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Psychiatry Research 127 (2004) 43–53
PSYCHIATRY RESEARCH
www.elsevier.com/locate/psychres

Face to face: visual scanpath evidence for abnormal processing of facial expressions in social phobia

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Received 9 August 2003; received in revised form 30 December 2003; accepted 23 February 2004

Abstract

Cognitive models of social phobia propose that cognitive biases and fears regarding negative evaluation by others result in preferential attention to interpersonal sources of threat. These fears may account for the hypervigilance and avoidance of eye contact commonly reported by clinicians. This study provides the first objective examination of threat-related processing in social phobia. It was predicted that hyperscanning (hypervigilance) and eye avoidance would be most apparent in social phobia for overt expressions of threat. An infrared corneal reflection technique was used to record visual scanpaths in response to angry, sad, and happy vs. neutral facial expressions. Twenty-two subjects with social phobia were compared with age- and sex-matched normal controls. As predicted, social phobia subjects displayed hyperscanning, (increased scanpath length) and avoidance (reduced foveal fixations) of the eyes, particularly evident for angry faces. The results could not be explained by either medication or co-morbid depression. These findings are consistent with theories emphasising the role of information processing biases in social phobia, and show promise in the application to treatment evaluation in this disorder.
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Keywords: Social phobia; Anxiety; Emotion; Threat; Face processing; Eye movements; Visual scanpaths

1. Introduction

The fundamental characteristic of social phobia (SP) is severe anxiety in social situations, with excessive concern that others may evaluate the sufferer's behaviour negatively (American Psychiatric Association, 1994). Symptoms of social anxiety are considered to be a manifestation of 'overactive' survival mechanisms. A breakdown in these mechanisms can produce phobic fears about social interactions that are out of proportion to the perceived danger. Cognitive models of anxiety, propose that dysfunctional beliefs and fears about evaluation in social phobia produce an enhanced attention to sources of potential threat, particularly social threat (Beck and Emery, 1985; Clark and Wells, 1995; Rapee and Heimberg, 1997).

Evidence from cognitive studies is consistent with the proposal by Beck and Emery (1985) that

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0165-1781/04/$ - see front matter © 2004 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.psychres.2004.02.016

the fear of social evaluation in social phobia produces 'hyperattention' to social threat cues. For instance, the content of social threat words (for example, inferior, criticised) interferes with the ability of socially phobic individuals to name the colour of these words on modified Stroop tasks, suggesting that they are automatically engaged by this threat-related content (Hope et al., 1990; Maidenberg et al., 1996). Initial exposure to social threat words also increases the speed of detection for subsequent probe stimuli in social phobia (Asmundson and Stein, 1994). These cognitive findings suggest that there is an excessive automatic engagement by signals of social threat in individuals with social phobia. Socially phobic individuals may also alter their overt (foveal) locus of controlled attention in dramatic ways. Clinical observation indicates that these individuals avoid looking at the faces of others, which may be an important indicator of social fears. In particular, social phobia has been associated clinically with the avoidance of eye contact (Greist, 1995; Marks, 1969; Öhman, 1986). Eye contact is a particularly important signal in social exchanges involving potential threat or attempted dominance (Darwin, 1872/1955; Strongman and Champness, 1968; Gould and Marler, 1984; Emery, 2000). Eyes are also considered to be the most fear-inducing feature in situations of social appraisal by others (Öhman, 1986).

The apparent contradiction between evidence of an attentional bias towards social threat cues in social phobia and the active avoidance of salient stimuli (such as eyes) might be resolved in terms of early and late attentional processes. For instance, the vigilance-avoidance hypothesis proposes that hypervigilance (or 'hyperattention') is associated with automatic (early) processing, while avoidance reflects the strategic (later) allocation of attentional processes (Beck and Clark, 1997). In this regard, the avoidance of eye contact in social phobia may represent a defensive strategy for coping with a hyperattention to perceived threat in social situations.

Evaluation of threat-related face processing in social phobia has previously been limited solely to face recognition studies. Socially phobic individuals show an enhanced recognition of negative compared with positive facial expressions (Lundh and Öst, 1996; Foa et al., 2000). Notably, recognition accuracy is particularly enhanced for angry faces (Gilboa-Schechtman et al., 1999), consistent with the notion that there is a functional hypervigilance (or hyperattention) for social threat and a consequent active avoidance of the source of threat.

Our group conducted the first study using visual scanpaths of overt attention to neutral face stimuli in social phobia (Horley et al., 2003). The pattern of eye movements and foveal eye fixations that form the visual scanpath provides an objective psychophysiological marker of directed visual attention in real time (Just and Carpenter, 1976). As such, they are potentially informative about the mechanics of social interaction and concomitant cognitive processes during the processing of face stimuli in disorders such as social phobia. Eye movement patterns may more directly reflect directed attention in that they provide an index of overt attention to face stimuli. In contrast, tasks such as the Stroop and dot probe provide an indirect measure of attention, via inferences from reaction time performance to stimuli that which are manipulated in terms of sematic content. Faces are biologically meaningful stimuli that communicate signals of threat to social phobia individuals, in regard to their fears of evaluation by others.

In healthy subjects, visual scanpaths tend to follow a triangular pattern, in which fixations are directed mainly to the salient features that define facial expressions, the mouth and the eyes (Walker-Smith et al., 1977; Mertens et al., 1993). Our preliminary results indicated that socially phobic individuals have a pattern of hyperscanning for face stimuli (suggestive of a heightened vigilance), but they also show a marked avoidance of the eyes when making foveal fixations (Horley et al., 2003). This pattern of concomitant hyperscanning and avoidance of the eyes was clearly different from the scanpath disturbances revealed in our studies in other disorders, including restricted scanpaths to faces in schizophrenia (Gordon et al., 1992; Manor et al., 1999; Williams et al., 1999; Loughland et al., 2002) and greater foveal attention to threat in posttraumatic stress disorder (PTSD) (Bryant et al., 1995). Several visual scan-

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