Brain-Computer Interface to Enhance Attention in Alzheimer's disease
Supplement award to R01DC009834
National Institute on Deafness and Other Communication Disorders
Oregon Health & Science University
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This administrative supplement proposes to add a group of adults with mild Alzheimer's disease (AD) to the parent award R01DC009834. We will implement the same experimental methods that were approved in Specific Aims 2 and 4 of the parent award with this additional clinical population. The outcome measure of changes in Information Transfer Rate (ITR) as a result of training remains the same and we are adding two secondary behavioral measures for reading skills that were approved by the NIDCD program officer.

Individuals with AD present with attention and language deficits secondary to their dementia syndrome. Reading impairments are typical, and affect daily activities ranging from reading text (such as menus or magazines) to reading salient cues in their environment for wayfinding. The supplement goal is to enhance attention and reading skills in people with mild AD through a visual-attention-to-letters training paradigm. The training uses a letter-based brain-computer interface (BCI), the Rapid Serial Visual Presentation (RSVP) Keyboard system, which was already established in the parent award. It displays letters while EEG is recorded and uses a machine learning classifier and language model to decide the user's intended letter.

It is proposed that BCI training improves attention and fundamental reading skills in adults with mild AD. We plan to recruit 24 participants with possible or probable AD and language impairment from the NIA-funded P30 Oregon Alzheimer's Disease Center of which Barry Oken, MD, PhD is associate director. AD Center recruitment ensures all participants are diagnosed and characterized using the National Alzheimer's Coordinating Center guidelines. Participants will present with a Global Clinical Dementia Rating score of 0.5 – 1 and deficits in reading, and will pass an established cognitive screen for RSVP Keyboard BCI use. Participants enroll in a single arm intervention with multiple baseline A-B design and outcomes measures obtained 3 times before and 3 times after intervention in a 2-month period. Two training opportunities are planned. First, participants perform a BCI RSVP calibration task twice weekly for 6 weeks. Feedback about attention and intended letter selection accuracy are provided based on P300 waves. Second, participants view a simulated RSVP Keyboard for 15 minutes daily on home computers as a process-specific attention training task. Three outcome measures are: (1) ITR, an EEG (P300) measure related to attention; (2) sentence reading fluency; and (3) letter-word identification. Reading skills are assessed with standardized, valid subtests of the Woodcock-Johnson IV Tests of Achievement. It is hypothesized that ITR, reading fluency and letter-word identification skills are improved with the training. This supplement strengthens the current assistive technology research program and provides data for a larger research agenda on translational BCI skills and training paradigms for individuals with cognitive and motor impairments, including those with AD.