

**Language that conveys emotion: a commentary on Hinojosa, Moreno and Ferré (2019)**

Francesca M.M. Citron

Department of Psychology, Lancaster University

Address correspondence to:

Francesca Citron  
Department of Psychology  
Fylde College  
Lancaster University  
LA1 4YF  
Lancaster, UK

Telephone: +44 1524594573  
E-mail: [fmm.citron@gmail.com](mailto:fmm.citron@gmail.com)  
ORCID: 0000-0002-2859-5224  
Twitter: @fmm\_citron

Over the last 20 years, research on the effects of emotion on language processing has flourished. Converging evidence from behavioural and neurophysiological studies has shown that the emotive content of verbal materials affects language processing in systematic ways. In particular, emotionally-laden words, similarly to pictures and faces, capture attention at early processing stages, are given processing priority over emotionally neutral words, and elicit enhanced and sustained electrophysiological activation compared to neutral words (e.g., Citron, 2012; Kissler, Herbert, Peyk, & Junghofer, 2007; Kousta, Vinson, & Vigliocco, 2009). These findings show that certain evolutionary ancient parts of our brain, dedicated to the detection of threats as well as food and sexual partners, are additionally recruited in response to abstract and symbolic stimuli, namely written and spoken words (Anderson, 2010; Hamann & Mao, 2002; Ponz et al., 2013), even when presented in isolation. These findings are relevant to traditional models of word recognition (Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001; Jacobs & Grainger, 1994; Norris, 2013; Plaut, McClelland, Seidenberg, & Patterson, 1996), which had emphasised effects of a range psycholinguistic variables including word length, neighbourhood size, frequency, familiarity, age of acquisition, and imageability, among others, but not taken into account potential effects of affective variables such as emotional valence and arousal.

Pioneering work on the electrophysiological correlates of emotion word processing was thoroughly reviewed by Kissler, Assadollahi and Herbert (2006), and the subsequent fast growth of electrophysiological and neuroimaging studies in the field was reviewed and critically evaluated by Citron (2012). Hinojosa, Moreno and Ferré (2019) now update and expand those reviews by including research beyond the single word level to investigate effects of emotive content on grammatical and semantic processes at the sentence and discourse levels. Their extensive critical review therefore represents an invaluable source of information for scholars interested in the interplay between emotion and language. They also highlight a number of limitations to our current knowledge on how emotion affects language processing and propose future directions for research on affective neurolinguistics.

Current debates have focused on how the emotion and the language neural networks affect one another (Herbert, 2019), whether the two dimensions of emotion – valence and arousal – are to be considered lexical or semantic properties (Citron, 2012), whether the processing of one dimension precedes and informs the processing of the other (Gianotti et al., 2008; Recio, Conrad, Hansen, & Jacobs, 2014), and whether the effects of emotion on combinatorial and semantic processes are unique to the affective properties of words or are equally elicited by other

psycholinguistic properties (Molinaro, 2019). While this and other work in affective neurolinguistics has focused on literal language, I would like to draw attention to a different aspect of the relationship between emotion and language; namely, that certain language we use may be especially suited to convey our emotional states and feelings. This is the case of figurative language which includes metaphors, *She has a bubbly personality*, idioms, *He's over the moon*, and irony, among others.

Initial pioneering work by Ortony and Fainsilber (1987) showed that people tend to use more metaphors in the description of autobiographical memories when they were asked to explain *how they felt* compared to *what happened*, and that more metaphors were used in the description of more intense feelings (Fainsilber & Ortony, 1987). See also Drew and Holt (1988, 1998) for related research on the use of idioms. Yet until recently, apart from this initial work, the empirical investigation of figurative language processing and its neural underpinnings, like work on language processing more generally, had largely been conducted without considering emotive content (for meta-analyses, see Bohrn, Altmann, & Jacobs, 2012; Rapp, Mutschler, & Erb, 2012; Yang, 2014).

Recent neurophysiological research has shown that figurative language evokes stronger emotional responses in readers than literal language (Bohrn et al., 2012; Citron & Goldberg, 2014; Forgács et al., 2012; Rojo, Ramos, & Valenzuela, 2014). That is, a meta-analysis of 23 neuroimaging studies of figurative language processing and experimental studies have shown significantly enhanced activation of the left amygdala in response to figurative compared to literal language, among other regions of the emotion as well as extended-language networks (Bohrn et al., 2012; Citron, Cacciari, Funcke, Hsu, & Jacobs, 2019a; Citron & Goldberg, 2014; Citron, Güsten, Michaelis, & Goldberg, 2016a; Citron, Michaelis, & Goldberg, 2019b; Forgács et al., 2012). Amygdala activation is typically associated with the automatic and fast processing of evolutionary relevant stimuli (Cunningham & Brosch, 2012; Lindquist, Wager, Kober, Bliss-Moreau, & Feldman Barrett, 2012), therefore suggesting that formulating something in a metaphorical or figurative way engages readers more strongly at the emotional level compared to formulating the same or a similar message using literal language.

Given the growth of research on emotion and language, ratings of affective variables have been included in recent databases of figurative as well as literal linguistic materials alongside more traditional psycholinguistic variables (Citron et al., 2016b; Citron, Lee, & Michaelis, 2019c; Montefinese, Ambrosini, Fairfield, & Mammarella, 2013; Schmidtke, Schröder, Jacobs, & Conrad,

2014). Such databases reveal that metaphorical sentences and stories tend to be rated as more emotionally intense than their literal counterparts (with very similar meaning; Citron et al., 2019c). When such stimuli are used, stronger emotive neural and physiological responses are to be expected in response to figurative expressions. However, certain studies have specifically selected figurative and literal stimuli that were comparable on explicit judgments of emotional valence or arousal; for instance, *She looked at him sweetly* was not rated as more positive nor more emotionally arousing than *She looked at him kindly* (Citron et al., 2019a; Citron & Goldberg, 2014; Citron et al., 2016a; Citron et al., 2019b; Forgács et al., 2012). Results from these studies nonetheless showed stronger activation of the amygdala when reading familiar metaphorical sentences or stories for comprehension when compared to otherwise comparable literal stimuli. With other factors such as familiarity and imageability also controlled for, these results imply that expressing something figuratively engages the reader more strongly (Citron et al., 2019a; Citron & Goldberg, 2014; Citron et al., 2016a). Thus, the use of common figurative expressions carries a persuasive advantage and is better suited to convey emotive content than literal language. This aspect, together with a recognition that figurative expressions are pervasive in everyday communication (Cameron, 2008; Pollio, Barlow, Fine, & Pollio, 1977) ought to encourage scholars with an interest in language and emotion to include figurative expressions in their investigations in order to gain a more comprehensive and ecologically valid overview of language processing.

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