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Direction of stimulus movement alters fear-linked individual differences in attentional vigilance to spider stimuli

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A R T I C L E I N F O

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A B S T R A C T

Researchers have proposed that high spider-fearful individuals are characterised by heightened attentional vigilance to spider stimuli, as compared to low spider-fearful individuals. However, these findings have arisen from methodologies that have uniformly employed only static stimuli. Such findings do not inform upon the patterns of fear-linked attentional selectivity that occur in the face of moving feared stimuli. Hence, the present study developed a novel methodology designed to examine the influence of stimulus movement on attentional vigilance to spider and non-spider stimuli. Eighty participants who varied in level of spider-fear completed an attentional-probe task that presented stimuli under two conditions. One condition presented stimuli that displayed an approaching movement, while the other condition presented stimuli that displayed a receding movement. Fear-linked heightened attentional vigilance was observed exclusively under the latter condition. These findings suggest that fear-linked attentional vigilance to spider stimuli does not represent a uniform characteristic of heightened spider-fear, but rather is influenced by stimulus context. The means by which these findings inform understanding of attentional mechanisms that characterise heightened spider-fear, and avenues for future research, are discussed.

1. Introduction

Across individuals the physical approach of a potential threat signals increasing probability of danger and will likely to result in attentional vigilance to the threat and the elicitation of a fear response. For example, observing the sudden approach of a speeding truck as we cross the road will likely capture our attention and provoke anxiety, leading us to move outside its path. Likewise, if a nesting magpie were to swoop at us from its tree in a display of territorial aggression, then the bird will likely capture our attention and provoke anxiety, leading us to move away from the tree. Hence, despite the resulting anxiety response, enhanced attentional vigilance to rapidly approaching threats allows for a heightened ability to avoid the danger posed by such threats. Conversely, were it that case that the same objects were not approaching, for example if the truck or bird were receding, then these objects would be less likely to capture attention and provoke an anxious response.

Some theorist have proposed that attentional vigilance to approaching objects, like those described above, reflects an evolutionary trait present in all individuals that functions to heighten fear (Hsee, Tu, Lu, & Ruan, 2014) and attentional vigilance (Franconeri & Simons, 2003; Parker & Alais, 2007) in order to limit risk to our well-being posed by environmental threats. Specifically, individuals who suffer from specific fears, such as fear of spiders, have been found to display heightened attentional vigilance to feared stimuli relative to non-feared stimuli. However, despite the plausible impact of approach and receding movements on attentional vigilance to threatening stimuli, researchers investigating individual differences in such patterns of attention have almost exclusively employed static stimuli. For example, using a Stroop-like paradigm researchers have demonstrated that high spider-fearful individuals, relative to low spider-fearful individuals, show longer latencies to colour name spider-related words as compared to spider-unrelated words, indicating relatively heightened attention to the lexical content of the spider-related words (Kindt & Brosschot, 1997; Watts, McKenna, Sharrock, & Trezise, 1986). Investigators using visual search paradigms have also demonstrated that individuals with heightened spider-fear display heightened attention to static pictures of spiders. For example, high spider-fearful individuals demonstrate speeded detection of pictures of spiders presented amongst static arrays of non-spider pictures, such as insects, mammals, or flowers (Pflugshaupt et al., 2005; Rinck, Reinecke, Ellwart, Heuer, & Becker, 2005; Öhman & Mineka, 2001). Additionally, when searching for an insect

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target stimulus in an array of static spider stimuli, high spider-fearful individuals demonstrate heightened attention towards the spider stimuli, relative to low spider-fearful individuals (Miltner, Krieschel, Hecht, Trippe, & Weiss, 2004; Rinck et al., 2005).

Another common paradigm for assessing attentional vigilance to static stimuli in spider-fear is the attentional-probe task (MacLeod, Mathews, & Tata, 1986). In this task participants are presented with pairs of static stimuli, for example an image of a spider and an image of a butterfly. Shortly after, a probe is presented in the location previously occupied by one of the stimuli, and participants must quickly identify the probe. It is assumed that probe identification latencies will be shortest when attention has been allocated to the where the probe had appeared. Hence, by comparing the speed with which participants correctly identify probes that appear in each stimulus position, the relative degree to which participants demonstrate attentional vigilance to each of the two stimuli can be determined. Using this paradigm, investigators have revealed patterns of probe identification latencies that are indicative of heightened attentional vigilance to static spider-related stimuli amongst high spider-fearful individuals as compared to low spider-fearful individuals (Lipp & Derakshan, 2005; Mogg & Bradley, 2006).

For individuals with clinical phobia of spiders the movement of spiders, and approaching movements in particular, often hold a direct motivational meaning, acting as a cue of increased likelihood of harm that in turn elevates fear. For example, in their survey of patients with spider phobia Mcnally and Steketee (1985) observed that movement was a particularly salient and fear-inducing feature of spiders for 77% of respondents. Researchers have also demonstrated that approaching movements specifically are a particular cause of elevated fear amongst individuals with clinical phobia of spiders. Rachman and Cuk (1992) asked patients with spider phobia and non-phobic controls to observe a live spider in a terrarium and to later report on observed spider behaviour and their level of fear during viewing. Spider phobic participants, compared to control participants reported observing greater frequency of approach movements, and greater fear in response to approach movements. The specific impact on fear of approaching movements made by threat-related stimuli, such as spiders, has also been observed amongst individuals generally. Threat-related stimuli has been observed to elicit heightened activity in cortical regions associated with threat processing, and greater fear, when exhibiting approaching movements relative to when not exhibiting approaching movements (Mobbs et al., 2010; Riskind, 1997; Riskind, Kelley, Harman, Moore, & Gaines, 1992; Sagliano, Cappuccio, Trojano, & Conson, 2014).

While some studies have examined attentional processing in response to moving spider stimuli, critically no previous research has directly examined fear-linked differences in attentional vigilance to spider stimuli under conditions where spider stimuli display approaching movements. For example, Vrijsen, Fleurkens, Nieuwboer, and Rinck (2009) investigated attentional vigilance to images of spiders and non-spider objects that simultaneously moved in left, right, up, or down directions along a path on a computer screen. Alpers et al. (2009) employed fMRI neuroimaging techniques to assess changes in amygdala activity in the face of images of spider and birds that were overlaid. Carretié et al. (2009) examined neural indices of attentional distraction under conditions where a spider stimulus moved across a computer screen towards participants' point of attentional fixation. Rinck, Kwakkenbos, Dotsch, Wigboldus, and Becker (2010), presented participants task-irrelevant moving and non-moving spiders within an immersive virtual environment, observing that spider-fearful participants demonstrated equivalent attention toward static spiders and moving spiders. In considering this finding, Rinck and colleagues proposed that spiders moving side to side or up and down may be no more threatening to fearful participants than static spiders, and suggested that the movement of spider stimuli may moderate attention to a greater degree if the movement was clearly associated with changes in potential of danger.

Given these findings, conditions under which feared stimuli move in an approaching direction provide a novel and intriguing circumstance under which to examine fear-linked differences in attentional vigilance to spider stimuli. Hence, the aim of the present study was to examine fear-linked differences in attentional vigilance to spider stimuli under conditions where stimuli display approaching movements, and to contrast this with fear-linked differences in attentional vigilance to spider stimuli under conditions where stimuli display an equivalent amount of movement in a receding direction. Critically, this comparison will ensure that any moderating influence of approaching movement implicates the direction of movement, and is not simply the result of the presence of movement alone. The study developed a novel variant of the attentional-probe task (MacLeod et al., 1986) capable of measuring attentional vigilance to spider stimuli relative under two conditions. One condition presented stimuli that gradually became larger in size so as to display an apparent approach movement towards the viewer. A second condition presented stimuli that gradually became smaller size so as to display an apparent receding movement from the viewer.

A logical contemplation reveals three alternative possibilities that could arise when comparing fear-linked differences in attentional vigilance to spider stimuli under these conditions. It may be the case that the discrepancy between approaching movement and receding movement exerts no effect on fear-linked differences in attentional vigilance to spider stimuli. If this were the case, then fear-linked differences in attention vigilance to spider stimuli would not differ under conditions were spider stimuli display approaching movement or conditions where spider stimuli display receding movement. Alternatively, it may be that fear-linked differences in attentional vigilance to spider stimuli are enhanced under conditions where spider stimuli are approaching, relative to when spider stimuli are receding. Lastly, it may be that fear-linked differences in attentional vigilance to spider stimuli are enhanced under conditions where spider stimuli are receding, relative to when spider stimuli are approaching. By examining fear-linked differences in attentional vigilance to spider stimuli under conditions where spider-related stimuli are approaching, and conditions where spider-related stimuli are receding, the present methodology will determine the validity of each of these alternative possibilities.

2. Method

2.1. Participants

The purpose of participant recruitment was to create two participant groups that differed in spider fear, with one group representing individuals with relatively higher levels of spider-fear and one group representing individuals with relatively lower levels of spider-fear. Participants were recruited from a group of 700 undergraduate students who earlier identified their willingness to be invited to participate in the study as part of a bi-annual student recruitment procedure that is conducted by the psychology department at the university. All individuals reserved the right to refuse the invitation to participate.

Eighty individuals were recruited to participate. These participants comprised 24 males and 56 females, and had a mean age of 18.09 years (SD = 1.32, Range, 17–23). During the experimental session participants completed the Fear of Spiders Questionnaire (FSQ). In order to create two participant groups representing individuals that were relatively higher in spider-fear and individuals that were relatively lower in spider-fear, a median split was conducted on participants' FSQ scores. Individuals who fell in the bottom half of this split were labelled the Lower Spider-fear Group (N = 40, 16 male; Age, M = 18.08, SD = 1.31; FSQ scores, M = 13.18, SD = 9.01, range = 0–33), and individuals who fell in the top half of this split were labelled the Higher Spider-fear Group (N = 40, 8 male; Age, M = 18.10, SD = 1.36; FSQ scores, M = 68.24, SD = 21.87, range = 34–114). This gave rise to a between groups factor of Spider-fear Group (Lower Spider-fear Group, Higher Spider-fear Group).