



## Difficulty in disengaging attention from threatening facial expressions in anxiety: A new approach in terms of benefits



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### ABSTRACT

*Background and objectives:* Recent work suggests that the ability to disengage attention from threatening information is impaired in anxiety. The present study compared the difficulty to disengage from angry, fearful and neutral faces in Low Trait Anxious individuals (LTA) versus High Trait Anxious individuals (HTA) at two stages of facial expression processing (i.e., initial and later face processing).

*Methods:* HTA and LTA individuals performed an attentional shifting task to assess attentional disengagement. Participants had to classify a peripheral target letter, appearing 200 or 500 ms after a face was displayed.

*Results:* LTA individuals were quicker when the letter appears after 500 ms compared to 200 ms regardless of the emotion of the face. An impaired disengagement in HTA individuals was observed for fearful and angry faces (i.e., no reaction differences between 200 and 500 ms) but not for neutral faces. These results suggest that it is particularly difficult for anxious individuals to switch attention from one stimulus to another if the engaged stimulus is a threatening face.

*Limitations:* Generalisation of our results is restricted to trait anxiety and emotional facial expression processing.

*Conclusions:* LTA individuals can benefit from the emotional processing (i.e., from 200 to 500 ms) to make a rapid attentional shift and engagement to the target stimuli whereas HTA individuals did not and continue to process the threatening facial expression. These results also point out the role of top down processes on the regulation of disengagement from threatening information in anxiety.

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Attentional bias towards threat in anxiety is a relatively robust phenomenon (see Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007; for a meta-analysis). This attentional bias has been observed in various paradigms (e.g., dot probe task, spatial cueing task, visual search task) and refers to a general tendency to allocate selective attention towards potentially threatening information (e.g., Fox, 2002). However, as suggested by Posner and Petersen (1990), attention comprises different components (i.e., shifting, engagement and disengagement). In order to measure these different components, Koster, Crombez, Verschuere, and De Houwer (2004) adapted the dot probe task. Using this task, Saleminck, van den Hout, and Kindt (2007) found that trait anxiety is related to disengagement difficulties and not to quick orienting. Another paradigm measuring whether the bias operates primarily

in shifting or disengagement components is the modified cueing paradigm (Fox, Russo, Bowles, & Dutton, 2001). Several studies using this task showed a difficulty in disengaging attention from threat but no facilitated attentional capture by threat in anxious people (e.g., Fox, Russo, & Dutton, 2002; Koster et al., 2004).

To account for this “delayed disengagement hypothesis” in anxiety, Cisler and Koster (2010) proposed a framework describing the interrelations between the attentional components, mediating mechanisms, and stages of information processing. They suggested that the disengagement difficulty might be a combination of automatic and strategic processing. This disengagement difficulty “refers to the degree to which a threat stimulus captures attention and impairs switching attention from the threat to another stimulus” (Cisler & Koster, 2010, p. 208). This tendency maintains cognitive resources on the source of threat and may maintain and enhance anxiety states (see also Fox et al., 2002).

In order to measure disengagement from emotional facial expressions, Georgiou et al. (2005) used the Fox et al.’s attentional shifting task (2001, experiment 5). In this task, while the stimulus is

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presented at the centre of the screen, a target letter appears after 600 ms (either X or P) at one of four locations for 50 ms (above, below, to the left or to the right). Georgiou et al. (2005) showed that high trait-anxious individuals took longer to classify peripheral target letters when fearful facial expressions, relative to sad, happy, or neutral expressions, were presented at fixation. Moreover, Moriya and Tanno (2011, experiment 2) only found a difficulty in disengaging from angry faces in socially anxious individuals when the face remained on the screen during the target display, but not when there was a temporal gap between the face and the target (experiment 1). This difficulty to disengage in high socially anxious people was characterized by longer reaction times for angry faces compared to neutral faces after presentation times of 300 ms or longer (i.e., 500, 700 and 1000 ms) but not for shorter presentation times (i.e., 100 and 200 ms). Taken together, these results suggested that (a) the face must remain on the screen during the complete processing in order to evidence a difficulty to disengage in anxious individuals and (b) the difficulty to disengage takes place after presentation time of 200 ms. Besides, Weierich, Treat, and Hollingworth (2008) explained that within orienting processes, one could expect vigilance towards a stimulus at an early stage of presentation (e.g., 100 ms–200 ms) and within disengagement processes, problems to disengage from a stimulus at longer presentation times (e.g., 200 ms–800 ms).

The stimuli that have been widely used to study attentional bias are emotional facial expressions (EFE). In fact, these stimuli act as important social cues and can be used to examine how emotionally relevant information is prioritized. As suggested by Cisler and Koster's (2010) framework, research on attentional disengagement has to clearly specify which stage of processing is at stake. Unfortunately, previous studies varied the EFE duration presentation without clearly taking into account the various stages of facial expression processing. In the following paragraphs, we will review data on the time course of EFE processing.

Magnetoencephalography (MEG) recordings indicate that, as early as 100 ms after presentation, stimuli can be categorized as "faces" (Lui, Harris, & Kanwisher, 2002). Moreover, the perceptual analysis of facial features has been associated with a specific Event Related Potential (ERP), the N170, which peaks 150–200 ms post stimulus. According to Ashley, Vuilleumier, and Swick (2004), the emotional effects on N170 do not appear selective for any specific expression, suggesting a non specific role of configural and attentional effects associated with encoding of structural facial cues, rather than with emotional significance per se. Then, posterior ERPs components around 250 ms after face onset might index the discrimination between emotional and neutral expressions (Krolak-Salmon, Fischer, Vighetto, & Mauguier, 2001). Two other ERPs components may be involved in the processing of EFE. The first component, named N300, is supposed to reflect an affective processing (Rossignol, Philippot, Douilliez, Crommelinck, & Campanella, 2005) — for example, this component reacts more to affective features of stimuli rather than to physical characteristics (Carretié & Iglesias, 1995). The second component, the P3b, peaking at parietal sites around 450 ms, arises when an attended stimulus is detected. It is believed to reflect decision making and premotor response-related stages (Rossignol et al., 2005). Recently, Toffanin, de Jong, and Johnson (2011) have proposed an electrophysiological marker of attentional disengagement, the P4pc (Positivity 400 ms post-target posterior contralateral). Whereas attentional engagement can be studied by means of the N2pc (Negativity 200 ms post-target posterior contralateral) component of ERP, they showed, using a rapid serial visual presentation paradigm and spatial-cuing paradigm, that the P4pc occurs only in contexts where there is a need to disengage.

Taking into account these electrophysiological data, we assume that the capacity to switch attention from a face to another

stimulus could take place in the initial stage of face processing (i.e., around 170 ms) and continue in the later stage of information processing (i.e., from 200 to 500 ms). Bar-Haim, Lamy, and Glickman (2005) investigated attentional disengagement using both ERP and behavioural data in an attentional shifting task. They showed that high-anxious people were slower to respond to targets. Moreover, the ERP waveforms suggested that slower reaction times in high-anxious people might reflect attentional dwelling on the faces' cues. The lack of emotion effect in this study could be attributed to the moment when the target appears (i.e., 600 ms). Indeed, at this stage, the EFE processing is mostly achieved. Furthermore, Moriya and Tanno's (2011, experiment 2) results presented above showed that socially anxious individuals demonstrated difficulty disengaging from angry faces displayed for 300 ms, which in fact corresponds to duration of affective processing (indexed by the N300).

Finally, research suggested a differential attentional processing of fearful facial expressions and angry facial expressions. According to Davis and Whalen (2001), individual differences in anxiety may be attributable to a neural system for threat processing, involving the amygdala, which modulates attentional vigilance, and which is more sensitive to fearful than angry faces. Indeed, fearful faces tend to be ambiguous and therefore require higher attention from the threat processing system. However, Mogg, Garner, and Bradley (2007), using a dot probe task with eye-movement recordings, showed that fearful and angry faces elicited similar biases and that high anxious individuals were more likely to gaze directly at intense negative facial expressions. These results could be explained by considering the different component processes of attention, namely, *shifting* versus *maintenance*. According to Mogg et al. (2007), "the amygdala may indeed modulate attention to threat, but its level of activation may be a function of both initial orienting and maintained attention" (p. 167). Initially, angry and fearful faces may attract attention to the same extent but differ in their capacity to hold attention. Mogg et al.'s (2007) lack of difference in biases between angry and fearful faces may be due to their dot probe task that is not appropriate for investigating maintained attention (i.e., the component in which angry and fearful faces processing should differ).

The current study aimed at replicating Moriya and Tanno's (2011) study in trait anxious individuals by using only two critical presentation times. Moreover we extended Moriya and Tanno (2011) and Georgiou et al.'s (2005) studies by comparing the difficulty to disengage from fearful and angry faces. Using an attentional shifting task, we examined whether anxiety would produce a difficulty in disengaging in the first step of perceptual/sensory processing of a face (200 ms), or whether such an effect would only be observable during the affective processing of the face (500 ms). We predicted that LTA individuals would benefit from the emotional processing of the face to make a rapid attentional shift and engagement to the target stimuli (i.e., the reaction times were expected to be lower at 500 ms compared to 200 ms) whereas HTA individuals would continue processing the facial expression. Moreover, for HTA individuals, if anger differs from fear in its ability to maintain attention then we should find greater difficulty in disengaging from angry facial expressions compared to the fearful facial expression.

## 1. Method

### 1.1. Participants

Participants were 72 undergraduate students from Lille University (34 women and 38 men; mean age: 21.53 years). All

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