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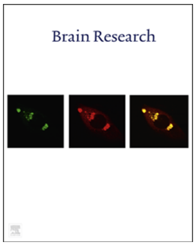

Research Report

Emotion word recognition: Discrete information effects first, continuous later?

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ABSTRACT

Manipulations of either discrete emotions (e.g. happiness) or affective dimensions (e.g. positivity) have a long tradition in emotion research, but interactive effects have never been studied, based on the assumption that the two underlying theories are incompatible. Recent theorizing suggests, however, that the human brain relies on two affective processing systems, one working on the basis of discrete emotion categories, and the other working along affective dimensions. Presenting participants with an orthogonal manipulation of happiness and positivity in a lexical decision task, the present study meant to test the appropriateness of this assumption in emotion word recognition. Behavioral and electroencephalographic data revealed independent effects for both variables, with happiness affecting the early visual N1 component, while positivity affected an N400-like component and the late positive complex. These results are interpreted as evidence for a sequential processing of affective information, with discrete emotions being the basis for later dimensional appraisal processes.

1. Introduction

Two main conceptions have been proposed to best describe human emotions, each being in accordance with convincing empirical data. On the one hand, a class of theories assumes that emotions are processed along a limited number of affective dimensions (Russell, 2003; Wundt, 1896). The 'core affect' theory (Barrett and Bliss-Moreau, 2009; Russell, 2003; 2005; 2009), for example, assumes that emotions are "grounded in continuous and fluctuating affective states described as pleasant or unpleasant, with some level of arousal" within the core of the body (cf. Wilson-Mendenhall et al., 2013, p. 1). Within this class of theories, two affective dimensions, i.e. valence (ranging from a pleasant to an unpleasant pole) and arousal underlie human

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emotional experiences and evaluations, which is well in line with many empirical findings (Barrett and Bliss-Moreau, 2009; Russell, 2003). Discrete emotion theories, on the other hand, assume a limited set of functionally distinct emotion categories (Darwin, 1872; Ekman, 1992; Panksepp, 1998), which is primarily supported by studies that compared affective responses across different cultures (Elfenbein, 2013) and species (Panksepp, 1998). The existence of discrete emotions like fear, anger, disgust, sadness, and happiness is widely accepted, even though less consensus is reached regarding further emotions (like pride) or a common definition.

Even though discrete emotion models and dimensional models of affective space have traditionally been proposed as opposing viewpoints, several more recent models seek to integrate both conceptions in a single theoretical framework (Panksepp, 2008; Russell, 2005). The core affect theory mentioned above, for example, explicitly distinguishes between the two-dimensional core affect, which is seen as the first order state underlying continuous fluctuations in emotional life, and second order emotional meta-experiences that are derived from it (Russell, 2005). Discrete emotions, in this view, “are complex Gestalts that typically include simpler, more primitive feelings of Core Affect” (cf. Russell, 2005, p. 27), i.e. they depend on and are derived from the core affect. An alternative unifying framework is provided by Panksepp (2008), whose model is based on neurophysiological and neuroanatomical evidence for discrete emotional states in the mammalian brain (Panksepp, 1998). Panksepp assumes that discrete emotions are genetically ingrained basal processes that originate in subcortical circuits, such as the periaqueductal gray (PAG), while affective dimensions depend on neocortical circuits such as the dorsolateral prefrontal cortex. In the neocortex, discrete emotions are adapted to and shaped by sociocultural demands, with one important function being to “cluster [the formally discrete emotions] into constellations of positive and negative affect” (cf. Panksepp, 2006, p. 22). Following this view, affective dimensions are clearly derived from more basal discrete emotions, which is the exact opposite sequence when compared to the core affect model. Moreover, Panksepp explicitly emphasizes that three (temporally succeeding) levels-of-analysis must be distinguished: (a) a primary process—level where discrete emotions arise from subcortical processes, (b) a secondary process—level where emotions from the first process-level are transformed into conditioned responses based on classical and instrumental conditioning (e.g. fear-conditioning in LeDoux, 2000) and (c) a tertiary process—level that represents interactions of the previous levels with higher-order, neocortical cognitive processing (Panksepp and Watt, 2011).

The most obvious discrepancies between these two unifying frameworks relate to the different time frames of emotion processing, which is why temporally more fine-grained analyses have been asked for (Barrett and Wager, 2006). According to Russell (2005; 2009), discrete emotions are derived from fluctuating states best described in terms of affective dimensions, which implies a succession with temporal priority for the dimensional core affect. The hierarchical model suggested by Panksepp (2008), in contrast, predicts a temporal order of processing where discrete emotions based at first and second level precede a third one related to affective dimensions. To test these opposing predictions, we employed an event-related potentials (ERP) study of emotion effects in word recognition using a lexical decision task (LDT).

Previous research on visual word processing using the ERP methodology documents that electroencephalography (EEG) recordings provide an excellent measure to investigate the temporal dynamics of implicit affective processing as triggered by the LDT (for a review, see Citron (2012)). Different temporally early and late ERP components have been identified to reveal effects related to emotional processing. The N1 component, peaking around 100 ms, is sensitive to differences in early attentional resource allocation for positive versus negative stimulus categories (words: Hofmann et al., 2009; pictures: Foti et al., 2009). Such early effects are visible before the stimulus is analyzed in full detail, and in case of emotional words, have been shown to result from conditional learning (Fritsch and Kuchinke, 2013) as it would be expected by secondary level processes (Panksepp and Watt, 2011). Similarly, a negative deflection peaking between 200 and 300 ms is visible in word recognition tasks around the time frame of word identification (early posterior negativity, EPN; Citron, 2012), modulated by implicit and automatic processing of affective information irrespective of its polarity (e.g., Kissler et al., 2009; pictures: Foti et al., 2009). Later components that reflect emotional processing like the N400 and the LPC (late positive complex, around 500–800 ms) are discussed to indicate higher-order evaluative processes (words: Kanske and Kotz, 2007; pictures: Foti et al., 2009), in accordance with the description of Panksepp's tertiary process-level.

While there is a history of dimensional emotion effects in word recognition (Citron, 2012), recent work suggests that word processing is also affected by discrete emotion information when the material is controlled for dimensional emotion effects (Briesemeister et al., 2011a, 2011b; see also Ponz et al., in press; Silva et al., 2012). With an orthogonal manipulation, it should thus be possible to examine temporal differences of dimensional and discrete emotion processing and their role in differentiating words from nonwords. Based on Panksepp's model of hierarchical emotion processing (Panksepp, 2006) we predicted that (conditioned) discrete emotion information affects early ERP components (N1, EPN), whereas dimensional emotion information affects later ERP components (N400, LPC) as these address post-lexical cognitive evaluations at the tertiary process-level in neocortex (Panksepp and Watt, 2011). The reverse result-pattern would be supported by the core affect theory (Wilson-Mendenhall et al., 2013).

2. Results

2.1. Pilot study

A repeated measures ANOVA for LDRTs yielded significant main effects of happiness ($F(1,21)=11.995$, $p=0.002$, $\eta^2=0.364$) and positivity ($F(1,21)=5.206$, $p=0.033$, $\eta^2=0.199$), but no significant interaction ($F(1,21)=2.270$, $p=0.147$, $\eta^2=0.098$). Words highly rated on happiness (highHap) were processed faster ($M=623$ ms, $SD=97$ ms) than words weakly related to happiness (lowHap; $M=643$ ms, $SD=109$ ms). Neutral words (neu; $M=627$ ms, $SD=101$ ms) were processed faster than positive words (pos; $M=640$ ms, $SD=105$ ms). Planned pairwise