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Perceiving one's body shapes empathy

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HIGHLIGHTS

- Interoception and empathy share neural circuits such as the anterior insula.
- No prior studies explore whether interoception modulates affective *and* cognitive empathy.
- We showed that interoception predicts higher cognitive *and* affective empathy.
- Interoception is relevant to understanding and sharing of other people's emotions.

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ABSTRACT

Background: Empathy is a basic human ability with affective and cognitive facets and high interindividual variability. Accurately detecting one's internal body signals (interoceptive sensitivity) strongly contributes to the awareness of oneself and is known to interact with emotional and cognitive processes. This study investigated whether interoceptive sensitivity (i.e., heartbeat perception task) shapes affective and cognitive empathy.
Methods: Ninety-three participants were asked to report the valence of their feelings, as well as the degree of compassion, arousal, and distress they felt in response to pictures depicting other people in pain or in non-pain situations. Participants also had to estimate how painful the situation was.
Results: Main results showed that greater interoceptive sensitivity enhanced the estimated degree of pain (cognitive empathy), as well as arousal and feelings of compassion (affective empathy), in response to painful pictures.
Conclusions: The accurate perception of bodily states and their representation shape both affective and cognitive empathy. This perception enables us to feel more compassion for another person and to evaluate the pain that they experience as being more intense.

1. Introduction

1.1. Empathy: definition

In the eighteenth century, Hume and Smith used the word “sympathy” to refer to the ability to feel as the other person feels. Later, Lipps [1] used the term “Einfühlung” to describe a form of projection that artists could use to imagine what it would be like to be someone else or to be an inanimate object. The term Einfühlung (which literally means “feeling into”) was later translated into “empathy” by Titchener [2]. For Lipps, sympathy refers to the ability to project oneself onto another (“inner imitation”) in order to feel as the other person does. The projection is based on the perception of an emotional gesture of another person, which directly activates the same emotion in the perceiver (i.e., emotional sharing). Nowadays, most definitions of empathy include an affective component [3], but there is still no agreement about the exact nature of the feeling. de Vignemont and Singer [4] argue that empathy occurs when the observation of the other's emotion induces a similar affective state in the observer. For Decety and Lamm [5], the affective response has to result from an “emotional sharing”, while Baron-Cohen and Wheelwright [6] suggest that the affective response does not have to be similar, but has to be adjusted and appropriate (e.g., feel sad for a friend who is angry). Finally, Batson [7] states that affective empathy encompasses any emotion that focuses on the well-being of the other person and thus refers to empathic concern, which is similar to compassion.

It has been suggested that, in addition to the affective dimension, empathy also refers to the ability to take the perspective of others [8] and to understand others' feelings or, more generally, others' points of view [9]. There is now general agreement that the cognitive component of empathy relates to taking the perspective of others in order to understand and predict others' various mental states (e.g., thoughts, emotions).

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Notably, most research now suggests that empathy is a multidimensional concept that involves an affective *and* a cognitive subcomponent [3,10]. Evidence has shown that these subcomponents are associated and that they influence each other [3,11,12]. On the basis of these previous studies, we therefore define empathy as a multidimensional construct that involves both affective and cognitive components that refer, respectively, to the ability to share another person's emotional states and to infer that person's experiential states [4,13].

1.2. Empathy: simulation and perception–action models

According to the most influential model, i.e. the simulation model, empathy results from the simulation of another person's state [14] such that there is a match between the other's emotional state and the neural/body representations of this state in the empathizer. This model has been supported by several neuroimaging studies. They revealed the presence of a "shared neural circuit" involving the anterior insula (AI) and the anterior cingulate cortex (ACC), among other brain regions, which activate when one experiences pain *and* when one observes someone in pain [15,16]. The shared neural circuit is also proposed by the perception–action model, which is based on the existence of mirror neurons that are activated during the execution and observation of an action and on the existence of motor representations that allow us to understand, imitate, or prepare actions [17]. From these findings, some theorists [18] have postulated that a similar mechanism might underlie the empathic responses [18,19]. The perception–action model suggests that there might be a match between the representations of the empathizer's emotion and the target such that there is an unconscious and automatic activation of neural representations of emotional states that are similar to the emotional states of those observed. In other words, the attention allocated to the other's emotional state activates the representation of the emotional concept associated with this emotion [20]. Supporting this hypothesis, several studies have shown a neural overlap during the observation/decoding of either the experience or the expression (by imitation or spontaneously) of an emotion [15,21–25]. For instance, this shared neural circuit has been demonstrated during empathy for disgust, such that the AI is activated during the experience of disgust and when observing someone expressing disgust [25]. This overlap has been suggested to underlie the ability of the empathizer to experience the same feeling as the target's emotion. The empathizers might then introspect their feeling in order to understand it, and then attribute this feeling to the other.

1.3. Empathy and interoceptive sensitivity

The perception–action model and the role of the shared neural circuit in empathy are supported by previous findings showing that at an intrapersonal level, the AI is a key structure underlying the ability to represent the state of the body and to perceive changes arising from the body as feelings and sensations, referred to as *interoceptive sensitivity* (IS [26]). Furthermore, at an interpersonal level, many studies revealed that empathy for pain tasks leads to greater activation in the AI/ACC [15,22,27] (see [28] for a meta-analysis), and some found that greater activation in the AI/ACC is associated with reports of stronger compassion responses (i.e., affective empathy) and higher ratings of pain intensity (i.e., cognitive empathy) in response to people experiencing pain [15,16].

Taken together, these findings thus suggest that there may be an interdependence between IS and empathy, specifically empathy for pain, such that this shared circuit enables individuals to activate their own body representations of pain when observing someone in pain, leading to stronger empathic responses. This hypothesis is in line with Singer et al.'s [13,15] assumption that impaired access to one's own emotional state may be associated with impaired simulation of the other's emotional state within the AI, leading to lower empathy. Specifically, they argue that because the AI/ACC allows mapping of the representation of physiological activity predicted to be associated with an emotional response to a specific event, AI/ACC activation simulates how another person will emotionally respond to the same event.

Although the hypothesis about the role of IS in empathy is theoretically and empirically driven, the empirical evidence remains indirect, and so far scant direct evidence is available to suggest that empathizing for someone depends on the level of IS in the empathizer. In relation to the affective dimension of empathy, previous research showed that higher IS is associated with a better understanding of one's own emotional experience and with a more intense emotional experience. Indeed, Herbert and colleagues [29] showed that greater IS is associated with lower levels of alexithymia. Furthermore, IS contributes to emotional feelings in terms of arousal: greater IS is associated with higher ratings of arousal [30,31] and with greater heart rate deceleration in response to emotional stimuli. Taken together, these studies indicate that IS and emotional experience are associated with each other. In fact, IS, the subjective experience of emotions, and cardiovascular arousal are underlain by similar brain regions (e.g., AI, ACC [30,32]). Thus, increased activation in these regions could explain the associations between high IS, low levels of alexithymia, and more intense emotional experience.

To our knowledge, only four studies have investigated the links between IS and either affective or cognitive empathy. At a behavioral level, Terasawa et al. [33] found an association between greater IS and a lower intensity threshold of emotional facial expression, in response to which participants reported feeling an emotion. In contrast, Handford et al. [34] failed to find an association between IS and performance in decoding complex mental states expressed by eye gazes. At a neural level, Ernst et al. [35] showed that the activity of the AI during an affective empathy task was enhanced when participants were required to attend to their heartbeats for a short period. Finally, Fukushima et al. [36] used heartbeat-evoked potential (HEP) in order to investigate the association between empathy and the brain activity associated with the processing of the cardiovascular system (HEP) [37]. They showed that the amplitude of HEP was higher when participants evaluated the valence of emotional gazes and was positively correlated to higher empathic concern trait scores. Therefore, although constituting valuable first explorations of possible functional interdependence between IS and empathy, these studies present some limitations: (1) they focused on only one of the two dimensions of empathy state (either affective or cognitive); or (2) they did not directly investigate the level of IS (i.e., performance) of the participants; or (3) they did not investigate whether the effects are specific to empathy or are associated with all forms of affective experiences (i.e., arousal and distress feelings).

In view of these limitations, it thus appears crucial to further explore whether IS modulates empathy responses. At a theoretical level, this study supports the perception–action model such that the activation of an extensive embodied representation of pain in individuals with high levels of IS would allow them to better understand the emotional state of the target and to share it.

1.4. Hypotheses

In this study, we aimed to investigate the influence of IS (i.e., heartbeat perception task) on affective and cognitive empathy for someone in pain and on other forms of affective responses. Regarding affective empathy, we focused on compassion, which refers to other-oriented and regulated feelings in response to someone in a negative situation [38]. In terms of affective but not empathic responses, we focused on feelings of distress, which are self-oriented and non-regulated feelings [38]. Greater abilities to regulate emotional responses (measured by an index encompassing emotional control, emotional and behavioral inhibition, and attentional focus) are associated with higher ratings of empathic concern, whereas lower scores on this index are associated with higher reports of distress [38,39]. Therefore, because Fustos et al. [40] showed that higher IS is associated with better regulation strategies, we hypothesized that higher IS is associated with reports of *higher* compassion and *lower* feelings of distress