General Background

Cognitive theories of anxiety suggest that selective attention to negative cues enhances anxiety. Research indicates that anxious individuals pay particular attention to threat-related information. Biased processing of threat-related information probably represents the strongest, most consistently-demonstrated correlate of individual differences in anxiety (for reviews see Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJendoorn, 2007; Mogg & Bradley, 1998; Williams, Watts, MacLeod, & Mathews, 1997).

Threat-related attention bias has been extensively studied in normative and patient populations using a variety of tasks (e.g., the emotional Stroop, variants of Posner’s spatial cuing paradigm, visual search tasks, and the dot-probe attention task). We use the dot-probe attention task for four central reasons: a) the task has well-established success in demonstrating threat-related bias with various high anxious populations including patients with PTSD (Bar-Haim, et al., 2007; Bryant & Harvey, 1997; Dalgleish, et al., 2003; Elsesser, Sartory, & Tackenberg, 2004); b) the task has been used successfully to train attention in normative as well as clinically anxious samples (Bar-Haim, 2010; Hakamata, et al., 2010); c) the task demonstrates sensitivity to stress-related fluctuation in performance in both non-selected civilians and enlisted soldiers (Bar-Haim, et al., 2010; Wald, et al., in press); and d) recent studies demonstrate with increasing depth and precision the manner in which neural and genetic substrates relate to performance on the dot-probe task, thus linking task performance to both individual differences in symptomatic expression and to individual differences in neural function and genetics (Eldar, Yankilevich, Lamy, & Bar-Haim, 2010; Monk, et al., 2006; Monk, et al., 2008; Perez-Edgar, et al., 2010).
The Dot-Probe Attention Task

In the dot-probe task pairs of stimuli, one with emotional valence and one neutral, are presented in differing locations on a computer screen, followed by a small visual probe appearing in the location vacated by one of these (Figure 1). Participants are required to respond as quickly as possible to the probe without compromising accuracy. Response latencies on the task provide a “snap-shot” of the distribution of the subject’s attention, with faster responses to probes presented in the attended relative to the unattended location. For example, attention bias to threat is evident when participants are faster to respond to probes that replace threat-related rather than neutral stimuli. The reverse pattern indicates threat-related attentional avoidance.

The cue stimuli are face photographs of 20 different individuals (10 male, 10 female) taken from the NimStim stimulus set (Tottenham, et al., 2009), except for one female taken from the Matsumoto and Ekman set (Matsumoto & Ekman, 1989). The face pairs were randomly divided into two sets (A and B), whereby in each session, only one set is used. All faces were placed on a background as in the Matsumoto and Ekman set. Two different pictures of each individual were selected, depicting angry and neutral expressions. Participants are presented with pairs of faces of the same actor (neutral-angry or neutral-neutral). Each face photograph subtends 45mm in width and 34mm in height. The face photographs are presented with equal distance to the top and bottom of the fixation cross, with a distance of 14mm between them. The top photograph is positioned about 20mm from the top edge of the screen.

Throughout the session trials, the screen background is black, while the photographs are surrounded by a single 58mm wide by 94mm tall white rectangle denoting the general area of the screen on which to focus. Each trial begins with the presentation of a fixation display (500ms; white cross 1*1 cm at the center of the screen), on which the participants are requested to focus their gaze. The fixation display is followed by a face pair display (500ms). Immediately following the faces display, a target probe appears. The target-probe display consists of an arrowhead pointing either left or right (“<” or “>”), and appears at the location previously occupied by one of the faces. Participants are required to determine which symbol appeared by pressing one of two pre-specified buttons on a mouse. The target remains on the screen until the subject responds. A new trial begins following an ITI (500ms).

Threat bias measurement

The bias measurement protocol consists of 120 trials (80 angry-neutral and 40 neutral-neutral presentations). Angry-face location, probe location, probe type, and actor are fully counterbalanced in presentation. If the subject performs with less than 70% accuracy on the first
10 trials, the program will display a warning and the experiment will be aborted. This warning provides an opportunity to re-brief the subject and initiate data collection again. The task takes about 5 minutes to complete.

**ABM/Placebo training**

The ABM/Placebo protocol consists of 160 trials (120 angry-neutral and 40 neutral-neutral presentations). In the placebo condition, angry-face location, probe location, and actor are fully counterbalanced in presentation. In the ABM condition, the target appears at the neutral-face location in all angry-neutral trials. Probe type (\(<\) or \(>\)) is not factorially counterbalanced but appears with equal probability for each of the following: angry-face location, probe location, or actor. A short break is delivered every 40 trials. If accuracy is kept above 70%, no indication is provided during the break. However, if accuracy falls below 70% in the preceding block, a warning will accompany the break slide, providing an opportunity for the experimenter to remind the subject not to compromise accuracy. The participant then continues training. The task takes about 7 minutes to complete.

The tasks are run using the E-Prime 2 software package (PST, Pittsburgh, PA).

**Figure 1.** Sequence of events in a single dot-probe attention task trial.
References


