

Individual differences in activation and functional connectivity across modality and processing level



Introduction

- Reading comprehension difficulties due to decoding deficits (e.g. dyslexia) have been extensively studied using neuroimaging methods.
- To date there has been limited limited work on the neural basis of individual differences in comprehension skill.
- Previous research shows performance on auditory and visual tasks of word- and passage-level processing to be related to reading comprehension ability (Nation et al., 2010; Catts et al., 2006).

Current study

• Explore differences in activation and functional connectivity during word- and passage-level processing across modalities as a function of comprehension ability.

Methods

Participants:

N = 32; Aged 14-18 (M= 17.4)

All had normal decoding skill, but considerable variation in comprehension skill.

fMRI tasks: Single-Word Task (event-related)

- Visual word: Printed real words, e.g. roof
- Spoken word: Spoken real words, e.g. "post"
- False font: Printed symbols, e.g. •□)(●
- Vocoded speech

Passage Task (2 block types) block

• Excerpts of spoken and printed narratives, alternating between modalities within each story.



PPI analyses show connectivity to a seed region in a certain psychological context (i.e. task condition) without the effect of factors that remain constant across tasks (e.g. resting state)

Seed regions defined from taskspecific behavioral PLS

Findings:

- Differential connectivity in temporal/ visual areas as a function of modality and processing level
- Less connectivity for both spoken and printed passage in effort-related areas (?)
- No significant correlation between context-dependent functional connectivity and reading comprehension scores

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Psychophysiological Interaction (PPI)





Behavioral PLS

0.50-0.25 -0.25

Spoken Word Printed Word

Better comprehenders (BC) activate in red to speech and blue to print.

Poorer comprehenders (PC) activate in **red** to print and **blue** to speech.

For all, L=R, p=.05 FDR correct Passage: Seed in left LSTG/ MTG **Printed > Spoken Passage**



Single-Word: Seed in left VWFA **Printed Single-Word > Spoken Single-Word** Spoken Single-Word > Printed Single-Word









Reading comprehension & Single-Word task (spoken & printed)



63.31% of covariance p = 0.01

	Discussion
cted	 Reading comprehension is related to activation across modality for passage processing.
	 Reading comprehension is relationship is modality-specific for single-word processing.
	 Modality-specific functional connectivity is not related to reading comprehension.
	Future Directions
	 Combined eye-tracking and fMRI for visual passages. A behavioral metric along with naturalistic processing
	 Explore specific lexical and grammatical factors of passages known to be related to variability in comprehension ability.
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