Gaze Direction and

Two-choice Reaction Time:

Multiple Tests of a Theory

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Summary

The relationship between voluntary eye movements and cognition was examined in terms of Kinsbourne's (1972) account of conjugate lateral eye movements (CLEMs). This account is itself based upon his (1970) attentional gradient model of lateralized cerebral asymmetry. A novel methodology was devised with gaze position (GP) and visual field (VF) as the independent variables and manual reaction time (RT) as the dependant measure. A divided VF paradigm using two-choice RT tasks was used thereby avoiding the ambiguities of orthodox CLEM methods. The tasks were, letter (X,V) identification, a lexical decision using words and non-words, simple geometrical shapes, and a mental rotation task. Five visual display units (VDUs) arranged in the form of a Maltese cross subtending 50 degrees horizontally and 35 degrees vertically functioned as tachistoscopes. Trials were either randomized (R) over the VDUs or presented in blocks (B) on each VDU in turn. Under R conditions using verbal tasks, a GP x VF interaction was found for horizontal GPs. This interaction was due to RTs being fastest when the VF and GP hemispace were congruent (e.g., LVF and LGP). Under B conditions, a GP main effect was found for verbal tasks. This effect was shown by RTs being fastest when subjects looked to the right GP, both VFs producing this effect. No reliable effects were found for visual-spatial tasks. The GP effects found under B conditions were weak and inconsistent and required a form of meta analysis to demonstrate their reliability. No evidence was found for an interaction of GP with task difficulty. A number of possible explanations, including Kinsbourne's models, were examined. The direction of the GP x VF interaction when trials were randomized was contrary to the predictions made from Kinsbourne's models and the GP main effect found under B conditions was not predicted by them; hence "arousal" and "attention" as used by Kinsbourne were rejected. If eye movements and cognition were regarded as a dual task workload, then intrahemispheric interference could account for the interaction. However, it could not account for the GP effect under B conditions, nor could it account for the absence of any effects with visual-spatial tasks. Also, neuroanatomical considerations made global intrahemispheric arousal and interference implausible as explanations. One possible explanation was that under both presentation conditions, an habitual bias towards right hemispace occurred. But this bias could be reversed if motor interference occurred in the left hemisphere between saccade control and subvocalization. Interference would only occur with randomized trials and verbal tasks, producing the GP x VF interaction. This explanation also accounted for the absence of any effects when visual-spatial tasks were used. The overall results were evaluated in relation to other accounts of CLEM production and also against modern developments in cerebral laterality investigations.