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BRIEF REPORT

Dynamical patterns of human postural responses to emotional stimuli

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Abstract

Postural displacements in response to emotional activation have recently been proposed as a direct and objective index of approach–avoidance behavior in humans. Here, we present the results of an experiment designed to assess spontaneous postural responses to discrete affective pictures, briefly presented in random order of valence. Our findings question the interpretation of phasic postural responses to emotional stimuli as approach–avoidance behavior. Further, we identify a robust dynamical pattern, characterized by specific features indicating that attentional processes may play a role in human postural responses to emotional stimuli.

Descriptors: Postural responses, Emotion, Approach-avoidance, Orienting response, Center of pressure

The approach–avoidance distinction is central to the understanding of both human and animal motivated behavior (Elliot, 2008). Whereas in animal investigations the actual movement toward a reward or away from an aversive stimulus has been and still is a relevant objective measure to probe the psychological and related neurophysiological mechanisms of motivated behavior (Blanchard & Blanchard, 1969; Fonio, Benjamini, & Golani, 2009), in human research, an objective index of physical approach or avoidance remains elusive.

A series of empirical studies has examined the pulling or pushing of levers as a possible motor index of approach–avoidance behavior. In this framework, a faster pull of the lever (arm flexion) in the presence of a positive compared to a negative stimulus is assumed to indicate approach, whereas a faster push of the lever (arm extension) in the presence of a negative compared to a positive stimulus is believed to represent avoidance (Rutherford & Lindell, 2011). Experimental evidence, however, has shown that the matching of arm flexion or extension to approach or avoidance behavior, respectively, depends on the experimental instructions, which may influence the affective coding of specific motor actions on a representational level that interferes with response selection (Eder & Rothermund, 2008).

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A recent study has suggested an alternative experimental methodology to assess approach–avoidance responses to emotional activation in controlled laboratory settings (Hillman, Rosengren, & Smith, 2004). Postural sway was measured while subjects stood on a force platform viewing pictures from three affective categories: pleasant, unpleasant, and neutral. It was hypothesized that positively evaluated pictures would evoke body movement toward the stimulus (approach behavior) and, correspondingly, negatively evaluated pictures would produce body movement away from the stimulus (avoidance behavior). Because forward movement decreases the actual distance between the subject and the affective stimulus, whereas backward leaning increases the subject–stimulus distance, it is reasonable to argue that postural sway can be used as an objective measure of approach–voidance behavior that is not influenced by experimental instructions. In this study, women exhibited a posterior displacement in response to all pictorial stimuli, which was more pronounced, however, for the unpleasant pictures. Although this posterior displacement to unpleasant pictures could be interpreted as avoidance behavior, the observation that pleasant stimuli also triggered a posterior movement in women, whereas in the same study men exhibited less backward displacement to unpleasant pictures than to pleasant and neutral ones, renders the approach–avoidance interpretation problematic. Furthermore, in that experiment, pictures from the same affective category were presented together in blocks. Thus, the authors aimed at exploring postural behavior induced by sustained emotional states, rather than assessing phasic responses to discrete emotional stimuli.

A second study examined postural sway in response to emotional stimuli as a possible index of approach–avoidance behavior utilizing pictures from three affective categories (pleasant, unpleas-

Here we propose an alternative hypothesis that postural responses to emotional stimuli may be related to attentional processes. This hypothesis is supported by the following findings: (a) A similar dynamical pattern of COP responses is evoked by all visual stimuli regardless their valence (Figures 1a and 2a,c); (b) the amplitude of the COP negative (posterior) displacement in women is potentiated for pleasant and unpleasant stimuli, which are more attentionally demanding compared to neutral stimuli (Figure 2a); and (c) the dynamical pattern of COP responses reveals a characteristic plateau region that persists during the visual stimulation period and terminates after the stimulus offset (Figures 1a and 2a,c). The presence of such a prolonged (up to 5 sec) plateau may indicate a sustained period of perceptual processing requiring increased allocation of attentional resources. (d) Simultaneous heart rate recordings reveal a cardiac deceleration in response to emotional pictures that replicates previous findings, where such decelerations were characterized as an attentional bradycardia indicative of an orienting response (Bradley, 2009).

In summary, in this brief report we uncover a dynamical pattern of spontaneous human postural responses to discrete, briefly presented affective pictures. Our findings question the interpretation of postural responses to emotional stimuli as approach–avoidance behavior and suggest a previously unrecognized involvement of attentional processes.

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