Impact of Uncontrollability on Brain Areas Activated by the Anticipation of Disgust and Phobicogenic Snake Videos

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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 fear responses to aversion, 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 amygdala, insula and anterior cingulate cortex (ACC). The present event-related fMRI study enrolled volunteers both with and without specific phobias of snakes to identify the neural areas recruited in the anticipation of and response to videos of different emotional content (disgust, snakes, fish). Uncontrollability was manipulated by giving subjects control on half of the trials to avoid viewing the videos. Barlow’s theory of anxiety emphasizes uncontrollability as one of the most important generalized psychological influences on the development of specific phobias. Research on anxiety has investigated controllability (Armfield et al. 1996; Drugan et al. 1997; Gladstone et al. 2003), but no study has examined its effects on the neural correlates of anxiety.

HYPOTHESIS
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 serve as a moderator of those activations and result in larger neural responses than when video presentation can be controlled.
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 6 participants (5 females, mean age 25, range 18-46) and Non-phobics consisted of 5 participants (2 females, mean age 20, range 19-22). Participants were right-handed and neurologically normal. Phobics met criteria for DSM-IV diagnosis of specific phobia of snakes and were absent of all clinical disorders as assessed by the Structured Clinical Interview for the DSM-IV (First et al. 1996). Non-phobics were absent of all clinical disorders including specific phobia of snakes as assessed by the SCID. Informed consent in accordance with rules set by the University of Wisconsin at Madison Human Sciences Committee was obtained from all participants prior to the experiment.

Stimuli
The stimuli consisted of 3-s snake, disgust, and fish videos (24 each). Each video was standardized for several psychological attributes (e.g. arousal, valence, etc.) during pilot rating sessions prior to the study. Additionally, physical attributes such as brightness, contrast, scene complexity and movement of the stimuli were equalized. Videos were presented to participants in the scanner using Axioptics goggles mounted on the head coil of a 3.0 Tesla GE SIGNA Scanner (TR=2 s).

Procedure
Experimental Paradigm
Each trial began with an anticipation period signaled by a cue. An 5 preceded snake videos, a P preceded disgust videos, and an F preceded fish videos. Subjects were instructed at the onset of the study that they will be receiving these videos. Uncontrollability was indicated by the color of the anticipation cue. A blue or yellow cue indicated a controllable trial, and the other color indicated an uncontrollable trial. When a subject had an uncontrollable trial, they invariably receive the video. When a subject had a controllable trial, if reaction time (RT) was fast enough to a red target square that followed the cue after a variable delay, they received the presented video. Otherwise, they received the anticipated video. Of the 72 total video trials, half were cued as uncontrollable and the other half controllable. A success rate of approximately 50% was achieved with online monitoring of RT by DMDX software. Each trial ended with one Likert online rating about the nature of the stimuli-valence, arousal, disgust, and fear-counterbalanced across conditions.

RESULTS

CONCLUSIONS
1. As predicted, anticipation of aversive events lead to greater activation in bilateral insula, ACC, and amygdala. For the phobics, this was especially the case for the anticipation of snake videos. The non-phobics only showed anticipation effects for the disgust videos.
2. Uncontrollability appeared to act as a moderator on the activation observed in anticipation of the aversive videos in that it resulted in larger insula responses when control was not possible.
3. These anticipation and uncontrollability effects indicate that for the phobics, the snake stimuli are most salient and essentially wipe out any effects for disgust. On the other hand, for the non-phobics, the disgust stimuli are most salient and show the anticipation and uncontrollability effects that the phobics show only for the snake stimuli.

REFERENCES