Neural correlates of emotion word processing: the complex relation between emotional valence and arousal

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Emotion is characterised by a two-dimensional structure: valence describes the extent to which an emotion is positive or negative, whereas arousal refers to the intensity of an emotion, how exciting or calming it is. Emotional content of verbal material influences cognitive processing during lexical decision, naming, emotional Stroop task and many others.

Converging findings showed that emotionally valenced words (positive or negative) are processed faster than neutral words, as shown by reaction time and ERP measures, suggesting a prioritisation of emotional stimuli (Scott et al., 2009).

Contrasting results were found though when comparing positive and negative words. Some authors found a slowdown in processing negative words compared to positive and attributed it to automatic vigilance (Algom et al., 2004). Those studies failed to control for important lexical and semantic features which might have confounded the results (Larsen et al., 2006).

Furthermore, only one dimension of emotion, valence, has been repeatedly manipulated. Arousal has often not been considered or has only been controlled (Kanske & Kotz, 2007; Kissler et al., 2009).

The aims of our studies were to disentangle the effects of valence and arousal by manipulating both of them in a lexical decision task (LDT); to quantify the extent to which emotion affects lexical processing beyond other lexical and semantic variables; to determine at what stage of processing emotional effects take place by measuring EEG. A LDT was chosen because it is a direct measure of lexical access and it was the most commonly used in the studies reviewed.

Reaction time results revealed a main effect of arousal and an interaction between emotional valence and arousal: high arousal words were responded to faster than low arousal words, and this difference was much more pronounced for negative words compared to positive words. No significant difference between positive and negative words was found. Also, a regression analysis showed a unique contribution of the emotion factor in predicting lexical decision latencies, beyond other variables.

ERP results also showed an interaction between the two emotional dimensions around 200-300 ms, as indexed by a posterior negative component (EPN), with higher amplitude for negative low arousal words and positive high arousal words compared to negative high arousal and positive low arousal ones. This complex interaction will be interpreted according to Robinson et al. (2004). It is important to mention though that valence and arousal interacted at an early stage of processing, when we are accessing our mental lexicon. The EPN has repeatedly been shown to index discrimination between valenced and neutral stimuli, but no relation between valence and arousal has previously been investigated.

These findings highlight the importance of arousal, which interacts with valence, and suggest the possibility to integrate emotion in models of lexical access. This research more generally contributes to understanding how the emotional dimensions interact and therefore has implications beyond psycholinguistics, for research on emotion, affective disorders, neuropsychology and rehabilitation.

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