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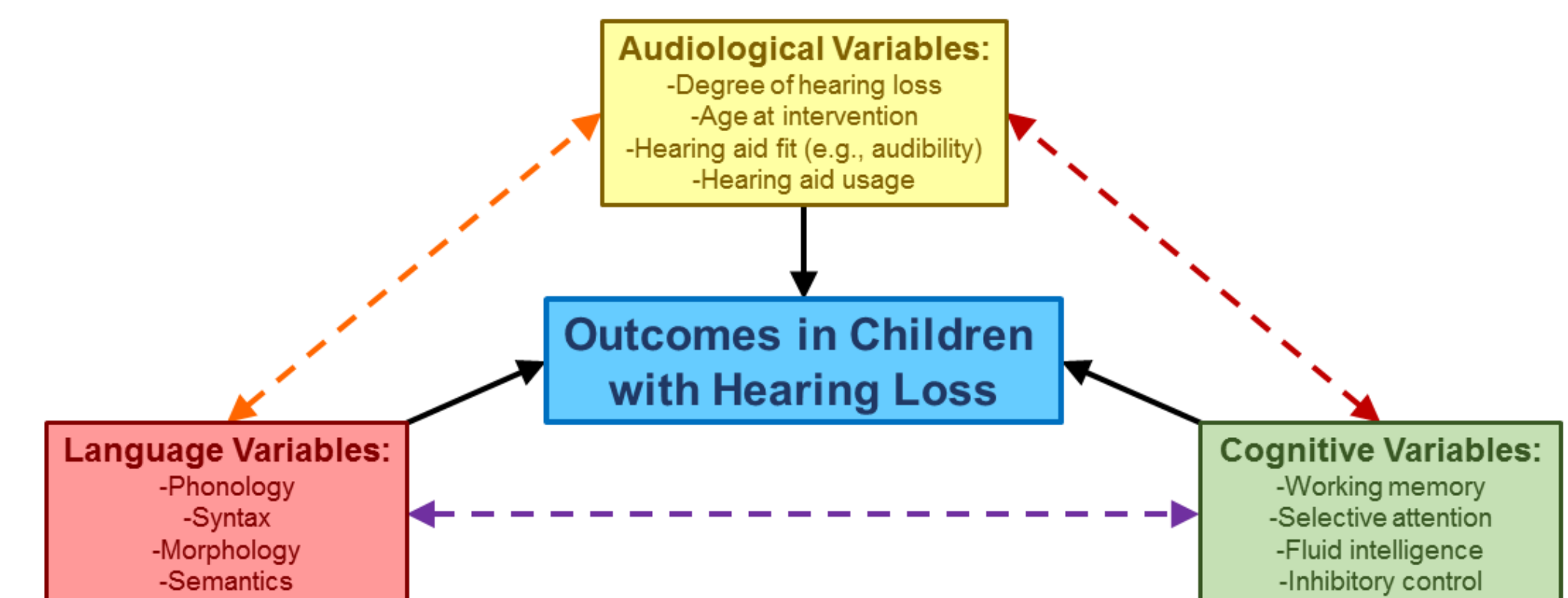
## Purpose

To determine the impact of mild-to-severe hearing loss and subsequent hearing aid intervention parameters on attention, memory, and executive function in children and adolescents

## Background

- About 1 in 400 children are born with some degree of hearing loss
- While over 95% of children receive a newborn hearing screening, deficits in language and cognition often persist in children with even modest hearing loss compared to their normal-hearing peers
- These deficits relate to degree of hearing aid use, age at intervention, and adequacy of hearing aid fit (e.g., audibility)
- Children with severe-to-profound hearing loss present with decrements in working memory, executive function and selective attention; recent work suggests that language function measures scale with performance in these other cognitive domains
- Whether domain-general deficits arise in those with more moderate degrees of hearing loss is unknown
- The current study probes the impact of hearing loss on cognitive and neural development in children with mild-to-severe hearing loss using a novel, multimodal imaging approach with advanced behavioral testing

## Specific Aims



**Aim 1:** To identify the impact of mild-to-moderate hearing loss on neurophysiological markers of visual attention, memory, and executive function in hard-of-hearing children relative to normal hearing peers.

**Aim 2:** To determine the effects of intervention age, hearing aid usage, and hearing aid fit on the behavioral performance and neurophysiology of visual attention and memory function in children who are hard of hearing.

## Approach

### Participants:

- 25 children aged 7-15 years old (avg. age 11.52 years) with bilateral mild-to-moderate hearing loss (i.e., better-ear pure tone average between 25 and 55 dB) who wearing hearing aids (HAs)
- 25 age-matched children (avg. age 11.52 years) with normal hearing

### Magnetoencephalography (MEG) and Magnetic Resonance Imaging (MRI):

UNMC MEG System:

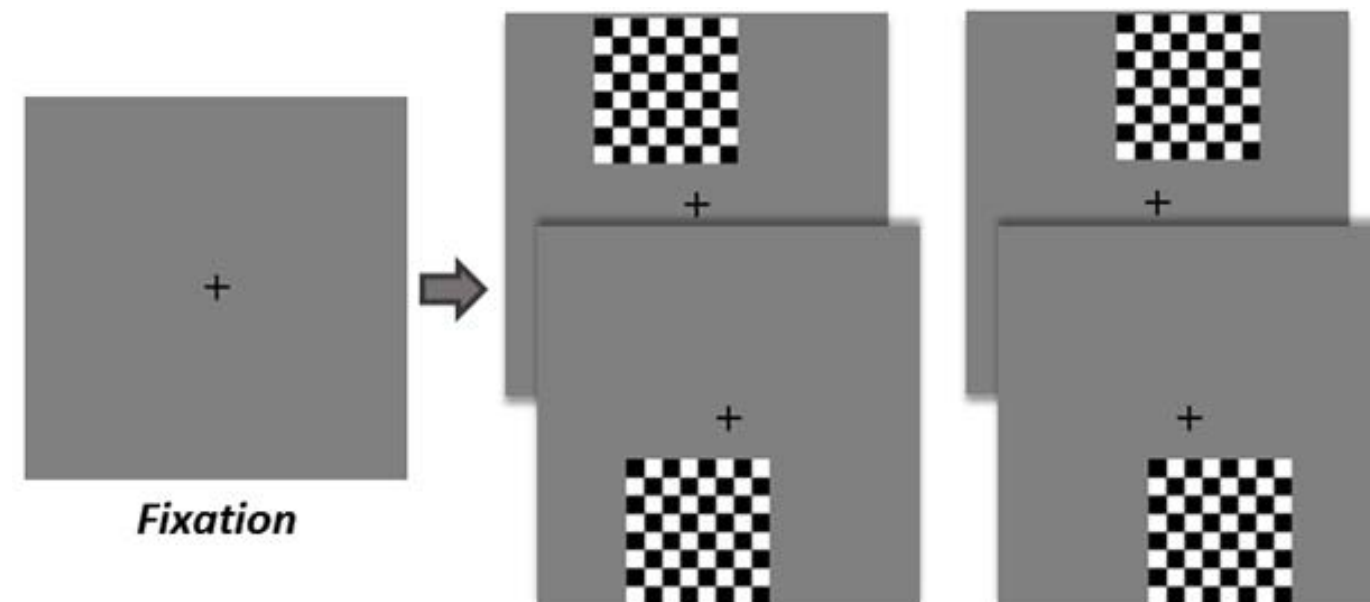


Werner 3T MRI System:

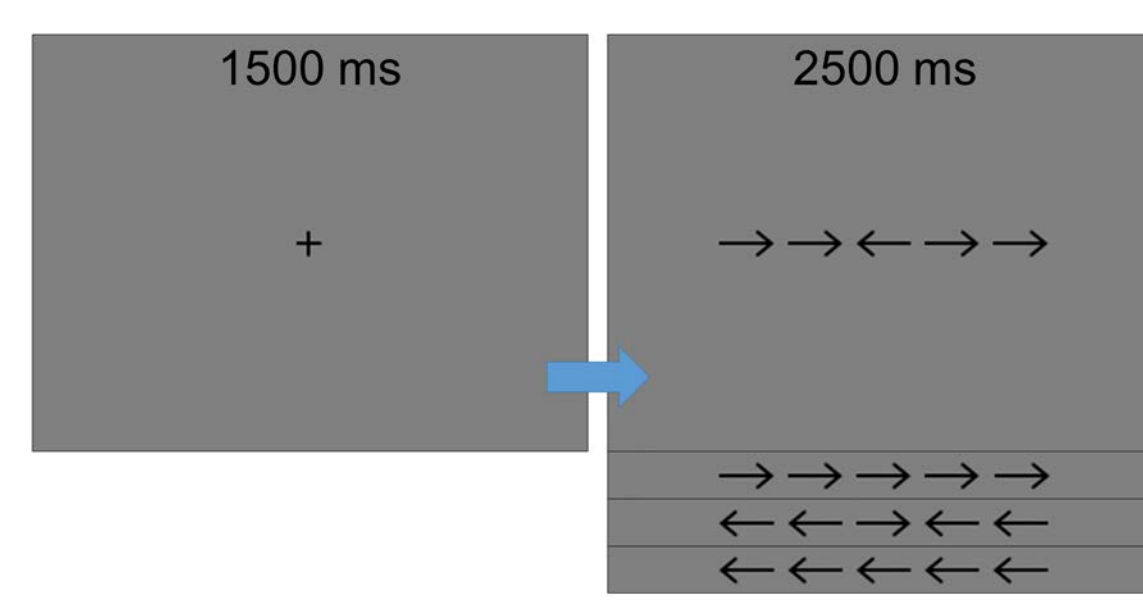


### MEG Tasks:

Visual processing task:



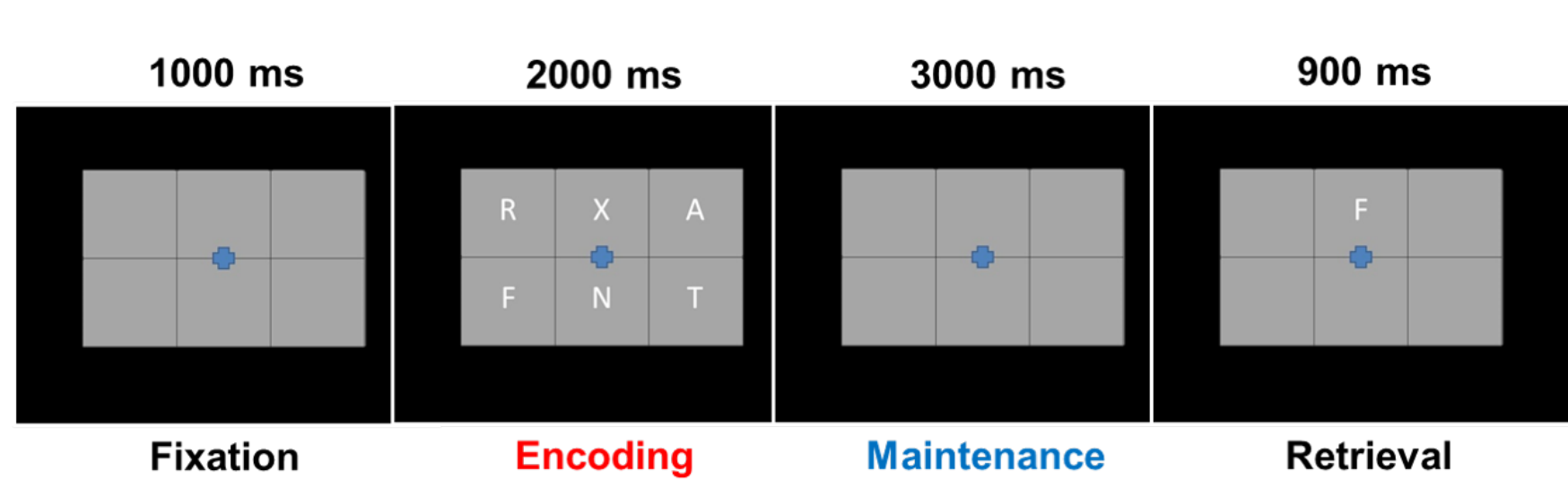
Visual selective attention task:



Abstract reasoning task:



Verbal working memory task:

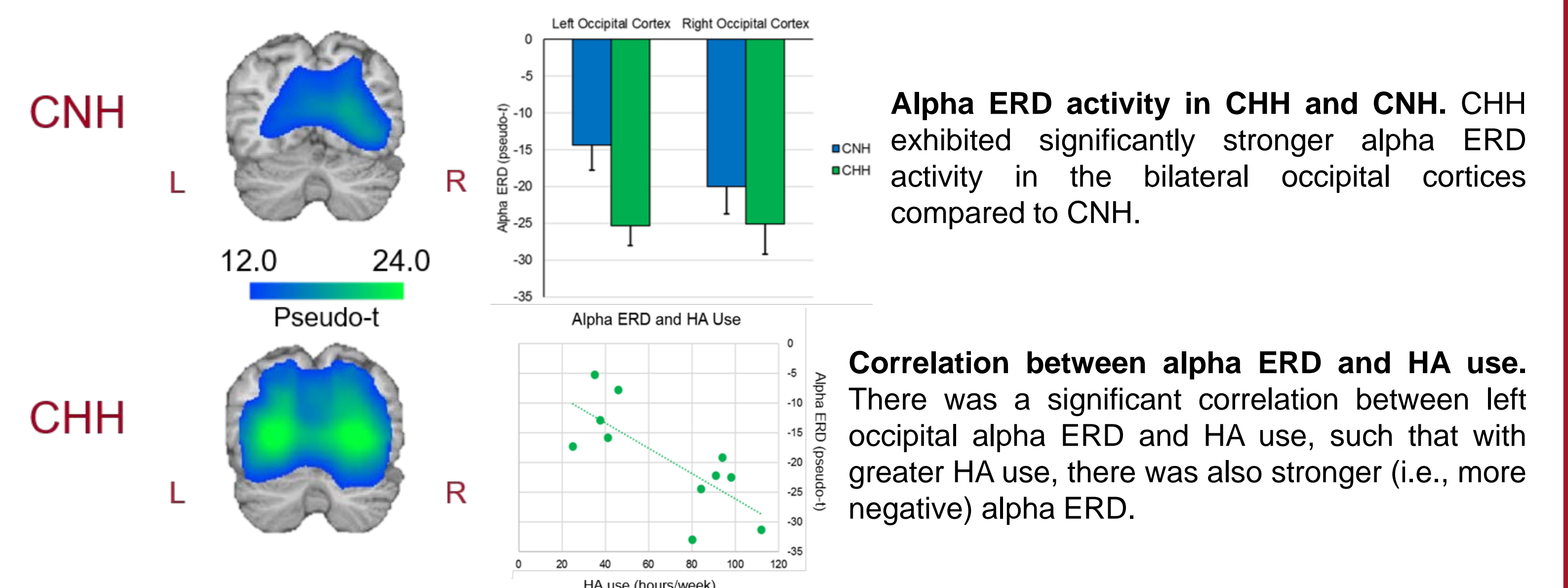


### Audiometric and Neuropsychological Measures:

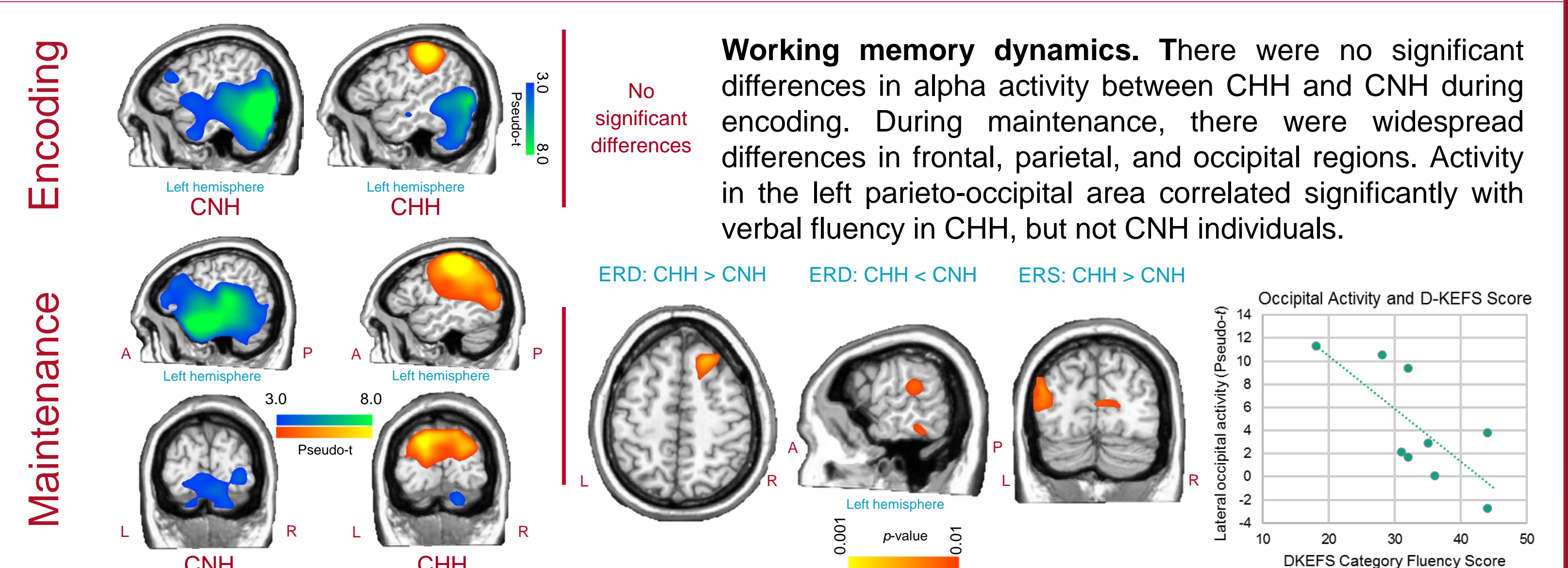
- Air and bone conduction thresholds will be obtained for each ear at 250, 500, 1000, 2000, 4000, and 8000 Hz using a portable, iPad-based audiometer system
- Hearing aid usage will be assessed via a self-report questionnaire
- Hearing aid functionality will be assessed by a licensed audiologist
- A battery of neuropsychological tests, including the Weschler Abbreviated Scale of Intelligence (WASI-II), the NIH Toolbox, and the Delis-Kaplan Executive Function System (D-KEFS), will be used to assess verbal and nonverbal cognitive ability

## Preliminary Findings

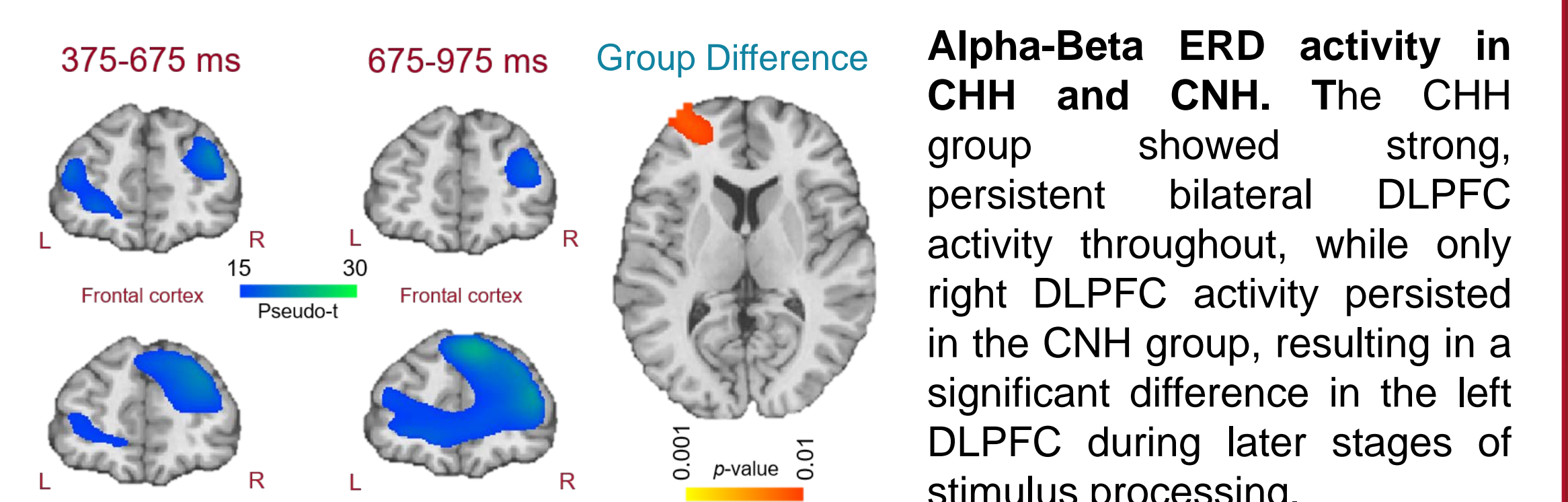
### Visual Processing



### Verbal Working Memory



### Abstract Reasoning



## Future Directions

While recruitment is ongoing, we intend to utilize the results of this study as a springboard by which to develop a large-scale investigation into the trajectory of cognitive and neural development in children who are hard of hearing. We hope that these results will provide a quantitative biological marker of cognitive improvement and therapeutic efficacy, as well as aid in the development of new academic resources for these children.