Available online at www.sciencedirect.com

ScienceDirect

www.elsevier.com/locate/brainres

Research Report

The influence of emotional salience on the integration of person names into context

Lin Wang[a,*], *Marcel Bastiaansen*[b], *Yufang Yang*[a]

[a]*Key Laboratory of Behavioral Science, Institute of Psychology, Chinese Academy of Sciences, China*
[b]*NHTV Breda University of Applied Sciences, Breda, The Netherlands*

ARTICLE INFO

Article history:
Accepted 15 March 2015
Available online 23 March 2015

Keywords:
Person names
Emotional salience
ERP
N400
P600

ABSTRACT

Previous event-related potentials (ERP) studies on the processing of emotional information in sentence/discourse context have yielded inconsistent findings. An important reason for the discrepancies is the different lexico-semantic properties of the emotional words. The present study controlled for the lexico-semantic meaning of emotional information by endowing the same person names with either positive or negative valence. ERPs were computed for positively and negatively valenced person names that were either congruent or incongruent to previous emotional contexts. We found that positive names elicited an N400 effect while negative names elicited a P600 effect in response to the incongruence. These results suggest that the integration of positive and negative information into emotional context exhibits different time courses, with a relatively delayed integration for negative information. Our study demonstrates that using person names constitutes a new and improved tool for investigating the integration of emotional information into context.

1. Introduction

The cognitive processing of emotionally salient information has been extensively studied in cognitive neuroscience. One long-standing view is that the processing of emotional information is prioritized due to its biological relevance to species survival (Lang et al., 1997). Generally, emotion can be conceptualized along two dimensions: valence (pleasant vs. unpleasant) and arousal (arousing vs. calm) (Russell, 1980). Very pleasant or unpleasant stimuli are usually highly arousing. Here we use the term emotional salience to refer to both valence and arousal. Emotional salience can be conveyed by words or sentences. A dissociation between emotional salience and semantic attributes has been made (Osgood et al., 1957). For instance, the word 'snake' conveys both emotional salience (e.g., highly arousing, negative valence) and lexico-semantic meaning (e.g., a kind of reptile, with a long shape). The activation of the meaning of an emotionally salient word has been shown to depend on the context in which the word was presented (Lai et al., 2012), and different neural substrates have been proposed for the activation of the semantic and emotional meaning of the same word (Liu et al., 2010).

The present study used ERPs to examine how the emotional salience of a word is processed during language comprehension, more notably, in situations where emotional valence matches or

*Correspondence to: Institute of Psychology, Chinese Academy of Sciences, Chaoyang District, Lincui Road 16, Beijing, 100101, China. Fax: +86 10 64872070.
E-mail address: wangl@psych.ac.cn (L. Wang).

http://dx.doi.org/10.1016/j.brainres.2015.03.028
0006-8993/

mismatches the emotional valence of a given short discourse. The integration of (emotionally neutral) words has been extensively studied using a violation paradigm, in which the critical words either fit or violate a preceding sentence or discourse context. Two ERP components have been very robustly related to meaning integration. The N400 is a negativity that occurs between 300 and 500 ms after stimulus onset, with a centro-parietal maximum distribution (Kutas and Hillyard, 1980). The N400 amplitude is sensitive to the degree of match or mismatch between a word's meaning and its context, with unpredicted (or difficult to be integrated) words eliciting a larger N400 than predicted (or easy to be integrated) words. The other ERP component, the P600, was also often reported in response to violations. The P600 is a positivity that occurs between around 500 ms and 1200 ms post-stimulus, with a centro-posterior distribution. The P600 effect is typically found in response to syntactic violations (Hagoort et al., 1993; Osterhout and Holcomb, 1992), but is also elicited by violation of meaning (Kuperberg, 2007). Interestingly, it has been shown that people do not always immediately detect anomalies in sentences when the anomalous information fits the global context (e.g., "After a serious airplane crash, the *survivors/victims* should be buried properly."). The temporary failure to detect a mismatch between a word's meaning and its previous context was found to elicit a P600 effect instead of an N400 effect (Nieuwland and Van Berkum, 2005; Sanford et al., 2011). The P600 effect elicited by semantic anomalies may reflect an attempt to reinterpret the unexpected input (Kuperberg, 2007) or simply general cognitive control (Kolk and Chwilla, 2007).

So far, most ERP studies on emotion and language have employed isolated words as stimuli. Both early (such as P1, N1, P2) and late (such as N400 and late positive component, i.e., LPC) effects have been reported in response to emotional salience (for a review, see Citron, 2012). Early effects have been interpreted as reflections of automatic attention devoted to emotionally salient words, while late effects have been associated with (a less automatic) evaluation of the emotional salience. Nevertheless, meaning in language is usually conveyed by sentences or texts. It has been shown that context can influence the retrieval of the meaning of upcoming words rapidly (Kutas and Federmeier, 2011). Therefore, a number of ERP studies have recently investigated how emotional words are integrated into sentence/discourse contexts. Various ERP effects have been reported in these studies using different paradigms.

1.1. *Processing emotional/neutral words in contexts*

Several studies presented emotional and neutral words in neutral sentence/discourse contexts (Bayer et al., 2010; Holt et al., 2009; Wang et al., 2013). For instance, "Colin decided to walk to the market. On the way, he saw a *diamond/snake/button* on the ground." Holt et al. (2009) found larger N400s for both positive and negative words compared with neutral words, which might indicate a mismatch between the neutral context and the emotional salience of the words. However, Wang et al. (2013) found a smaller N400 for positive words than for negative words, which might indicate facilitated semantic integration of pleasant compared to unpleasant words. In addition, both Holt et al. (2009) and Bayer et al. (2010) reported a larger late positivity for negative words, which might reflect a re-evaluation of the negative words.

The above three studies manipulated the emotional salience of words in neutral contexts, so the observed effects were mainly caused by a mismatch between the emotional words and the neutral context in the emotional dimension. In order to dissociate emotional and semantic processing, De Pascalis et al. (2009) and Martín-Loeches et al. (2012) further manipulated the semantic fit of the emotional/neutral words in an otherwise neutral sentence context. For instance, "The *loved/gratuitous* girl arrives." "The *ugly/square* girl arrives." "The *oval/cooked* mirror reflects." Both studies found equally large N400 effects in response to the semantic violations for the emotional and neutral words, although they also observed a smaller N400 for positive words irrespective of their semantic fit. These results seem to suggest independent processing between emotional salience and semantic fit.

In order to investigate how the emotional salience of words is processed in emotional context, several studies manipulated the fit between emotional words and emotional discourse contexts. The emotional context was induced by different means, and the target words were emotional words that either matched or mismatched with the emotional context. For instance, Delaney-Busch and Kuperberg (2013) created an emotional context by introducing emotional words in the context (e.g., "Colin saw a *stunning/horrifying* object on the ground. He realized that it was a *diamond/snake* right away."). They found no N400 difference between the emotionally congruent and incongruent words. According to the authors, the absence of an N400 effect might indicate that people bypassed deep semantic analysis of the valence-incongruent emotional words due to the strong activation of their emotional salience. Another body of studies (Baetens et al., 2011; Bartholow et al., 2001; Van Duynslaeger et al., 2007, 2008) used linguistic descriptions of social behaviors to create an emotional context (e.g., "Mary smiles at everyone on the way to work. She always stops to help when she sees someone with car trouble. Mary gave her sister a *hug/slap*."). These studies reported larger P300s over parietal regions in response to emotional violations (note that an N400 effect was also observed in the study by Baetens et al., 2011), which might indicate an evaluation of the incongruence between the target word and the emotional context. Finally, some other studies (León et al., 2010; Leuthold et al., 2012; Moreno and Vázquez, 2011; Moreno and Rivera, 2013) used descriptions of social scenarios to convey emotional context (e.g., "Abbey was a famous, well-respected golf critic, who informed the golf pro that he had no chance of winning the next open. The golf pro was *distraught/delighted*."). León et al. (2010) found larger N1/P2 and a larger N400 for incongruent compared to congruent emotional words, indicating early ERP responses to the emotional violation in discourse context. However, Leuthold et al. (2012), Moreno and Vázquez (2011), and Moreno and Rivera (2013) reported a larger N400 and a subsequent post-N400 frontal positivity for the incongruent emotional words.

1.2. *Processing differences between positive and negative words in contexts*

On the basis of ERP findings, some studies reported differences in processing between positively and negatively valenced words