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SYMPOSIUM

The Key to Unlocking the Virtual Body: Virtual Reality in the Treatment of Obesity and Eating Disorders

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Abstract

Obesity and eating disorders are usually considered unrelated problems with different causes. However, various studies identify unhealthful weight-control behaviors (fasting, vomiting, or laxative abuse), induced by a negative experience of the body, as the common antecedents of both obesity and eating disorders. But how might negative body image—common to most adolescents, not only to medical patients—be behind the development of obesity and eating disorders?

In this paper, I review the "allocentric lock theory" of negative body image as the possible antecedent of both obesity and eating disorders.

Evidence from psychology and neuroscience indicates that our bodily experience involves the integration of different sensory inputs within two different reference frames: *egocentric* (first-person experience) and *allocentric* (third-person experience). Even though functional relations between these two frames are usually limited, they influence each other during the interaction between long- and short-term memory processes in spatial cognition. If this process is impaired either through exogenous (e.g., stress) or endogenous causes, the egocentric sensory inputs are unable to update the contents of the stored allocentric representation of the body. In other words, these patients are locked in an allocentric (observer view) negative image of their body, which their sensory inputs are no longer able to update even after a demanding diet and a significant weight loss. This article discusses the possible role of virtual reality in addressing this problem within an integrated treatment approach based on the allocentric lock theory.

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Introduction

Obesity and eating disorders are usually considered unrelated problems with different causes. However, research with adolescents is questioning this belief; apparently, unhealthful weight-control behaviors—such as fasting (going without eating for 24 hours for weight control), vomiting, or laxative abuse—are the common antecedents of both obesity and eating disorders.[1–6] For example, Neumark-Sztainer and colleagues[2] discussed the results of the Project EAT II (Eating Among Teens), a longitudinal study involving 2516 ethnically and socio-economically diverse adolescents. They report that, 5 years later, the use of unhealthful weight-control behaviors

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Abbreviations: (CBT) cognitive behavioral therapy, (VR) virtual reality

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increased six times the risk for binge eating with loss of control, three times the risk for being overweight, and two to five times the risk for extreme weight-control behaviors such as the use of diet pills and self-induced vomiting. A similar result was found by Stice and associates;[6] in a longitudinal study where fasting was the best predictor for the onset of binge eating and bulimia nervosa 5 years later.

Epidemiological studies indicate that childhood obesity has different ethnic, socioeconomic (compared with affluent white children, poor Hispanic, white, and black children have 2.7, 1.9, and 3.2 times higher odds of obesity, respectively), and behavioral risk factors.[7] Behavioral variables, such as higher television viewing and higher physical inactivity levels, were all independently associated with higher obesity prevalence.

In a 4-year longitudinal study on 496 adolescent girls, Stice and coworkers[5] studied the psychological and behavioral risk factors for the onset of obesity in adolescent girls. Their data show that participants who were on a weight-loss diet or who used maladaptive compensatory behaviors for weight control were at increased risk for obesity 4 years later.

The present results have several clinical implications. First, they suggest that it is particularly important to educate adolescents about effective weight-control strategies. This conclusion has been highlighted by Raynor and colleagues[8] who stated that, "randomized trials testing family-based, behavioral modification interventions for pediatric obesity, which provide low-calorie dietary prescriptions emphasizing nutrient-dense food choices, greatly improve weight status and show a decrease or no change in eating pathology in children." Second, the evidence that youths practicing unhealthful weight-control behaviors are at higher risk for obesity and eating disorders implies that prevention and treatment interventions should also focus on the causes of these behaviors.

In a message on the Yahoo Answers UK site, an adolescent girl writes, "I'm 16 - so the classic insecure girl - although on the outside I cover up with a massive personality and I seem really confident about myself but just recently and defiantly in the past few days I have been looking at myself and yes I can see bone but I also see fat - I know I'm skinny but I'm stupidly skinny yet I have a huge bum and boobs and I've stopped eating properly and it hurts." (*http://uk.answers.yahoo.com/question/index?qid=20100718191717AAvCXjN*).

The words of the girl clearly explain her behavior: she stopped eating properly because she did not like her body.[9] A study by Kostanski and Gullone[10] with a sample of 431 Australian preadolescent children (7 to 10 years) confirms this interpretation: preadolescents as young as 7 years of age are unsatisfied with their body appearance and deliberately engage in restrictive eating behaviors. But how does a negative body image influence the development of obesity and eating disorders? In their provocative editorial, Schwartz and Henderson admitted that there is no simple answer to this question.[11]

In this article, I review the "allocentric lock theory" proposed as an antecedent to both obesity and eating disorders.[12,13] Specifically, I consider the possibility of an allocentric negative body image that is not altered by contrasting egocentric representations driven by perception. In other words, these patients are locked to an allocentric (observer view) negative image of their body that their sensory inputs are unable to update even after dramatic body changes. I discuss the possible role of virtual reality (VR) in addressing this problem as part of an integrated treatment approach. Specifically, I recommend adding a 10-session body-image rescripting protocol based on VR to the treatments of obesity and eating disorders to improve long-term outcome. The results of two controlled trials with 211 obese patients[14] and 36 binge eating patients[15] are used to support this treatment recommendation.

Allocentric Lock Hypothesis

Our Experience of the Body

As noted by Klatzky,[16] "A reference frame is a means of representing the locations of entities in space." Evidence from psychology and neuroscience indicates that our spatial experience, including the bodily one, involves the integration of different sensory inputs within two different reference frames: *egocentric* and *allocentric* (see **Figure 1**).[17,18]

The egocentric frame (first-person view) refers to the body of the observer and allows him/her to locate objects relative to the body center (as in the video game *Crysis*; **Figure 1**, left-hand side); within this frame, the position of an object changes if the subject moves.[19] In contrast to this frame, the allocentric frame (third-person view) refers to space external to the perceiver. Within this frame, the position of an object does not change if the subject moves (as in the video game *Pac-Man*; **Figure 1**, right-hand side). More, the object thus exists even if there is no relation with the self or another person.[19]