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Short Communication

Interoceptive sensitivity facilitates both antecedent- and response-focused emotion regulation strategies

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ABSTRACT

The ability to perceive bodily signals (interoceptive sensitivity) modulates emotional experience. However, there is scarce evidence that interoceptive sensitivity also modulates the use of emotion regulation strategies. The present study investigated whether individual differences in interoceptive sensitivity are associated with the habitual use of two main emotion regulation strategies: reappraisal (antecedent-focused) and suppression (response-focused). All participants (N = 402) completed the Emotion Regulation Questionnaire and underwent the heartbeat perception task. Individuals with higher interoceptive sensitivity showed both greater habitual reappraisal and suppression use compared to those with lower interoceptive sensitivity. These findings suggest that better detection of ones' bodily signals facilitates the selection and implementation of antecedent-focused as well as response-focused emotion regulation strategies.

1. Introduction

In their daily lives, humans do not only have access to external environmental cues, but they also perceive signals from the inner body that provide a sense and feedback of their physiological condition (Herbert & Pollatos, 2012). This accurate self-perception of visceral activity and changes arising from the body classically refers to the concept of "interoceptive sensitivity" (IS) (Craig, 2003).

When considering the current literature, it appears that IS presents an important component of emotional processing and experience. Indeed, early theories of emotion, such as those proposed by James (1884) and Damasio (1994), postulate that bodily reactions play a crucial role in subjective emotional experience. Concretely, they argue that emotional stimuli automatically trigger changes in bodily physiology and that the perception of the latter forms the basis of emotional feelings.

With regard to IS, more recent studies have shown that IS correlates positively with the ability to understand and describe ones' feelings. Besides, when viewing affective pictures, higher IS is associated with stronger links between actual bodily arousal (heart rate) and subjective arousal ratings (Dunn et al., 2010; Pollatos, Herbert, Matthias, & Schandry, 2007).

Of particular interest, research indicates that IS does not only influence emotional experience, but also affects the regulation of emotional responses. For example, IS is positively associated with frustration tolerance, affect differentiation and affect tolerance (Weiss, Sack, Henningsen, & Pollatos, 2014). Besides, IS has been shown to facilitate the successful down-regulation of negative emotion via reappraisal strategies (Füstös, Gramann, Herbert, & Pollatos, 2013).

Taken together, these preliminary findings suggest that IS may play a crucial role in emotion regulation processes. However, the above-mentioned studies have exclusively focused on the relation between IS and reappraisal abilities (Füstös et al., 2013), without examining the habitual use of other, more specific emotion regulation strategies. Therefore, the present study investigated whether IS modulates the habitual use of two main emotion regulation strategies: reappraisal and suppression.

Emotion regulation typically refers to the processes by which individuals modulate their emotional experiences, expressions, and the situations giving rise to the emotion (Gross, 2002). As emotions unfold over time, emotion regulation strategies are often differentiated along the timeline of the emotion- generative process (Gross, 2002). Consequently, two types of regulation strategies can be defined on the basis of whether they are used before response tendencies become active (i.e., antecedent-focused) or once the emotional response has been triggered (i.e., response-focused) (Gross, 1998).

With regard to antecedent-focused strategies, most research has concentrated on *reappraisal*, which involves changing the way of

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thinking about an emotion eliciting event in order to modulate the emotional impact of the situation. Reappraisal is broadly considered as a beneficial and adaptive regulation strategy, leading to healthier patterns of affect, greater well-being and enhanced interpersonal functioning (John & Gross, 2004). By contrast, the response-focused strategy of *suppression* refers to the inhibition of the outward signs of an ongoing emotion via a deliberate reduction of emotion expression. The latter appears to be often maladaptive, causing diminished control of emotion as well as decreased well-being and more negative social consequences (John & Gross, 2004).

In view of the above-mentioned information, the current study aimed to fill the gap in the literature about IS and emotion regulation by examining whether IS is associated with the habitual implementation of reappraisal and suppression strategies. Specifically, given that high IS facilitates emotion regulation via reappraisal (Füstös et al., 2013) and that IS is positively associated with the beneficial effects of reappraisal (e.g., well-being; Herbert, Blechert, Hautzinger, Matthias, & Herbert, 2013), we hypothesized a positive relation between IS and the habitual use of reappraisal. Furthermore, because high IS is negatively associated with the deleterious consequences of expressive suppression (e.g., altered physical and mental health; Aldao, Nolen-Hoeksema, & Schweizer, 2010), we hypothesized that IS will be negatively associated with the habitual use of suppression.

2. Methods

2.1. Participants

Four hundred and two participants (158 men) with a mean age of 23.27 ($SD = 4.58$) took part in the study. Participants were screened for health status using an anamnestic questionnaire. They were only included if they did not have a history of any Axis 1 disorder. All participants gave their written informed consent. They received an amount of 5€ in return for their participation. Experiments were conducted in accordance with the Declaration of Helsinki and with the approval of the local ethics committee.

2.2. Material

2.2.1. Emotion regulation strategies

A German translation (Abler & Kessler, 2009) of the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) was used to assess the habitual use of reappraisal and suppression. The ERQ consists of 6 items measuring reappraisal (e.g., *I control my emotions by changing the way of thinking about the situation I'm in*) and 4 items measuring suppression (e.g., *I control my emotions by not expressing them*). Participants are required to indicate whether they agree with each statement on a 7-point scale ranging from 1 (=*strongly disagree*) to 7 (=*strongly agree*). The questionnaire demonstrates good scale score reliability for the suppression (Cronbach's alpha = .76) and reappraisal factors (Cronbach's alpha = .74) (Abler & Kessler, 2009).

2.2.2. Heartbeat perception task

Participants sat in a sound-attenuated chamber and IS was assessed using four heartbeat counting phases (varying in length) in accordance with the Mental Tracking Method (Schandry, 1981). Therefore, ECG was prepared by attaching nonpolarizable Ag–AgCl electrodes to the right mid-clavicle and lower left rib cage. Participants were requested to count their own heartbeats silently between onset and offset of an acoustic signal. During heartbeat counting (four phases in random order: 15 s; 25 s; 35 s and 45 s), participants were not permitted to take their pulse or to use any other forms of manipulation that might facilitate the task. At the end of the counting phase, participants were asked to verbally report the number of counted heartbeats. IS was estimated as the mean heartbeat perception score according to the following transformation: $1/4\ \Sigma\ (1 - (|\text{recorded heartbeats} - \text{counted heartbeats}|)$ / recorded heartbeats). The computed score can vary between 0 and 1, with higher scores indicating more accurate heartbeat perception and thus higher IS.

2.3. Procedure

The present research is part of a larger study about interoception and psychological functioning. All participants first realized the heartbeat perception task and then filled in the ERQ.

3. Results

Two participants presenting IS or ERQ scores of more than 3 standard deviations above the mean were discarded as outliers. Before performing statistical analysis, skewness and kurtosis of the data were examined. All parameters were between -1 and 1, indicating that the data are univariately normally distributed. The mean heartbeat perception score was .69 ($SD = .18$, range = .16–1.00), and the means (SD) of reappraisal and suppression scores were 4.42 (1.05) and 3.54 (1.24), respectively.

Results reveal significant correlations between IS and reappraisal scores ($r = .17$; $p = .001$) as well as between IS and suppression scores ($r = .17$; $p = .001$) (Fig. 1). With regard to gender, females used more suppression than males (females: $M = 3.65$; $SD = 1.27$; males: $M = 3.37$; $SD = 1.18$; $F(1, 399) = 4.75$; $p = .03$). No group differences were found neither for IS nor for the use of reappraisal strategies ($ps > .45$).

4. Discussion

In the present study, we examined whether individual differences in IS were related to the habitual use of two different emotion regulation strategies: reappraisal and suppression. In accordance with our hypothesis, IS was positively correlated with reappraisal use, suggesting that

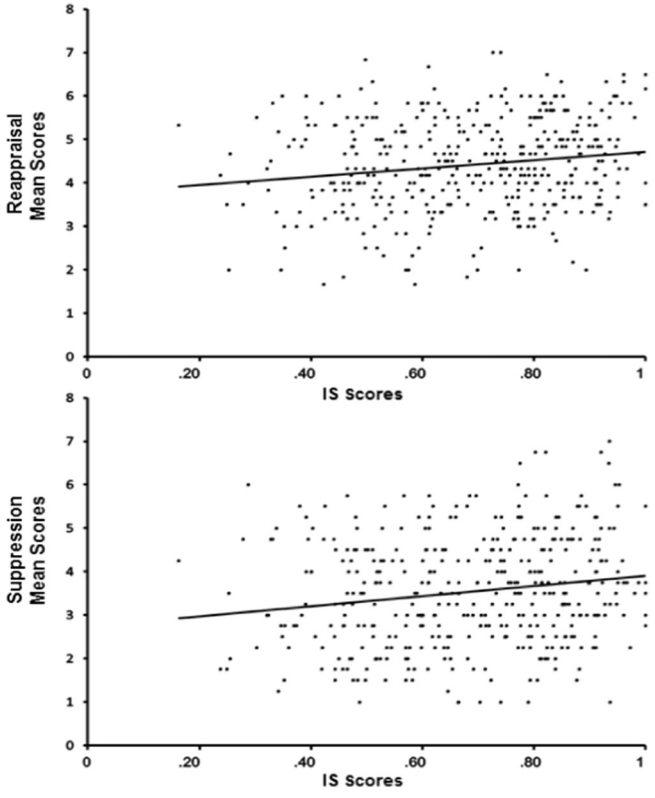

Fig. 1. Correlations between Emotion Regulation Questionnaire (ERQ) scores for each strategy (reappraisal and suppression) and IS scores.