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The role of physiological arousal for self-reported emotional empathy

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ABSTRACT

The capacity to represent the emotional and mental states of others is referred to by the concept of empathy. Empathy further differentiates into an emotional and a cognitive subcomponent, which in turn is known to require a tacit perspective-taking process. However, whether the empathizer by himself needs to enter an affective state as a necessary precondition for emotional empathy remains a matter of debate. If empathy would require a vicarious emotional reaction, specific physiological markers of affective responding should be detectable in the empathizing person.

In the present study, we investigated the relationship between self-reported empathy and psychophysiological responses in young, healthy participants. We assessed emotional and cognitive empathy with the Multifaceted Empathy Test on the one hand and the corresponding heart rate and skin conductance responses (SCR), affective startle modulation and heart rate variability on the other.

We found a negative relationship between SCR and self-reported emotional empathy: higher SCR to emotional stimuli predicted lower empathy ratings. We conclude that physiological arousal is not necessary and might even diminish empathy for others.

1. Introduction

Empathy refers to the ability to adequately represent the emotional and mental states of others. Although not restricted to human beings – with rudimentary forms also found in other higher mammals as well – it can be considered crucial for the social and cultural evolution of the human species (de Waal and Preston, 2017). From fundamental interactions like mother-child bonding to the regulation of complex societal processes, empathy is a basic underlying component of our everyday social life (Decety et al., 2016). Deficits in the ability to empathize or in empathetic concern for others are associated with severe mental disorders such as autism and anti-social personality disorder (Anderson and Kiehl, 2014; Kok et al., 2016).

Even though empathy has gained popularity as a research topic, it is also subject to conceptual and methodological debates (Cuff et al., 2016). In general, it is agreed upon that empathy is composed of cognitive as well as emotional subcomponents (Cuff et al., 2016): while the former describes the ability to accurately attribute emotions to other people, the latter reflects the degree to which the empathizer is affected by and can "feel with" the other person. Cognitive empathy, which is related to the concepts of 'theory of mind' and 'perspective taking', is usually measured by tasks that require the correct identification of socially relevant emotional scenes or expressions. Emotional empathy has been assessed by presenting participants with emotional scenes and having them rate the degree to which they feel affected by the displayed emotional states. However, while research has shown distinct patterns of neural activation when witnessing emotions in others (Decety and Lamm, 2006), the necessity of sharing of and partaking in the other's affective state as a precondition for empathy, referred to by the term of "affective isomorphism", remains a matter of conceptual debate (Gangopadhyay, 2014; Michael, 2014; Zahavi and Overgaard, 2012). Does empathy require the empathizing individuals to "simulate" or share the target's emotion and enter such a "hot" affective state themselves? While most researchers adhere to this so-called "simulation account" of empathy and support this notion (de Vignemont and Singer, 2006; Gallagher, 2012a), different authors question this position and propose an alternative view (Smith, 2017; Svenaeus, 2016; Walsh, 2014; Zahavi, 2008, 2014; Zahavi and Rochat, 2015), summed up in the

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question: “Can't I empathically grasp that my child is afraid of the dark, without myself being afraid of the dark?” (Zahavi and Rochat, 2015). Nevertheless, this “direct-perception” model of empathy has invited counter-criticism on conceptual grounds (Jacob, 2011), leading to extensive debate (Gallagher, 2012b). While this ongoing dispute is oftentimes based on theoretical arguments, it might better be clarified by delegating it to empirical inquiry. To investigate this question, one could ask study participants about the subjective state they are in. However, assessment by self-report measures carries the risk of being confounded by a reporting bias, especially when asking about attributes that are highly valued such as empathy. Presumably, few people would easily admit that they do not feel anything while witnessing a person in distress. The results could as well reflect motivational differences instead of differences in empathetic ability (Klein and Hodges, 2001). It therefore seems useful to include additional, more reliable measures of emotional responsiveness. Thus, the main aim of our study was to elucidate how psychophysiological indices of affective responding relate to self-reported cognitive and emotional empathy. We assessed empathy with the Multifaceted Empathy Test (MET), a well-established and validated task commonly used in empirical studies (Duesenberg et al., 2016; Dziobek et al., 2008; Grimm et al., 2017; Pokorny et al., 2017; Wingenfeld et al., 2016; Wingenfeld et al., 2014). In this task, photographic pictures of emotional scenes (e.g. winning a sports contest, exchanging hugs, grieving, etc.) and expressions (e.g. joy, anger, grief, etc.) are displayed on a computer screen. Participants are asked to correctly identify the target’s emotion (cognitive domain) and to rate the degree of empathic concern they felt for the person in the picture (emotional domain). In addition to the ratings, skin conductance and heart rate were recorded during stimulus processing, both common measures of affective arousal and sensitive to emotional content (Lang, 2014; Lang et al., 1993). We further employed the affective startle-modulation paradigm by presenting an acoustic startle probe towards the end of the target picture presentation while measuring the electromyographic (EMG) response of the orbicularis oculi muscle (Bradley et al., 1999; Cuthbert et al., 1996), and assessed heart rate variability (HRV) throughout the presentation of the emotional slides, a measure that is related to emotional regulation and potentially to the correct processing of emotions (Park and Thayer, 2014).

We hypothesized that self-reported empathy measures in the MET should correspond to affective responses to emotional content as assessed by physiological indices. Based on the principal notion of empathy that requires affective resonance and isomorphism between the empathizer and the target person (Cuff et al., 2016; Walter, 2012), we expected higher arousal, as reflected in higher heart rate and skin conductance responses, to predict increased self-reported, emotional empathy. Furthermore, this positive relationship with emotional empathy should also apply to appraised stimulus valence, as reflected in affective startle modulation. We expected an interaction between EMG responses and the emotional stimulus valence (positive vs. negative) (Bradley et al., 1999); the magnitude of which should again be associated with self-reported emotional empathy. Also, since preliminary evidence suggests a role of cardiac afferent input in socio-cognitive processing of emotional information (Gaebler et al., 2013; Quintana et al., 2012), we also hypothesized to find indices of HRV positively related to empathy measures.

2. Methods

2.1. Participants

In total, 90 healthy participants (45 women, age 18–33 years, m = 23.5, SD = 3.5) completed the study. Participants were undergraduate students, recruited at the Humboldt University and Free University Berlin. One male participant had to be excluded because of technical difficulties.

Exclusion criteria were any neurological, psychiatric or psychological disorders, acute or persistent medical disease and current medication other than hormonal contraception. All participants were of normal body weight (mean body mass index = 21.1, SD = 2.3), all female participants were in the luteal cycle phase.

Study procedures were approved by the local ethics committee. All participants signed a written informed consent.

2.2. Design and procedure

The described experiment was part of a larger study that also investigated spatial learning and memory retrieval as well as decision making processes (Nowacki et al., 2017; Piber et al., 2018). Participants arrived in the morning. The experiment was split in into two consecutive parts; the physiological recording and the rating session of the MET.

2.2.1. Physiological recording

Participants were seated in a comfortable laboratory chair and were prepared with electrodes for ECG, SCR and EMG recordings. The experiment was run with E-Prime 2.0 (Psychological Software Tools), stimuli were presented on a 21-inch flat screen monitor. Acoustic stimuli were presented via headphones. Prior to stimulus presentation, experimental instructions were presented in written form on the screen. Participants were instructed to remain calmly seated and attend to the pictures presented. Before recordings started, six acoustic startle habituation probes were presented at randomly set intervals ranging from 6 to 8 s. The picture stimuli were taken from the MET paradigm and depicted people in emotionally charged situations, displaying various positive and negative emotions. Stimuli were presented in a randomized order with a duration of 6 s. The inter-stimulus interval varied randomly between 10 and 14 s

2.2.2. The Multifaceted Empathy Test (MET)

We assessed cognitive and emotional empathy with the short version of the MET, a PC-assisted test consisting of photographs showing 30 picture stimuli with people in emotionally charged situations (Dziobek et al., 2008). The MET can be regarded as an ecologically valid measure intended to produce strong emotional reactions. To assess cognitive empathy, participants were required to infer the mental state of the subject in the photo and asked to indicate the correct emotion from a list of four (multiple choice). To assess emotional empathy, participants were asked to rate the degree of empathic concern they felt for the person in the picture (Likert scale, 0 — not at all to 9 — very much). Pictures were presented in six blocks of 10 picture stimuli. Assessment of cognitive and emotional empathy was varied between blocks. In the first block, participants were asked about cognitive empathy, each picture was rated for cognitive as well as emotional empathy.

2.3. Physiological data acquisition and reduction

2.3.1. Startle EMG recording

Startle modulation reflects the valence of emotional foreground stimulation (Deuter et al., 2014), supposedly caused by mechanisms of motivational priming. The paradigm has been extensively validated by the International Affective Picture Inventory (IAPS) (Lang et al., 1999), however, subsequent studies could also demonstrate effects of different emotional scenes and facial expressions as well (Alpers et al., 2011; Anokhin and Golosheykin, 2010; Hess et al., 2007).

Electrodes for EMG recording of the orbicularis oculi muscle were attached below the participant's right eye at an inter-electrode distance of 15 mm (center-to-center). The EMG signal was recorded on hard disk with a BIOPAC MP 150 system and an EMG 100C amplifier via Kendall Tyco Arbo H124SG electrodes at 16-bit resolution and 1 kHz sampling rate. Hardware band-pass filter settings were 10 to 500 Hz, followed by a 28 Hz software high-pass filter (van Boxtel et al., 1998). The raw