

# Effective connectivity analysis in children: exploring the impact of the dorsal and ventral part of inferior frontal gyrus on phonological and orthographic processing

**Jiuru Wang**

Vanderbilt University, Nashville, Tennessee, United States

**Neelima Wagley**

Arizona State University, Tempe, Arizona, United States

**Dr. James Booth**

Vanderbilt University, Nashville, Tennessee, United States

## Abstract

Learning to read requires the integration of top-down and bottom-up processing of orthographic and phonological information. This study investigates how the dorsal and ventral inferior frontal gyrus (dIFG and vIFG) interact with posterior regions, including the ventral occipitotemporal cortex (vOT) and temporoparietal cortex (pSTG-SMG), during a visual word rhyming task. Using Dynamic Causal Modeling (DCM) on fMRI data from children aged 10 to 17 years, we examine directional influences among these regions under four conditions involving phonological and orthographic conflict and non-conflict. We hypothesize that dIFG exerts stronger top-down influence than vIFG, particularly under conditions of conflict. Additional hypotheses address the balance between top-down and bottom-up influences, region-specific effects of phonological and orthographic conflict, and the relationship between top-down modulation and reading skills. Data collection is complete, with 72 participants assessed, and analyses are underway. This pre-registered study aims to advance understanding of the neural mechanisms underlying reading development and inform interventions for reading difficulties.