

Difficulty Disengaging from Affective Stimuli in Anxiety: Converging Evidence of Reaction Time and Eye Movement

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Introduction

- Individuals high in anxiety are sensitized to detect threatening information in the environment (MacLeod, Matthews, & Tata, 1986; Mogg & Bradley, 1998)
- Reaction time cognitive research appears to indicate that this is a problem with **difficulty disengaging**, and not hypervigilance (Koster et al., 2004).
- Reaction time (RT) tasks involve at least a two-stage process: (1) shifting of visual attention, and (2) execution of the behavioral response. No study has investigated which process is impaired during difficulty disengaging.
 - We tested this distinction through measurement of eye movement (EOG) during the RT task.
- If difficulty disengaging reflects trouble with visual disengagement of attention, highly anxious individuals should show delays in visual shift. If difficulty disengaging reflects trouble with behavioral response execution, eye movement should be the same for low and high anxious individuals.

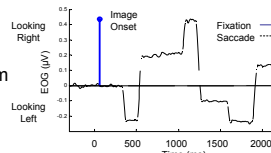
Method

- **Task** – Probe detection task (MacLeod, Matthews, & Tata, 1986) using IAPS images (Lang, Bradley, & Cuthbert, 2005).
 - Target-neutral image pairs presented for 500 ms and 2000 ms exposure durations, followed by response probe indicating button press.
 - Target image categories: threat, positive emotion, neutral non-emotional images of people, neutral images of inanimate objects (neutral condition)



Measures

- Trait anxiety – STAI Trait Index (Spielberger et al., 1983)
- Reaction time (RT; ms)
- Eye movement – horizontal electrooculogram
 - Probability of first fixation on target image
 - Proportion viewing time on target image
 - Saccadic reaction time to image onset
 - Saccadic reaction time to response probe
- **Participants** – 70 psychology students at San Francisco State University (56 female, 14 male; mean age=25.1) grouped into high trait anxious (HTA) and low trait anxious (LTA) categories based on median split.
 - HTA n = 30; STAI ≥ 43
 - LTA n = 28; STAI ≤ 37



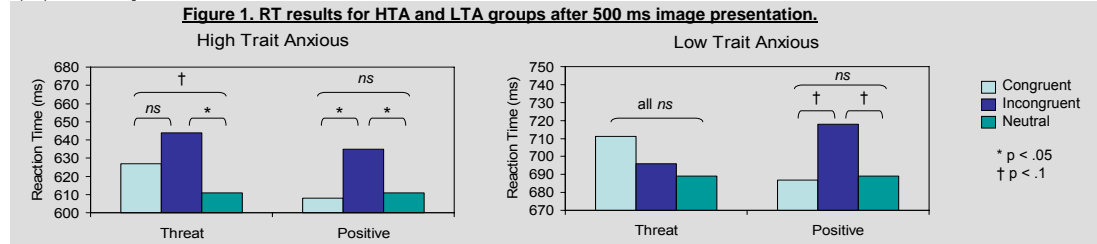
Hypotheses

- Attention bias for threatening information in the HTA group
 - RTs for 'congruent' condition (i.e. response probe replaces target image) will be relatively faster than 'incongruent' condition (i.e. response probe replaces neutral image) at 500 ms.
 - Increased probability of first fixation and viewing time proportion for threat.
- HTA group will show difficulty disengaging, not hypervigilance, for threat stimuli.
 - RTs for neutral conditions will be significantly faster than incongruent conditions, but will not differ from congruent conditions.
 - Saccadic reaction time following image onset will not vary by anxiety group.
- Is difficulty disengaging associated with visual shift delay or response interference?
 - If it relates to visual shift, we expect delayed saccadic reaction time to the response probe in HTA versus LTA groups.
 - If it relates to behavioral response execution, we expect no effect of anxiety on saccadic reaction time to the response probe.

Results

Reaction Time

- For the 500 ms presentation condition, t-test comparisons revealed **attention bias for positive images** [$t(27)=2.05, p<.05$] in the HTA group, as well as a pattern of results indicating **difficulty disengaging from both threat and positive images**, as there were significant differences between incongruent and neutral conditions, [threat: $t(27) = 3.03, p<.01$; positive: $t(27) = 2.52, p<.05$], but not between congruent and neutral conditions, [threat: $t(27) = 1.82, p<.1$; positive: $t(27) = -.19, ns$].

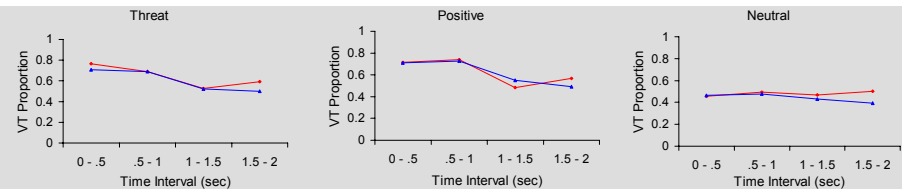


- For the 2000 ms presentation condition, t-test comparisons failed to reveal attention bias or avoidance in any condition for either group.
- 4 (image type) x 2 (congruency) x 2 (display time) x 2 (anxiety group) mixed ANOVA revealed no interaction effects, but detected main effects of image type [$F(3,159)=9.54, p<.001$], congruency [$F(3,53)=7.20, p<.05$], display time [$F(3,53)=7.34, p<.01$], and anxiety group [$F(1,53)=5.04, p<.05$].

Eye Movement

- Probability of first fixation on target image: neutral $M=.50$, positive $M=.69$, threat $M=.73$, non-emotional $M=.80$ [$F(3,135)=84.75, p<.001$]
- Proportion of time spent viewing target images was calculated for four time intervals: 0-500 ms, 500-1000 ms, 1000-1500 ms, and 1500-2000 ms.
 - 4 (image type) x 4 (time interval) x 2 (anxiety group) mixed ANOVA revealed significant main effects of image type [$F(3,135)=56.71, p<.001$] and time interval [$F(3,135)=63.95, p<.001$], as well as a significant interaction between picture type and time interval [$F(3,135)=16.24, p<.001$], but no effect of anxiety group.

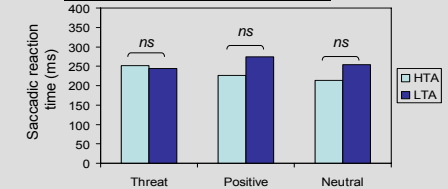
Figure 2. Viewing time (VT) proportion for threat, positive, neutral images across time interval for HTA and LTA groups.



- 4 (image type) x 2 (anxiety group) mixed ANOVA for saccadic reaction time to image onset failed to reveal an effect of anxiety group [$F(3,135)=.83, ns$], providing evidence against the presence of hypervigilance in HTA participants.

- For the condition in which difficulty disengaging was detected (500 ms presentation), a 4 (image type) x 2 (anxiety group) mixed ANOVA for saccadic reaction time to response probe failed to reveal an effect of anxiety group [$F(3,111)=1.49, ns$], indicating that **HTA participants do not experience delays in shifting visual attention from affective images** (see Figure 3).

Figure 3. Saccadic reaction time to response probe after 500 ms image presentation.



Discussion

- Attention bias for threat and positive images in the HTA group results from difficulty disengaging, rather than hypervigilance.
- Present evidence indicates that **difficulty disengaging in anxiety may be due to problems with behavioral response execution, and not with shifting visual attention**.
 - Attention bias in anxiety may consist of interference in top-down processes (e.g. response tasks), as opposed to delays in bottom-up processing.
- Further evidence to indicate a distinct effect of anxiety on top-down and bottom-up attention processes comes from the finding that patterns of attention bias differed for HTA and LTA groups in the reaction time measure, but not in eye movement measures.
 - This provides preliminary evidence to indicate that anxiety influences attention via interference in top-down processes associated with response execution.
- Future replication of the current results would have significant implications for cognitive models and treatment approaches for anxiety.
 - Cognitive anxiety treatments should focus on higher level executive processes associated with decision making and action execution, rather than automatic processes associated with visual attention.