FEATURE

Virtual Reality Approaches to Addiction Treatment

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Adam Leventhal is currently a member of the Division 29 student committee and a second year student in the clinical psychology Ph.D. program at the University of Houston. Prior to moving to Houston, he graduated from the University of California, Santa Barbara where he studied animal models of addiction. Adam's research interests involve cognitive approaches to understanding addiction and diagnostic issues in substance-abusing populations with comorbid mental disorders, such as depression. Adam intends to pursue a career as a researcher and clinician.

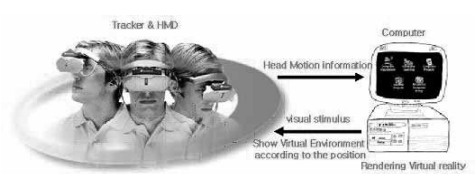
INTRODUCTION

Many drug users experience an increase in their desire to use when exposed to drug-related stimuli. This response, commonly referred to as craving, involves significant cognitive and physiological changes and is believed to play an important role in relapse. Cue exposure therapy (CET) is a treatment designed to reduce substance use by extinguishing craving reactions to stimuli associated with drug taking (Havermans & Jansen, 2003). This treatment involves frequent presentations of drug-related cues to elicit craving, while drug consumption is inhibited. Typical stimuli that have been used in CET are pictures of drugs and other related images, videos, mental imagery, and drug paraphernalia.

Theoretically, repeated exposure diminishes craving reactions and promotes learning of an abstinence response in relapse-provoking environments. However, a recent review of cue exposure treatments demonstrated that current methods are unsuccessful in maintaining abstinence because they lack some essential components (Conklin & Tiffany, 2002). The circumstances in CET may not accurately simulate cue complexes that are present in genuine drug use environments. A meta-analysis of laboratory data indicates that typical cue exposure methods effectively produce the cognitive desire to use but may not elicit strong physiological reactions that are typical of intense craving (Carter & Tiffany, 1999). In addition, existing methods of CET may not lead to transfer of learning to real-world situations. Consequently, investigators are working to construct more authentic stimuli that can be used in future CET programs.

WHAT IS IMMERSIVE VIRTUAL REALITY?

Researchers are currently exploring the use of immersive virtual reality (IVR) as a paradigm for stimulus exposure in CET for addiction (Kuntze et al., 2001; Lee et al., 2003). IVR uses a head-mounted visual display to present virtual images to make a person look, feel, hear and interact in a computer-generated situation. IVR systems link a three-dimensional environment with a tracker that senses a subject's position (Fig. 1). When a person moves, the virtual display compensates to give the participant the feeling that he or she is in the virtual situation. Because IVR environments are created by a programmer, they can be manipulated to simulate any real world situation. IVR has previously been used for psychological purposes, including the assessment and treatment of phobias, panic disorder, psychosis, chronic pain, eating disorders, obesity, sexual dysfunction, and posttraumatic stress (see Glanz, Rizzo, & Graap, 2003 for a review). Recently, IVR's therapeutic applications been utilized in addiction.



TWO EXAMPLES OF VIRTUAL REALITY APPLICATIONS FOR ADDICTION TREATMENT

Two laboratories are presently developing and testing cue exposure protocols using IVR environments (Kuntze et al., 2001; Lee, et al., 2003). Marcus Kuntze and his colleagues at the University of Basel in Basel, Switzerland have developed an IVR-based cue exposure paradigm for opiod-dependent patients. In their protocol, cue exposure is presented in a virtual bar setting, which consists of tables, stools, and other furniture decorated in a neutral style. Drug related stimuli, such as heroin, swabs, syringes, needles, and blood, are presented in the virtual setting. The presentation sequence of cues can be easily manipulated to make exposure graduated (i.e., beginning with swabs and ending with used paraphernalia that is spotted with blood) or presented in any other desired order. During exposure sessions, physiological measurements of electrocardiographic activity, oxygen saturation, respiratory rate, and blood pressure are taken to gauge the effectiveness of drug-associated cues against neutral-control stimuli (books, bread) in the same IVR environment. After cue exposure, patients participate in cognitive-behavioral therapy. Investigators at the University of Basel performed a pilot study that showed promising results for their program. They are presently conducting a controlled study to test the efficacy of IVR-based CET for opiate addiction.

In addition to narcotic-abusing populations, the potential value of IVR systems for tobacco use is currently being investigated (Lee et al., 2003). Before they developed a virtual environment for cue exposure, Lee et al. (2003) first asked smokers about what types of environments would elicit one's craving. They found that bars were most often cited by participants as a setting that evokes craving and that an alcoholic drink, a pack of cigarettes, a lighter, an ashtray, and a glass of beer were common objects that were reported to induce craving. Consequently, the IVR environment was constructed to resemble a bar (Fig. 2), in which objects previously rated to provoke craving were included as drug-related cues. Simulated human beings, known as avatars, are also included in cue exposures. During exposure sessions, avatars walk around the bar smoking a lit cigarette that produces realistic plumes of smoke (Fig. 3). In comparison to a classical method of cue exposure (picture), the IVR environment produced a significantly greater increase in self-reported tobacco craving before and after exposure (Lee et al., 2003).

IMPLICATIONS

Recent evidence indicates that cue exposure using IVR may be more effective in treating addiction than traditional CET devices, such as pictures and videos (Kuntze et al., 2001; Lee, et al., 2003). However, using IVR in addiction treatment leads to several ethical concerns. IVR exposures may induce severe craving that may be painful for the participant. There is also the potential for IVR to worsen clinical outcomes because patients may use substances to counteract the negative effects of realistic virtual exposures. Kuntze and colleagues apply cognitive therapy and progressive muscle relaxation techniques after exposures to minimize these risks. Ethical codes for IVR applications in psychotherapy, diagnostics, and research are proposed in the June 2002 issue of CyberPsychology and Behavior (Kuntze, Soermer, Mueller-Spahn, & Bullinger, 2002).

To summarize, virtual CET is a contemporary application of modern technology that appears to be of value in addiction treatment. While current findings suggest that IVR may be useful in the treatment of nicotine and opiate addiction, future study is needed to investigate whether IVR approaches can reliably produce significant craving responses in other types of abuse. In addition, empirical evidence that directly supports virtual reality methods of CET as an effective treatment of drug addiction is currently lacking, although these investigations are in-progress (Kuntze et al., 2001). Presently, the costs of IVR systems are too high to be practically implemented in most clinic settings. Therefore, IVR-based psychotherapy remains in the research laboratory, for now.

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