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Mobile and other applications for mental imagery to improve learning disabilities and mental health

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Abstract

Mental imagery is the mental ability for representing static or dynamic, mainly optical information in working memory. Mental imagery is involved in supporting mental operations as perception, strategic planning, concept formation, pattern recognition problem solving etc. and furthermore in dyslexia, dyscalculia and other learning disabilities. The usage of mobile and other applications to assess, intervene, and finally improve mental imagery abilities is under investigation in this article. Mental imagery via mobile tech apps can offer great opportunities to people who encounter many problems as far as concerned mental health and more specifically meliorate their mental state, brain activity, high spatial ability, development of their perception. In this paper we identified that advantage of technology through avatars, virtual reality and mobile devices. Mental imagery and mobile tech apps, are extremely beneficial in anxiety, stress disorders, depression, and people with brain injury or other disabilities.

Keywords: *Mental Imagery, Technology, Avatars, Virtual Reality, Mobile.*

1. Introduction

Mental imagery is the ability of the brain to create images, smells, sounds, emotions and vividly fantastic events, an experience similar created by other senses without the presence of an external stimulus [1]. Mental imagery is defined as the blend of all the senses that are designed to create or reformulate a picture or mental condition in the mind [2]. Mental imagery helps to reduce stress and increasing self-confidence [3]. Technology has a great impact in mental health [4], [5]. Also contributed substantially in our lives, our societies, and our sciences. This development works for the benefit of all people as it generates unprecedented data to further promote creativity, as well as new conditions for the goals people now set [6], [7]. Mental imagery via technology has an impact on many areas of health promotion and general in wellbeing [8].

Wilson et al (2008) in their research included 352 active-duty U.S. Soldiers. The goal of this research was to examine the cognition and attitude levels of the soldiers as far as concerned the access in medical care via technology. Participants completed the Soldier Technology Survey (STS). A large percentage of the soldiers' sample had access in internet (about 96% of them) and mentioned that they were positive to use technology for medical care. In addition, 33% reported their preference in using technology services for medical care and not a counselor face to face. In conclusion, the research showed that soldiers have the knowledge and the willing to accomplice medical care with technology services [9].

Simon et al (2004) in their Randomized Controlled Trial, gathered 600 primary patients who were starting a depression treatment. The intervention included at first a usual primary care, then telephone care management, 8 sessions cognitive-behavioral psychotherapy program by telephone and 3 telephones feedback to the treating doctor. Patients, after the intervention, mentioned to the questionnaires that they were very pleased from the addendum of technology (telephone psychotherapy). Simon and associates estimated that the telephone psychotherapy program in primary care patients who beginning depression treatment can be an effective way for a better outcome. In addition, patients who would not be able to come to the therapist for various reasons such as distance or the stigma of mental disorder, with the usage of technology they had the opportunity for medical treatment [10].

Richardson et al (2009) in their research according to the bibliography from 2003 marked off the following data. The usage of technology via Tele-mental health can be very useful to many people with many ways like email, telephone, virtual reality, internet and videoconferencing. Many researchers tried to combine technology with mental health and medical care in order to help patients that can receive psychotherapy or supportive counseling even though medication management via technology. The sectors that Richardson and associates found the usage of technology were mental health services for deaf people, cancer patients, cognitive-behavior therapy (CBT) for stress disorders in general and others case studies [11].

Kane et al (2008) selected 10 blind computer users in their study. The intervention contained two devices, (Apple iPhone and ASUS My Pal A730 Pocket PC) and before the usage of the devices, participants informed by an authorized person about the usage of each device and the integration of specific tasks. At first, every single participant had the opportunity to describe orally each task and then to fulfill three practice tasks. The tasks consisted from: placing a phone call, reading an e-mail message and finally playing a song. Results showed that the usage of technology (touch screen devices) in this study was very easy for blind users and they could get involved in the services that technology can provide [12].

Draffan and his associates (2009) coordinated 455 students from England with dyslexia to use specific software and hardware to evaluate the benefit of this free cost providing technology. That package of software and hardware consisted from "General-purpose hardware'', "Special-purpose hardware'', "General-purpose software'' and "Special-purpose software''. All participants used the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST version 2.0). The results showed that the majority of participants were very pleased and satisfied as far as concerned the efficacy of software and hardware technology [13].

2. Mobile and Mental Imagery

Mobile devices have a significant role in mental health and could be very beneficial as far as concerned the wellbeing and health promotion [14], [15], [16], [17], [18], [19], [20]. In this chapter we can observe how mental imagery and mobiles can cooperate and be helpful in our lives.

Stopczynski et al (2013) supported that mental imagery via brain computer interface systems can provide the ability to people with disabilities to express their feelings and their thoughts. So, they proposed the ''Smartphone Brain Scanner (SBS2)''. This application is available in mobile services. This program includes a set of three different images with specific directions, such as relax, right, left. Investigators support that for controlling the effectiveness of this implementation the subject should be preceded by neurofeedback training. For this reason, they conducted two interventions in neurofeedback that lasted one week. The results showed that the ability to control the brain activity is very particular and unique and needs special and specific strategies. Finally, they concluded that the ability of the user to have direct contact with this audio-visual material, enables the user to control his/her brain activity [21].

Gavilan et al (2014) in their research investigated how mental imagery affects mobile advertising and they supported that the influence of mental imagery in advertising was very strong. The experiment included sms versus mms, informational versus transformational ads and three dimensions of mental imagery: vividness, quantity and elaboration. Finally, the researchers indicated that the improvement of confidence and trust is achieved through the promotion of mobile advertising and mental imagery [22].

Holmes et al (2011) examined the effect of mental imagery via mobile (Short Message Service). Mental imagery and short message service (sms), could affect positively the mood in bipolar disorder. They gathered 23 bipolar patients (with a diagnosis of DSM-IV) and a control group (healthy volunteers). For six months they used a mobile phone messaging system and the results showed that the influence of mental imagery via mobile device was significantly improved the mental state of the participants and reduced depression and anxiety levels [23].

3. Virtual Reality and Mental Imaging

Virtual reality may be a beneficial method of treatment for anxiety disorders [24]. Further investigations have shown that disorders like flight fear, social phobia, panic disorder and PTSD can be improved with virtual reality [25], [26], [27], [28], [29]. Also, in the last decade VRET is less costly and very easy in use [30], [31]. Morganti et al., (2003) in their research protocol supported that in some circumstances, virtual education was as beneficial as vivo education in people with learning disabilities. The opportunity to use technology and mental imaging combined, promotes also the potential of I-learning. The suggestion of mental imaging through virtual reality (VR) can be an effective and low-cost intervention which can help in retrieval of patients with brain injury [32].

Mintz and Litvak in Israel, presented a 3-D model of the solar system. Their program aimed in astronomy teaching. Students could control the outcome of the scene by putting their reflections in their own mental experience. This flexibility could help them to understand the information of the program. There are 4 modes of observation which the user can choose: "The Free-Mode'', "Sun-in-Site view'', "Planetary view'', and "Geocentric view''. Teachers can guide students to explore among these four modes and make their own conclusions. The 3-D model allowed a great learning experience, provided the learner the ability to understand the connection between distance, motion and time. Also expedited the mental imaging of three-dimensional space [33].

Rothbaum et al (1996) in their case study, tested a 42 years woman in USA, who had fear of flying. Virtual reality exposure (35-45 min creating real environmental conditions) and anxiety management techniques (thought-stopping, cognitive restructuring, breathing relaxation), helped her to manage her phobia. The subject was tested in a virtual airplane using anxiety management techniques

(AMT) and virtual reality (VR). Woman had the privilege to act with her own rhythm in the procedure. VR exposure has been proposed as the preferred option instead of vivo exposure. The results showed that the procedure was successful and the woman managed to reduce anxiety about flying. Finally, the woman admitted that the phobia was eliminated after six sessions of VR treatment [34].

Trindade et al (2002) estimated that 3-D virtual environments could help students with high spatial ability to develop their perception. The program concerns Physics and Chemistry at the final year of high school and first year of university. The 20 participants got involved in a program called ''Virtual Water''. The students completed the PARC test to check their spatial ability before the final simulation. PARC test consisted of specific questions that aimed in understanding of the virtual exploration which would follow. SPSS 10 windows was used for the statistical analysis. The results indicated that 3-D virtual environments were very helpful for students and developed the conceptual understandings [35].

Hoffman et al., (2004), tested a 40 years old man who had experienced burn and was hospitalized in a medical center. The day before the intervention specific drugs were administered to the patient (Oxycodone, Hydromorphone, Morphone). The intervention required from the patient to wear a photonic, nonelectrical, water-friendly VR helmet which was made by the research group and use it in the hydro tank. The patient could explore with a joystick the virtual environment. Researchers estimated that virtual reality (VR) could be used as an influential psychological pain-control technique. VR may allow clinicians to cure and recover more incidents and cases of phobias. Also, patients with phobias find the idea of VR treatment less repellent than vivo treatment. Furthermore, VR exposure therapy has shown its effectiveness in treating fear of heights, fear of spiders, fear of flying, claustrophobia, eating disorders, and posttraumatic stress disorder [36].

Parsons & Rizzo (2008), from Institute for Creative Technologies, University of Southern California, in their meta-analysis managed to estimate the importance of VRET (virtual reality exposure therapy) in anxiety and specific disorders. Some of the malfunctions that reported were panic disorder, post-traumatic stress, acrophobia, fear of driving, claustrophobia, agoraphobia, aviophobia and arachnophobia. After internet research, 21 studies that included a number of 300 people total, concluded that virtual reality treatment was effective. The data bases they included were MedLine (1990–2006), PsycLIT (1990–2006), EMBASE (1990–2006), Cochrane Library (1990–2006), and ISI Web of Science electronic databases (1990–2006). Thus, VRET appears effective for psychotherapeutic standpoint and finally VRET can minimize anxiety and phobia symptoms according to the literature [37].

Riva et al., (2007), in their study investigated how virtual reality can create emotions in conditions like stress, relax and neutral. The sample was sixty-one undergraduate students of Psychology from the Catholic University of Milan. The participants were all mentally healthy and they wanted to participate voluntarily. Students answered in six self-report questionnaires: the Beck Depression Inventory (BDI), Visual Analogue Scale (VAS), Positive and Negative Affect Schedule (PANAS), State Trait Anxiety Inventory (STAI), UCL Presence Questionnaire, Independent Television Company Sense of Presence Inventory (ITC-SOPI). Researchers used (ANOVA) and SPSS 13 for their statistical analysis. Each participant sat in a swivel chair in front of an authorized computer and completed the procedure of the intervention. The results showed that VR is affective in any emotional condition (anxiety and relaxation). Also, the level of presence was significantly higher in the anxious and in the relaxing parks. In control condition they had not emotional induction [38].

3. Avatars and Mental Imagery

Avatars and other high-tech apps can assist in the training of medical students (such as nursing students) and the implementation of virtual reality technologies will be able to provide, communication and assessment abilities with simulated patients [39,40]. They can also develop better their teaching strategies [41]. These interventions can help to treatment of diseases and general mental illnesses that are believed to be the second leading cause of disability and premature mortality in the developed world according to surveys [42,43].

Thirioux et al (2010) recruited nine healthy individuals right handed and without mental disorders. They were placed in front of a personal computer at a distance of 80 cm. The screen of computer was set exactly at the height of the eyes of each participant. In the intervention the AnyFlo system was applied which created virtual avatars according the norms of physical movements of the body. Individuals watched six movies with E-Prime software, and each one was represented by a virtual avatar in the virtual environment. For the better perception of each participant, they placed them on a wooden board. Individuals kept their hands to a metal bar. That bar had two buttons one in the left and one in the right side. The results showed that the self-location in a specific place and time (of each individual), using an avatar and also mental imagery process, was accomplished in that intervention [44].

Cohen et al (2014) utilize a brain–computer interface (BCI) system and a (fmri) functional magnetic resonance imaging using also a virtual reality feedback. The goal was that participants had to use the BCI system in virtual

environment. The process of the experiment consisted of three parts. In all three conditions an avatar represented the participant who had specific instructions to follow in order to complete the experiment. The participants were tested under two conditions: mental imagery (MI) and motor movement (MM). So, each participant could see an avatar in the screen and under the instructions of the researchers, the subject is asked to do specific movements using MI or MM. Finally results showed that participants can use specific procedures through mental imagery or motor movement with the accession of an avatar in a virtual environment [45].

Amorim et al (2000) in their research conducted an experiment divided in three phases. They used a virtual environment with a personal computer for each participant. In the screen there were also different avatars that represented every participant who used a specific personal computer. Then, they asked from the participants to visualize and memorize the avatars features that were in the screen. Then participants were asked, to close their eyes and imagine each time the disappeared avatar and when that goal was achieved, they were proceeded to the next level. Researcher's purpose was to show how each participant could imagine that he/she was himself/herself the avatar through mental imagery. The goal was for the participants to improve their cognitive elaboration of spatial knowledge. The results were measured with ANOVA and showed that the contribution of mental imagery affected the recognition process [46].

Because stroke is one of the main factors causing disability I Badia et al (2012) coordinated 9 healthy participants. Researchers used brain-computer interface (BCI) a virtual reality (VR) system (with avatars) and mental imagery. They placed each participant in a desktop computer. Each one of the participants could control a virtual avatar through mental imagery. The intervention divided in four steps: first step was the Passive observation of the movements of the avatar (the control group), secondly participants observed and imitated the avatar, then the participant imagined and imitated mentally the avatar's movements and finally each participant imitated mentally himself/herself the avatar's movements. The results showed that users/participants could control a virtual avatar through mental imagery in a virtual environment with a brain-computer interface (BCI) [47].

4. Conclusions

Mental imagery via technology have been used in many areas and population groups to reduce anxiety disorders, eating disorders, post-traumatic stress, panic disorder, depression, phobias like acrophobia, aviophobia, claustrophobia People with disabilities had the opportunity (with mental imagery via technology) to express their feelings and their thoughts. Mental imagery via technology can also improve learning disabilities, spatial ability, memory, perception, critical thinking, confidence and trust.

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