Body Image 20 (2017) 130–136

Contents lists available at ScienceDirect

Body Image

journal homepage: www.elsevier.com/locate/bodyimage

Can you feel the body that you see? On the relationship between interoceptive accuracy and body image

Giorgia Zamariola[a,*], Flavia Cardini[a,1], Emanuel Mian[b,c], Andrea Serino[d,2], Manos Tsakiris[a,2]

[a] Lab of Action & Body, Department of Psychology, Royal Holloway, University of London, TW20 0EX Egham, Surrey, UK
[b] Interdisciplinary Center for Obesity and Bariatrics (C.I.B.O.), Istituti Clinici Zucchi, via Zucchi 24, 20052 Monza, Italy
[c] Emotifood Body Image & Eating Disorders Unit, via Palestro, 12, 20900 Monza, Italy
[d] Laboratory of Cognitive Neuroscience, Center for Neuroprosthetics, Ecole Polytechnique Fédérale de Lausanne, Campus Biotech, CH-1202 Genève, Switzerland

ARTICLE INFO

Article history:
Received 19 May 2016
Received in revised form 25 January 2017
Accepted 26 January 2017

Keywords:
Interoception
Interoceptive accuracy
Interoceptive awareness
Body image
Body-awareness
Self-awareness

ABSTRACT

Interoception and exteroception for body signals are two different ways of perceiving the self: the first from within, the second from outside. We investigated the relationship between Interoceptive Accuracy (IAcc) and external perception of the body and we tested if seeing the body from an external perspective can affect IAcc. Fifty-two healthy female subjects performed a standard heartbeat perception task to assess the IAcc, before and after the Body Image Revealer (BIR), which is a body perception task designed to assess the different aspects of body-image. The performance of the lower IAcc group in the heartbeat perception task significantly improved after the exteroceptive task. These findings highlight the relations between interoceptive and exteroceptive body-representations, supporting the view that these two kinds of awareness are linked and interact with each other.

Introduction

Perception of one's own body depends on the integration of bodily signals from the outside (exteroception; Blanke, Slater, & Serino, 2015; Tsakiris, 2010) and the inside (interoception; Herbert & Pollatos, 2012; Tsakiris, Tajadura-Jiménez, & Costantini, 2011). These signals contribute to one's body image, that is, "the picture we have in our minds of the size, shape, and form of our bodies and to our feelings concerning these characteristics and our constituent body parts" (Slade, 1988 cited in Skrzypek, Wehmeier, & Remschmidt, 2001, p. 216). Body image can be described as the multidimensional psychological experience of embodiment, in particular the physical appearance of one's own body (Cash, 1990), also including one's self-perceptions and self-attitudes towards the body, namely, thoughts, beliefs, feelings and behaviours (Cash, 2004). Skrzypek et al. (2001) state that the concept of body image can be divided into two different aspects: one component relates mainly to the perception of body size, and the other to the affective disposition towards one's body appearance. Therefore, body image disturbances may include perceptual distortions or feelings of dissatisfaction towards one's appearance (Thompson, 2004). In this light, it is worth taking into consideration both components of body image, since there might be a dissociation between problems related to the perception of one's own body or affect towards one's own body (Cash, 2002).

Recent studies investigated how interoceptive and exteroceptive bodily processes interact with each other to modulate body experience. For instance, individuals with lower interoceptive accuracy have been shown to experience a stronger Rubber Hand Illusion (RHI, Tsakiris et al., 2011). Intriguingly, a similar but inverse relationship holds between interoception and attitudes towards one's body. For example, Ainley and Tsakiris (2013) showed that the degree to which individuals are aware of their inner body signals (i.e., Interoceptive Accuracy, IAcc) is inversely correlated with self-objectification, which is the tendency to experience one's body as an object (Fredrickson & Roberts, 1997). Others have found an inverse relationship with body-image satisfaction (Emanuelsen, Drew, & Köteles, 2014): in two samples of healthy participants, results showed that lower interoceptive accuracy, measured using the heartbeat perception task, is associated with higher body dissatisfaction, as evaluated using the Body Image Ideals Questionnaire by Cash and Szymanski (1995). These observations suggest

* Corresponding author. Present address: Université Catholique de Louvain, 10, Place du Cardinal Mercier, bte L3.05.01, B-1348 Louvain-la-Neuve, Belgium.
E-mail address: giorgia.zamariola@uclouvain.be (G. Zamariola).
[1] Present address: Anglia Ruskin University, Department of Psychology, East Road, Cambridge, CB1 1PT, Cambridgeshire, UK.
[2] Andrea Serino and Manos Tsakiris equally contributed to the manuscript.

http://dx.doi.org/10.1016/j.bodyim.2017.01.005
1740-1445/

Table 1
Descriptive statistics for all the variables.

Variable	All participants (N = 51)	Higher IAcc group (N = 26)	Lower IAcc group (N = 25)
Mean age years (*SD*)	22.10 (4.04)	22.35 (4.28)	21.84 (3.84)
Mean BMI[a] (*SD*)	21.60 (4.00)	21.86 (4.06)	21.32 (3.92)
N participants BMI < 18	6	4	2
N participants BMI > 25	9	6	3
Mean IAcc[b] pre (*SD*)	.62 (.16)	.75 (.10)	.47 (.07)
Mean IAcc post (*SD*)	.66 (.18)	.74 (.14)	.56 (.16)
Mean cognitive (*SD*)	−0.76 (9.77)	−2.43 (8.45)	0.97 (10.87)
Mean affective (*SD*)	1.28 (10.11)	−1.87 (7.40)	4.55 (11.58)
Mean metacognitive (*SD*)	−.90 (10.82)	−1.83 (9.13)	0.07 (12.46)
Mean optative (*SD*)	−6.23 (9.73)	−8.61 (9.42)	−3.75 (9.61)

Note: a BMI < 18 stands for underweight and a BMI > 25 represents overweight.
[a] Body mass index.
[b] Interoceptive accuracy.

that interoceptive processing extends from the basic levels of multisensory integration to the conscious (affective) attitudes that we hold about our body, highlighting the role of interoception in different hierarchical levels of body-representations.

Notably, eating disorders (ED) are characterized by low IAcc (Blascovich et al., 1992; Fassino, Pierò, Gramaglia, & Abbate-Daga, 2004; Harver, Katkin, & Bloch, 1993) and a high tendency for self-objectification (Calogero, Davis, & Thompson, 2005). For instance, Pollatos et al. (2008) showed that interoception, as measured by using a heartbeat perception task, is decreased in patients with anorexia nervosa compared to healthy participants. Eshkevari, Rieger, Longo, Haggard, and Treasure (2012) further showed a stronger RHI in participants with ED, significantly predicted by lower self-reported interoception and self-objectification. These findings have been interpreted as reflecting greater visual capture and greater sensitivity towards the external visual body perception in ED patients. Lastly, an alteration in the anterior insula activity, a key area for processing and integrating interoceptive information (Kaye, Fudge, & Paulus, 2009) which is activated during interoceptive tasks (Critchley, Wiens, Rotshtein, Ohman, & Dolan, 2004), has been found in people with anorexia nervosa, confirming the link between ED and interoception, as mediated by altered insular processing.

To summarize, existing findings from ED and healthy adults suggest that the processing and interaction of interoception and exteroception bodily signals play a key role in the construction of one's own body image. However, the extent to which different levels of interoceptive accuracy are linked to differences in the perceptual or affective components of body-image remains unknown. To address this question, here we measured interoceptive accuracy in healthy participants with a heartbeat perception task. Although heartbeat awareness is not the only component of interoception, we focused on this dimension, as it is the one most commonly investigated by the current literature (Garfinkel, Seth, Barrett, Suzuki, & Critchley, 2015) and which can be reliably measured by well-validated tasks (Schandry, 1981). Then, in the same participants we assessed body image with the Body Image Revealer (BIR) software (Mian & Gerbino, 2009), a digital method aimed at quantifying individuals' perception of their body from the outside. BIR presents participants with a modified picture of their own body and then allows them to adapt it until the picture matches their cognitive (i.e., the perception of their own body size), affective (i.e., the way they feel about their own body), metacognitive (i.e., the way they think that other people see their body), and optative (i.e., the way they would like their body to be) components of their body image.

We first investigated whether there is a relationship between levels of IAcc and performance on the different tasks of the BIR (cognitive, affective, metacognitive, and optative). In line with previous findings, we predicted that people with higher IAcc would be more accurate in body perception task, whereas subjects with lower IAcc might show difficulties in perceiving their external body image, predicting a positive relationship between accuracy in the heartbeat counting task and BIR ratings. Since differences in body size and shape might affect the ability to perceive one's own body from the inside and the outside (Bruch, 1962; Herbert & Pollatos, 2014; Pollatos et al., 2008), body mass index (BMI) was also considered as a covariate. Indeed, under- and overweight individuals have been shown to misperceive their own bodies (Garner, Garfinkel, Stancer, & Moldofsky, 1976), resulting in lower IAcc and worse performance at the BIR. The second question we addressed is whether the two tasks can directly influence each other. It might be the case that focusing on one's own body image might alter IAcc, and in particular, in line with Ainley, Tajadura-Jiménez, Fotopoulou, and Tsakiris (2012), self-observation might enhance the ability to feel the body from the inside. To test this hypothesis, the heartbeat counting task was administered twice, once before and once after the BIR task (pre- and post-conditions) to measure if the exteroceptive awareness task could influence performance on the interoceptive task.

Method

Participants

Fifty-two young (M_{age} = 22.21, SD = 4.04), healthy females students at Royal Holloway, University of London, were recruited using the Psychology Department's experiment management system. The study was approved by the Department of Psychology Ethics Committee, Royal Holloway.

Participants signed an informed consent form and at the end of the experiment they received a debriefing form that explained the aim of the study. The experiment lasted 30 min and participants received £5 each for their participation.

For each subject, height and weight were assessed using a measuring tape and a scale in order to calculate their BMI. BMI was calculated using the following formula: mass in kg/height in m^2. A BMI range from 16 to 18.5 is considered to be underweight, from 18.5 to 25 is considered to be normal weight and a range from 25 to 30 is considered to be overweight. Thirty-six participants were normal weight (M = 20.63, SD = 1.87), six participants were underweight (M = 17.00, SD = 1.10) and nine were overweight (M = 28.40, SD = 3.20). The average BMI of the sample was 21.56 (SD = 3.96).

One participant was excluded because she performed the BIR task randomly (i.e., higher percentage of body distortion), without paying attention to the different tasks. Therefore, the data analysis was performed with 51 results. Table 1 reports the descriptive statistics of all participants.