INTRODUCTION

Understanding how pre-literate children’s language abilities and underlying brain networks relate to future reading ability is important to identifying pre-literate children who may be at-risk for reading problems, and contributes to our understanding of cognitive development. Developing brain networks for language become highly overlapping with brain networks that emerge during literacy acquisition.

**Specific Aim:** To examine whether language ability, neural activation, and neural connectivity in pre-readers predict reading ability one year later (ages 4.5-5.5) once children begin learning to read.

**New:** Psycho-physiological interaction (PPI) for fNIRS

<table>
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<tr>
<th>Participants</th>
<th>37 children age 3-5.45</th>
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<tbody>
<tr>
<td>fNIRS Neuroimaging</td>
<td>Block design: 24 trials</td>
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<td>Each trial: 6 stimuli presented auditorily with 100ms ISI</td>
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<td>12 words, 12 pseudowords</td>
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<td>NIRS-SPM for GLM analyses</td>
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<td>fNIRS PPI Methods</td>
<td>Standard GLM analysis was conducted to model the contribution of predictors (i.e. onset and offset of experimental stimuli) to the time-course of each channel. To estimate the neural signal from the hemodynamic response, the first eigenvariate time-course data of the voxels within the seed ROI were deconvolved. We used a seed ROI of left IFG and left STG, respectively. The GLM for the PPI consisted of 1) a vector corresponding to the experimental factor, 2) the deconvolved neural signal in the ROI, and 3) the interaction term generated from the element-by-element product of the mean-centered time-course neural signal data in each region. A contrast vector where the interaction term is weighted 1 and all other regressors are weighted 0 assigns the main effects of the experimental task and physiological correlations as covariates of no interest. This contrast accounts for voxels which may exhibit task-specific correlations with the seed ROI due to shared anatomical connectivity or subtractive inputs. Group maps were generated comparing the activation to the task relative to baseline as modulated by activation in the seed ROI.</td>
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RESULTS

Sensitivity to lexicality in L. Inferior Frontal Gyrus, R. Inferior Parietal Lobule, and R. Temporal Gyrus

Neural activation and connectivity for speech predict future reading ability

FINDINGS

Reading ability at Time 2 was predicted by language ability, neural activation in LIFG and STG, and connectivity at Time 1.

**New:** Time 1 neural connectivity between left IFG and right STG accounted for reading abilities at Time 2—beyond what behavior and neural activation explained. Increased connectivity associated with increased reading ability.

**Activation**

Greater activation for words and pseudowords in bilateral STG

Greater activation for words vs. pseudowords in LIFG

**Connectivity**

Connectivity between LIFG (seed) and right STG—modulated by task (words vs. baseline)

Predicting Reading

**Letter-word decoding** ability predicted by phonological awareness, phonological memory, and neural connectivity (LIFG-RSTG PPI)

**Pseudoword reading** ability predicted by phonological awareness and neural connectivity

**Passage comprehension** predicted by phonological awareness, LIFG activation, and neural connectivity

**Summary:** Such insights into the brain-basis of emergent healthy/typical reading can be used to understand children who are struggling to learn to read—early identification of at-risk children

PPI analysis adapted for fNIRS data—new source of insight into brain function in development.

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