The BIAS-VR. Assessing body image disturbance using a virtual reality software. Preliminary results.

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Abstract. Aim: The current study presents initial data on the psychometric properties of a new Virtual Reality (VR)-based body image assessment software (BIAS-VR). Body image distortion and body image dissatisfaction were assessed in two different conditions: perceived and ideal body size were evaluated a) when participants were embodied in a virtual body, and b) when participants saw the virtual body in front of them. Method: 26 female college students participated in the study. Before starting the VR-assessment tasks, body image distortion and body image dissatisfaction were measured using a paper-based silhouette test. Body dissatisfaction, drive for thinness and body anxiety were also assessed using questionnaires, and actual body mass index (BMI) was measured. Then, participants were randomly exposed to both assessment conditions in a counterbalanced order. Participants' body dissatisfaction (the discrepancy between perceived and ideal BMI) and body distortion (the discrepancy between perceived and actual BMI) were calculated in each condition. Results: Paired-sample t-test showed no significant differences (p>.05) between conditions when assessing either body distortion or body dissatisfaction. Pearson correlations showed significant, moderate and large positive and negative correlations (p<.05) between the BIAS-VR and the other body image-related questionnaires. Conclusion: BIAS-VR shows good convergent validity and may be an adequate tool for the assessment of body image disturbance. However, further research into the influence of BMI and the role of embodiment techniques is required.

Keywords. Body image distortion, body image dissatisfaction, virtual reality, embodiment, assessment.

1. Introduction

Body image disturbance (BID) has been strongly associated with several negative psychosocial consequences, such as depression, anxiety and social impairment, and is considered a risk factor for developing an eating disorder (ED) [1]. BID involves dysfunctional cognitions, attitudes, and emotions related to the way in which individuals experience their own body shape or weight [2]. Among the tools most widely used to assess BID are figural rating scales, in which individuals must select their perceived and ideal body size from among a series of silhouettes ranging from very slim to very large [3]. Even though paper-based instruments show robust psychometric properties [4], recent studies have used new procedures in which body image representations are assessed using more realistic computerized human-based 3D scales [5,6,7] and embodiment techniques [8]. Thus, virtual reality (VR) not only allows the creation of a

3D body with the same proportions and physical particularities as the participants, but makes them feel that this virtual body is their own by using embodiment-based procedures [8,9].

The aim of this study is to provide initial data on the psychometric properties of the VR-based Body Image Assessment Software (BIAS-VR), a new version of a previously developed 2D software [5]. The BIAS-VR allows participants to modify the width of a 3D virtual body in order to generate a figure that represents their perceived body image (a virtual body with the BMI they believe that they have) and a figure that represents their ideal body image (a virtual body with the BMI they would like to have). Once these tasks are completed, the software estimates participants' body image dissatisfaction (the discrepancy between perceived and ideal BMI) and body image distortion (the discrepancy between perceived and actual BMI). In this study, the BIAS-VR was administered in two different conditions: a) participants were embodied in the virtual body using visuomotor synchronization and were then asked to generate their perceived and ideal body image (the embodied condition); b) participants saw the virtual body in front of them and, from this perspective, were asked to generate their perceived and ideal body image (the non-embodied condition). Furthermore, the relationships between body image distortion and body image dissatisfaction according to the BIAS-VR, in both embodied and non-embodied conditions, and other body image-related measures were also assessed.

2. Method

Twenty-six female college students from the University of Barcelona (M_{age} = 21.96, *SD* = 1.89; M_{BMI} = 22.85, *SD* = 4.90) participated in the study. After providing signed informed consent, participants were measured in order to calculate their actual BMI, and then completed a battery of tests. Body image distortion and body image dissatisfaction were assessed using a paper-based silhouette test (*Body Image Assessment Test*; BIAS-BD) [4], and body dissatisfaction, drive for thinness and body anxiety were assessed by means of questionnaires: *Eating Disorder Inventory* (EDI-3) *drive for thinness* (DT) and *body dissatisfaction* (BD) scales, *Physical Appearance State and Trait Anxiety Scale* (PASTAS), and *Body Shape Questionnaire* (BSQ). Then, participants were administered the BIAS-VR in the two conditions (embodied and non-embodied) in random order. Starting from a female or male 3D virtual body with a BMI of 22.5 kg/m^2, participants could increase or reduce the body size (BMI) of the virtual body they owned (the embodied condition) or saw in front of themselves (the non-embodied condition) in order to represent their perceived and ideal body size (Figure 1).

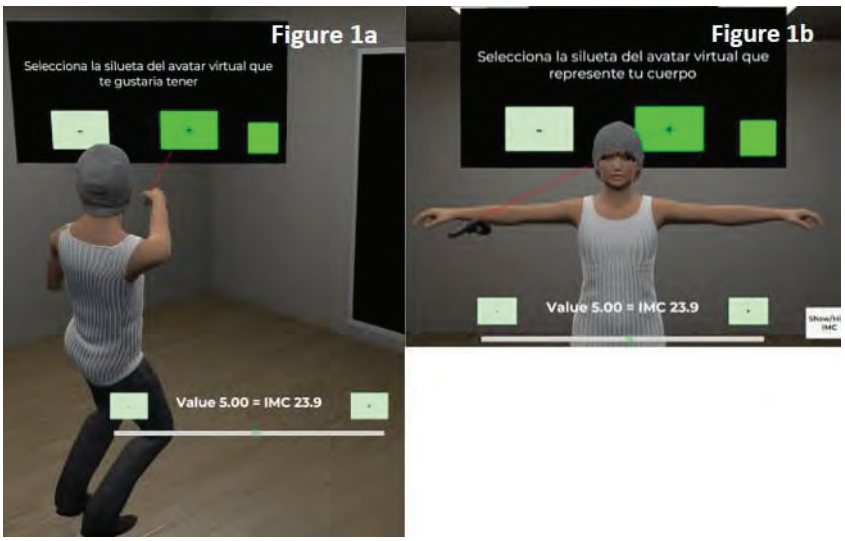

Figure 1. Body image assessment tasks in the embodied (a) and non-embodied (b) conditions.

3. Results

Paired-sample t-test showed no significant differences (p>.05) between the two conditions (embodied and non-embodied) in either body image dissatisfaction or body image distortion measures as assessed by the BIAS-VR. Overall, and independently of the condition, students tended to overestimate their body size (i.e., perceived BMI was higher than actual BMI) and desired to have a slimmer body (i.e., perceived BMI was higher than ideal BMI). Pearson correlations were also conducted to assess the relationship between body image distortion and body image dissatisfaction measures of

Table 1. Pearson correlations for the main variables of the study.

Measures	Body distortion (BIAS-VR) embodied condition	Body dissatisfaction (BIAS-VR) embodied condition	Body distortion (BIAS-VR) non-embodied condition	Body dissatisfaction (BIAS-VR) non-embodied condition
Body distortion (BIAS-BD)	-.392*	.544**	-.361	.529**
Body dissatisfaction (BIAS- BD)	-.009	.357	-.126	.525**
EDI-BD	-.510**	.722**	-.628**	.633**
EDI-DT	-.499**	.537**	-.461*	.483*
PASTAS	-.599**	.689**	-.625**	.620**
BSQ	-.506**	.757**	-.613**	.635**
BMI	-.821**	.695**	-.856**	.627**

***Note*:** Body Image Assessment Test (BIAS-BD), Eating Disorder Inventory (EDI-3) drive for thinness (DT) and body dissatisfaction (BD) scales, Physical Appearance State and Trait Anxiety Scale (PASTAS), Body Shape Questionnaire (BSQ), Body mass index (BMI).

** = statistically significant at p <.05 level*

*** = statistically significant at p values <.01*

the BIAS-VR (in both embodied and non-embodied conditions), and other body image-related questionnaires (Table 1). The results showed that:

- There were statistically significant relationships (p<.05) between body image distortion/dissatisfaction assessed with the BIAS-VR, in both conditions, and body image distortion assessed with the paper-based BIAS-BD (silhouette test). However, there was only a statistically significant relationship (p<.05) between body dissatisfaction assessed with the BIAS-VR in the non-embodied condition and body image dissatisfaction assessed with the BIAS-BD.
- There were statistically significant relationships (p<.05) between body dissatisfaction/distortion, assessed in both conditions, and other paper-based questionnaires, such as body dissatisfaction (EDI-BD), drive for thinness (EDI-DT), body anxiety (PASTAS) and body image concerns (BSQ).
- Surprisingly, there was a significant but negative relationship (p<.05) between body distortion of BIAS-VR and the other body image-related measures. Taking a closer look at our data, it was observed that individuals (n=7) with overweight and obesity underestimated their perceived virtual body size compared to individuals with healthy BMIs. This underestimation was observed in the BIAS-VR but not in the paper-based questionnaires.
- Consistent with these results, a negative significant correlation between BMI and body image distortion assessed with the BIAS-VR was also found.

4. Conclusion

This study provides preliminary data on the psychometric properties of the BIAS-VR, a new VR-based software for the assessment of body image disturbances. When assessing body image dissatisfaction, BIAS-VR showed good convergent validity with other standardized paper-based questionnaires that also assess body image dissatisfaction and other body-related concerns, regardless of whether the assessment task was enhanced with embodiment techniques (from the first-person perspective) or whether it was

conducted with a virtual body located in front of the participant (from an external perspective). Unexpectedly, when assessing body image distortion, the BIAS-VR showed significant but negative correlations with other standardized paper-based questionnaires that also assess body image distortion and other body-related concerns, in both the embodied and the non-embodied conditions. These results may be explained by contraction bias [7], a perceptual error produced when a standard reference (i.e., a virtual body with a BMI of 22.5 m/kg^2) is used in size estimation tasks. Thus, size estimation is at its most accurate when the BMI of the participant is closest to the standard reference and becomes increasingly inaccurate as the difference increases.

The use of the first-person (embodied) versus the third-person perspective did not affect the results of the BIAS-VR's body size estimation tasks, which supports previous findings reported by Corno et al. [8]. Both studies were conducted with non-clinical samples. Future research should assess whether these results are replicated in ED patients.

The results found show that BIAS-VR may be an adequate tool for the assessment of BID. However, further research into the influence of BMI and the role of embodiment techniques is required.

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