Working Memory Regulates Anxiety-Related Threat Processing Biases

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Anxious individuals show negative interpretive bias, and attentional bias to threat. They also show general deficits in working memory (WM) and executive control. Is there a link?

Attentional Control Theory (Eysenck et al., 2007) states that anxious people have a weakness in executive control, especially inhibition, which is exacerbated in the presence of threat. Cognitive biases represent a failure to inhibit orienting towards threat. They should therefore be exaggerated when executive control is weakened.

Several studies tested this using an individual-differences approach. Often, anxiety or a correlate only predicted cognitive biases in low-attentional control participants (e.g. Derryberry & Reed, 2002; Salemink & Wiers, 2012; Susa et al., 2014). However, a better test requires within-participants manipulation of executive control (Derakshan & Eysenck, 1998) – in a single group of participants, anxiety should predict threat-related bias more clearly when executive control is impaired.

These studies attempt this for the first time. Interpretive bias was assessed in Study 1, and attentional bias in Study 2. In both studies, executive control was experimentally 'impaired' by imposing a WM load (see Lavie et al., 2004).

Study 1

68 unselected Turkish students (59 females, *M* age 21.37) completed the State-Trait Anxiety Inventory – trait scale. They then read ambiguous stories, which could be interpreted as either threatening or benign, under high (remember 6 digits) or low (1 digit) WM load. Later, they saw threatening and non-threatening summaries of each story, and were asked which was most correct. Interpretive bias is their probability of choosing the negative summary, minus the probability of choosing the positive summary.

Trait anxiety and WM load interacted on interpretive bias, $F (1, 66) = 5.49$, $p = .02$. Trait anxiety only predicted bias under high WM load, $B = .02$, $p = .006$, but not under low WM load, $B = -.001$, $p = .93$.
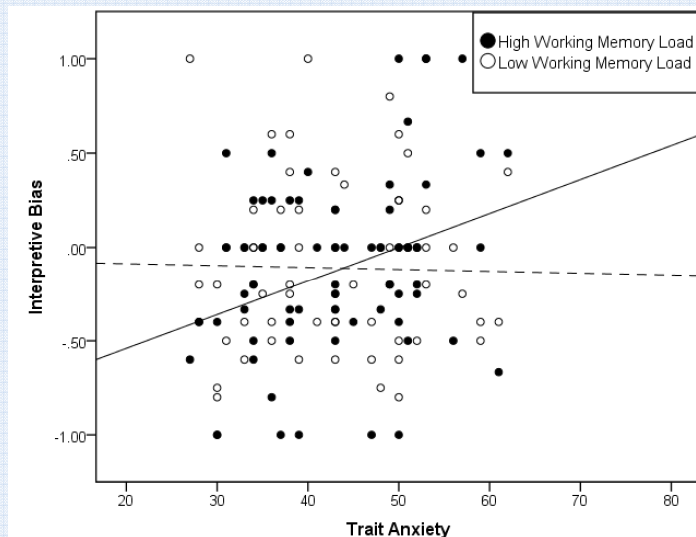

Study 2

53 unselected Turkish students (33 females, *M* age 21.51) completed the same anxiety scale, then underwent fear conditioning. 8 Japanese characters (CS1) were presented with a loud startling sound US, 8 were presented without the sound (CS2).

Then, participants completed a dot-probe task. On each trial, one CS1 and one CS2 were presented either side of the screen for 100ms. Participants then responded to a target stimulus, which appeared in either the threat CS1 or neutral CS2's location. They did this ask under both high and low WM load. Attentional bias is the mean RT to targets in the neutral location minus the RT to targets in the threat location.

Again, trait anxiety and WM load interacted, $F (1, 51) = 4.71$, $p = .03$: anxiety predicted attentional bias under high WM load, $B = 1.59$, $p = .004$, but not under low WM load, $B = .06$, $p = .89$.
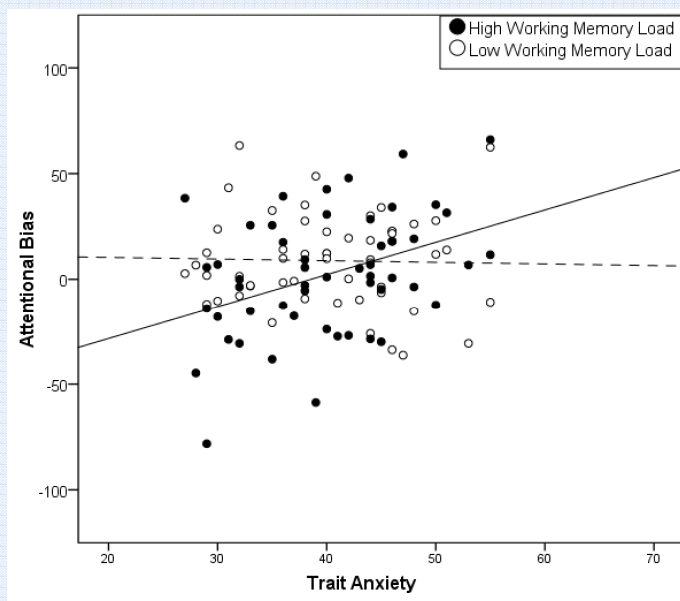
Discussion

In two studies with different samples and dependent measures, anxiety did not predict threat bias under low WM load, but did predict bias *in the same participants* under high WM load. This strongly supports the hypothesis that cognitive biases represent a failure of cognitive control (Eysenck et al., 2007). Practically, it also shows that WM loads can be a useful tool for researchers wishing to assess biased threat-processing.

Clinically, these results are important because they evidence an indirect link between biased processing of threat and executive control deficits in anxiety. Executive control deficits do not directly bias processing, but they do increase the chance of latent biases manifesting themselves.

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