ELSEVIER

Journal of Anxiety Disorders 21 (2007) 931–943

Journal of Anxiety Disorders

# Interoceptive awareness mediates the relationship between anxiety and the intensity of unpleasant feelings

Olga Pollatos [a,*], Eva Traut-Mattausch [a], Heike Schroeder [b], Rainer Schandry [a]

[a] *Department of Psychology, University of Munich, Leopoldstr. 13, 80802 Munich, Germany*
[b] *Danuvius-Klinik Ingolstadt, Germany*

Received 12 October 2006; received in revised form 16 November 2006; accepted 14 December 2006

**Abstract**

This study examined the relationship between interoceptive awareness, anxiety, and the intensity of unpleasant feelings. The perception of visceral signals (interoceptive awareness) plays an important role in the pathophysiology of anxiety disorders. Nevertheless, studies simultaneously investigating relationships between emotion processing, anxiety, and interoceptive awareness remain sparse. The present study was designed to elucidate the interrelations between these variables. Trait anxiety and interoceptive awareness were assessed in 102 healthy participants. Following this, neutral and unpleasant pictures were presented and subjects were asked to rate perceived emotional pleasantness and arousal. We found that both interoceptive awareness and trait anxiety were significantly positively correlated with mean arousal scores for unpleasant pictures. A positive relationship between interoceptive awareness and trait anxiety was also found. Subsequent regression analyses showed that the relationship between emotional arousal and trait anxiety was mediated by differences in interoceptive awareness. Our results highlight the possible role of interoceptive awareness in the development of trait anxiety and may have further implications for theoretical models of anxiety disorders and their treatment.


*Keywords:* Personality; Interoceptive awareness; Feelings; Emotional arousal; Anxiety

## 1. Introduction

The extent of an individual's sensitivity to bodily signals (''interoceptive awareness'') is considered to be an essential variable in many theories of emotions such as that proposed by

* Corresponding author. Tel.: +49 89 2180 6356; fax: +49 89 2180 5233.
*E-mail address:* pollatos@psy.uni-muenchen.de (O. Pollatos).

0887-6185/$ – see front matter 
doi:10.1016/j.janxdis.2006.12.004

James in the 19th century (Damasio, 1994, 1999; James, 1884; Schachter & Singer, 1962). Interoceptive awareness is mostly quantified by measuring an individual's ability to accurately perceive their own heartbeat (Cameron, 2001; Critchley, Wiens, Rotshtein, Ohman, & Dolan, 2004; Jones, Leonberger, Rouse, Caldwell, & Jones, 1986; Pollatos, Gramann, & Schandry, 2007; Schandry & Bestler, 1995; Wiens, 2005). James (1884) was among the first to postulate that viscero-afferent feedback is closely associated with emotional experience, stating that ''bodily changes follow directly the perception of the exciting fact, and that our feelings of the same changes as they occur IS the emotion''. In short, we feel emotions because we perceive our bodily reactions (Bennett & Hacker, 2005). The somatic marker hypothesis formulated by Damasio (1994, 1999) and Damasio et al. (2000) is an example of a recent psychological theory incorporating feedback from the peripheral nervous system (somatosensory and visceral). The authors refer to the obligatory body-relatedness of feelings stating that ''the body is the main stage for emotions, either directly or via its representations in somatosensory structures of the brain'' (Damasio, 1999).

According to James and Damasio, subjects who perceive bodily signals with a high level of accuracy should experience emotions more intensely. Several studies, in which emotions were for the most part assessed on the basis of questionnaires (Critchley et al., 2004; Katkin, Wiens, & Ohman, 2001; Wiens, Mezzacappa, & Katkin, 2000), have demonstrated a positive relationship between interoceptive awareness and the experience of emotions. Concerning affective judgments, individuals usually report feeling energized and attentive on the one hand versus relaxed and sleepy on the other (Barrett, Quigley, Bliss-Moreau, & Aronson, 2004). Factor analysis studies of self-reported mood have repeatedly identified activation or *arousal* as a descriptive component of such self-reports (Barrett et al., 2004; Reisenzein, 1994; Russell & Barrett, 1999; Thayer, 1996).

Arousal also emerges as a crucial element in judging the emotions of others, for example, in determining emotions from facial expressions (Barrett et al., 2004; Bullock & Russell, 1986; Russell, Bachorowski, & Fernandez-Dols, 2003). When making such judgments, the deficit shown by individuals with amygdala damage partly lies in this perception of activation (Vuilleumier, Richardson, Armony, Driver, & Dolan, 2004). Using emotional stimuli, some empirical data exists showing higher emotional arousal in subjects with high interoceptive awareness: Wiens et al. (2000) found significantly higher self-rated arousal for affective film clips of pleasant and unpleasant valence, and Pollatos, Kirsch, & Schandry (2005b) demonstrated higher self-reported arousal scores for unpleasant and pleasant pictures. The question of whether or not interoceptive awareness is a significant mediating variable when assessing the relationship between emotion arousal and other personality variables, such as anxiety, remains open.

Interestingly, a recent study was able to show that interoceptive awareness is positively related to anxiety measures in healthy subjects (Critchley et al., 2004). The observed relationship between anxiety and interoceptive awareness in healthy subjects is also found in clinical populations. In several studies, anxiety disorders, including panic disorder and social phobia in particular, were found to be closely associated with interoceptive awareness (Ehlers, Margraf, & Roth, 1992; Ehlers, Mayou, Sprigings, & Birkhead, 2000; Pineles & Mineka, 2005; Van der Does, Antony, Ehlers, & Barsky, 2000; Wald & Taylor, 2005; White, Brown, Somers, & Barlow, 2006; Zoellner & Craske, 1999). For example, Ehlers et al. (1992, 2000) found a higher degree of interoceptive awareness in panic patients. In a similar study with children, increased panic symptoms were associated with an enhanced ability to perceive internal physiological cues as measured