Neural Correlates of Anticipation and Uncontrollability in Snake Phobia

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INTRODUCTION

Anticipation and uncontrollability have been implicated as major contributors to anxiety disorders in general (Barlow, 2002). Consistent with a large literature on brain responses to aversive stimuli, a recent study in our laboratory (Nitschke et al., 2006) implicated a number of brain regions in the anticipation of and response to aversive pictures, including the anterior cingulate cortex (ACC), insula, amygdala and orbital frontal cortex (OFC). The present event-related fMRI study enrolled volunteers both with and without specific phobia of snakes to identify the neural areas recruited in the anticipation of and response to videos of differing emotional content (snake, fish, disgust). Uncontrollability was manipulated by giving subjects control on half of the trials to avoid viewing the video. Barlow’s theory of anxiety emphasizes uncontrollability as one of the most important generalized psychological influences on the development of specific phobia. Research on anxiety has investigated controllability (Armfield et al., 1996; Dragan et al., 1997; Gladstone et al., 2003), but no study has examined its effects on the neural correlates of anxiety.

HYPOTHESES

1. In phobics, anticipation of snake videos will activate regions identified in Nitschke et al. (2006), including the insula and amygdala.

2. Uncontrollability over video presentation will result in larger neural effects for the disgust videos but not the snake videos.

3. Non-phobics are expected to show anticipation and uncontrollability effects for the disgust videos but not the snake videos.

METHODS

Participants

Two groups of participants were studied. **Snake phobics** consisted of 12 participants (9 females, mean age 23, range 18-46) and **Non-phobics** consisted of 12 participants (4 females, mean age 23, range 19-30). Participants were right-handed and neurologically healthy. Videos were standardized for DSM-IV criteria of specific phobias of snakes and were absent of all other clinical disorders as assessed by the Structured Clinical Interview for the DSM-IV (SCID-I/P). Non-phobics were absent of all clinical disorders including specific phobias of snakes as assessed by the SCID. Informed consent in accordance with rules set by the University of Wisconsin Human Subjects Committee was obtained from all participants prior to the experiment.

Stimuli

The stimuli consisted of 3 -snake, fish, and disgust videos (24 sec). Each video was standardized for the potentiometric cues (e.g. arousal, valence, disgust, fear) during pilot rating sessions prior to the study. Physical attributes such as brightness, contrast, scene complexity and movement of the stimuli were equally. Videos were presented to the participants in the scanner using Arcade graphics mounted on the head coil of a 3.0 Tesla GE SIGNA Scanner (TR=2 s).

Procedure

Experimental Paradigm:

Participants were administered several anxiety and phobia questionnaires, followed by a mock scanner session during which they practiced the experimental task. Each trial began with an anticipation period signaled by a cue. An 8-second video clip consisted of either a control video (no cue) or a video stimulus to be received. The video stimuli were single D preceded disgust videos, and an F preceded fish videos. Subjects were instructed at the start of the study that they would be receiving these videos. Uncontrollability was indicated by the color of the cue. A blue or green cue indicated a controllable trial, and the other color indicated an uncontrollable trial. A trial was considered uncontrollable if the participant anticipated the video. On 50% of the trials, the cue was colored as yellow, red, or blue which was equal. On the other half of the trials, the color was equal. A success rate of approximately 50% was achieved with online monitoring of the video by the subject. Each trial ended with three likert online rating about the nature of the stimulus - valence, arousal, disgust, and fear - counterbalanced across conditions.

RESULTS

Anticipation

In phobics, anticipation of snake videos activated ACC, bilateral insula and bilateral amygdala more than anticipation of fish and disgust videos (Figure 1). In non-phobics, anticipation of disgust videos activated bilateral insula, bilateral OFC and dorsal and perigenual ACC more than anticipation of fish or snake videos (Figure 4). There was no significant difference between anticipation of fish and snake videos in non-phobics in that anticipation of the fish video activated the right insula. Activation effects were mirrored in the video response data (Figure 3a and 3b).

SIGNIFICANCE

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REFERENCES


CONCLUSIONS

1. As predicted, anticipation of aversive events led to greater activation in the ACC, bilateral insula, amygdala and OFC. For the phobics, this was especially the case for the anticipation of snake videos. The non-phobics predominantly showed anticipation effects for the disgust videos in comparison to the snake. Uncontrollability appeared to act as a moderator on the activation observed in phobics with elevated worry and anxiety. On the other hand, for the non-phobics, the disgust stimuli are most salient and show anticipation effects similar to that of the phobics for the snake stimuli. For the non-phobics, the disgust stimuli are most salient and show anticipation effects similar to that of the phobics for the snake stimuli.

1. These anticipation and uncontrollability effects indicate that for the phobics, the snake stimuli are most salient. On the other hand, for the non-phobics, the disgust stimuli are most salient and show anticipation effects similar to that of the phobics for the snake stimuli.