Context-dependent neural responses in insula and amygdala when viewing affective animal videos

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Background

Humans have the ability to experience a variety of emotions, yet it is unlikely that there are simple one-to-one mappings between discrete emotions and neural activity (Kragel & Labar, 2016; Hamann, 2012). The current study aims to further examine the neural substrates of emotions elicited by complex, dynamic environments and the extent to which environmental context modulates affective responses.

To elicit a range of negative emotions across contexts, a series of video clips depicting animals in different environments was presented to individuals during fMRI collection. Animals have the ability to elicit a range of emotions. We focused on the effect that context has on affective responses to insects and other pests, which have been associated primarily with feelings of disgust (Davey et al., 1998; Lorenz et al., 2014) but may be strongly modulated by the surrounding context.

We performed a set of preliminary analyses using univariate fMRI to compare the neural correlates of affective responses across several categories of animal video clips.

Methods

Participants

20 right-handed adults (Mₐge = 22, SDₐge = 2.65; 12 females)

Materials

Category (11 videos each) | Hypothesized Primary Emotion(s)
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A) Pests in the home | Strong disgust; some fear
B) Pests in nature | Disgust; some fear
C) Dangerous animals in nature | Fear
D) Neutral animals in nature | No strong emotions
E) Moving objects (control condition) | No strong emotions

Post-experiment Surveys

Beck Anxiety Interview (Beck & Steer, 1990)
Disgust Scale emphasizing pathogen and insect disgust (Lorenz et al., 2014)
Fear Survey Schedule-III (Arrindell, 1980)

Results

Post-scan Rating

Participants viewed each video again and provided five ratings: a) along the affective dimensions of arousal and valence using the Self-Assessment Manikin (SAM; Lang, 1980), and b) along 9-point rating scales of disgust, fear, and pleasantness.

Arousal

Valence

3 x 5 repeated-measures ANOVA for emotion categories and video categories
2 x 5 repeated measures ANOVA for emotion dimensions and video categories

Significant main effects and interactions in both analyses

Bonferroni-corrected paired t-tests
Select comparisons highlighted in red; *significant at p = .01

Discussion

As expected, we observed increased activation in the insula when participants viewed videos of pests (primarily insects) compared to dangerous animals. Furthermore, we observed 1) increased activation in the insula when participants viewed videos of pests in a home environment compared to pests in nature, and 2) increased activation in the amygdala when participants viewed videos of dangerous animals compared to pests in general.

The fMRI data are further supported by corresponding affective responses obtained through the post-scan rating scales. Together, the data emphasize the importance that context has on emotional processing, including affective responses to insects/pests. Furthermore, these results provide further support that at least partially-segregated brain networks support the emotions disgust and fear.

Despite the observed dissociation in the neural and behavioral data, the insula and amygdala likely do not work in isolation to support affective responses and do not uniquely support the experience of disgust and fear emotions, respectively (Schienle et al., 2002). For example, increased insula activation was observed when participants viewed neutral animal videos compared to dangerous animal videos.

The preliminary analysis presented here provides a foundation for follow-up analyses: 1) examination of functional connectivity between insula and other brain regions/networks as a function of affective state, 2) application of MVPA to classify affective responses across contexts based on unique patterns of brain activity, and 3) relationships between neural activation and affective ratings.

References


