Healing Phobias using Augmented Reality

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Abstract--- Technology is constantly changing and becoming more advanced. Looking into the future, technology will evolve into something truly unbelievable. Use of technology has been very serendipitous in the field of psychology. In the treatment of psychological disorders, augmented reality has given precursory manifestation to be a useful tool due to its adaptability to the patient needs and therapeutic intent and interactivity. Another pertinent aspect is the quality of the user's acquaintance in the augmented reality system determined from emotional engagement and sense of presence. This experience could increase the Augmented Reality ecological validity in the treatment of phobias. This paper elucidates the use of Augmented Reality in the evaluation and treatment of psychological disorders, focusing on phobias: Claustrophobia- fear of having no escape, Acrophobia- fear of heights and phobia of small insects (Katsaridaphobia-cockroaches and Arachnophobia-spiders) with the help of this technology.

Keywords--- Augmented Reality, AR, Phobias, Claustrophobia, Acrophobia, Katsaridaphobia, Arachnophobia, HMD, FAS, SUDS

I. INTRODUCTION

Augmented reality (AR) is a new technology in which various virtual elements are incorporated or assimilated into the user's acumen of the real world. The most significant aspect of AR is that the virtual elements add relevant and helpful information to the real scene. In 1966, *Professor Ivan Sutherland* of Electrical Engineering at Harvard University envisioned the first model of one of the most imperative devices used in both AR and VR today the head-mounted display or HMD. Being primitive in the scale of computer technology, its graphical dexterity was adequately curbed and provided just transparent wireframe models of generated environments. Nonetheless, it was the first step in making AR a usable possibility.

Augmented reality has been around for years but was not coined until Professor Tom Caudell called it "Augmented Reality" in the year 1990. Starting from these premises, the aim of this paper is to review the recent studies on the use of AR in the evaluation and treatment of psychological disorders, focusing on current uses of AR in psychology and the various factors that make a new technique useful for the treatment of psychological disorders expanding the possible fields of use of Augmented Reality. Augmented Reality has proved to be effective in the treatment of phobias.

i) Fight your Fear of Cockroaches and Spiders with AR

The first analyzed study that used an AR system to assess and treat specific phobias was conducted by Juan et al. (2004).

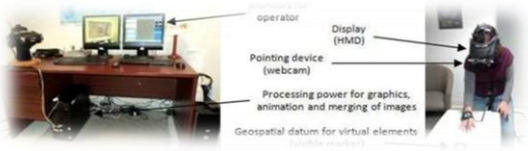

Fig. 1: HMD-AR System

Juan et al. (2005), for the first time, evaluated the effectiveness of an AR system not in one single case but in a sample of nine patients with Katsaridaphobia and Arachnophobia. The AR exposure involved the gradual appearance of one or more spiders/cockroaches and the possibility for the patients to approach them with hands, to look in boxes in order to simulate when you are searching for a small animal in your house, and to beat and throw

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away them. A single individual with Katsaridaphobia was assessed using an HMD-AR system. The AR device used was an HMD system connected with a camera and a PC. The camera, placed on the HMD, recognized the marker through the movement of the subject's head, projecting the virtual cockroaches in front of the subject. The AR single exposure session consisted progressively in seeing, touching, and finally killing one or more virtual cockroaches. The therapist chose in any moment how many cockroaches had to appear on the scene, their size, and if they had to move or not. During the treatment, the augmented cockroaches were able to arouse anxiety in patient that decreased after an hour of exposure.

With respect to psychological measures, anxiety, fear, and avoidance behaviors were assessed using Fear and Avoidance Scales (FAS) and Subjective Units of Discomfort Scale (SUDS). In particular, after exposure, the patient was able to approach, interact, and kill real cockroaches. The data showed a decrease in anxiety score after exposure and clinical improvements regarding patient's phobia.

ii) Acrophobia

Acrophobia is an intense fear of heights and consequent avoidance of situations related to heights like terrace, games related to heights, airplanes, helicopters, etc.

In 2006, Juan et al. advanced the use of immersive photography in an AR system to treat acrophobia. For evaluating this system, forty-one healthy volunteers walked around at the top of a staircase in a real environment and using the immersive photography environment. After their experience, the participants filled out the SUS questionnaire to assess their subjective sense of presence. The data showed that the AR condition induced a sense of presence equal to the one experienced by the subjects in the real world.

Fig. 2: Acrophobia Treatment with the Help of HMD-AR

Another study, conducted by Juan and Prez (2010), compared an acrophobic virtual reality (VR) and AR environment assessing differences in the sense of presence and anxiety elicited by the two systems. Twenty healthy participants underwent both experimental conditions and after using each system (AR or VR), they completed an adapted SUS questionnaire. Moreover, at six different moments during the two experiences, the participants were also asked to rate their anxiety level from 0 (no anxiety) to 10 (very high anxiety). Regarding the sense of presence, the results showed no differences between the two systems. Moreover, data revealed that anxiety levels decrease after the exposure.

Among these studies, seven of them also considered fear and avoidance behaviors showing that AR was able to reduce significantly fear and avoidance behaviors after the stimuli exposure. Finally, as regards the quality of user's experience, five studies measured presence and three of them evaluated reality judgment showing a high sense of presence in the AR system.

iii) Claustrophobia

The word claustrophobia comes from the Latin word claustrum which means "a shut in place" and Greek phobos meaning "fear". Claustrophobia is an anxiety disorder in which the sufferer has an irrational fear of having no escape or being closed-in.

There are numerous causes of claustrophobia including excessively small tonsils, emotional responses formed by classical conditioning or genetic predisposition. There are two crucial symptoms of claustrophobia: fear of enclosed spaces and fear of constriction.

The primary purpose of the present study was to carry out a controlled, multiple-baseline design across 4 participants to determine the effectiveness of VR/AR exposure in the treatment of claustrophobic fear. We hypothesized that the virtual claustrophobic context would activate a high degree of anxiety in the patients, and that they would be able to overcome their claustrophobic fear through virtual/augmented exposure. The aforementioned two versions of the system (monitor, HMD) provided two conditions to be investigated. For ethical reasons, only non-clinical subjects were targeted.

The entire system was placed on top of a desk. The participants experienced the system in a normal office environment, including seating position and height. The room light was dimmed to improve the immersion effect.

After the introduction into the experiment and assessing the participant's tendency towards clinical claustrophobia users were given the opportunity to make themselves briefly familiar with the use of the system. The order of the conditions has been randomized. Each participant experienced both conditions in one session. Then, the subjects got the task to proceed through the four rooms while exploring the environment to an extent to be able to report on as much detail as they can afterwards. Reaching the fourth and final room ends the task and the subjects were asked to fill in the questionnaires (SUDS, FAS etc)

The same procedure was repeated a week later with the same participants to control the so-called "wow effect" and learning and training effects. With this newly found technology, many advantages and disadvantages can develop.

Advantages of Augmented Reality

- Anyone can use it.
- When used in the medical field to train, it can save lives.
- Can be used in exposing military personnel to real live situations without exposing them to real life danger.
- Knowledge, information increments are possible.
- Experiences are shared between people in real time.
- Form of escapism.

The mobile user experience will be revolutionized by AR technology as did gesture and touch (multi-modal interaction) in mobile phones.

Mobile usability is improved by AR acting as the primary interface.

Disadvantages of Augmented Reality

- Spam and Security.
- Social and Real-Time vs. Solitary and Cached.
- User Experience: Socially, using AR may be inappropriate in some situations.
- Interoperability.
- Openness: Content layers can be developed by consumers for display.
- Content may obscure and/or narrow a user's interests or tastes. For example, people may want off-the-beaten-track places and not KFCs or McDonalds.
- Privacy control will become a big issue. Walking up to a stranger or a group of people might reveal status, Tweets, and information that may cause breaches of privacy.

Future of Augmented Reality

Technology is constantly changing and becoming more advanced. Looking into the future, technology will evolve into something truly unbelievable. We have already seen a glimpse of what this technology can provide through the development of Google Glass. This advance and unique technology is known as augmented reality.

Scientists continue to experiment with augmented reality, creating and researching new ways to reach consumers. Augmented reality has barely been "born" it is still developing and we have a lot to learn. It will change the way we see the world. It can be defined as the "interaction of superimposed graphics, audio and other sense

enhancements over a real-world environment that's displayed in real-time." It is a type of virtual reality that aims to duplicate the world's environment in a computer. Its goal is to create a system in which the user cannot tell the difference between the real world and the virtual augmentation of it. What does the future of augmented reality hold? It will bring a whole new experience! It is making its way into the marketing place by working with top brands and corporations.There is a variety of technology and applications emerging from augmented reality that will change the future. It is changing the way people see and learn from their surroundings. We can expect virtual fitting rooms where you can try on apparel live, 3D games, geo-location with real time displayed maps and huge advancement in the industrial, military, medical and education fields. People will not have to worry about being bored. Everyone will have endless entertainment anytime, anywhere! The tasks we perform in ordinary life will be brought to life and transform experiences and increase engagement.

II. CONCLUSION

The aim of this paper was to review the recent studies on the use of AR in the evaluation and treatment of psychological disorders, focusing on current uses of AR in psychology and the various factors that make a new technique useful for the treatment of psychological disorders, expanding the possible fields of use of AR.

In general, the presented studies show that the AR seems to be a promising and useful tool for intervention in the treatment of specific phobias. Nevertheless, the small sample of subjects examined and the lack of control group and randomized controlled studies necessitate more randomized controlled experiments for exploring the AR efficacy in the clinical treatments. Despite these limitations, AR is proving to be a new technique useful to patients to experiment with technologically different and severe situations, as the exposure to fear or phobic stimuli, in a safe environment under the control of the therapist. Indeed, an AR system extends interactivity for assessing and supervising patient's reactions in real time and adaptability for creating controlled exposure settings based on the patient's needs or therapeutic purposes. Furthermore, it is to be noted that AR allows subjects/patients to manipulate and control the virtual elements, interacting with virtual objects placed in the real world in real time.

As a consequence, the experience to amplify the physical world with virtual contents can improve the ecological validity of the "mixed reality" on environment, augmenting the sense of presence and engagement of the subject/patient. Indeed, studies of VR have shown that virtual stimuli are comparable to the real stimuli with regard to emotional responses. Finally a strong and deep sense of presence and engagement can, also, improve the adherence to treatment.

Overall, AR may represent a new challenge for the assessment and treatment of different kinds of psychological disorders, such as eating and anxiety disorders performing new studies based on systematic measures of psychological and neurophysiologic effects.

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