Searching for asymmetries in the detection of gaze contact versus averted gaze under different head views: a behavioural study

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Abstract—Eye contact is a crucial social cue constituting a frequent preliminary to interaction. Thus, the perception of others’ gaze may be associated with specific processes beginning with asymmetries in the detection of direct versus averted gaze. We tested this hypothesis in two behavioural experiments using realistic eye stimuli in a visual search task. We manipulated the head orientation (frontal or deviated) and the visual field (right or left) in which the target appeared at display onset. We found that direct gaze targets presented among averted gaze distractors were detected faster and better than averted gaze targets among direct gaze distractors, but only when the head was deviated. Moreover, direct gaze targets were detected very quickly and efficiently regardless of head orientation and visual field, whereas the detection of averted gaze was strongly modulated by these factors. These results suggest that gaze contact has precedence over contextual information such as head orientation and visual field.

Keywords: Gaze contact; visual search; gaze direction; head orientation; social attention.

INTRODUCTION

The eyes not only subserve visual perception but support interpersonal communication in everyday life by indicating the direction of others’ attention and more generally by conveying information about mental states, such as intentions, beliefs, desires, etc. (see Baron-Cohen et al., 1995). Among all gaze directions, those establishing eye contact between two individuals seem to play an important role in many

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ways. For instance, as a precursor of social interaction, direct gaze or gaze contact can have a variety of meanings ranging from the expression of hostility to that of intimacy, which makes it an essential cue that has to be detected and decoded early for adaptive behaviour (Kleinke, 1986). Surprisingly, however, the perception of averted gaze and the automatic shift of attention that it induces in the observer have attracted more interest than the processes triggered by gaze contact (e.g. Driver et al., 1999; Friesen and Kingstone, 2003; Hood et al., 1998). Yet there is evidence that gaze contact, relative to averted gaze, can improve face recognition (Hood et al., 2003; Vuilleumier et al., 2005), speed categorisation of an interlocutor’s gender (Macrae et al., 2002), and perhaps make a face look more attractive (Kampe et al., 2001). Brain imaging studies have also shown enhanced responses in the fusiform gyrus (known to be involved in face perception), as well as amygdala activity (classically linked to emotional processes) for faces with direct as compared to averted gaze (George et al., 2001; Kawashima et al., 1999). Furthermore, sensitivity to gaze contact appears very early in newborns and would appear to serve as an essential foundation for the development of social skills (Baron-Cohen et al., 1995; Farroni et al., 2002). Moreover, gaze contact provides a signal to which human beings are exquisitely sensitive. It is unclear whether this sensitivity is related to specific perceptual mechanisms for gaze detection or more general mechanisms for shape perception applied to detection of the morphology of the human eye (Kleinke, 1986). However, it suggests that the detection of direct gaze may yield asymmetric performances in comparison with the detection of averted gaze.

This question was examined using visual search by von Grünau and Anston (1995), who reported that a straight gaze target embedded in averted gaze distractors is detected faster and better than an averted gaze target among straight gaze distractors. However, this study employed a very small number of subjects, and its main result was based on an asymmetric design that may generate spurious search asymmetries (Rosenholtz, 2001). The first two experiments used confounding distractor conditions, with two types of distractor (straight and averted) for the averted gaze target and only one type of distractor (averted-only) for the straight gaze target. Only the third experiment used a single type of distractor for straight as well as averted targets and confirmed the asymmetry in the detection of straight relative to averted gaze. However, the stimuli were a single pair of highly schematic eyes, featuring gaze as seen under frontal head view. Thus low-level visual properties, such as the vertical symmetry of straight gaze, may have confounded the results. (This confound cannot be ruled out by their control experiment, which used a single object rather than pair of objects as well as heterogeneous distractors.) There is also the question as to what extent the processes recruited by such very schematic stimuli reflect natural gaze processing. In particular, several studies have shown that head orientation (congruent or incongruent with gaze direction) can influence the perception of gaze direction (Langton, 2000; Langton et al., 2000; Pageler et al., 2003; but see also Perrett et al., 1992). For example, Vuilleumier et al. (2005) have shown an advantage for the recognition of faces seen with direct