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Selective attention and avoidance on a pictorial cueing task during stress in clinically anxious and depressed participants☆

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ABSTRACT

Although it is well established that attentional biases exist in anxious populations, the specific components of visual orienting towards and away from emotional stimuli are not well delineated. The present study was designed to examine these processes. We used a modified spatial cueing task to assess the speed of engagement and disengagement from supraliminal and masked pictorial cues depicting threat, dysphoria, or neutral content in 36 clinically anxious, 41 depressed and 41 control participants. Participants were randomly assigned to a stress or neutral condition. During stress, anxious participants were slow to disengage from masked left hemifield pictures depicting threat or dysphoria, but were quick to disengage from supraliminal threat pictures. Information processing in anxious participants during stress was characterized by early selective attention of emotional stimuli, occurring prior to full conscious awareness, followed by effortful avoidance of threat. Depressed participants were distinct from the anxious group, displaying selective attention for stimuli depicting dysphoria, but not threat, during the neutral condition. In sum, attentional biases in clinical populations are associated with difficulties in the disengagement component of visual orienting. Further, a vigilant-avoidant pattern of attentional bias may represent a strategic attempt to compensate for the early activation of a fear response.

Cognitive bias in the processing of emotional information has been identified as a key mechanism in the maintenance of fear and vigilance (Mathews & MacLeod, 2002; Mogg & Bradley, 1998). Studies carried out in clinical and non-clinical populations indicate that anxious participants selectively attend to negative or threatening words and pictures (Bradley, Mogg, & Millar, 2000; Mogg, Philippot, & Bradley, 2004), particularly when these stimuli are of moderate to high emotional intensity (Koster, Crombez, Verschuere, Van Damme, & Wiersema, 2006; Wilson & MacLeod, 2003). Among anxious participants, the attentional bias is thought to occur in the early evaluative stage of stimulus analysis (Fox, 2002; Mogg, Bradley, & Williams, 1995). These findings are based primarily on studies utilizing the emotional Stroop and dot probe tasks, which both measure a bias in the allocation of attention to emotional content in the context of multiple or competing sources of information. Despite their substantial contribution to the literature, these tasks do not specify a precise attentional mechanism, which could involve a number of processes that underlie visual spatial attention (Posner, Inhoff, & Friedrich, 1987; Salemink, van den Hout, & Kindt, 2007). An important question for clinical researchers is whether attentional biases among anxious populations reflect a deficit in allocating attention (engagement) or disengaging attention, which refers to the release of attention from its current location. The focus on attentional allocation or disengagement has clear relevance to cognitive theories of anxiety, in that a deficit in the shifting and allocation of attention suggests heightened vigilance and a sensitized threat detection mechanism. A deficit in disengagement, on the other hand, suggests that threat detection is normal but attentional flexibility, the ability to adaptively shift attention from one stimulus to another, may be dysfunctional, leading to problems in self-regulation, rumination, and other forms of maladaptive coping.

Disengaging attention from emotional cues

Some studies have addressed this issue by utilizing a modified spatial cueing task with emotional stimuli, which assesses covert shifts of attention (Ellenbogen, Schwartzman, Stewart, & Walker,

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2002; Stormark, Nordby, & Hugdahl, 1995). Spatial cueing assesses the latency to respond to a neutral target following either a valid or invalid cue presentation (Posner, Snyder, & Davidson, 1980), which can be either emotional or neutral in content (Stormark et al., 1995). Cues are valid when presented in the same hemifield as the target, and invalid when presented in the contralateral hemifield of the target. Invalid cueing necessitates participants to first shift to the location of the cue, and then to disengage from that location and move attention to contralateral visual space where the target stimulus appears. The process of disengagement incurs a "cost" which can be measured as a delay in reaction time for invalid relative to valid trials. Thus, the valid vs. invalid manipulation permits differentiation in reaction time between the engagement and disengagement of spatial attention (Luck et al., 1994; Posner, Nissen, & Ogden, 1978). More importantly, an index of the efficiency of disengagement from emotional stimuli can be generated by comparing reaction time to disengage from emotional cues with reaction time to disengage from neutral cues.

Attentional biases in anxiety disorders

Although there is evidence of facilitated attentional engagement (Calvo & Avero, 2005; Koster et al., 2006), attentional biases in anxious participants are largely attributable to difficulties in disengaging attention from a threatening stimulus (Amir, Elias, Klumpp, & Przeworski, 2003; Fox, Russo, & Dutton, 2001; Koster et al., 2006; Salemink et al., 2007). Studies in this area, with one exception (Amir et al., 2003), have targeted non-clinical populations identified as having high scores on an anxiety inventory, and with one exception (Koster, Verschuere, Burssens, Custers, & Crombez, 2007), have not used masked stimuli to assess the early "pre-conscious" evaluative stage of stimulus analysis. There is a need at this juncture, therefore, for research that targets the underpinnings of the early stages of information processing, and does so in clinical populations.

In addition to attentional vigilance, active "avoidance" of emotional faces and words has been observed in some studies of anxious participants (Koster et al., 2006; Mogg, Bradley, Miles, & Dixon, 2004; Waters, Nitz, Craske, & Johnson, 2007), and following exposure to aversive stress (Ellenbogen, 2005; Ellenbogen et al., 2002; Mansell, Clark, Ehlers, & Chen, 1999). A number of hypotheses regarding the role of attentional avoidance have been formulated. Attentional avoidance may represent an adaptive response to low-intensity threat (Wilson & MacLeod, 2003). From this perspective, it would be more likely to occur for stimuli of low threat value and in individuals with low trait anxiety. Attentional avoidance may represent a mechanism used to help regulate emotional and biological reactivity associated with exposure to threat (Ellenbogen et al., 2002; Ellenbogen, Schwartzman, Stewart, & Walker, 2006). Finally, attentional avoidance may represent a potentially maladaptive mechanism occurring in response to an early attentional bias to threat (Koster et al., 2006; Mogg, Bradley, et al., 2004; Mogg, Philippot, et al., 2004). Using eye tracking methods, university students spent a high proportion of time gazing at emotional pictures during early visual processing (0–500 ms), but not during later processing (+1500 ms) when their gaze was directed away from pictures depicting threat (Calvo & Avero, 2005). Thus, anxious individuals who show an attentional bias within the first 500 ms of information processing may also show an ensuing avoidant response, the effect of which could block learning that is critical for extinguishing irrational fears (i.e. learning that fear associated with a distant dog bark, or a picture of a dog, is not threatening). Clearly, more work is needed to better understand this phenomenon.

Attentional biases in major depression

In depressed populations, evidence of an attentional bias has been both positive (Eizenman et al., 2003; Gotlib, Krasnoperova, Yue, & Joormann, 2004; Joormann & Gotlib, 2007; Mathews, Ridgeway, & Williamson, 1996) and negative (McCabe & Toman, 2000; Mogg, Bradley, Williams, & Mathews, 1993). Some have argued that attentional biases in depression occur late in the information processing sequence – in the elaborative phase, whereas the processing of threatening information in anxiety states begins early – in the pre-attentive or "pre-conscious" phase (Mathews & MacLeod, 1994; Williams, Watts, MacLeod, & Mathews, 1997). Recent studies indicate that attentional biases in depression are specific to pictorial stimuli depicting themes of sadness and loss, but not other types of negative stimuli (Gotlib et al., 2004; Joormann & Gotlib, 2007). Although there is no clear consensus, attentional biases in depression appear to be complex and a function of the task used to measure attention (Eizenman et al., 2003), the type of stimuli presented (Gotlib et al., 2004), and the exposure duration of the stimuli (Mogg et al., 1995).

Attentional biases following stress inductions

Certain cognitive abnormalities are evident only during stress or a negative mood state (Scher, Ingram, & Segal, 2005). The most common prediction tested in this line of research is the notion of mood congruency, where stress and negative emotional states promote information processing of negatively valenced stimuli. The findings, however, have been inconsistent. Although many studies have found that laboratory stressors and mood induction procedures facilitate the processing of threatening information (Gilboa & Gotlib, 1997; Ononaiye, Turpin, & Reidy, 2007; Sposari & Rapee, 2007), others have reported either no effect (Mathews & Sebastien, 1993; Mogg, Kentish, & Bradley, 1993) or avoidance (Garner, Mogg, & Bradley, 2006; Mansell et al., 1999). The mixed results are due, in part, to the wide variety of stressors used, including anxious mood induction, cognitive challenges, and physical exercise, and to differences in the populations studied (e.g. clinical vs. non-clinical). We examined the effects of a repetitive loss stress induction on mood, salivary cortisol levels, and selective attention in university students using a spatial cueing paradigm (Ellenbogen et al., 2002). Relative to a neutral condition, the students were faster to respond on invalid trials with a negative cue than on invalid trials with a neutral cue following the stressor, thereby indicating attentional avoidance of negative words. Attentional avoidance was also found to have an important role in mood regulation (Ellenbogen et al., 2002, 2006). Interestingly, the relationship between stress-induced attentional avoidance, mood change, and cortisol levels was limited to trials where the emotional stimulus was presented in the left hemifield, suggesting the possible role of a right hemisphere mechanism. Evidence of a right hemisphere bias in the processing of emotional stimuli has been reported in a number of behavioral (Fox, 2002; Mogg & Bradley, 1999) and brain imaging studies (Hardee, Thompson, & Puce, 2008; Morris, Ohman, & Dolan, 1999). In sum, stress exposure may reveal changes in emotional information processing that are not otherwise evident at baseline states. Moreover, attentional biases during stress may be more pronounced when emotional stimuli are presented to the left hemifield.

Objectives of the present study

Our general theoretical framework centers on the premise that both clinical dysfunction and stress influence cognitive processing and attention in ways that are relevant to the individual's current affective-motivational state. The model is similar to the information