The influence of socio-biological cues on saccadic orienting

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to the University of Exeter as a thesis for the degree of

Doctor of Philosophy in Psychology, June 2011.

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Abstract

Previous research has suggested that viewing of another's averted eye gaze causes automatic orienting of attention and eye movements in observers due to the importance of eye gaze for effective social interaction. Other types of visual cues with no social or biological relevance, such as arrows, are claimed not to produce such a direct effect on orienting behaviour. The finding that processing of eye gaze is reduced in individuals with Autistic Spectrum Disorders as well as following damage to the orbitofrontal cortex of the brain, suggests that gaze processing is indeed critical for effective social behaviour and therefore eye gaze may constitute a "special" directional cue. This thesis tested these ideas by examining the influence of socio-biological (eye gaze and finger pointing) and non-social cues (arrows and words) on eye movement responses in both healthy control participants and those with damage to the frontal lobes of the brain. It further investigated the relationship between orienting to gaze and arrow cues and autistic traits in a healthy population. Important differences between the effects of socio-biological and non-social cues were found on saccadic eye movements. Although in the pro-saccade tasks, arrow cues caused a similar facilitation of responses in the cued direction as eye gaze and pointing cues, in the anti-saccade tasks (in which participants have to respond away from the location of a peripheral onset), arrows had a greatly reduced effect on oculomotor programming relative to the biologically relevant cues. Importantly, although the socio-biological cues continued to influence saccadic responses, the facilitation was in the *opposite* direction to the cues. This finding suggests that the cues were being processed within the same "anti-response" task set (i.e. "go opposite") as the target stimulus. Word cues had almost no effects on saccadic orienting in either pro- or anti-saccade tasks.

Schematicised eye gaze cues had a smaller magnitude effect than photographic gaze cues suggesting that ecological validity ("biological-ness") is an important factor in influencing oculomotor responses to social cues. No relationship was found between autistic traits and orienting to gaze or arrow cues in a large sample of males. However, findings from the neurological patients point to a possible double-dissociation between the neural mechanisms subserving processing of socio-biological and non-social cues, with the former reliant on the orbitofrontal cortex, and the latter on lateral frontal cortex. Taken together, these results suggest that biologically relevant cues have privileged access to the oculomotor system. The findings are interpreted in terms of a neurocognitive model of saccadic orienting to socio-biological and non-social cues, and an extension to an existing model of saccade generation is proposed. Finally, limitations of the research, its wider impact and directions for future work are discussed.

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