



# JCR

Journal of  
CyberTherapy  
& Rehabilitation

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## In This Issue

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The Effect of Activities in Virtual Worlds as a Communication Environment to Understand Each Other

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## EDITORIAL

Welcome, readers and researchers, to the Spring 2010 issue of the Journal of CyberTherapy & Rehabilitation (JCR). Our peer-reviewed quarterly academic journal continues to explore and support the uses of advanced technologies for therapy, training, education, prevention and rehabilitation. JCR is unique in the fact that it focuses on the rapidly expanding worldwide trend of applying ground-breaking technology towards the field of healthcare, with an emphasis on the fields of psychiatry, psychology, physical medicine and rehabilitation, neurorehabilitation, oncology, obesity, eating disorders and autism.

With a growing international base of readers and supporters driven by a similar goal of advancing the use of technology in the healthcare sector, JCR has received positive attention from peers, international institutions and international conferences. To keep readers abreast of new developments, within this issue of JCR we present comprehensive articles submitted by preeminent scholars in the field, featuring such topics as combining physical activity with learning in an augmented reality setting, including the sense of olfaction more commonly in VR, and how communication is used in virtual worlds like Second Life.

In the first article Voorhees et al. study the relationship between attitude and adherence to treatment in adolescents with sub-threshold depression in order to improve public health strategies to prevent depressive disorders.

Next, Baus and Bouchard address the sense of olfaction and ways in which it can further and enrich VR any advocate the growth of the field while discussing possible applications in virtual environments.

In an attempt to merge learning and physical activity in the classroom, Hsiao next looks at using augmented reality and VR applications to provide more effective teaching methods and increase retention, while providing much-needed exercise to the younger population at the same time.

In the fourth article, Alquda et al. use Virtual Humans to look at how race and sex can affect how people inter-

pret others' pain, pain coping skills, related mood, and other factors.

Lastly, Park discusses the use of Second Life as an example of how activities in virtual worlds might be used as a communication environment to better understand each other, with an emphasis in this study on gender.

As well as continuing to provide our readers with the latest studies presented in an informative and engaging medium, we will be offering one Continuing Education quiz per issue as a further added service to our subscribers and others interested in supporting their education. For more information, see page 95.

I would like to sincerely thank the contributing authors for their inspiring work and dedication to this field of research. I also want to thank JCR's Associate Editors – Professor Botella, Professor Bouchard, Professor Gamberini and Professor Riva for their leadership and hard work, as well as or internationally renowned Editorial Board for their contributions. I would also like to take this opportunity to welcome new Board members – Linda A. Jackson of Michigan State University, Julian Dooley of Edith Cowan University, Wijnand IJsselsteijn from the Eindhoven University of Technology, Joshua Fogel from the University of New York, and XiaoXiang Zheng of Zhejiang University – whose diverse background and placement around the globe will bring added richness to our board. We encourage readers and subscribers to contact us with ideas and we welcome submissions. Your input continues to enrich our publication.

With the start of a new year, new possibilities abound and we will continue to promote the growth of the diverse field of advanced technologies for healthcare in Europe and worldwide. We are happy to count you as a part of this movement and thank you for your continued support.

Brenda K. Wiederhold, Ph.D., MBA, BCIA  
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## ADOLESCENT INTERNET DEPRESSION PREVENTION: PREFERENCES FOR INTERVENTION AND PREDICTORS OF INTENTIONS AND ADHERENCE

Monika Marko<sup>1</sup>, Joshua Fogel<sup>2</sup>, Elton Mykerezzi<sup>3</sup>, and Benjamin W. Van Voorhees<sup>1,4,5</sup>

Adolescents in primary care with sub-threshold depression (not reaching criteria for disorder) symptoms may be candidates for early intervention to prevent the onset of major depressive disorder. However, we know little about their attitudes toward such interventions or what may predict motivation or adherence for preventive interventions. We also describe preferences for different types of interventions and conduct exploratory analyses to identify predictors of motivation to prevent depression and subsequent adherence to an Internet-based intervention. Adolescents with sub-threshold depressed mood favored novel behavioral treatment approaches, such as Internet-based models for depression prevention. Adolescent beliefs about the intervention and perceived social norms predicted intention to participate in depression prevention. The most important significant predictors of adherence were beliefs about the intervention. Careful attention to the specific beliefs and attitudes of users toward intervention should be incorporated into intervention design as well as evolving public health strategies to prevent depressive disorders.

*Keywords:* Depressive Disorder, Adolescents, Attitudes, Intervention, Internet

### INTRODUCTION

Twenty-eight percent of adolescents in the United States report their current mood as depressed, while only 2-5% meet the symptom threshold for major depressive disorder at any given time (Kessler & Walters, 1998; Rushton, Forcier, & Schectman, 2002). The great majority have sub-threshold depression symptoms, which do not currently meet criteria for major depression but often will progress to major depressive disorder (Andrews, 1994). By the age of 24, one-quarter of adolescents in the U.S. will develop a depressive disorder, with a substantial adverse impact on the individual and society and with costs in excess of 100 billion dollars per year (Cicchetti & Toth, 1998; Kessler & Walters, 1998; Weissman et al., 1999). However, even sub-threshold depressive symptoms at the levels of minor depression (two symptoms

for greater than one week) are associated with considerable cost and impairment of social and academic functions (Asarnow et al., 2005). Early or preventive interventions targeting individuals with sub-threshold symptoms (20% of primary care attendees) (B. W. Van Voorhees et al., 2005, 2006) have been recommended to reduce the burden of depressive disorders (Garber, 2006; B. W. Van Voorhees et al., 2009). Unfortunately, some individuals with mild depressive symptom levels, who are the primary targets of indicated prevention strategies, demonstrate negative attitudes and beliefs toward depression, which make them reluctant to consider an intervention (Druss, Hoff, & Rosenheck, 2000; Fortney, Rost, & Zhang, 1998; Jaycox et al., 2006; Leaf, Bruce, Tischler, & Holzer, 1987; Lin & Parikh, 1999; Sihvola et al., 2006).

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## THE SENSE OF OLFACTION: ITS CHARACTERISTICS AND ITS POSSIBLE APPLICATIONS IN VIRTUAL ENVIRONMENTS

Oliver Baus<sup>1,3</sup> and Stéphane Bouchard<sup>1,2,3</sup>

Virtual environments (VE) aim to reproduce life-like experiences, but despite indications that the olfactory sense plays a significant role in everyday life, the integration of olfactory stimuli in VEs is rare. The aim of this paper is to review the literature on olfaction and its potential applications in Virtual Reality (VR). Indications supporting the integration of odorants in VR include the privileged connections between the olfactory system and the brain regions involved in the processing of virtual stimuli used in clinical applications, as well as the interaction between odors, the other senses, and various psychological processes. Presently, smells are mostly integrated in VR applications for post-traumatic stress disorder and drug addiction, but further uses of odorants in VEs could include pain distraction, various training scenarios, such as emergency response and relaxation, and investigations of multi-sensory integration.

*Keywords:* Olfaction, Smell, Odor, Virtual Environment, Virtual Reality

“Of all the ways of getting sensory information to the brain, the olfactory system is the most ancient and perhaps the least understood” (Ratey, 2001, p. 62). The sense of smell is believed to have been a major catalyst in the evolution of the primitive brain, and it is suspected that the entire limbic system actually evolved from its original function of interpreting odorants and emitting pheromones (Ratey, 2001). Its significance for animals is readily recognized (Ache & Young, 2005). It plays a role in their search for food, navigation and orientation, reproductive behavior, and social organization (Albrecht & Wiesmann, 2006). Although many of these aspects also apply to humans (Albrecht & Wiesmann, 2006), many tend to consider olfaction of minor importance (Shepherd, 2006).

The relatively minor interest in the olfactory sense is also reflected in the field of virtual reality (VR), and various factors may contribute to the underutilization of olfactory stimuli in virtual environments (VE). According to Sad-

owski (1999), these factors include the perception that incorporating olfaction stimuli would neither enhance the virtual experience, nor be useful in concrete applications. Most importantly, the primary obstacle to a generalized integration of olfactory stimuli in VEs may be the difficulty in dispensing and controlling the odorants in the environment (Sadowski, 1999).

To date, relaxation techniques (Kawai & Noro, 1996), posttraumatic stress disorder (PTSD) treatment (Gerardi, Rothbaum, Ressler, Heekin, & Rizzo, 2008), and drug addiction research (Bordnick et al., 2008; Ryan, Kreiner, Chapman, & Stark-Wroblewski, 2009) belong to the rare applications integrating olfactory cues in clinically pertinent VR scenarios. More specifically, Kawai and Noro (1996) coordinated olfactory cues with the content of stereoscopic 3-D images, for example, using the fragrance of a forest with 3-D images of a green forest, in order to experiment with the relaxation effects of such combina-

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## CAN WE COMBINE LEARNING WITH AUGMENTED REALITY PHYSICAL ACTIVITY?

Kuei-Fang Hsiao<sup>1</sup>

Augmented Reality (AR) technology is being applied in an increasingly large range of applications for improved educational efficiency. In this study, a new approach to the implementation of AR in the educational environment was taken by creating a Chemistry Augmented Reality Learning System (CARLS), using the existing teaching curriculum, together with physical activity. This system combined learning with three types of physical activity— aerobic fitness, muscle strength and flexibility fitness. A large sample of students (n=673) from five high schools was divided into four groups. The first three groups used the CARLS learning system while a control group used a keyboard and a mouse to operate the computer. We explored changes in academic achievement, as well as attitudes towards learning about science, resulting from the implementation of CARLS. This study reveals that the students using all three types of physical activity together with CARLS result in significantly higher academic performance compared to the traditional Keyboard-Mouse CAI (KMCAI). The improvement is most evident for the non-memorized knowledge component of science. Moreover, the students in the AR group with "muscle strength" physical activity had a significantly more positive learning attitude change toward science than those in the KMCAI group. An additional benefit of our approach is that students also obtained better physical fitness while learning.

*Keywords:* Augmented Reality, Physical Activity, Information Technology, Academic Achievement, Learning Attitude

### INTRODUCTION

Numerous researchers have reported the importance of physical activity not only for physical and mental health, but such studies have also indicated a potential positive impact on intelligence (Chomitz et al., 2009; Hillman, Erickson, & Kramer, 2008), and cognitive development (Neubauer, 2008; Sibley & Etnier, 2003). Further, physical activity was even proven to positively correlate to students' academic performance (Hillman, Erickson, & Kramer, 2008; Castelli et al., 2007; Coe et al., 2006). Recent research done on fourth-eighth grade students revealed that both mathematics and English test scores increased as the passed number of fitness tests increased (Chomitz et al., 2009). Other research conducted on third and fifth grade students (Castelli et al., 2007), found that "aerobic fitness" was positively associated with total academic achievement, including reading and mathematics.

Moreover, students' body mass index (BMI) was negatively associated with their total academic achievement. Therefore, Chomitz et al. pointed out that "promoting fitness by increasing opportunities for physical activity during Physical Education (PE), recess, and out of school time may support academic achievement" (Chomitz et al., 2009).

While the importance placed on standardized testing is increasing, many schools in the United States have tried to diminish or even eliminate PE programs, although no empirical evidence suggests that this elimination could result in higher academic performance (Hillman, Erickson, & Kramer, 2008). A similar situation is also apparent in Taiwan. Contrary to the "Health Related Physical Fitness" policies of the Ministry of Education in Taiwan (Ministry of Education, 2007a, 2007b), many schools have diminished

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## SEX AND RACE DIFFERENCES IN RATING OTHERS' PAIN, PAIN-RELATED NEGATIVE MOOD, PAIN COPING, AND RECOMMENDING MEDICAL HELP

Ashraf F. Alqudah<sup>1</sup>, Adam T. Hirsh<sup>2</sup>, Lauren A. Stutts<sup>3</sup>, Cindy D. Scipio<sup>3</sup>, and Michael E. Robinson<sup>3</sup>

This study examined the influence of Virtual Humans' (VH) sex and race on participants' ratings of pain intensity, pain unpleasantness, pain-related negative mood, pain coping, and recommendations for medical help. Seventy-five undergraduates viewed a series of VHS and provided computerized visual analog scale (VAS) ratings for the five domains listed above. Mixed model ANOVA analyses showed that participants of both sexes and races viewed female VHS as experiencing greater pain intensity, greater pain unpleasantness, a greater number of pain-related negative moods, poorer coping skills, and a greater need to seek medical help for their pain. Participants of both races rated Caucasian VHS as experiencing more negative moods and poorer coping skills do deal with their pain. The novel computerized VH technology used herein allowed for the standardization of pain expression across sexes and races of VH stimuli, thus allowing us to remove the influence of biases when creating the study stimuli. This is a notable advantage over other research methodologies in this line of inquiry. Several future research and education applications of this VH technology are discussed.

*Keywords:* Pain Assessment, Virtual Technology, Mood, Coping, Medical Help

### INTRODUCTION

Empirical investigations support the presence of sex differences in pain (Dao & LeResche, 2000; Ellemeier & Westphal, 1995; Frot, Feine, & Bushnell, 2004; Hawthorn & Redmond, 2000; Robinson, Riley, Myers, Papas, Wise, Waxenberg et al., 2001; Robinson & Wise, 2003; Robinson & Wise, 2004; Unruh, 1996; Vallerand & Polomano, 2000). Some studies have shown that females perceive and express higher levels of pain than males in clinical settings (Hawthorn & Redmond, 2000). Sex-related differences in pain perception have also been found in experimental pain settings (Frot, et al., 2004). These sex differences extend to the observation of pain in others, with one study finding that par-

ticipants rated female subjects as experiencing greater pain intensity in an experimental pain task compared to males (Robinson & Wise, 2004).

Sex-specific relationships between pain and negative affect have been reported in both community and clinical samples (Riley, Robinson, Wade, Myers, & Price, 2001). In the National Health and Nutrition Examination Survey, pain and depression were more prevalent in females than in males (Magni, Caldieron, Rigatti-Luchini, & Merksey, 1990). In clinical pain samples, the prevalence of depression and anxiety is typically higher for females (Unruh, 1996). Although little is known about the differences between males and females in coping with pain, Unruh, Ritchie, & Merskey (1999)

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## THE EFFECT OF ACTIVITIES IN VIRTUAL WORLDS AS A COMMUNICATION ENVIRONMENT TO UNDERSTAND EACH OTHER

Hyungsung Park<sup>1</sup>

The purpose of this study is to explore the possibility of using virtual worlds such as Second Life as a tool to develop an understanding of male and female gender roles in the classroom and in social life. Specifically, virtual worlds offer possibilities for users to experience role playing with other people, of different ethnicities and gender roles, which may allow them to better recognize characteristics of male/female gender roles and give them a different perspective of men and women in the real world. Through these activities in Second Life, we found that users had positive attitudes about gender identification and developed an increase in respect towards other people. At the same time, also explored the benefits of using virtual worlds for educational applications.

*Keywords:* Virtual World, Communication, Learning Environment, Second Life, Role Playing

### INTRODUCTION

Our future society is an age of knowledge and information. In this new period, entrenched stereotypes and prejudices may yield to a more balanced sense of social values based on rationality and dignity. This will be a direct result of empowering the individual, without the distinction of sexual, ethnic, or class discrimination. Talented individuals who may otherwise be stifled will have a better chance to be realize their own potential and become socially recognized.

Jonassen et al. (1999) argues that technologies can be applications of human knowledge to solve real-world problems. Such technological tools can support human needs and expand the individual's functional capacities. This knowledge can be constructive, aid in informational resource management, and requires producing communication connectivity. In the same context, Second Life is a social virtual environment tool and new media for exploring communication environments may improve mutual understanding between men and women concerning gender roles. Virtual worlds continue to grow as a significant component of many children's and adults' leisure time. They are being used in education worldwide, and they

play an increasingly important part of our culture as a whole.

Different societies reflect cultural values that vary, alter and evolve with given social, political and environmental locations. Male and female gender roles, and the interaction between the two, have long been a key determinant of social-cultural values. In other words, expectations of male and female behavior are set according to gender differences and variance. However, such expectant interpretive analysis is within accordance to age modification variants. A gender role is set within a particular social, political, and environmental context shared between male and female subjects. However, such expectant interpretive analysis is within accordance to age modification variants. This is social science and humanity's framework for the desired analysis. Gender is the primary component of the gender system in human society, which refers to the set of arrangements by which a society transforms biological sexuality into products of human activity, and in which these transformed needs are satisfied (Reiter, 1975).

Thorne (1999) classified four kinds of meaning for gender playing. Of the gender playing used in this research, one

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