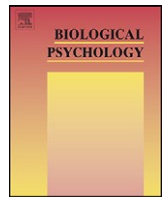


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# Biological Psychology

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## Letter to the Editor

### Q1 Accuracy and awareness of perception: Related, yet **distinct** (commentary on Herbert et al., 2012)

The finding of Herbert and colleagues (2012) in the January issue of *Biological Psychology* sheds interesting new perspectives on the correspondence between homeostatic challenges and accuracy of heartbeat perception. One of their conclusions is that changes in autonomic activity, which in their study were induced by short-term fasting, intensify overall Interoceptive Awareness (IAw). Below, it is argued that this conclusion can be somewhat misleading; a more nuanced conclusion and additional directions for future research based on this revised conclusion are proposed.

In the article of Herbert and colleagues as well as in numerous other articles, heartbeat perception tasks are considered to be a proxy of IAw. To say that “cardiac IAw [ . . . ] reflects the sensory accuracy of perceiving one’s own cardiac signals” (p.77, Herbert et al., 2012) is to say that IAw and Interoceptive Accuracy (IAc) are synonymous, whereas in fact they are not. IAc specifically refers to the capability of accurately perceiving changes in homeostatic function. To be aware, means to be cognizant, to be mindful. Thus IAw should be taken to mean the cognizant, mindful perception of bodily signals (given the definition of interoception proposed by Herbert and colleagues). Although IAw can be accompanied by an accurate perception of bodily sensations, such accuracy is not necessarily implied. This distinction between awareness and accuracy is highlighted by a study of Khalsa and colleagues (2008) who found that IAw is increased in meditative practices, but IAc is not.

Nevertheless, the idea that IAw and IAc can be used interchangeably is widespread, and most prevalent in the heartbeat perception literature (e.g., Stewart et al., 2001; Sturges and Goetsch, 1996). This practice likely stems from the interoceptive sensitivity hypothesis (Ehlers and Breuer, 1992; Tyrer, 1973), which states that high anxious persons and panic disorder (PD) patients (conditions associated with high IAw) have a more accurate perception of bodily sensations. Of the numerous studies that found results supporting the interoceptive sensitivity hypothesis, all barring no exception, used heartbeat perception tasks (e.g., Critchley et al., 2004; Ludwickrosenthal and Neufeld, 1985; Richards et al., 2003; Schandry, 1981; Zoellner and Craske, 1999). On the other hand, studies looking at the accuracy of perception of non-cardiac interoceptive signals such as respiration, found that individuals with high negative affectivity – a trait associated with higher IAw (Stegen et al., 2001), as well as with anxiety and PD – are less accurate perceivers under negative affective conditions than are controls (Bogaerts et al., 2005; van den Bergh et al., 2004), which is contradictory to the interoceptive sensitivity hypothesis. Such findings are indicative that (1) IAw and IAc are indeed two distinct concepts, and (2) that good accuracy on heartbeat perception tasks does not necessarily translate to accurate perception of other bodily processes.

The arguments above illustrate that considering heartbeat perception tasks as a measure of overall IAw, or of overall IAc, is to discard all the necessary nuance regarding interoception. Although heartbeat perception tasks are a measure of one type of IAc, interoceptive sensations are heterogeneous in nature. As a result, accuracy of heartbeat perception cannot simply be assumed to correlate with accurate perception of other interoceptive sensations such as gastro-intestinal or respiratory sensations. Unfortunately, standardized tasks measuring non-cardiovascular types of IAc are currently far and few between: such tasks should receive more attention in future research.

Of additional importance is that intra-individual changes in performance on the heartbeat perception task in the study of Herbert et al. (2012) followed an increase in inotropic cardiac activity. This could be indicative that not all homeostatic challenges that alter cardiac activity, may lead to an increased accuracy of heartbeat perception. E.g., it can be argued that homeostatic challenges which lead to a decrease in inotropic activity, perhaps lead to a decreased accuracy of heartbeat perception, because discriminatory feedback of overlying somatic tissues is reduced. Given that accurate perception of heartbeat can occur solely through somatic afferents from tissue overlying the heart region, or solely through visceral afferents (Khalsa et al., 2009), it is of importance to understand whether intra-individual changes in accuracy of heartbeat perception are specifically associated with either of both somatic or visceral afferents.

In conclusion, we would like to more accurately rephrase the summarizing remark of Herbert and colleagues, as this has important implications for interpretation of all interoception related studies as well as for future directions for their own and other’s research. Their results indicate that homeostatic challenges which lead to an increase in inotropic cardiac activity, lead to an increased accuracy of heartbeat perception and perhaps increased awareness of heartbeats, but there is no conclusive evidence that they lead to an increase of other types of IAc, nor to an increase of overall IAw. It is unclear whether homeostatic challenges leading to a decrease in inotropic activity, lead to changes in accuracy of heartbeat perception.

Based on this, further studies should be designed to understand whether the improvements in accuracy on the heartbeat perception task only follow homeostatic challenges which increase inotropic cardiac activity, or whether they also follow challenges which decrease inotropic cardiac activity. Additionally, it may be relevant to anesthetize somatic tissue overlying the heart as has been done in the study of Khalsa et al. (2009), in order to clarify whether the increases in performances of accuracy are specifically due to somatic or visceral afferents. The most important message is that we need to acknowledge the distinction between awareness and accuracy of perception, and that we need to remain careful in extrapolating conclusions based solely on heartbeat perception

tasks as if they are representative of other types of IAc or of general IAw.

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