The aim of our project is to improve rehabilitation strategies for hemianopia and spatial neglect (inattention), which are disabling visual and cognitive perception conditions that commonly occur as a result of severe traumatic brain injury (TBI) and stroke. Hemianopia is a sensory loss: it is the loss of half the field of vision on the same side in both eyes. By comparison, neglect is a cognitive impairment: it is a cognitive failure to report or respond to stimuli on one side (usually the left) that cannot be attributed to sensory loss. Hemianopia and neglect can occur separately or together. While people with hemianopia are aware of their visual field deficit, people with neglect are often completely unaware that anything exists on the affected side. A striking example of neglect is eating the food from only one side of the plate. Both hemianopia and neglect prevent detection of objects on the affected side, resulting in unsafe walking and driving. These conditions reduce quality of life and the capacity for independent living. Furthermore, neglect is a strong predictor of poor outcome in stroke rehabilitation. It is estimated that almost 3 million Americans suffer from spatial neglect.

We propose to evaluate the effect of a novel optical device combined with a new computerized training regimen in helping people with hemianopia and neglect detect and avoid obstacles on the affected side when walking and driving. The optical device, expansion prism (EP) glasses, uses high power prism segments embedded in a regular spectacle lens to project areas from the affected (blind/neglected) side onto the unaffected (seeing) side. The prisms are placed on the upper and lower part of the lens with a clear area of spectacle lens in between. The EP glasses have already shown great promise in assisting people with hemianopia without neglect, but have not yet been evaluated in any formal clinical trials for people with neglect (though preliminary clinical experience suggests that they may be helpful for people with neglect).

Although the EP glasses will help a person to detect objects on the blind/neglected side, he/she may have difficulties applying that information in everyday situations. Therefore, the purpose of the new training regimen that we are proposing is to help people learn how to interpret the information from the prisms so that they can correctly identify the location of objects detected via the prism and respond appropriately (e.g., avoid a collision when walking or turn to face a person approaching on the blind/neglected side). We will use a computer-based touch screen training tool that we are developing. The training involves reaching out and touching objects displayed on the blind/neglected side and the seeing side of the visual field in conditions of increasing visual difficulty.

We will conduct a series of studies to determine whether the combination of the EP glasses and training result in improved performance on tasks representative of everyday activities, including detecting pedestrians when driving in a simulator and judging potential collisions with other people or objects when walking in a virtual shopping mall. In addition, we will compare our treatment to other treatments for hemianopia and neglect to determine the relative effectiveness of the different treatments on our walking and driving simulator tasks.

Our research addresses a problem of significant public health impact that is relevant to both military and civilian populations. Potentially, our combination treatment will enable people with hemianopia and neglect to move about more safely when walking, controlling the movements of their wheelchair, or even driving. This will lead to greater independence and improved quality of life. Unlike other treatments, with only short-term effects, the EP glasses are a permanent visual aid, which will provide assistance in the long term.
Potentially, our treatment will help TBI victims in recent and ongoing conflicts as well as older veterans and civilians who suffer strokes, have had brain surgery, or sustain a TBI in non-military incidents (e.g., in a motor vehicle accident). At the end of the 3-year study, the EP glasses and training regimen will be available for implementation in civilian and military rehabilitation centers. The potential benefits of this treatment are high while the risks are very low (similar to adapting to a new pair of bifocal glasses).

Our proposed studies represent a formal implementation of an evidence-based approach to determining the effectiveness of treatments in rehabilitation, including the proper use of control groups and evaluation of practice effects. The need for such evidence-based rehabilitation is a major requirement of current trends in medicine and public health policy. However, carefully designed controlled studies are not common in rehabilitation. Our approach with controlled studies and innovative functional outcome measures will set a new standard for research in the field of hemianopia and neglect rehabilitation.