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## Interactive Media in Training and Therapeutic Intervention

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## Virtual Reality in the Treatment of Eating Disorders and Obesity: State of the Art and Future Challenges

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**Abstract:** *Virtual Reality (VR) is an advanced human-computer interface that allows the user to interact with and become immersed in a computer-generated environment in a naturalistic fashion.*

*Different clinical data suggest that VR can help in addressing two key features of eating disorders and obesity not always adequately addressed by existing approaches: body experience disturbances and self-efficacy.*

*In fact, performance-based methods are the most effective in producing therapeutic change across behavioral, cognitive, and affective modalities. The experiential approach allowed by VR helps patients in discovering that difficulties can be defeated, so improving their cognitive and behavioral skills for coping with stressful situations. On the downside, the cost of this technology remains relatively high, its availability is still limited and some patients (1-2%) may experience simulation sickness.*

*The paper discusses the pros and cons of this approach presenting the results coming from the last controlled clinical trials.*

### INTRODUCTION

Different new technologies have been introduced over the last few years that are increasingly finding application in health care delivery for patients with eating disorders and obesity. These include self-help (supervised and unsupervised), telemedicine, telephone therapy, e-mail, Internet, computer software, CD-ROMs, portable computers, and virtual reality techniques.<sup>1</sup> One of the most promising is virtual reality (VR), an advanced form of human-computer interface that allows the user to interact with and become immersed in a computer-generated environment in a naturalistic fashion.<sup>2</sup>

In fact, therapists are using VR to provide a new human-computer interaction paradigm in which users are active participants within a computer-generated three-dimensional virtual world.<sup>3</sup> Using VR in this way, the patient is more likely not only to gain an awareness of his/her need to do something to create change but also to experience a greater sense of personal efficacy.<sup>4</sup>

This feature of VR has been extensively used in different clinical psychology treatments - from phobias to sexual disorders - and it is expected to increase in the future.<sup>5,6</sup> In particular, an area in which VR may offer a competitive advantage is the treatment of eating disorders and obesity.

Different clinical data suggest that VR can help in addressing two key features of eating disorders and obesity not always adequately addressed by existing approaches: body experience disturbances and self-efficacy.<sup>7</sup>

The paper discusses the pros and cons of this approach presenting the results coming from the last controlled clinical trials.

### RATIONALE AND CLINICAL DATA

Distorted body image, negative emotions and lack of faith in the therapy are typical features of these disturbances and are the most difficult characteristics to change. One innovative approach to their treatment is to enhance tradi-

<b>Hardware</b>	Graphic Workstation with high-end graphic card
	Head Mounted Display or 3D shutter glasses
	Tracking System (Head and Hands)
	VR Gloves
<b>Software</b>	VR environment

**Table 1:** VR Components

tional cognitive-behavioral therapy (CBT) with the use of a virtual environment.<sup>1,3,9</sup>

A first approach is the one offered by the Integrated Experiential Therapy (IET). Developed by Giuseppe Riva and his group inside the VREPAR and VEPSY Updated European funded projects (<http://www.cybertherapy.info>) is a relatively short-term, patient oriented approach that focuses on individual discovery.<sup>10-12</sup> IET shares with CBT the use of a combination of cognitive and behavioral procedures to help the patient identify and change the maintaining mechanisms. However it is different for:

- Its use of Virtual Reality (VR): 10 VR sessions.
- Its focus on the negative emotions related to the body, a major reason patients want to lose weight.
- Its focus on supporting the empowerment process. VR has the right features to support empowerment process, since it is a special, sheltered setting where patients can start to explore and act without feeling threatened.

For the virtual reality sessions, the Virtual Reality for Eating Disorders Modification - VREDIM - is used. VREDIM is an enhanced version of the original Virtual Reality for Body Image Modification (VEBIM) immersive virtual environment, previously used in different preliminary studies on non-clinical subjects<sup>13,14</sup>

VREDIM is composed by 14 virtual environments, used by the therapist during a 50-minute session with the patient.<sup>11</sup> After a first assessment session, the next 9 sessions are used to assess and modify:

- *the symptoms of anxiety related to food exposure.* This is done by integrating different

cognitive-behavioral methods (see Table 1): Countering, Alternative Interpretation, Label Shifting, Deactivating the Illness Belief and Temptation Exposure with Response Prevention.<sup>15,16</sup>

- *the body experience of the subject.* To reach this goal, the virtual environment integrated the therapeutic methods used by Butter & Cash<sup>17</sup> and Wooley & Wooley.<sup>18</sup> In particular in VREDIM the virtual environment is used in the same way as guided imagery<sup>19</sup> is used by the cognitive and visual/motorial approach. Moreover, in terms of learning theory, repeated and prolonged exposure with the conditioned stimulus “seeing one’s own body” is supposed to induce decreases in the conditioned negative reactivity by preventing negative reinforcement, e.g., avoidance.<sup>20</sup>

The VR sessions (see Figure 1) approximate natural settings, providing an alternative for exposure and desensitization exercises as well as a more general enhancement to therapy. Specifically, VR is believed to increase motivation by allowing individuals to virtually witness changes in their behavior and shape and reach their own conclusions based on actual experience. During a typical VR sessions, patients are asked to wear a head mounted VR display system. An approach similar to guided imagery is used to lead the subject through various zones over the course of ten sessions. Stimuli that contribute to abnormal eating behaviors are identified and associated anxiety and body experiences are targeted for modification.

Subjects are also asked to identify figures that most closely resemble their current and ideal body sizes. They are also confronted with a photograph of their actual body.

This approach was validated through different case studies<sup>21</sup> and trials. In the first one, uncontrolled, three groups of patients were used<sup>22</sup>: patients with Binge Eating Disorders (BED), patients with Eating Disorders Not Otherwise Specified (EDNOS), and obese patients with a body mass index higher than 35. All patients participated in five biweekly sessions of the therapy. All the groups showed improvements in overall body satisfaction, disordered eating, and related social behaviors, although these changes were less noticeable in the EDNOS group.

More recently, the approach was tested in different controlled studies. The first one involved twenty women with BED who were seeking residential treatment.<sup>11</sup> The sample was assigned randomly to IET or to CBT based nutritional therapy. Both groups were prescribed a 1,200-calorie per day diet and minimal physical activity. Analyses revealed that although both groups were binge free at 1-month follow-up, IET was significantly better at increasing body satisfaction. In addition, IET participants were more

likely to report increased self-efficacy and motivation to change.

In a second one, the same randomized approach was used with a sample of 36 women with BED.<sup>12</sup> The results showed that 77% of the ECT group quit bingeing after 6 months versus 56% for the CBT sample and 22% for the nutritional group sample. Moreover, the ECT sample reported better scores in most psychometric tests including EDI-2 and body image scores. In the final one, recently presented in the Medicine Meets Virtual Reality Conference 2005, IET was compared with nutritional and cognitive-behavioral treatments, using a randomized controlled trial, in a sample of 211 female obese patients. Both IET and CBT produced a better weight loss than NT after a 6-month follow-up. However, IET was able to significantly improve, over CBT and NT, both body image satisfaction and self-efficacy. This change produced a reduction in the number of avoidance behaviors as well as an improvement in adaptive behaviors.



**Figure 1:** A patient is trying the Integrated Experiential Therapy

The Spanish research group led by Cristina Botella has compared the effectiveness of VR to traditional CBT for body image (based on Cash<sup>23</sup> and reported on a small controlled study with a clinical population.<sup>24</sup>

The main tool they developed is a 3D figure, experienced through an immersive headset, whose body parts (arms, thighs, legs, breasts, stomach, buttocks, etc.) that could be enlarged or diminished.<sup>8</sup> Further, the body could be

	<b>Indicative Prices (as 01 Jan 05)</b>
<i>VR Workstation</i>	
SGI Onyx4 visualization system with InfinitePerformance & InfiniteReality4 graphics	250000 US\$
SGI Onyx 350, V12 Graphic Card, 2x400MHz processors, 512 Mbyte Ram, 18 Gbyte Hard Disk	18000 US\$
Xeon branded PC, 2x3Ghz processors, 1Gbyte Ram, 2x200 Gbyte Hard Disk and 17" monitor	4200 US\$
Pentium IV or Athlon XP branded PC, 3.4 Ghz processor, 512 Mbyte Ram, 200 Gbyte Hard Disk and 17" monitor	2600 US\$
<i>Consumer graphic cards</i>	
Nvidia GeForceFX 6800 Ultra 256 Mbyte Vram PCI Express	550 US\$
ATI Radeon X800 Pro All-in-Wonder 256 Mbyte PCI Express	550 US\$
<i>Professional graphic cards</i>	
Quadro4 FX 4400 512 Mbyte Vram PCI Express	1600 US\$
ATI FireGL X3-256 256 Mbyte Vram AGP	1200 US\$
<i>Tracking system</i>	
Polhemus Fastrak	7000 US\$
Ascension PC Flock of Birds	2200 US\$
Intersense Intertrax 2	1100 US\$
<i>3D Shutter Glasses</i>	
<i>StereoEyes Wireless</i>	320 US\$
<i>Elsa 3D Revelator IR</i>	180 US\$
<i>Head Mounted Display</i>	
<i>Kaiser Proview XL 40/50 (XGA resolution – 3D, wide fov)</i>	50000 US\$
Daeyang I-Visor DH4400 VP 3D (SVGA resolution – 3D)	1900 US\$
Olympus Eye-Trek FMD-700 (SVGA resolution – 2D)	1300 US\$
Daeyang I-Visor DH4400 VP (SVGA resolution – 2D)	1200 US\$
Sony Glasstron PLM-A35 (Video output only – 2D)	500 US\$
<i>VR Gloves</i>	
Pinch Glove	2000 US\$
5DT Right Hand	650 US\$

**Table 2:** VR Hardware

evaluated wholly or in parts and placed in different contexts (for instance, in the kitchen, before eating, after eating, facing attractive persons, etc.).

Within the published study, five patients - 3 with Anorexia Nervosa and 2 with Bulimia Nervosa completed the traditional treatment and 8 - 4 with Anorexia Nervosa and 4 with Bulimia Nervosa - completed the VR condition.

Although both groups showed improvements on general ED measures, there were no significant between-group differences. However, the VR group did show greater improvement on measures of body image, dysphoria, and anxiety, leading the authors to conclude that VR targets disturbances in body image better than standard CBT. On a 10-point scale, patients rated the realism of VR from 7 to 9. Since then, the group has also developed a VR simulator of food and eating<sup>25</sup> actually under evaluation with patients.

## CONCLUSIONS

In summary, the published data suggest that VR can help in addressing two key features of eating disorders and obesity not always adequately addressed by existing approaches: body experience disturbances and self-efficacy. VR technology offers an innovative approach to the treatment of body image disturbance, a difficult concept to address in therapy. Previously, cognitive-behavioral and feminist approaches have been the standard interventions, although in our experience, it seems that many patients continue to struggle with negative body image post-treatment.

As emphasized by social cognitive theory, performance-based methods are the most effective in producing therapeutic change across behavioral, cognitive, and affective modalities.<sup>26,27</sup> The proposed experiential approach could help patients in discovering that difficulties can be defeated, so improving their cognitive and behavioral skills for coping with stressful situations.

On the downside, a limited number of patients (less than 2%) experienced simulator sickness, which consists of nausea, disorientation, and eye strain or blurred vision during and after use. In addition, the cost of this technology remains

relatively high (see Table 1) and availability is still limited: a typical VR system as the one used in the studies discussed before costs between 15000 and 25000 euro (hardware 10000-15000 euro; software: 5000-10000 euro).

Finally, communication networks have the potential to transform VEs into shared worlds in which individuals, objects, and processes interact without regard to their location. In the next five years, such networks will probably merge VR and telemedicine applications allowing us to use VR for such purposes as distance learning, distributed training, and e-therapy.

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