

Keeping the Body in Mind

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Abstract

In this short review, we focus on symptoms related to body representation and action awareness in two major Psychiatric Diseases: Anorexia Nervosa and Schizophrenia. First, the neurocognitive processes underlying pathological body image distortion in anorexia nervosa and delusions of alien control in schizophrenia are presented briefly. We then consider the impact of recent research findings on the development of novel forms of therapy for each of the two diseases. Greatest awareness of the latest research on neurocognitive impairments in anorexia nervosa and schizophrenia may help a therapist to better understand a patient's subjective experience. In turn, this might help the patient to better understand and thus better deal with his/her cognitive symptoms.

Keywords: Anorexia nervosa; Schizophrenia; Body representation; Action awareness; Sense of effort; Frontoparietal networks

Here, we review the impact of recent research in cognitive psychology and cognitive neuroscience on the development of novel rehabilitative interventions in psychiatric disorders. We focus on anorexia nervosa (AN) and schizophrenia, which are respectively associated with strong distortions of body representation and action representation.

Body Representations in AN

One of the most relevant clinical symptoms of AN for the cognitive psychologist is the strong distortion of the mental representation of the body [1]. Patients suffering from AN (most of whom are young women) often report feeling fatter and larger than they really are. Even though a slight (<5%) overestimation bias is found in healthy women, the phenomenon is significantly exaggerated in patients suffering from AN [2]. Even when the patient reaches a very low actual body weight, she is never satisfied and still considers herself to be fatter or larger than her internal standard. This illusion is particularly impressive because it persists when the patient looks at her own image in a mirror or crucial in AN because this impairment could counteract the benefits of therapy by increasing the obsessive will to lose weight and thus maintaining restrictive eating behaviours [3]. Even though most of the studies to date have emphasized the presence of a disrupted conscious body image in AN, few authors have suggested the involvement of a body schema distortion in this condition [4,5]. The body schema can be defined as a dynamic sensorimotor representation of the body that initiates and guides actions. It is elicited by action-regardless of whether the latter is imagined, anticipated or executed [6,7]. To test the involvement of the body schema in AN, Guardia et al. [8,9] studied a body-scaled action-anticipation task in which female patients suffering from AN and healthy control participants had to judge whether or not an aperture was wide enough for them to pass through. The anticipation of body-scaled action was severely impaired in patients with AN; they considered that they could not pass through the aperture, even when it was wide enough. Hence, the patients with AN behaved as if their body was larger than in reality. This observation suggested that body schema disturbance is a core feature of AN. The rapid, massive weight loss in AN may be responsible for the mental overestimation of the body schema [10]. The patient may feel that she is locked into the body she had before the disease. Other spatial tasks involving the body schema seem to be also affected. Guardia et al. [11] investigated the effect of passive lateral body inclination on the tactile Subjective Vertical (SV). Fifty participants (25 patients with AN and

25 healthy controls) were asked to manually set a rod into the vertical position under three postural conditions. Under the tilted condition, a significant, abnormal deviation of the tactile SV towards the body was evidenced in the patients with AN. This effect was confirmed in a visual SV task [12] and may have been caused by higher weighting with respect to the egocentric frame of reference. Taken as a whole, these results suggest that body size overestimation in AN is not solely due to psycho-affective factors but also involves impaired neural processing of body dimensions in the parietal networks known to subservise the emergence of body schema. Novel therapies based on both physical exercise and virtual reality [13,14] should focus on the body in general and updating the emaciated body's new boundaries in particular.

Modifying a patient's vision of his/her body has been already used clinically to relieve certain symptoms. For instance, mirror therapy is a non-pharmacological treatment strategy that has been used for many years to alleviate phantom limb pain [15,16]. Mirror therapy consists in creating the illusion that the reflection of the moving unaffected limb in a mirror corresponds to the lost limb. This false vision of the paralyzed moving limb may be capable of restoring neural activity corresponding to the lost limb in the motor areas of the brain, which in turn might block the pain signals. In the field of eating disorders, frequent body exposure via mirror therapy alone decreases the extent of negative body-related emotions [17]. Marco et al. [18] have recently emphasized the value of adding a body image techniques enables individuals to feel as if a virtual body viewed in front of them is their own body viewed from behind [19] or as if they are inside and can control the another person's body [20]. For instance, Preston and Ehrsson [21] found that immersing a participant in a thinner or larger body could modify the degree of body satisfaction. Given that these techniques have been administered in healthy individuals, it is now imperative to test these techniques in people with eating disorders (such as AN).

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Awareness of Action in Schizophrenia

One of the first-rank symptoms of schizophrenia is the delusion of alien control, [22]

For example, patients state that:

“The force moved my lips. I began to speak. The words were made for me” [22]

“I am just a puppet who is manipulated by cosmic strings. When the strings are pulled my body moves and I cannot prevent it.” [23]

“They inserted a computer in my brain. It makes me turn to the left or right” [24].

Data from laboratory research suggest that patients with schizophrenia have an impaired sense of voluntary action. In line with Frith's hypothesis [25], Lafargue et al., [26] suggested that these patients have a disrupted sense of effort. The latter can be likened to a subjective experience of willed effort; under normal, non-pathological conditions, a person who is involved in a motor act may feel that she/he is exerting a certain effort in order to energize the body. The neural mechanism that underpins this phenomenon has been referred to as “efference copy” [27,28] the brain takes copies of the central orders coding for force and transforms them into an effort sensation before they even leave the brain [29] - giving the person a feeling of enhanced control over her/his actions.

The sense of effort gives willed actions a specific perceptive content [30-32]. In a study by Lafargue et al. [26], schizophrenic patients with delusions of alien control and healthy controls were asked to produce rapid muscle contractions of different intensities in proportion to numerical values (on a 10--point scale) presented by the experimenter. A statistically significant, linear relationship between the numerical values and the exerted forces was observed for both patients and control subjects. However, the relationship was weaker for the schizophrenic patients with delusions of alien control. Lafargue et al. concluded that in schizophrenia, the delusion of alien control arises (at least in part) from an impaired sense of effort. Other studies have shown that schizophrenic patients are abnormally aware of the sensory consequences of their movements [33-35] and taken as a whole, these findings suggest that in schizophrenia, the delusion of alien control is associated with less awareness of efferent (top-down) neural information [26,36] and an exaggerated awareness of afferent (bottom-up) neural information [34,35]. In other words, the patients may experience a loss of control of their willed actions, which leaves the way open for delusions of alien control. At the neural level, this may be due to instability in frontoparietal networks [26,37]. If this hypothesis is correct, greater stability of the neural network underpinning the awareness of willed actions might influence the formation and persistence of delusions of control [26,38]. The above findings may help a therapist to better understand a patient's subjective experience. In turn, this might help the patient to better understand and thus better deal with his/her cognitive impairments. The challenge here is to provide patients with an explanation of delusions of control rooted in their subjective experience, which is thus consistent and potentially acceptable. According to meta-analyses [39], cognitive behavioral therapy has not hitherto been effective in reducing the symptoms of schizophrenia or preventing relapse. Nevertheless, it is likely that psychotherapy can enhance patients' quality of life by developing their metacognitive skills [40-42], i.e. the ability to think about their own cognitive function. Novel forms of therapy should focus on the latest neurocognitive information about delusions of control.

Conclusion

One may now be able to describe the neurocognitive mechanisms underlying pathological body image distortion in AN and delusions of alien control in schizophrenia. Therapy can and should be informed by new knowledge about impaired neurocognitive mechanisms. Contemporary psychotherapy of AN and schizophrenia should give more prominence to representations of the body and awareness of actions

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