NeuroImage 155 (2017) 312–321

Contents lists available at ScienceDirect

NeuroImage

journal homepage: www.elsevier.com/locate/neuroimage

The impact of individuation on the bases of human empathic responding

John E. Kiat[a,*], Jacob E. Cheadle[b]

[a] Dept. of Psychology, University of Nebraska-Lincoln, Lincoln, NE 68588-0308, United States
[b] Dept. of Sociology, University of Nebraska-Lincoln, Lincoln, NE 68588-0308, United States

A R T I C L E I N F O

Keywords:
Empathy
P300
Late-positive potential
EEG
Emotional expressivity
Cognitive reappraisal

A B S T R A C T

While there is substantial overlap in the neural systems underlying empathy for people we know as opposed to strangers, social distance has been shown to significantly moderate empathic neural responses towards the negative experiences of others. Intriguingly however, variance in empathic neural responses towards known and unknown targets has not been reflected by behavioral differences as indexed by self-reported empathic ratings. One explanation for this disconnect is that empathic evaluations of known and unknown individuals draw on different bases (e.g. target identity/reactions) within the empathic process. To test this hypothesis, we utilized high density EEG to assess how individuating targets with personal names moderated the link between behavioral pain ratings and attentional processing oriented towards (a) initial target processing and (b) subsequent expressions target discomfort. Consistent with prior findings, no differences in pain ratings between individuated and unindividuated targets was observed. However, individual mean pain rating differences for individuated targets was strongly positively related to attentional processing levels, indexed by the P300, during the initial presentation of those targets, a relationship absent for unindividuated targets. In contrast, pain ratings for unindividuated targets was positively related to levels of attentional processing, indexed by the Late Positive Potential (LPP), during the subsequent discomfort expression stage. Furthermore, the LPP response to individuated target discomfort was positively linked to behavioral measures of emotional expressivity whereas the LPP response to unindividuated target discomfort was positively associated with cognitive appraisal. These findings suggest that individuation can significantly shift the bases of empathic responding.

Introduction

Empathy and social cognition

Empathy—the ability to perceive, understand, and share the emotional states of others (Decety and Jackson, 2004)—underlies many aspects of social cognition. Empathic processes play a fundamental role in prosocial and altruistic behavior (Bartal et al., 2011; de Waal, 2008; Zaki and Ochsner, 2012), social attachment (Decety, 2011), and affective communication (Buck and Ginsburg, 1997; Hill and Martin, 1997).

Virtually all models of empathy distinguish between cognitive and affective dimensions of empathic processing (Decety and Jackson, 2004; Shamay-Tsoory et al., 2009). Relative to cognitive empathy, *affective empathy* is an ontogenetically and phylogenetically younger (de Waal, 2008; Decety and Svetlova, 2012; Shamay-Tsoory et al., 2009) emotive response (Singer et al., 2004) linked with internalized representations and emotional contagion (de Waal, 2008; Shamay-Tsoory et al., 2009) of a target's affective state. *Cognitive empathy*, on the other hand, is viewed as being a higher-order assessment of the perspective and experiences of the empathized target (de Waal, 2008; Hodges and Wegner, 1997). While these two components are often simultaneously engaged, developmental (Decety, 2010), behavioral (Harari et al., 2010; Mazza et al., 2014), neuroimaging (Banissy et al., 2012; Cox et al., 2012; Eres et al., 2015; Fan et al., 2011), and anatomical (Shamay-Tsoory et al., 2009) evidence suggest that they rely on distinct, dissociable systems.

In addition to these the affective and cognitive dimensions of empathy, research on empathy also highlights a third dimension of prosocial concern that encompasses processes associated with the expressed motivation to improve the experiences of others (Batson, 1991; Mariano et al., 2016; Zaki and Ochsner, 2012). This aspect of empathy in particular highlights the role of empathy in social connectedness, particularly the formation and maintenance of strong social bonds (Anderson and Keltner, 2002; Seyfarth and Cheney, 2013). It also highlights the interplay between empathy and social distance, the degree to which individuals perceive an affinity between themselves and empathized targets (Bogardus, 1925), as well as the likelihood of further interaction with those targets.

* Corresponding author.
E-mail addresses: johnkiat@huskers.unl.edu (J.E. Kiat), j.e.cheadle@gmail.com (J.E. Cheadle).

http://dx.doi.org/10.1016/j.neuroimage.2017.05.006
Received 29 November 2016; Accepted 4 May 2017
Available online 05 May 2017
1053-8119/ Published by Elsevier Inc.

Interpersonal distance and empathic processing

Despite the strong link between empathy and social connectedness, key nuances in the influence of social distance on the neural processes underlying empathic responding remain unexplored. In line with research showing significant differences in empathic neural responses towards known versus unknown individuals however (Leng and Zhou, 2010; Ma et al., 2011; Wang et al., 2016), a recent study by Meyer et al. (2013) reported findings suggesting that the cognitive and affective components of empathy are differentially engaged when empathizing with the social exclusion experiences of friends versus strangers, a strong manipulation of social distance.

Meyer et al. (2013) found that empathy for friends was associated with activation in the medial prefrontal cortex, which was functionally coupled with activity in affective regions such as the insula and dorsal anterior cingulate cortex. This activation pattern suggests that empathy for known individuals may be more strongly driven by mentalization systems involving self-other identification and affective responding (Gusnard et al., 2001; Hynes et al., 2006; Mitchell et al., 2006). In contrast, empathic processing for strangers was associated with dorsal medial prefrontal cortex activation without significant levels of functional connectivity with affective regions (Meyer et al., 2013), implying a more externalized mentalization and appraisal process without a significant affective element (Che et al., 2015; Eres et al., 2015; Mitchell et al., 2005). Intriguingly however, these neural differences were not associated with differential behavioral ratings of the negativity of target experiences (Meyer et al., 2013). This apparent incongruity is consistent with Wang et al. (2016) findings that showed neural response differences to pain stimuli preceded by friend versus stranger primes that while significant, were also not associated with significant behavioral differences (i.e. pain ratings) between the two conditions.

One potential explanation for this apparent brain-behavior disconnect is that empathic responding to known versus unknown targets may draw on different informational bases or cues (i.e. target identity, experiences) within the empathic process. This hypothesis is supported by research showing neurobehavioral links between the response to a threat to one's self and one's friends that are absent in responses to strangers (Beckes et al., 2012), suggesting that reducing social distance elevates the importance of target identity in empathic responding. This paper investigates the evidence for this hypothesis by utilizing high-density EEG to assess if attention related processing during (a) the initial response towards target individuals and (b) the subsequent discomfort expressions those targets, differentially predict pain ratings under individuated (named) versus unindividuated (unnamed) conditions.

Targets in this study were individuated through the use of personal names. Names are used in every known culture throughout recorded history, with cross-species evidence for the use of vocal labels (King and Janik, 2013) suggesting their roots may even predate the evolution of modern humans. Through this rich history, names have come to serve as one of the primary foundations for social relationships, shaping our expectations of ethnicity (Bertrand and Mullainathan, 2004; Watson et al., 2011), personality (Bruning et al., 1998; Mehrabian, 2001), intelligence (Erwin and Calev, 1984), creativity (Lebuda and Karwowski, 2013), and physical appearance (Lea et al., 2007). The shift in social connectivity induced by knowing a person's name make them ideal for assessing the influence of individuation on human empathy.

The current study represents the first investigation of the moderating influence of interpersonal distance on the informational bases underlying human empathic responses. In this investigation, we utilize a paradigm that distinguishes between attentional responses associated with the initial evaluation of targets and their subsequent expressions of discomfort (See Fig. 1).

Target event-related potential components

During the target evaluation phase, our primary attentional processing measure was the P300, a parietally distributed positive ERP (event-related potential) deflection peaking approximately 250–500 ms post-stimulus presentation (Lazzaro et al., 1997). The P300 is one of the most well-studied neural measures of attention related processing (Polich, 2007) with increased positivity in the component being associated with greater levels of focused attention (Kok, 2001; Mercure et al., 2008), heightened personal relevance of processed information (Gray et al., 2004; Ninomiya et al., 1998; Shi, 2016), and increased affective and motivational salience of presented stimuli (Nieuwenhuis et al., 2005; Schupp et al., 2006). In line with our hypothesis that the initial response to individuated (i.e. named) targets is more strongly linked with empathic responses relative to unindividuated (i.e. unnamed) targets, we anticipate that the P300 response to named individuals will be more strongly predictive of subsequent pain ratings relative to the P300 response to unnamed targets.

Drawing on prior neuroimaging investigations of dynamic pain expressions (Missana et al., 2014; Reicherts et al., 2012), our primary component of interest during the expression phase is the late positive potential (LPP). The LPP is a broadly distributed medial posterior positivity spanning the 400–1000 ms post-expression onset window. The LPP has been extensively utilized as a neural index of facilitated processing of motivationally salient stimuli (Hajcak et al., 2010; Schupp et al., 2000). This motivated attention can be driven by both affective content (Schupp et al., 2000; Schupp et al., 2007) and non-affective factors such as task relevance during neutral stimuli processing (Ferrari et al., 2008; Gable and Adams, 2013). Research has also shown the influence of affective content and target focus to be independent and additive rather than interactive (Ferrari et al., 2008; Weinberg et al., 2012).

The dual role of the LPP makes it ideal for investigating whether empathy for known versus unknown individuals draws on distinct foci. In line with research showing a stronger affective link in empathy for known individuals (Meyer et al., 2013), we anticipate that the LPP response to discomfort expressed by individuated relative to unindividuated targets will be more strongly associated with affective arousal. With respect to unindividuated targets, we anticipate the LPP towards target discomfort to be more task-focus related and more strongly associated with cognitive appraisal without a strong affective response element. In both conditions, we anticipate that the LPP will have a positive relationship with observed pain ratings. We hypothesize, however, that target discomfort evaluation will be the dominant informational base for empathic responses towards unindividuated targets relative to individuated ones, for whom we anticipate identity processing to play a stronger role. Thus, we postulate that the relationship between the LPP and observed pain ratings will be stronger for unindividuated targets relative to individuated ones.

Hypotheses

In summary, prior neuroimaging investigations have shown that interpersonal distance moderates empathic neural processing. These differences, however, have not been reflected by corresponding shifts in empathic behavioral responses. This study tests the hypothesis that instead of directly influencing the same underlying empathic process, the impact of individuation on empathic responding arises from a shift in the informational bases on which empathic responses are based. Our primary hypotheses are that relative to unindividuated faces, individuated target pain ratings will be more strongly predicted by attentional processing (P300) during the target introduction phase, whereas unindividuated target pain ratings will be more strongly linked with attentional processes (LPP) during the expression evaluation stage. In line with research showing that empathy for known targets has a stronger affective component (Meyer et al., 2013), we also hypothesize that the LPP response to individuated faces will have a stronger positive association with measures of affective expressivity while the LPP response to unindividuated faces will have a stronger positive association with measures of cognitive appraisal.