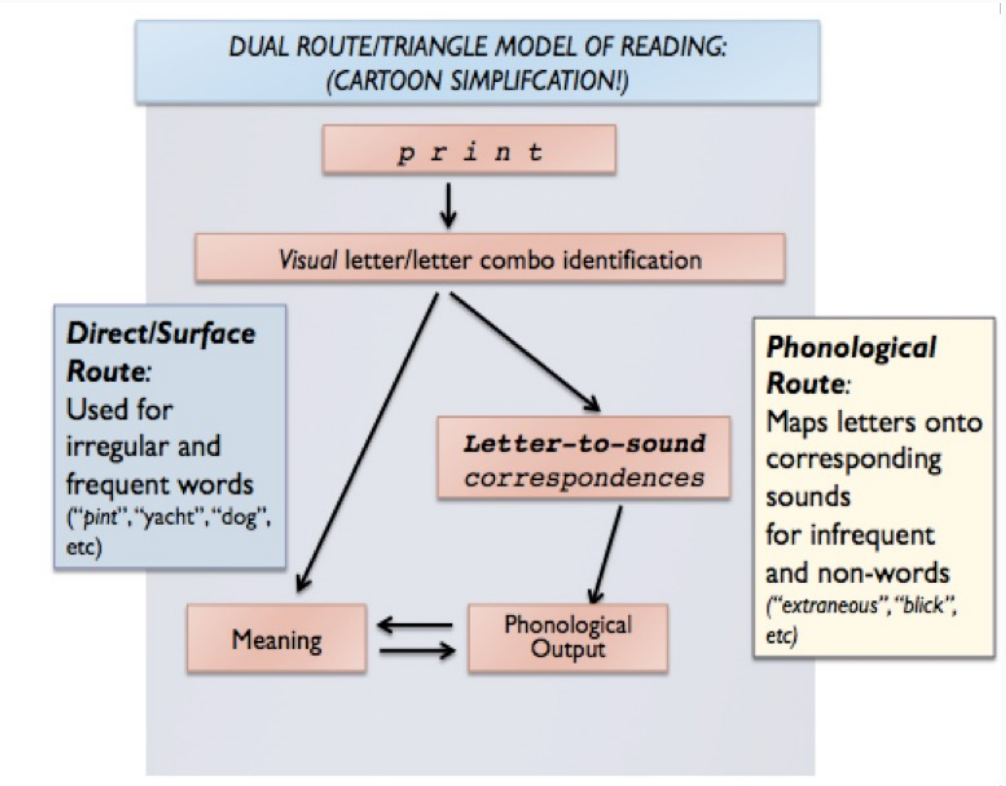
Deep dyslexia & the dual-route model



(Marshall & Necombe, 1973)

Practice

- How would someone with each of the reading disorders below read the letter strings on the left?
  - Put an X if you think the person won't read the word.
  - Put a check if they'd read it correctly
  - Use a sound-alike word to explain how a word would be pronounced.
  - Use a similar word if they'd read the wrong word



	Phonological	Surface	Deep	Alexia
pint				
cook				
firp				

Practice

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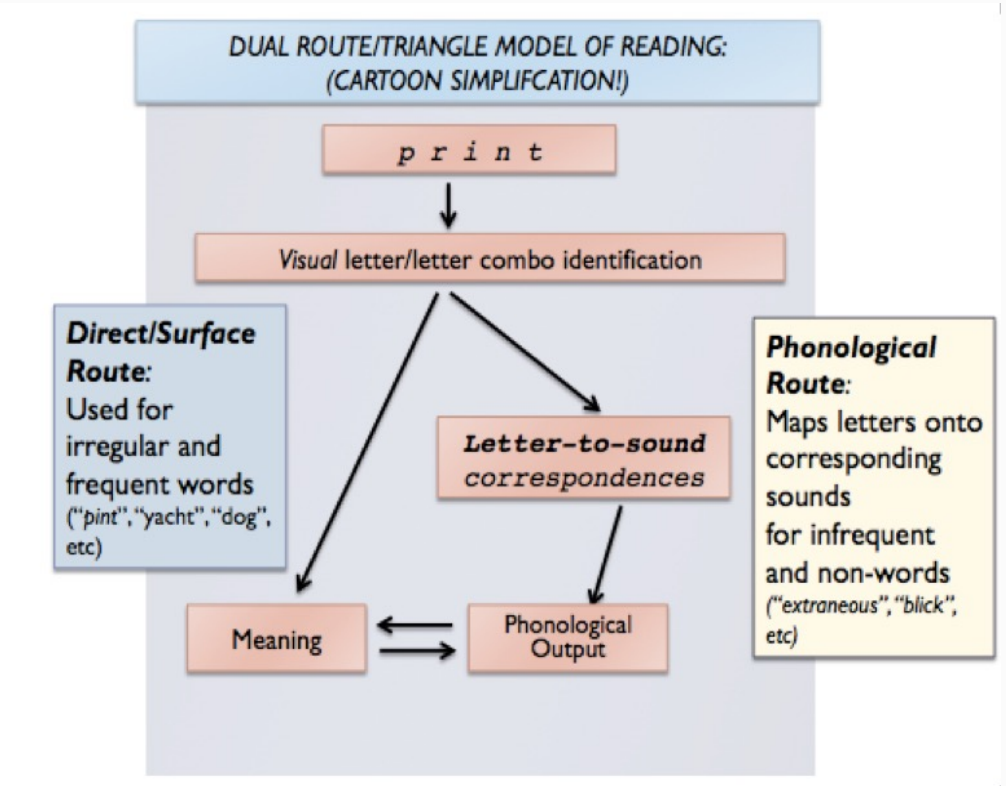

	Phonological	Surface	Deep	Alexia
pint	PINT	[like MINT]	BREATHE (via pant)	?
cook	COOK	COOK	FOOD	?
firp	?	FIRP	?	?

Review

- Dehaene suggests that when learning to read, humans co-opted (recycled) a brain area that was already good at recognizing the visual features that make up writing systems. It's called the visual word form area.
- Becoming literate increases VWFA's response to words and decreases its response to faces.
- Types of acquired reading disorders:
  - deep dyslexia: Can't read non-words, makes semantic substitutions
  - alexia: Can't read
  - surface dyslexia: Can't read non-words
  - phonological dyslexia: Can't read irregular words
- Dual route model can account for some of symptoms of acquired reading disorders

Key concepts

- ✓Visual word form area
- ✓Pure alexia
- ✓Phonological dyslexia
- ✓Surface dyslexia
- ✓Deep dyslexia
- ✓Dual-route model and acquired dyslexias