

Supplementary Materials

This is a supplement to the article by Houston et al. *A Pilot Study of Perceptual-Motor Training for Peripheral Prisms.*

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Supplement I. Detailed Training Protocol

Level 1

Level 1 promoted motor-proprioceptive adaptation of the prism-side hand. Targets were only presented to the blind side prism zones, speed was not emphasized (5 s stimulus duration), and only the prism-side hand was used. Patients were taught to sweep their hand into the blind side and detect it within the prism, align the hand with the target (also seen in the prism) and touch it. This provided visual feedback in addition to the auditory feedback described in the methods section. Fifty or more presentations were made in each zone (typical for prism adaptation experiments²⁶) and targets were 30mm square checkerboards (increased to 40mm if detection was poor). Video backgrounds were used unless detection was poor, in which case solid gray backgrounds were used first. In addition, there was an option for manual presentation of targets under experimenter control for cases where performance was initially very poor. The criterion for passing level 1 was 80% detection and touch error of no more than 4° on the level 1 task.

Level 2

The objective was to learn to discriminate targets appearing in the prism zones from those on the seeing side. The patient was instructed to notice the relative “blurriness” of the 30mm checkerboard target seen through the p-prism. Once they could distinguish “prism vision” from “regular vision”, they completed 100 training trials in which 30mm checkerboard targets were presented randomly to all zones. The following instructions were given: *“First decide if the stimulus is in the prism or your regular vision. If it is in the prism, use the hand on that side (blind side) to reach into the prism vision as you did in level 1. If it is on your seeing side, just reach and touch normally with the hand on that side. Go slow and make sure you keep your eye on the center fixation target.”* Level 2 was completed when no more than 4° touch error and at least 80% detection were exhibited in the prism zones.

Level 3

The objective was to decrease the prism side reaction time to approach that of the baseline seeing side, while remaining at or within 4° touch error and at least 80% detection. The training trials were identical to level 2, except that stimulus duration was gradually reduced, depending on seeing side performance, from ~5s to ~1s. The minimum criterion for passing level 3 was prism side reaction time not more than twice the seeing side reaction time.

Level 4

The objectives were to 1) maintain performance under increased cognitive load and 2) improve detection of hazards in natural scenes. Level 4 included 3 sub-tasks: 4.1 *stop-go* (refrain from making screen touches when the fixation cross was red in color); 4.2 *divided attention movie watching* (video clips played at the center of the display; the remainder of the background was a static image); and 4.3 *hazard detection* (videos from the driver's perspective played over the entire screen in which hazards repeatedly enter the vehicle's path from the prism side). In sublevel 4.3, patients maintained fixation on the cross and tapped the table with a stylus when the hazard was first detected in the p-prism. Sublevel 4.3 was different from the other levels since the targets were actual hazards within the video background (e.g., pedestrians in a crosswalk) and of much lower contrast than the checkerboard targets used in all other levels. As a result, higher resolution and/or better awareness of the p-prism vision were needed. The patient was taught to tuck their chin in while maintaining fixation on the central cross. This moved the upper prism closer to the line of sight and the prism image to a smaller vertical retinal eccentricity, aiming to improve visual sensitivity and enhancing detection in the prism vision. It was explained how this strategy could also be done in everyday life, not just during the training. They were carefully instructed not to look directly into the p-prisms. Once hazards were consistently detected, patients were instructed to touch the screen where the hazard first appeared (the hazards were moving towards the patients' virtual path of movement). Level 4 was completed when the hazard location was touched 80% of the time before it crossed into their intact visual field.

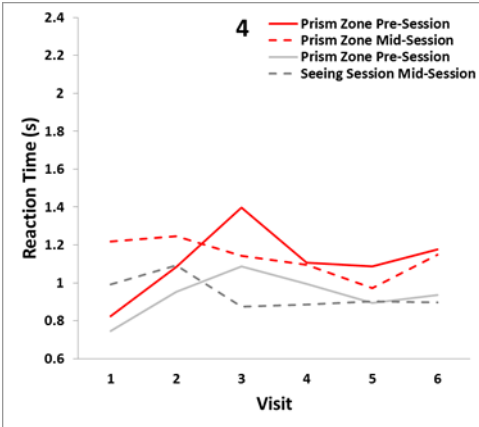
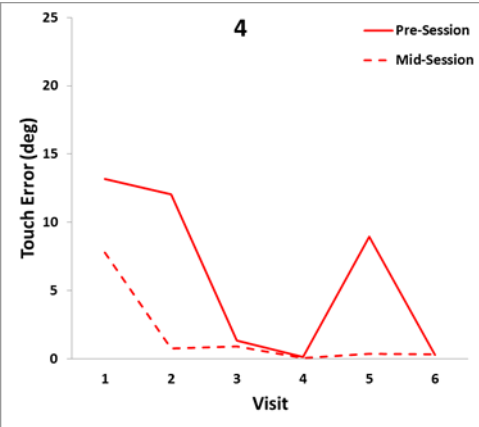
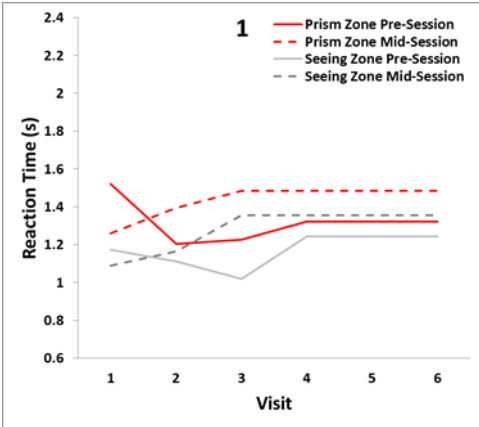
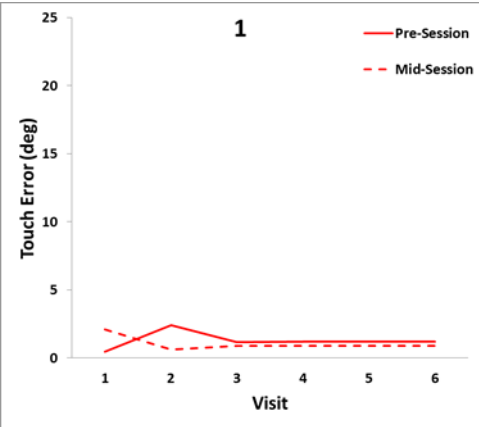
Level 5

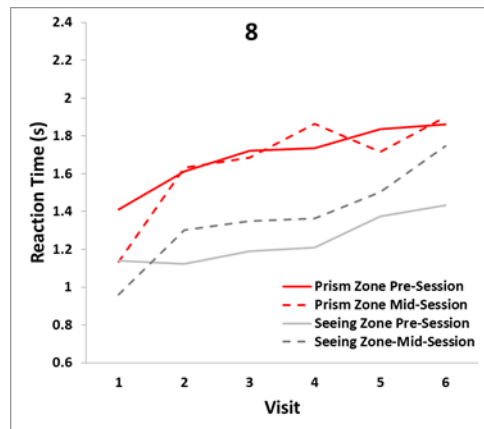
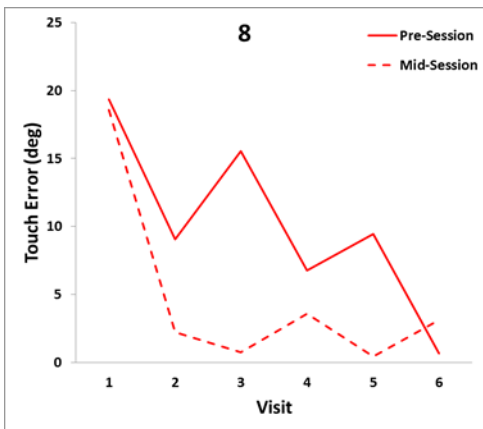
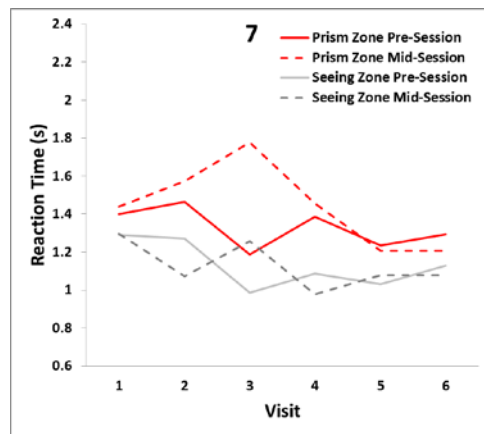
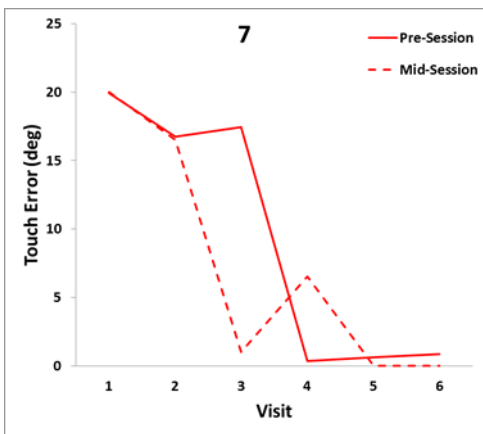
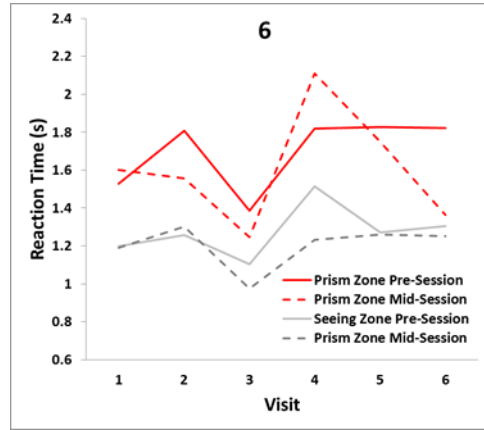
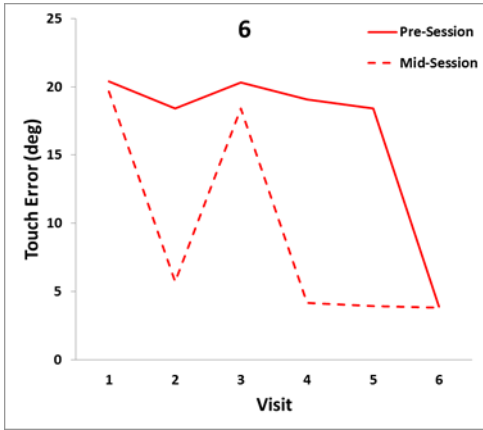
This level was designed to promote perceptual adaptation through verbal reinforcement of true target location and by calling attention to shifted parts of the background scene. This “scene-shift-feedback” is the type of visual feedback available in every-day use of the p-prisms where obstacles to be detected are frequently beyond arm’s reach. Baseline performance for this task was measured by asking the patient to verbally report whether a target appeared to the right or left of a human figure positioned in the center of a background photo. The experimenter recorded the response (no touch was made initially). Note: The targets and portion of the background within the p-prism are imaged (retinotopically) on the opposite side of the human figure than where they are truly located (Fig. 2a), but if perceptually adapted or applying a cognitive correction, patients may accurately report on which side of the screen the target had appeared (right or left). Patients were then asked to touch the targets while saying “right” or “left”, with feedback being provided by the software in the same manner as other levels. Level 5 was complete when touch error was at or within 4° with at least 80% correct verbal responses.

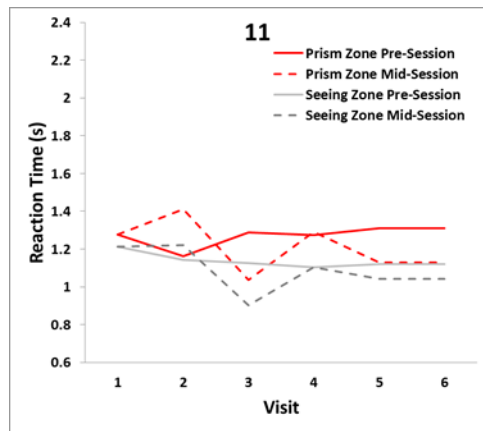
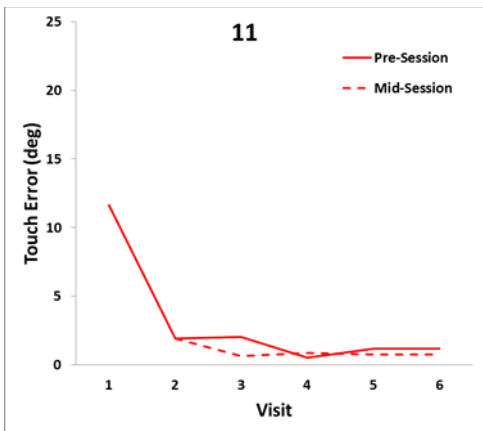
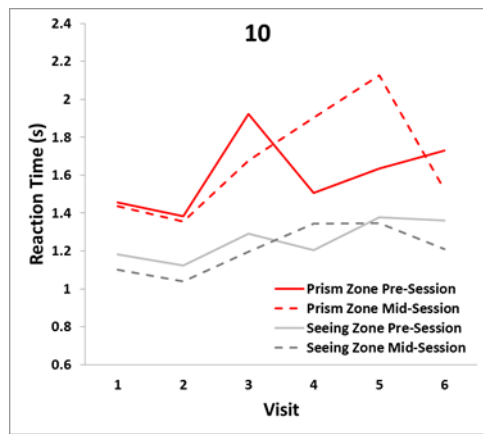
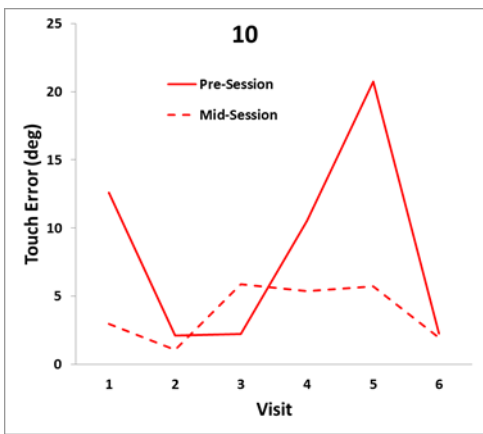
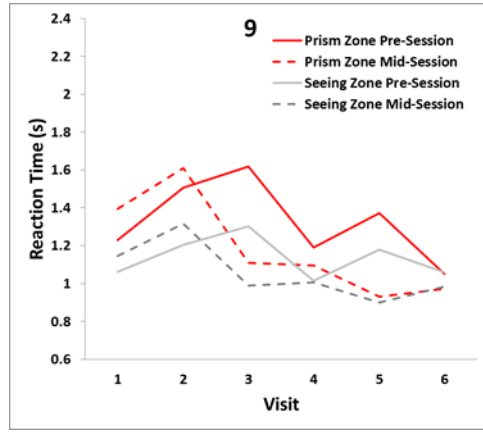
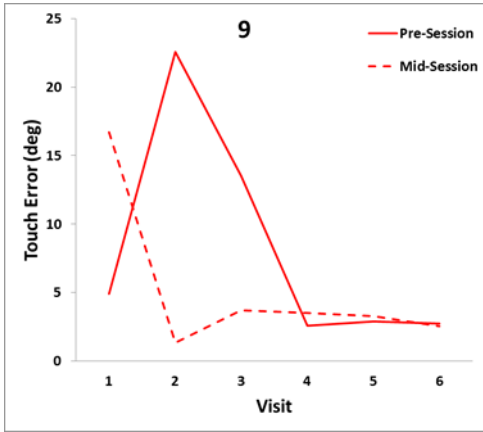
Supplement II. Individual Training Plots

Supp Fig 1: Individual training plots showing median touch error (left column) and reaction time (right column) by visit. Touch error plots are prism zone data only, reaction time plots show seeing (gray lines) and prism (red lines) data.

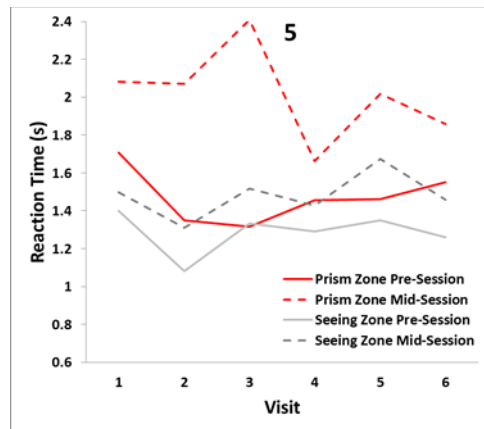
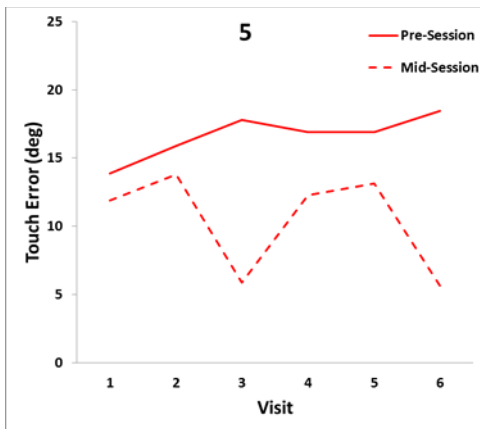
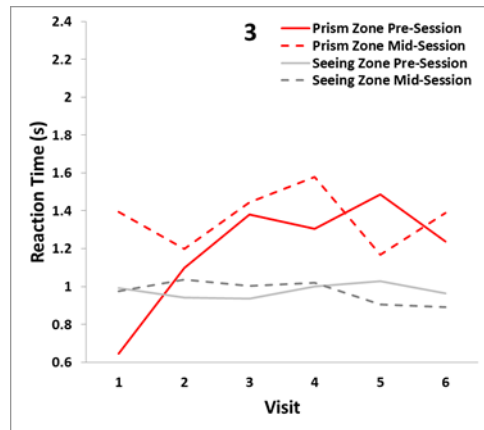
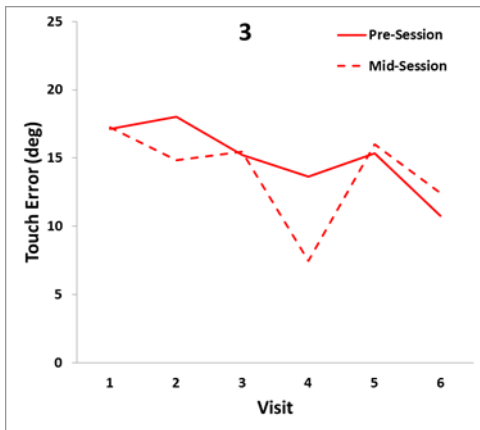
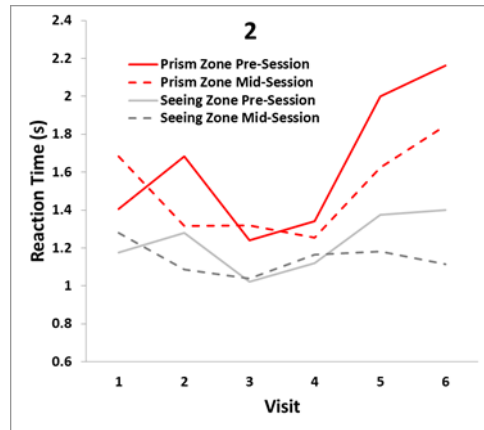
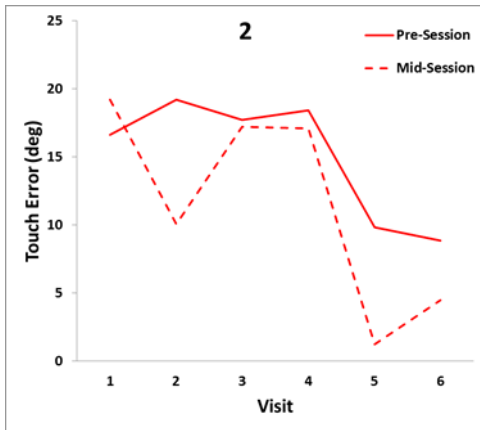
Successful Cases

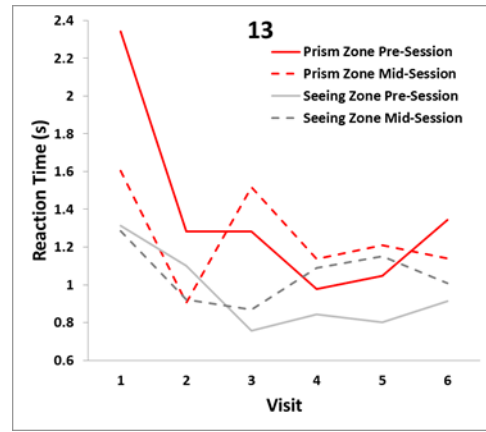
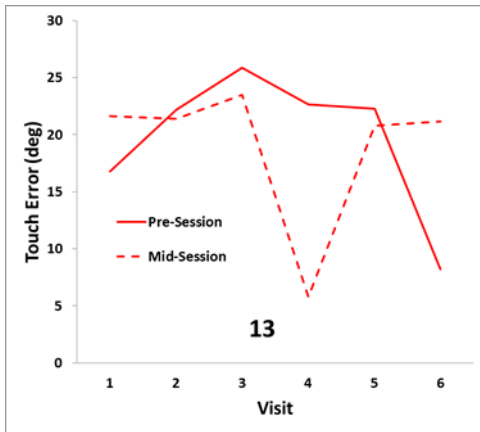
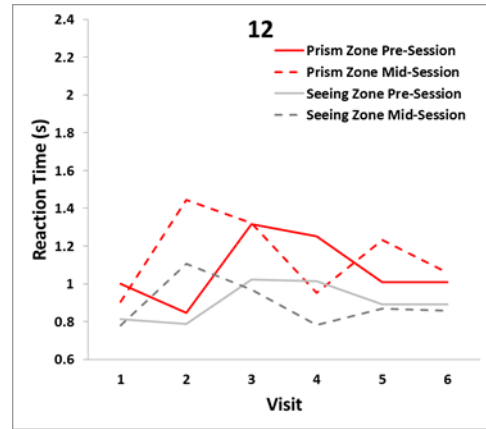
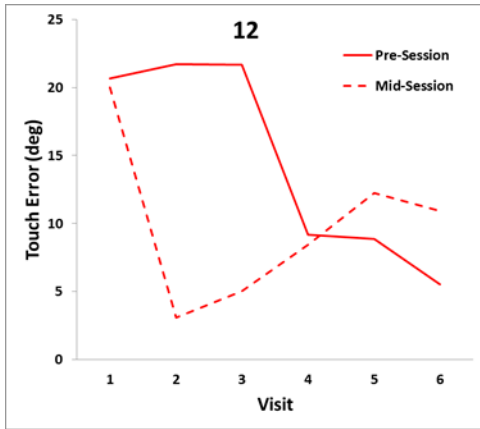






Less Successful Cases





Supplement III. Training Videos

Video 1: A patient with left hemianopia doing the performance task while wearing a head mounted gaze tracking system (Positive Science, www.positivescience.com) showing the view of the screen from the patient's perspective (except without hemianopia).

Video 2: A patient with left hemianopia wearing 57 Δ oblique p-prisms doing training

Video 3: Level 2 Task

The video illustrates training in right hemianopia with 57 Δ oblique p-prisms. Notice the audio feedback for correct and incorrect touches.

[Click here](#) to access videos.