Locked to a wrong body: Eating disorders as the outcome of a primary disturbance in multisensory body integration

ABSTRACT

In his recent paper “Distorted body representations in anorexia nervosa” Gadsby (2017) discussed empirical evidence regarding anorexic patients’ distorted body representations. In particular, he interpreted them using the O’Shaughnessy’s long-term body image (LTB) hypothesis (O’Shaughnessy, 1998): individuals with anorexia nervosa (AN) have a distorted LTB that tracks changes in the spatial content of the body and supplies this distorted content to other body representations. Even if we agree on the involvement of body memory in the distorted body representation, an open issue not fully addressed in the paper is: why AN patients do not update their LTBs to reflect their true dimensions? Our correspondence tries to answer to this question using a new neuropsychological and neurobiological theory: the Allocentric Lock Theory – ALT.

In his recent paper “Distorted body representations in anorexia nervosa” Gadsby (2017) discussed empirical evidence regarding anorexic patients’ distorted body representations. In particular, he interpreted them using the O’Shaughnessy’s long-term body image (LTB) hypothesis (O’Shaughnessy, 1998). Gadsby (2017) suggests that contents regarding body size, which are stored in the LTB, could be distorted in AN patients: a distorted LTB tracks changes in the spatial content of the body and supplies this distorted content to other body dynamic representations.

Even if we, and other researchers (Dakanalis et al., 2016; Gaudio & Riva, 2013; Mohr, Rickmeyer, Hummel, Ernst, & Grabhorn, 2016; Riva, 2012, 2014; Riva & Gaudio, 2012; Stinson, in press), agree on the involvement of body memory in the distorted body representations, an open issue not fully addressed in the paper is: why AN patients do not update their LTBs to reflect their true dimensions?

The recent research in neuroscience can help us in answering to this question. According to Moseley and colleagues (Moseley, Gallace, & Spence, 2012), our body representations are integrated in a coarse supramodal multi-sensory representation of the body and the space around it (“body matrix”), whose evolutive goal is to allow the individual to protect and extend her/his boundaries at both the homeostatic and psychological levels. More, its contents are shaped by predictive multisensory integration (Apps & Tsakiris, 2014; Talsma, 2015): higher-order networks generate predictions about the expected sensory inputs that are used to coordinate its contents into a coherent mental representation (Bayesian principle). Finally, these different bodily representations are integrated within an amodal spatial representational format, based on a three-dimensional coordinate system (spatial image), shared by both perceptual and linguistic knowledge (Kelly & Avraamides, 2011; Loomis, Klatzky, Avraamides, Lippa, & Golledge, 2007; Wolbers, Klatzky, Loomis, Wutte, & Giudice, 2011).

Starting from the above premises, in the last years our group of researchers developed a new neuropsychological and neurobiological theory to provide an answer to these specific questions: the Allocentric Lock (AL) Hypothesis (Gaudio & Riva, 2013; Riva, 2016; Riva & Gaudio, 2012; Riva, Gaudio, & Dakanalis, 2013). In brief, our framework suggests that AN may be the result of a multisensory processing deficit in the way expected (using predictive coding) versus experienced (from perception) bodily experiences are integrated. Specifically, the AL hypothesis suggests two possible impairments in AN multisensory processing (Riva, in press): (1) an impairment in the ability of correctly linking internal (interoceptive) bodily signals to their potential pleasant (or aversive) consequences; and (2) an impairment in the ability of updating the body memory (allocentric, offline) with new contents from real-time perception-driven inputs (egocentric, online).

If the first deficit can justify the link between negative affect and body perception suggested by Gadsby, the second can explain the inability of AN patients to update their body memory to reflect their true dimensions. As underlined by van der Stoep, Postma, and Nijboer (2017) to be able to compare spatial information between the senses (body centered – egocentric – online) and the memory (body independent – allocentric – offline): “sensory information needs to get together at some point during sensory processing and be
coded into a common reference frame” (p. 133). If this process of multisensory integration is impaired, the AN subject is locked to a negative allocentric (offline) memory of one’s body that is unable to update, even after a significant weight loss.

This hypothesis is in line with one of the possible explanations proposed by the author in the paper (Gadsby, 2017): “…Veridical visual input simply isn’t sufficient to override the underlying disturbance. It might be that visual input only temporarily corrects the LTB (before it falls back to being distorted) or it might be that the underlying disturbance is too great to override at all.” (p. 29).

New neuropsychological and neuroimaging published data seem to confirm the AL hypothesis (Gaudio, Brooks, & Riva, 2014; Gaudio, Wiemerslage, Brooks, & Schioth, 2016; Serino et al., 2015). On one side, compared to controls, eating disordered patients showed deficits in the ability to refer to and update a long-term stored (allocentric) representation with (egocentric) perceptual-driven inputs (Serino et al., 2015). On the other side, a systematic review of resting-state functional-MRI studies (Gaudio et al., 2016) concluded its analysis by suggesting “that several brain regions could be involved in body image disturbances and may sustain an impaired integration between real and perceived internal/external state of one's own body in AN patients” (p. 582). In our view these functional connectivity alterations, found in the corticobulbar circuitry and inducing both cognitive inflexibility and altered processing/integration of body signals, may lock the memory of the body to its negative offline (allocentric) content, priming the processing of any further body-related experience (Gaudio et al., 2014; Riva, Gaudio, & Dakanalis, 2015).

Gadsby concluded his paper by suggesting three future research lines that may help to understand AN and its aetiology: (a) testing distortion of alternative body schema dimensions; (b) testing tool extended aperture-passing affordances; (c) testing modification of the LTB through affect. Here we suggest two more research lines: (a) testing general multisensory integration deficits, for example between visual and nonsensory visual signals, and (b) testing specific multisensory body integration deficits, in particular between extra-terence (e.g. visual body perception) and interoception (e.g. body awareness) and/or between perception and memory.

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References


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