**Project Title:** A Behavioral Treatment for Traumatic Brain Injury Associated Visual Dysfunction Based on Adult Cortical Plasticity  
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**Background:** Traumatic brain injury (TBI) has been implicated by the World Health Organization to be a 21st century epidemic similar to malaria and HIV/AIDS, not restricted to the developed world (Chua, Ng, Yap & Bok, 2007). Patients may suffer form visual field deficits, diplopia or scotomata. Among surviving soldiers wounded in combat in Iraq and Afghanistan, TBI appears to account for a larger proportion of casualties than it has in other recent U.S. wars. Accumulating evidence suggests that the adult visual cortex retains significant potential for experience-dependent plasticity. A primary mechanism proposed to regulate adult plasticity is the ratio between inhibition and excitation in the visual cortex. Neuronal interactions are robustly affected by changes in the ratio, thus may constitute a tool to explore and manipulate adult plasticity. There is also evidence that plasticity is affected by pharmacological change of excitation or inhibition. Researchers found that neuronal interactions are modified by perceptual learning - an effect that was highly effectively applied to treat abnormal vision in amblyopic adults. Investigators have also observed disrupted neuronal interactions in elderly subjects, in concert with an extensive body of knowledge on perceptual and memory deficits accompanying normal aging. Moreover, we have found abnormal neuronal interactions in patients with depression. Scientists have a highly effective method for treatment visual deficits. This treatment triggers plasticity by changing the balance towards excitations.

**Objective:** Apply methods to improve visual dysfunctions caused by brain injuries.

**Specific Aims:**
1) Apply behavioral training to healthy control individuals using our paradigm that is adopted for peripheral vision. This experiment will provide exact indications on potential effectiveness of the treatment and the amount of expected improvement in the target populations.
2) Apply behavioral training to patients with traumatic brain injury-associated visual dysfunction. The aim of this experiment is to treat the visual deficits by inducing neuronal plasticity.
3) Develop an efficient and easy-to-use protocol for non-scientific personnel.

**Study Design:** Researchers propose to map the visual field in order to detect the region with defective neuronal interactions and to induce neuronal plasticity in order to improve vision inside the damaged field using behavioral training on a computer task. The “filling-in” effect that is induced by our treatment may reduce the area of the damaged field. Our treatment triggers plasticity by changing the balance towards excitations.

**Relevance:** This treatment has the potential to treat visual dysfunctions associated with traumatic brain injury using an easy-to-use non-invasive paradigm.