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The effect of alexithymia on early visual processing of emotional body postures

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ABSTRACT

Body postures convey emotion and motion-related information useful in social interactions. Early visual encoding of body postures, reflected by the N190 component, is modulated both by motion (i.e., postures implying motion elicit greater N190 amplitudes than static postures) and by emotion-related content (i.e., fearful postures elicit the largest N190 amplitude). At a later stage, there is a fear-related increase in attention, reflected by an early posterior negativity (EPN) (Borhani et al., 2015). Here, we tested whether difficulties in emotional processing (i.e., alexithymia) affect early and late visual processing of body postures. Low alexithymic participants showed emotional modulation of the N190, with fearful postures specifically enhancing N190 amplitude. In contrast, high alexithymic participants showed no emotional modulation of the N190. Both groups showed preserved encoding of the motion content. At a later stage, a fear-related modulation of the EPN was found for both groups, suggesting that selective attention to salient stimuli is the same in both low and high alexithymia.

1. Introduction

The ability to perceive and categorize emotional stimuli is highly relevant in social environments. Indeed, rapid processing of potentially threatening stimuli is crucial for minimizing the negative consequences associated with unpleasant cues. In support of this view, recent evidence has shown that unpleasant stimuli are detected more quickly than both pleasant and neutral stimuli (Fox et al., 2000; Hansen & Hansen, 1988; Öhman, Lundqvist, & Esteves, 2001). In addition, negative stimuli are associated with enhanced activation in perceptual occipito-temporal areas (Taylor, Liberzon, & Koeppe, 2000) and in subcortical structures, such as the amygdala, that are pivotal for emotional processing (Breiter et al., 1996; Fusar-Poli et al., 2009; Lane et al., 1998; Oya, Kawasaki, Iii, & Adolphs, 2002). These findings suggest that more processing resources are devoted to the visual processing of unpleasant stimuli than to pleasant or neutral stimuli (Carretié, Albert, López-Martín, & Tapia, 2009; Vuilleumier, 2002). Electrophysiological studies have also shown that fearful faces enhance early event-related potential (ERP) components such as the P1, reflecting exogenous spatial orienting of attention toward fearful stimuli (Pourtois, Thut, Grave de Peralta, Michel, & Vuilleumier, 2005; Pourtois, Grandjean, Sander, & Vuilleumier, 2004). In addition, both explicit (Batty & Taylor, 2003; Stekelenburg & de Gelder, 2004) and implicit (Cecere, Bertini, Maier, & Làdavas, 2014; Pegna, Darque, Berrut, & Khateb, 2011; Pegna, Landis, & Khateb, 2008) processing of fearful faces can modulate early stages of perceptual encoding of facial features and configurations, as indexed by the occipito-temporal N170 component (Batty & Taylor, 2003; Bentin, Allison, Puce, Perez, & McCarthy, 1996). Moreover, at a later stage of perceptual representation (around 300 ms after stimulus onset), faces expressing negative emotions increase stimulus-driven attentional capture, as suggested by a pronounced early posterior negativity (EPN; Bayer & Schacht, 2014; Calvo & Beltrán, 2014; Frühholz, Jellinghaus, & Herrmann, 2011; Rellecke, Sommer, & Schacht, 2012; Schupp et al., 2004; Valdés-Conroy, Aguado, Fernández-Cahill, Romero-Ferreiro, & Diéguez-Risco, 2014).

Besides facial expressions, human body postures represent a powerful tool for inferring the internal states of others (de Gelder et al., 2010). Indeed, body postures convey information about others' actions and emotions, both of which are useful for interpreting goals, intentions and mental states. Compared to faces, body postures offer the possibility to capture these signals from longer distances. Similar to the face-related N170, the

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observation of bodies elicits an early occipito-temporal negative deflection peaking at 190 ms after stimulus presentation, which has been termed the N190. It is thought to be generated in a restricted area of the occipito-temporal cortex, corresponding to the extrastriate body area (EBA; Meeren, de Gelder, Ahlfors, Hamalainen, & Hadjikhani, 2013; Taylor, Wiggett, & Downing, 2010; Thierry et al., 2006). This electrophysiological signature reflects the extraction of abstract properties of the human body form for categorization (Thierry et al., 2006), and represents the earliest component indexing structural features of human bodies (Taylor et al., 2010). Interestingly, both motion- and emotion-related information conveyed by body postures can modulate the N190 (Borhani, Làdavas, Maier, Avenanti, & Bertini, 2015). Indeed, in a recent electrophysiological study (Borhani et al., 2015), bodies with static or implied motion postures, and with or without emotional content (fearful, happy or neutral), were presented peripherally to the left or the right of a central fixation point. The N190 component, recorded from the right hemisphere, was modulated both by the presence of implied motion (i.e., larger N190 amplitude in response to body postures conveying implied motion compared to static postures) and by emotional content (i.e., larger N190 amplitude in response to fearful body postures). These modulations suggest that this visual processing stage encodes not only a perceptual representation of the visual stimulus as a body, but also a more detailed analysis of motion and emotion information conveyed by body postures.

Notably, the study by Borhani et al. (2015) did not show any modulation of the early P1 component. This is in keeping with other electrophysiological findings (Stekelenburg & de Gelder, 2004) that emotional stimuli modulate ERP components in the same time window as the N190 (i.e., the Vertex Positive Potential, which is considered the fronto-central counterpart of the N190), but not earlier components. Moreover, evidence for modulations of the P1 in response to emotional bodies is inconsistent (Meeren, van Heijnsbergen, & de Gelder, 2005; van Heijnsbergen, Meeren, Grèzes, & de Gelder, 2007), possibly because the P1 is highly sensitive to the physical properties of the stimulus (Halgren, Raij, Marinkovic, Jousmäki, & Hari, 2000; Rossion & Jacques, 2008).

At a later stage of perceptual representation (i.e., 300 ms post-stimulus onset), viewing fearful body postures elicits a pronounced early posterior negativity (EPN; Borhani et al., 2015). The EPN is a ERP difference in the processing of emotionally relevant stimuli and neutral stimuli, and occurs 200–300 ms after stimulus presentation (Schupp, Flaisch, Stockburger, & Junghöfer, 2006). This differential ERP appears as a negative deflection over temporo-parietal areas, and reflects exogenous attentional capture driven by salient emotional stimuli and the degree of attention needed to recognize relevant signals (Olofsson, Nordin, Sequeira, & Polich, 2008), such as body postures expressing fear. These results suggest the existence of a specialized perceptual mechanism tuned to the emotion and action-related information conveyed by human body postures.

Recent evidence suggests that individual emotional skills (Meaux, Roux, & Batty, 2014), empathic dispositions (Choi et al., 2014) and personality traits, such as antisocial behavioral tendencies (Pfabigan, Alexopoulos, & Sailer, 2012), might affect visual processing of emotional stimuli. Because the rapid perception of negative cues in social environments is highly adaptive, the influence of personality traits on visual processing of emotional stimuli, such as emotional body expressions, is an important avenue for research. One relevant trait is alexithymia, a multifaceted personality construct that is expressed with varying intensity in the general population, and characterized by a deficit in identifying, differentiating and describing feelings (Herbert, Herbert, & Pollatos, 2011; Parker, Keefer, Taylor, & Bagby, 2008; Taylor, Bagby, & Parker, 1991). Importantly, people with high levels of alexithymia exhibit difficulties not only in processing their own emotions, but also in processing the emotions expressed by others (Parker, Taylor, & Bagby, 1993; Sifneos, 1973). Alexithymic individuals show altered recognition of emotional stimuli (Grynberg et al., 2012; Ihme et al., 2014) and decreased activation of the amygdala during presentation of emotional stimuli (Jongen et al., 2014; Moriguchi & Komaki, 2013), specifically negative stimuli (Kugel et al., 2008; Pouga, Berthoz, de Gelder, & Grèzes, 2010; Reker et al., 2010; for a recent meta-analysis: van der Velde et al., 2013). However, it is unknown whether early visual processing of the emotional information conveyed by body postures might be similarly affected. Thus, this study was designed to investigate, using the high temporal resolution of ERPs, whether participants with low levels of alexithymia (LA) and high levels of alexithymia (HA) show similar electrophysiological modulations in response to body postures conveying information about others' actions and emotions. We studied both the early stage of structural body encoding, indexed by the N190 component, and the later stage of visual selective attention, reflected by the subsequent EPN component. In line with evidence suggesting impaired processing of emotional stimuli in alexithymia (Grynberg et al., 2012; Ihme et al., 2014), we expected that only LA participants would exhibit detailed visual encoding of the emotional content of body postures, with the greatest N190 amplitude in response to fearful body postures. Indeed, we expected that HA participants would not show any emotional modulation at the early stage of structural encoding, and, in particular, no fear-related enhancement of the N190 component. In addition, we explored whether alexithymia might also influence a later stage of perceptual representation, reflecting selective attention to salient stimuli (EPN).

2. Methods

2.1. Participants

Three-hundred university students completed the 20-item Toronto Alexithymia Scale (TAS-20; Taylor, Bagby, & Parker, 2003). Individuals with high and low TAS-20 total scores ($n = 18$, top quartile score >61; $n = 16$, bottom quartile score <36) were selected in order to obtain a sample with as large a variance on alexithymia as possible. The alexithymia module of the structured interview for the Diagnostic Criteria for Psychosomatic Research (DCPR) (Mangelli, Semprini, Sirri, Fava, & Sonino, 2006; Porcelli & Rafanelli, 2010; Porcelli & Sonino, 2007), previously used in alexithymia research (Grandi, Sirri, Wise, Tossani, & Fava, 2011), was also used in the present study to further confirm the presence or absence of alexithymia. In addition, due to the high association between alexithymia and depression (Allen, Qian, Tsao, Hayes, & Zeltzer, 2011; Hintikka, Honkalampi, Lehtonen, & Viinamäki, 2001; Honkalampi, Hintikka, Tanskanen, Lehtonen, & Viinamäki, 2000), the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) was administered to exclude participants with high levels of depression. Participants were included in the study if (i) they had no history of neurological, major medical or psychiatric disorder and (ii) their scores on the TAS-20 and the DCPR were congruent. Two participants with a high TAS-20 score and a low DCPR score were discarded; no participants reported high levels of depression on the BDI. All participants had equivalent educational backgrounds and were students at the University of Bologna. Thirty-two right-handed healthy volunteers were selected to take part in the experiment after screening for alexithymia: 16 HA participants (TAS, mean ± standard deviation: 63.62 ± 2.68; 6 males; mean age 20.68; range 18–25 years old) and 16 LA participants (TAS, mean ± standard deviation 31.56 ± 2.75; 6 males; mean age 21.18; range 19–26 years old). The two groups were matched in terms of sex and age. The two groups did not differ in terms of BDI score ($t(30) = -1.41$; $p = .16$). All participants gave their written