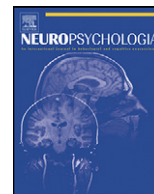




Contents lists available at ScienceDirect

Neuropsychologia

journal homepage: www.elsevier.com/locate/neuropsychologia

Prism adaptation improves visual search in hemispatial neglect

Styrmir Saevarsson^{a,*}, Árni Kristjánsson^{b,c}, Helmut Hildebrandt^d, Ulrike Halsband^a^a Department of Psychology, Neuropsychology, University of Freiburg, Freiburg, Germany^b Department of Psychology, University of Iceland, Iceland^c Institute of Cognitive Neuroscience, University College London, United Kingdom^d Institute of Psychology, University of Oldenburg, Germany

ARTICLE INFO

Article history:

Received 3 April 2008

Received in revised form 26 October 2008

Accepted 23 November 2008

Available online 30 November 2008

Keywords:

Hemispatial neglect

Visual search

Feedback

Cognitive load

Prism adaptation

ABSTRACT

Visuomotor prism adaptation has been found to induce a lateral bias of spatial attention in chronic hemispatial neglect patients. Here, two experiments were conducted to explore the effects of 10° prism adaptation on visual search tasks and standard visual inattention tests. Baselines and intervention effects were measured on separate days for all patients. The first experiment explored whether prism adaptation affects performance on a time restricted visual search task (maximum 3500 ms presentation followed by visual and auditory feedback). No positive effects of prism adaptation were found on accuracy in visual search nor on traditional neglect tests. These results accord well with previous studies showing that increased cognitive load can lead to prism de-adaptation or unchanged performance following prism adaptation. Response times in visual search became faster following intervention but this was not the case for the standard neglect tests. In the second experiment, the same single-featured search task was used, but the participants had unlimited search time and received no feedback on their response. This time, the patients showed accuracy improvements in visual search and all four on regular neglect tests. Therapeutic effects lasted for at least 90–120 min. Response times on all tasks became faster after prism adaptation. The results are consistent with studies showing effects of prism adaptation on neuropsychological neglect tests and other attentional tasks that are not speeded or time restricted, where feedback is not provided, or are performed following non-feedback-based tasks. The current findings show that prism adaptation improves visual search in neglect and that these beneficial effects can disappear with feedback.

© 2008 Elsevier Ltd. All rights reserved.

1. Introduction

Hemispatial neglect, an attentional deficit towards stimuli contralateral to a brain lesion, usually follows a right-sided brain lesion, normally generated by a stroke in the *a. cerebri media* (Heilman, Bowers, Valenstein, & Watson, 1987; Vallar, 1993). Lesions in superior temporal cortex (Brodmann's areas (BAs) 22 and 37; Karnath, Berger, Küker, & Rorden, 2004; Karnath, Ferber, & Himmelbach, 2001) or in the inferior parietal cortex (BAs 7 and 40) and the medial temporo-parietal junction (BAs 39 and 40; e.g. Mort et al., 2003; Vallar & Perani, 1987) have been shown to produce neglect symptoms. In addition, lesions in the frontal lobes (BAs 4, 6, 44 and 45; Husain & Kennard, 1996), insular cortex (BAs 13 and 14; Manes, Paradiso, Springer, Lamberty, & Robinson, 1999) and basal ganglia (Karnath, Himmelbach, & Rorden, 2002) have also been found to cause neglect symptoms (Halligan, Fink, Marshall, & Vallar, 2003; Smania et al., 1998). Zoccolotti et al. (1989) reported that 27–52% of right hemisphere stroke patients show neglect symptoms for more

than 2 months following their haemorrhage. Neglect has an enormous impact on the health services of the modern Western world and lays a heavy burden on patients' families (Kerckhoff & Rossetti, 2006; Milner & McIntosh, 2005). Effective treatments for neglect are, therefore, of great value.

1.1. Rehabilitation of neglect and visual search

Many different interventions have been developed to treat neglect, but most have shown limited or no clinical effects. Luauté, Halligan, Rode, Rossetti, and Boisson (2006) concluded, in a comprehensive review of the literature, that there are only a handful of interventions that have reliably been shown to result in benefits for neglect patients. These include visual scanning training, repeated neck muscle vibration associated with an extensive training program, mental imagery training, video feedback training and prism adaptation (PA). However, studies where patients are randomly assigned to treatments groups are still lacking (Bowen & Lincoln, 2006).

Prism adaptation is a relatively new treatment for neglect (Rossetti et al., 1998) although such adaptation effects have fascinated scientists since the nineteenth century (Helmholtz, 1962); Ivo

* Corresponding author. Tel.: +49 761 203 9442; fax: +49 761 203 9438.
E-mail address: saevarsson@daad-alumni.de (S. Saevarsson).