Neurofeedback in Alzheimer’s Disease
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Background
• Brain-computer interface (BCI) systems are controlled by users through neurophysiological input.
• Previous work has demonstrated that use of feedback mechanisms has the potential to improve user performance with BCIs.
• BCIs have emerged as a potential tool for broader populations, especially with regards to delivering cognitive training/interventions with neurofeedback.
• The goal of this study is to investigate application of a BCI system with neurofeedback (NFB) as an intervention for people with Alzheimer’s disease (AD), a neurodegenerative disease characterized by cognitive decline and associated functional impairments in language and reading.

Assessment Measures

Inclusion Criteria:
- MMini AD: Diagnosis of possible/probable AD
- Clinical Dementia Rating (CDR) of 0.5 or 1
- Montreal Cognitive Assessment (MoCA) score ≥ 14
- Language Impairment:
  - score ≥ 0.5 on language supplemental CDR or comparable clinical indication of language-related cognitive impairment

Summative Measures:
- Discourse Comprehension Test³
- Wechsler Adult Intelligence Scale 3rd Edition
- Digit Span Subtest
- Reading Confidence and Emotions Questionnaire²

Repeated/Formative Measures:
- Woodcock-Johnson Test of Achievement 4th edition
- Sentence Fluency Subtest
- Letter Cancellation Task¹
- Computerized Letter Span Task

Feedback Development

Display:

Mechanism:
- Significant relationship between posterior alpha power and behavioral performance in analogous n-back pilot task (n=5)
- Minimal relationship between performance accuracy and SSVEP activity at 9 Hz (highlighted 8-10 Hz)

Implementation:
- Relative power spectral density (PSD), µV²/Hz at P4
- Cutoffs for week #2 of intervention generated from average of week #1 posterior alpha activity (visits 1-3)
- Dynamic adaptation of relative PSD percentiles (dashed lines)

Research Design

Recruitment
Identification of potential participants through OHSU Layton Aging and Alzheimer's Disease Center

Screening
Screening measures and summative measures will be administered to determine eligibility for study

Baseline
Baseline performance on formative measures and RSVP task will be measured across 3-5 sessions (weekly)

Intervention
Intervention (RSVP with feedback) will be administered three times per week for 6 weeks; formative measures weekly

Follow-Up
Maintenance will be assessed with 1 follow up session 1 month following treatment period

Ongoing Results

Research Design

Letter Span: Forward Condition
Letter Span: Backward Condition
Letter Cancellation Task
WITAS Sentence Fluency Subtest

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Revised baseline assessment of dependent variables (SNs) to demonstrate learning effects and establish stable performance prior to intervention initiation (3-7 weeks; gray vertical line)