Session VII: Attention Breakout

Recorders: Wiener/Kim

The discussion group on attention concluded with the following proposal:

A key question in studies of neurorehabilitation is whether we can change the trajectory of recovery in patients with specific interventions. In the case of noninvasive brain stimulation, one viable approach may be to test the efficacy of combining stimulation techniques with demonstrated behavioral therapies.

In the field of attention, the syndrome of hemispatial neglect represents a chronic disorder characterized by lateralized deficits in attentional control. In patients with left neglect after right hemisphere stroke, attention and action are biased to the right. One proven behavioral treatment for neglect is the application of prism therapy, wherein subjects briefly wear a pair of prism lenses that skews their perception of the visual field to the right. When reaching to targets while wearing the lenses, subjects initially err by pointing too far to the right, but quickly learn to correct the error through a process of adaptation. When the lenses are removed, there is an "aftereffect": normal subjects overshoot too far to the left. However, when subjects with neglect wear and then remove the lenses, there is an improvement in their performance across a number of tasks.

Another promising class of treatments for neglect includes transcranial magnetic stimulation (TMS) or transcranial direct current stimulation (tDCS) therapy. A number of recent studies suggest that stimulating the right hemisphere or inhibiting the left hemisphere may relieve symptoms of neglect for a number of days.

The proposed experiment will compare the efficacy of prisms plus tDCS, as compared to prisms alone and tDCS alone in the treatment of patients with chronic Neglect.

Subjects:

Patients with single right hemisphere stroke $\geq$6 months post onset. Cerebellar strokes will be excluded because of prior research suggesting that they fail to demonstrate prism adaptation. Occipital damage and visual field deficits will be tabulated but not excluded.

Method:

Stimulation will be administered with anodal electrodes placed over the damaged right inferior parietal lobule, and cathodal electrodes placed over the intact left inferior parietal lobule. A within subject repeated measures design is proposed with four conditions: tDCS with prism therapy, tDCS alone, prism therapy alone, and sham tDCS. tDCS was chosen because of fewer IRB concerns, lower cost, and simpler administration. Although tDCS offers less spatial resolution than TMS, in this instance there is not a spatially precise hypothesis about the optimal target for stimulation, so higher resolution offers no specific advantage4.

Two types of outcomes will be measured. Number of trials to adaptation and magnitude of after-effect on a straight-ahead pointing task will be used to measure proximal effects. Traditional paper- and pencil measures and a virtual reality task will be used to measure more distal effects.

In each session, a subject will receive baseline testing on paper-and-pencil and VR measures, followed by stimulation and prism training, followed by post-training testing. The order of treatment conditions will be randomized across subjects. At least two weeks will intervene between treatments.

Comments and criticisms: While colleagues agreed that a within subject design will be the best method to reduce the number of required subjects, reservations were expressed about exposing subjects to each experimental condition. On the other hand, the number of subjects required to achieve sufficient statistical power would be much higher in a between subjects design, thus making the study less viable. Additional comments were on the effects of combined anodal and cathodal treatment, as there will be difficulty in ascertaining which type of stimulation provides a benefit (if any).

There was also discussion about the merits of stimulating while performing the training task versus stimulating prior to the training task. The attendees largely seemed to agree that stimulation during training was preferable.