



What makes sense in our body? Personality and sensory correlates of body awareness and somatosensory amplification

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ABSTRACT

The associations of body awareness (BA) and somatosensory amplification (SSA) with the Big Five personality factors and sensory modalities were investigated in a cross-sectional study. It was expected that both constructs would be related to introversion; and that SSA as opposed to BA would be connected with emotional lability. Perception of pain and bitter taste were expected to be associated with both BA and SSA; whereas heartbeat perception and balancing ability were not. A sample of university students ($n = 212$) filled out questionnaires assessing BA (*Body Awareness Questionnaire*, BAQ), SSA (*Somatosensory Amplification Scale*, SSAS) and the Big Five (*Big Five Inventory*, BFI), and a subsample of participants ($n = 118$) completed the sensory measurements (heart rate detection, balance, perception of pain and bitterness). SSA showed a weak connection with emotional lability and introversion, while BA was associated with openness and conscientiousness. Furthermore, SSA was related to the perception of pain and bitter taste, whereas BA was not related to any interoceptive modality. No correlations among the perceptions of different sensory modalities were found. According to these findings BA and SSA are related but not identical constructs; while interoceptive ability cannot be generalized across modalities.

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1. Introduction

Proneness to focus on information originating from within the body and monitor body processes has received considerable attention in the last decades. Initially, this characteristic was investigated with regard to pathological conditions. For example, hypochondriasis or health anxiety, somatization, and alexithymia were all found to be connected to somatosensory amplification (SSA), the tendency to experience somatic sensation as intense, noxious, and disturbing (Barsky, 1992; Barsky, Wyshak, & Klerman, 1990; Duddu, Isaac, & Chaturvedi, 2006; Krautwurst, Gerlach, Gomille, Hiller, & Witthöft, 2014; Wise & Mann, 1994; Witthöft & Hiller, 2010). Somatosensory amplification is thought to comprise a hypervigilance toward bodily sensations, an increased focus on weak and infrequent sensations, and a catastrophizing interpretation of these sensations, e.g. as symptoms of a disease (Barsky et al., 1990). Later, a distinction between evaluative (typically negative,

as in the case of SSA) and non-evaluative (neutral) focusing style was proposed (Shields, Mallory, & Simon, 1989). Possible benefits of the latter style, often referred to as body awareness (BA), were emphasized (Daubenmier, 2005; Farb et al., 2015; Impett, Daubenmier, & Hirschman, 2006; Mehling et al., 2009). BA and SSA, which are considered trait like characteristics, showing considerable inter-individual variability, are measured using self-report instruments (questionnaires). SSA is usually assessed using the *Somatosensory Amplification Scale* (SSAS), while a number of instruments were developed for the measurement of BA (e.g. *Private Body Consciousness Scale*, *Body Awareness Questionnaire*) (Mehling et al., 2009).

Although the temporal stability of various aspects of body awareness and somatosensory amplification is well established (Barsky et al., 1990; Köteles & Simor, 2013; Miller, Murphy, & Buss, 1981; Shields et al., 1989), the connection between facets of BA and SSA and major dimensions of personality has yet to be clarified. From a theoretical point of view, both constructs are related, by definition, to introspection and self-observation, which are often mentioned as fundamental characteristics of introversion (Barsky et al., 1990; Miller et al., 1981, p. 198). Similarly, the negative affect and anxiety (both belong to the personality dimension of neuroticism) incorporated into the definition of SSA (Barsky, 1979a; Barsky et al., 1990).

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Concerning empirical evidence, somatosensory amplification was associated with indicators of negative affect and neuroticism/emotional instability in several studies (Aronson, Barrett, & Quigley, 2001; Barsky & Wyshak, 1990; Ferguson, 2000; Lee, Watson, & Frey Law, 2010; Lee, Watson, & Frey-Law, 2013); however, no connection between SSA and any of the five major factors of personality were reported in one study (Jones, Schettler, Olden, & Crowell, 2004). Beyond neuroticism, a weak negative correlation between SSA and surgency/extraversion was found in one study (Ferguson, 2000); while SSA was connected to neuroticism and conscientiousness after controlling for alexithymia in another (Wise & Mann, 1994). Empirical findings on the connections between personality dimensions and BA are even more scarce. One study found no differences among meditators, dancers and a control group regarding the Big Five dimensions, although the levels of BA were significantly different (Sze, Gyurak, Yuan, & Levenson, 2010). Conversely, both self-reflectiveness and internal state awareness were associated with openness; while the latter was related to conscientiousness as well (Trapnell & Campbell, 1999). Additionally, considering its non-evaluative quality, BA should be independent of neuroticism/emotional stability or negative affect, as previously reported by several authors (Köteles, Simor, & Tolnai, 2012; Shields et al., 1989; Tolnai, Szabó, & Köteles, 2013). Although a connection with introversion appears to be plausible (Fenigstein, Scheier, & Buss, 1975), this hypothesis has not been tested empirically to date.

The relationship between SSA and BA is worthy of further elaboration. Although SSA was originally defined and discussed as comprising a heightened body focus (Barsky, 1979b; Barsky, Goodson, Lane, & Cleary, 1988), this connection was only evidenced decades later (Fabbri, Kapur, Wells, & Creed, 2001; Köteles & Doering, 2015). Body focus is often assumed to directly rely on, and process, sensory (interoceptive) information. According to empirical findings, however, neither SSA nor BA (as assessed by self-report instruments) are characterized by heightened sensitivity to interoceptive signals (usually measured using a heartbeat detection task) (Ainley & Tsakiris, 2013; Aronson et al., 2001; Barsky, Brener, Coeytaux, & Cleary, 1995; Dunn, Dalgleish, Ogilvie, & Lawrence, 2007; Emanuelson, Drew, & Köteles, 2015; Mailloux & Brener, 2002; Marcus, Gurley, Marchi, & Bauer, 2007). Recently, interoceptive accuracy and body focus are regarded as different constructs: the former is connected to the accuracy of detection of sensory information, while the latter refers to a conscious representation of the body (i.e., being aware of perceived changes) (Calì, Ambrosini, Picconi, Mehling, & Committeri, 2015; Ceunen, Van Diest, & Vlaeyen, 2013; Farb et al., 2015; Garfinkel, Seth, Barrett, Suzuki, & Critchley, 2015; Ginzburg, Tsur, Barak-Nahum, & Defrin, 2014), which can be affected by various biases and memories of past sensations (Brown, 2004). For example, somatosensory amplification, which actually could be considered body awareness accompanied by negative affect (Köteles & Doering, 2015), was associated with diminished interoceptive accuracy in several studies (Barsky, Cleary, Brener, & Ruskin, 1993; Barsky et al., 1995; Mailloux & Brener, 2002). In conclusion, SSA has been conceptualized as a specific cognitive bias which negatively impacts the accurate perception and interpretation of body signals (Mailloux & Brener, 2002).

A more differentiated distinction between various interoceptive signals may help to clarify the relationships between interoception, BA, and SSA, respectively. Interoception (and viscerosensation in particular) is characterized by relatively high perception thresholds; therefore, at least under healthy circumstances, we are barely able to sense information originating from the viscera (Ádám, 1998). This phenomenon can be explained by the limited capacity of our attentional and information processing systems (Pennebaker, 1982; Pennebaker & Lightner, 1980). As external stimuli are generally more important for everyday functioning (and necessary for survival from an evolutionary perspective), interoceptive input reaches consciousness only when the information transmitted is crucially important for the organism (Ádám, 1998). For example, the (normo)tension of single muscle fibers, vestibular information for maintaining balance, and resting heart rate are processed at lower levels of the central nervous system (i.e., in the brainstem).

These signals contribute to automatic homeostatic and motor regulation processes, and therefore they do not need to reach conscious awareness. Conversely, pathological conditions, injuries, and even the possibility of tissue damage, represent information that can be crucial to survival; thus, pain has evolved as a specific signal that is able to easily reach consciousness, catch attention, and initiate the necessary behavioral changes (Macdonald & Leary, 2005; Melzack & Wall, 1965; Wall, 2000).

As (1) pain-related information is present in conscious awareness, and (2) has a strong affective (i.e., aversive) component (Price, 1999), it might be influenced by cognitive biases. In line with these theoretical considerations, SSA was found to be connected to many pain-related conditions. For example, myofascial pain (Raphael, Marbach, & Gallagher, 2000), rheumatoid arthritis (Barsky et al., 1999), joint hypermobility syndrome (Baeza-Velasco, Gély-Nargeot, Bulbena Vilarrasa, & Bravo, 2011; Baeza-Velasco, Gely-Nargeot, Vilarrasa, Fenetrier, & Bravo, 2011), non-ischaemic/non-cardiac chest pain (Nakao, Tamiya, & Yano, 2005; Schroeder, Gerlach, Achenbach, & Martin, 2015; Schroeder et al., 2012; Zincir et al., 2014), headache (Barke, Gaßmann, & Kröner-Herwig, 2014), migraine (Yavuz, Aydinlar, Dikmen, & Incesu, 2013), and fibromyalgia (Duruk, Sertel Berk, & Ketenci, 2015) have all been associated with SSA in the literature. Additionally, one study found that SSA was related to pain perception in healthy individuals (Lee et al., 2010). However, our understanding concerning the connection between BA and pain is less clear. On the one hand, less focus on somatic pain has reduced suffering (Johnson, 2005); while on the other hand, greater focus on the sensory component of pain has benefited people with chronic low back pain (Burns, 2006).

Similarly to pain, sensitivity to bitter taste may have evolved as a defense (i.e., to facilitate avoidance of food that can be dangerous) and is characterized by a low perceptual threshold and a strong negative affective component (Glendinning, 1994; Li, Pakstis, Kidd, & Kidd, 2011; Shi, Zhang, Yang, & Zhang, 2003). Although the gustatory system is regarded as an exteroceptive sensory modality, it is represented together with interoceptive information in the nervous system (Avery et al., 2015). Based on these characteristics, it is plausible to assume that sensitivity to the bitter taste can also be connected to SSA and BA.

Vestibular information, although considered interoceptive, has a different quality than other sensory modalities (e.g. pain, taste). Studies found that vestibular signals influence the perception of somatosensory information and multisensory functions that may contribute to body awareness ((Ferrè, Berlot, & Haggard, 2015; Ferrè, Vagnoni, & Haggard, 2013). Furthermore, a recent review emphasizes the contribution of the cortical network of the vestibular system to body awareness and self-awareness (Lopez, 2016). These findings illustrate that conscious awareness is not required for vestibular input to play a modulating role in the perception of other signals, and general body awareness.

In summary, the current study was designed to shed more light on the personality and the sensory background of body awareness and somatosensory amplification. Regarding personality dimensions, based on the aforementioned empirical results and theoretical considerations, we expect (Hypothesis 1) a positive connection between introversion and both SSA and BA; (H2) a positive connection between neuroticism and SSA; and (H3) no connection between neuroticism and BA. We also intended to explore associations between the indicators of body focus and the remaining three Big Five dimensions. Concerning sensory modalities, it was expected that (H4) pain threshold and tolerance, as well as (H5) perceived intensity and unpleasantness of a bitter solution, would be positively connected to SSA and BA; while (H6) heartbeat detection ability and (H7) balancing ability would not.

2. Materials and methods

2.1. Participants

This was a cross-sectional study, involving both questionnaires and sensory measurements. Questionnaires were completed by 212

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