Eye dominance influences triggering action and interhemispheric transfer time: a Behavioural and Electrophysiological study

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Résumé

Our dominant eye (DE) is the one we unconsciously choose when performing a monocular task. Several studies revealed that the stimulation of this DE activates a larger cerebral network and with shorter latency than the stimulation of the non DE (e.g *Shima et al. 2010*; Neuroreport 21(12), 817-21). Despite these results, the functions and behavioral consequences of this lateralization remain poorly understood. Here, through a Poffenberger paradigm we performed behavioural and electrophysiological measures to decipher the temporal impact of eye dominance on visuomotor transformation and on interhemispheric transfer time (IHTT) respectively. Firstly, by selecting participants according to their DE and handedness, and varying the side of the stimulated visual hemifield in a simple reaction time task, we examine the influence of the eye dominance in a sensori-motor task. We showed that the temporal impact of eye dominance strongly depended on whether the participants were right- or left-handed. In right-handers, reaction times (RT) were shorter for targets presented in the hemifield contralateral to the DE whereas in left-handers, RT of left hand was shorter only in participants with right DE, without hemifield difference. Additionally, from the first use of the Poffenberger paradigm (1912), the idea is that, by comparing for a given responding hand reaction times for each visual hemifield, an estimation of the IHTT could be obtained. The present study demonstrates that this paradigm cannot lead to the correct estimation of the IHTT. In addition, it gives an explanation to the often reported IHTT negative values that otherwise appear illogical. Secondly, still in a Poffenberger paradigm, we used EEG recordings to more precisely evaluate the IHTT (eg *Rugg et al. 1984*; Neuropsychologia 22(2),215-25). Preliminary results in right-handers show a faster IHTT in subjects with right DE compared to those with left DE. In addition only right-handers with right DE show an asymmetry with a faster IHTT from right to left than from left to right. In sum, all these data converge to demonstrate a substantial impact of eye dominance on neural mechanisms involved in converting visual inputs into motor commands. These new findings highlights the need to consider the eye dominance that appears to be a hidden factor, in studies investigating the neural processes underlying visually-guided actions.

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