Development of a Large Scale Virtual Meeting Space for Drug and Alcohol Aftercare Counseling

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Abstract – The importance of aftercare programs for A&D relapse prevention has been consistently demonstrated [1]. However, the majority of patients do not participate in these aftercare programs. Reasons cited for non-participation include patient motivation, inconvenient scheduling, lack of services in the geographic area, fear of being stigmatized and failure of the treatment provider to coordinate services. Additionally, technology has not been broadly implemented to help patients to participate fully and effectively in A&D aftercare programs. This paper describe the framework and challenge of efforts to organize a Virtual Aftercare program which can serve as a low cost alternative or supplement to in-person group based aftercare programs.

Keywords: Virtual Reality, Education and Training, Web-based Technology

INTRODUCTION

"The National Institute on Drug Abuse (NIDA), the National Institute on Alcohol Abuse and Alcoholism (NIAAA), and National Institutes of Health (NIH), estimates that the economic cost of Alcohol and Drug (A&D) abuse was $246 billion in 1992, the most recent year for which sufficient data were available. This estimate represents $965 for every man, woman, and child living in the United States in 1992. "This study confirms the enormous damage done to society by alcohol and drug related problems," said NIAAA Director Enoch Gordis, M.D. "The magnitude of these costs underscores the need to find better ways to prevent and treat these disorders." [2]. In 2003, there were nearly 1.7 million admissions to publicly funded substance abuse treatment programs [3].

Alcohol and Drug (A&D) relapse is a key issue and an especially frustrating problem. Numerous studies have documented that high relapse rates prevail [4]. Prochaska, DiClemente and Norcross estimate the relapse rate is 60% within six months of discharge and most recovering addicts will make an average of 5-7 serious attempts at treatment [5].

The importance of aftercare programs for A&D relapse prevention has been consistently demonstrated [1]. However, the majority of patients do not participate in these aftercare programs. Reasons cited for non-participation include patient motivation, inconvenient scheduling, lack of services in the geographic area, fear of being stigmatized and failure of the treatment provider to coordinate services. Additionally, technology has not been broadly implemented to help patients to participate fully and effectively in A&D aftercare programs.

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BACKGROUND

Virtual Reality technology was first applied to the medical field beginning in the 1970's with medical diagnosis, procedures training, pre-operative planning, telemedicine, rehabilitation, and other treatment/diagnosis methods. Based on the success in the medical field and advances in the technology, Virtual Reality has migrated and has been effectively used in a number of behavioral health applications as a natural extension of cognitive-behavioral theory. The focus of this paper is to provide an overview of Virtual Reality as a therapeutic medium with seven examples grounded on cognitive-behavioral theory.

The cognitive-behavioral model of treatment of behavioral disorders represents an important underlying theory for the implementation of Virtual Reality in behavioral interventions. Cognitive-behavioral therapies represent a class of pragmatic approaches to understanding and treating psychiatric disorders and problems [6]. Cognitive-behavioral theories assert that cognitive and emotional processes mediate the acquisition and maintenance of psychopathology. Therefore, interventions focus on changing symptoms, behavior, and functioning. Virtual reality satisfies the aim and methodology of cognitive-behavioral interventions, which include a collaborative relationship between patient and therapist, goal setting, the imparting of skills that enable more adaptive problem solving, cognitive-behavioral assessment, self-monitoring, exposure therapy, behavioral activation/activity scheduling, and most importantly, relapse prevention [6].

Lee [7] argue that the ability of virtual reality to provide an exact replica of a situation or environment is a feature that has made it successful in behavioral interventions involving phobias such as anxiety. Affective dysregulation, including anxiety disorders, specific phobias, as well as panic disorder and post-traumatic stress disorder, may lead to significant impairments in normal life functioning. Research has shown that exposure therapy is effective for reducing negative affective symptoms [8]. Virtual reality is a novel tool to conduct exposure therapy because it comports well with the emotion-processing model, which holds that the fear network must be activated through confrontation with threatening stimuli and that new, incompatible information must be added into the emotional network.

Virtual reality has allowed clinicians to treat a number of disorders because of the unlimited number of scenarios and cues that could not be replicated in real-world treatments. The following paragraphs highlight some of the most significant uses of virtual reality in behavioral interventions and how they have broadened and enhanced patient treatment options:

Height Phobia: Virtual reality first emerged in the mental health field in the mid to late 1990's, as a treatment option for individuals with height phobia [9]. Rothbaum conducted the first controlled study to measure the effectiveness of virtual reality [10]. Patients with height phobia attended seven weekly sessions of VR exposure treatment. Seven others were left untreated. Rothbaum found that the treatment group showed significant improvements in anxiety, avoidance, attitudes and distress associated with exposure to heights. Emmelkamp conducted the first study to compare VR exposure with another treatment [11]. This study compared the success of virtual environment exposure therapy to in vivo treatment. Results indicated that the virtual environment was as effective as exposure in vivo. Of particular interest was that patients exposed to the virtual environment improved significantly in the areas of avoidance and anxiety.

Panic Disorder: Virtual reality has been used to treat panic disorder and agoraphobia, both of which are characterized by an intense sense of death, doom, or even destruction. Patients will feel dizzy, hyperventilate and gasp for air, sweat, and experience chest pain, nausea, and a fear of losing control or impending death [12]. Virtual reality offers an advantage to those suffering from panic with agoraphobia, in that exposure to anxiety-provoking situations can first be attempted in the office. This allows the patient to feel immersed and experience initial anxiety, which may then be overcome. The sense of presence experienced in the virtual world will help therapists establish a baseline upon which to compare the initial responses of phobics exposed to virtual worlds and the subsequent levels they can expect when the phobics achieve desensitization [12]. Lee have cited the successful use of virtual reality for treatment of the fear of public speaking as well [7].

Test Anxiety: The use of VR has had a substantial impact in the treatment of test anxiety. Test anxiety is usually conceived as a situation-specific personality trait, meaning that students with this condition are predisposed to reacting with heightened anxiety in the face of situations that involve evaluation. Studies estimate that between 15 and 25 percent of students suffer from high levels of examination-related anxiety [13]. Systematic desensitization is the most widely used procedure for combating test anxiety, but the multidimensional nature of this disorder argues in favor of the integration of this technique inside wider-ranging treatment packages. Virtual reality offers several advantages over in vivo. Tests can be staged at any time of year, and failure in a virtual examination has no bearing on student's actual grades. Virtual reality also permits the design of different exam situations, which thus "adapts the learning situation more closely to that of real life" [13].

Post Traumatic Stress Disorder: The United States Military has utilized the advantages of the virtual environment to treat soldiers suffering from PTSD, post traumatic stress disorder [9]. Post Traumatic Stress Disorder occurs after an individual is subjected to or witnesses a life-threatening event [14]. Exposure therapy has been named the current standard treatment for PTSD. Because it is not possible to re-expose a soldier to combat, virtual reality has been critical in reproducing a war-like environment. Before the integration of VR into treatment, soldiers had to rely solely on recalling memories of combat, which was often very difficult and very painful. Virtual reality gives therapist "a means of delivering potentially traumatic experiences to soldiers in a way that has never been possible before" [14].

Nicotine Dependency: Bornick conducted studies that implicate the effectiveness of virtual reality in managing nicotine cravings and conducting substance abuse research [15]. In a controlled pilot trial, thirteen nicotine dependent participants were allowed to smoke ad libitum, then exposed to VR smoking and VR neutral cues and compared on craving intensity. VR smoking cues significantly increased craving compared to VR neutral cues. On average, craving intensity increased 118 percent during exposure to VR smoking cues. Researchers attest to the useful of virtual reality because it allows experimental manipulation of cues in a systematic, standardized, repeatable methodology. Demonstration of cue reactivity to virtual cues represents an advance in drug addiction research by providing a standardized method to investigate addictive drug behaviors. Additionally, it "provides a viable method for evaluation of putative anticraving and cessation agents in addicted persons" [15].

Autistic Disorders: Cognitive-behavioral therapists cite virtual reality as one of the most useful tools for treatment of autistic disorders, such as Asperger's syndrome, a mild form of autism marked by normal intelligence and a variety of cognitive defects, including troubles with social interaction or adapting to change [16]. Like other therapists treating mental health disorders, clinicians treating autism applaud the wider, more flexible platform and variety of cues and scenarios offered through use of the virtual environment. The largest goal, in treatment of autistic spectrum disorders, is to teach social skills and appropriate social behaviors. Virtual reality is effective because it offers the simulation of various scenarios, while allowing patients to practice and learn through trial-and-error, without having to engage in real-world social inappropriateness [16].

Eating Habits: Foster argues that our virtual identity is not separate from our physical identity [17]. In an experiment to promote healthy eating habits, researchers found that as participants watched their avatars' bodies change, as a result of either exercise or overeating, they responded by either exercising or rejecting unhealthy food. Similarly, as patients see their own avatars conquer their fear of heights, addiction to nicotine, become healthy, drug-free, or sober, they will imitate these changes in their everyday lives.

It is evident that virtual reality is effective in treating mental health disorders. The most common reason cited by therapists for its use is the allowance of multiple scenarios and cues. Exposure therapy is critical in treating cognitive behavioral disorders and when real-world experience is often not an option, such as in the case of PTSD treatment, or when real-world teaching/training sessions may not be the most feasible therapy option, such as in the case of treating autistic disorders, virtual reality is reasonably the only other means to replicate real-world scenarios.

The virtual environment is also beneficial because it contributes to and enhances social interaction. Strong social networks and support systems are important in various therapy plans. Research has shown that though Internet availability, the virtual environment has become the new, dominant community [18]. Ridings & Gefen attest to the social support exchange offered in virtual communities [19]. People find emotional support, sense of belonging, and encouragement, in addition to instrumental aid. They also develop friendships that provide additional benefits beyond that of information exchange and social support, such as networking, companionship, and socializing [19].

Wellman examined the most notable features of virtual communities, which they described as computer-supported social networks (CSSNs) [20]. Among the list of benefits given for virtual communities was social support and strong ties. These are both critical features in drug rehabilitation and other therapies. "Virtual communities facilitate frequent, reciprocal, and often supportive contact and the placelessness of CSSN interactions facilitate long-term contact without the loss of relationships that often accompany residential mobility" [20]. One therapist who provides one-on-one counseling through a bulletin board reported that, while she has less social presence and cues than through in-person sessions, the greater anonymity of the virtual environment allows her clients to reveal themselves more. Members of virtual communities report experiencing feelings of closeness and came to regard others in the virtual community as their closest friends, even though they seldom met in person.

The results of Ridings & Gefen's study examining the reasons why people join virtual communities have profound implications for virtual reality therapy [19]. While membership in conventional face-to-face type of communities has fallen rapidly over the last 25 years, there has been a tremendous sustained growth in virtual community membership. This suggests that virtual communities may be filling the social void in conventional communities, which in turn implicates that the multidimensional applications found in virtual therapies may be replacing the use of traditional therapies that do not offer such variety. Schroeder explains that the multidimensionality of a virtual environment will affect the number of users, its popularity and sociability [21].

The benefits of Virtual Reality Environments in behavioral health have clearly been established in several areas, including improved training, better access to services, and increased cost-effectiveness and accuracy in performing certain conventional procedures. All of the case studies outlined above describe experiments or prototypes for virtual behavioral services. The next section describes the USM team's current research to develop a Virtual Reality meeting space with suitable properties and capabilities to be used for regular large scale drug and alcohol aftercare as well as other behavioral interventions.

REQUIREMENTS FOR LARGE SCALE VIRTUAL MEETING SPACE

In order to develop the requirements for system architecture for large scale Virtual Reality meeting spaces an examination of the services to be delivered through the system is necessary. The following is a list of prototype services developed in Second Life [22].

1- Counseling Group Meeting: Virtual group therapy sessions are scheduled and guided by the clinicians. These sessions provide the aftercare patients to support and guide each other's recovery.

Figure 1: Counseling Group Meeting

2- Homework and Communication With Individual and Group: Therapists can use simple management tools to assign individual or group assignments. Patients have individual mail boxes to get and submit homework and to send supporting messages to each other.

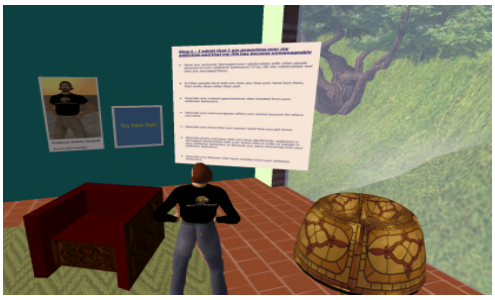

Figure 2: Homework and Communication With Individual and Group

3- Virtual Video and Audio Presentations: Therapists can present pre-recorded multimedia content to their patients in the virtual environment. These video/audio presentations can be played automatically to provide a library of useful/inspiring materials.

Figure 3: Virtual Video and Audio Presentation

4- Inspirational Vocational Arts and Crafts : Patients and therapists can create new 3 dimensional objects. These objects can be simply a visually appealing addition to the environment or can tell a personal story of recovery which other patients will find inspiring and beneficial.

Figure 4: Inspirational Vocational Arts and Crafts

5- Evaluations and Surveys: Standardized or customized assessments can be administered to patients automatically at regular intervals through the Virtual Environment. Statistics from these assessments are automatically collated for analysis

Figure 5: Evaluations and Surveys

6- Sale and Purchase of Real and Virtual Goods: Real world items such as books, videos, t-shirts, etc can be sold through the virtual environment. In addition, virtual art and craft objects can be sold or given away as reward for positive behavior.

Figure 6: Sale and Purchase of Real Virtual Goods

7- Remote Family Counseling : Family members of inpatient or recovering addicts can be provided limited access to attend family therapy workshops. These workshops help family members to understand the treatment process to better support the patient recovery.

Figure 7: Remote Family Counseling

8- Group Building Activities: The patients can engage in social activities to foster a strong sense of community. These group building activities range from sports to specially designed group exercises as well as informal gatherings.

Figure 8: Group Building Activities

9- One on One Sessions with Clinicians: Clinicians can schedule and conduct private one-on-one sessions in the environment to provide individualized therapy. This therapy can include whiteboard, videos, homework, assessments, etc.

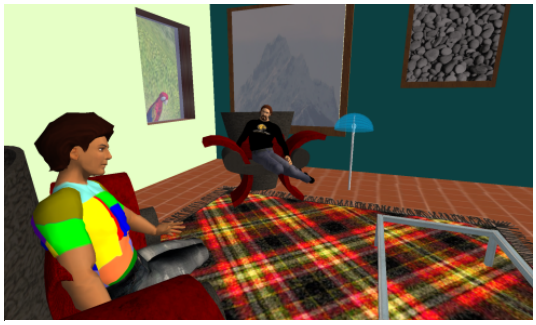

Figure 9: One on one Sessions with Clinicians

10- Spiritual Services: Addicts in recovery have a profound thirst for spiritual guidance. This need can be met in the environment through regular services and through faith based counseling provide by staff or volunteers.

Figure 10: Spiritual Services

The experimental prototypes in Second Life shown above garnered positive response from several behavioral service providers but Second Life, as a social media, clearly did not meet the need for security, backup,

administration, scalability, and integrated services. The next section describes the current focus of developing a locally hosted open source solution for hosting large scale virtual meetings for drug and alcohol aftercare.

PROPOSED IMPLEMENTATION APPROACH

The current implementation target is "OS-BEST" a blend of Opensim which is a project to emulate the features of Second Life, RealXtend which provides superior rendering and scripting capabilities in Python , MySql which provides the backend database for authentication and inventory, and various adapted the USM team has developed to support various meeting functions and grid administrative features[23][24]. OS-BEST provides security through SSH tunneling, local backups of the entire server, administrative server side features through a web- portal, and enhanced server-side functionality through python scripting. An overview of the OS-BEST architecture is shown in Figure 1 below.

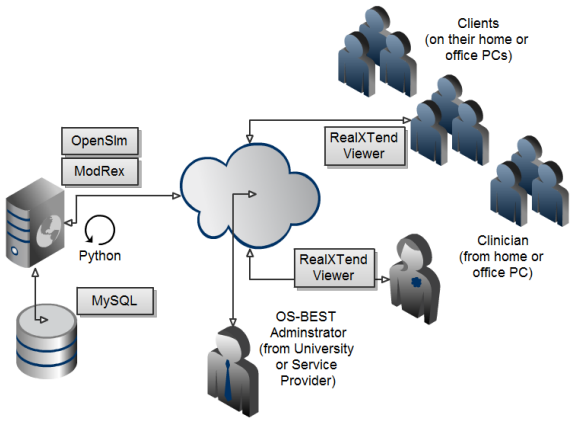

Figure 12. The OS-BEST virtual meeting architecture

One critical feature which has not been fully explored is scalability; the bottleneck in the basic architecture in Figure 1 is the network connectivity and performance of the central database. The load on central inventory, authentication and grid services grows with each simultaneous meeting eventually overwhelming the system. Three experimental modifications to the basic system are under consideration to help solve this problem as shown below.

Virtualized Virtual Reality Meeting Spaces: By using VMWare both virtual meeting and database servers can be spawned as needed [25]. Eventually hardware capacity will be reached and new server blades can be added to support more simultaneous meetings. The benefit of this solution is that it would provide a VR grid similar to Second Life but hosted locally and securely. A schematic of this solution is shown in Figure 13.

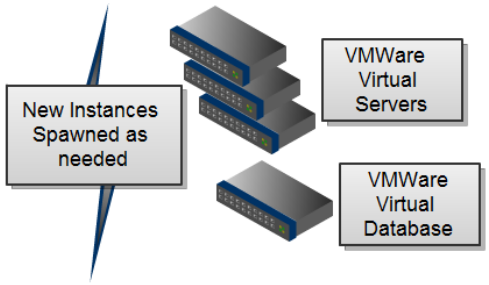

Figure 13: Virtualized Virtual Reality Services Solution

Decentralized Meeting Solution: Inventory (all the objects, scripts and avatars located in a meeting) is the heaviest load on the database and network. By decentralizing and having individual inventory for each meeting performance

should be improved. To maintain a minimal administrative capacity centralized authentication is maintained to allow global accounts. The benefit is easy scalability to the limits of the centralized authentication server which would be hundreds of logins per minute. The primary problem with this solution is that is foregoes "grid mode" in which larger territories can be composed of multiple servers working together.

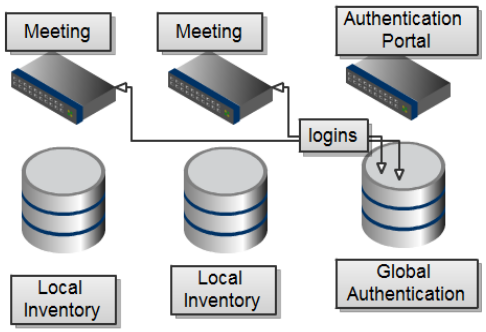

Figure 14: Decentralized Virtual Reality Services Solution

High Performance Solution: The USM data center architecture consists of rack mounted servers and a central storage area network (SAN) which provides speedy data access for the individual servers which have no hard drives of their own. This architecture is interesting since the high bandwidth high performance local network in the data center may mitigate the effects of centralization.

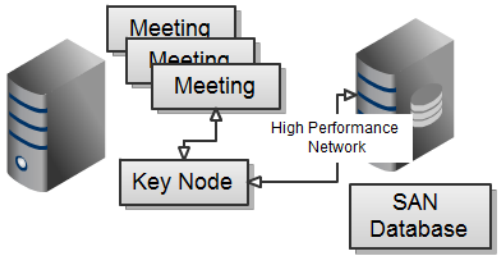

Figure 15: High Performance Virtual Reality Services

Experiments currently underway should determine the best solution which provides the best combination of performance, ease of administration, and stability for large scale virtual meetings.

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