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Virtual Reality as a Tool for Relaxation in an Academic Environment

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Abstract: Stress among college students due to extensive academic activities gives rise to a lot of health issues. Consistent short breaks during long hours of such a hectic schedule are required for a student to remain focused and have higher productivity. While many studies have been conducted in the area of Virtual Reality (VR) for relaxation, this paper explores its effect on a young population in an academic environment. An experiment is designed and conducted to understand the effectiveness of VR to provide quick relaxation to a student. The experiment uses Russell's Core Affect Model and Electrodermal Activity (EDA) as measures to understand the change in emotions. A major shift is seen from unpleasant to pleasant emotions after the VR experience. The EDA graphs are analyzed and compared showing the various effects of VR on the users.

Keywords: Immersive design, human computer interaction, emotional engagement, relaxation, virtual reality

1 Introduction

Students experience stress-related issues and deal with them on a regular basis which causes a lack of focus. Small breaks are needed by the students from such an environment after which they can go back to their academic activities feeling relaxed, focused and with increased productivity. Virtual Reality (VR) has been suggested as an effective mood induction medium and used as a tool to reduce stress and promote relaxation in various groups of people [1]. This paper provides new perspectives in dealing with stress among students through VR. Trend research shows that the young population is open to trying new technologies. Primary research shows that students and young working professionals use their majority of break time looking at screens. The possibility of replacing this screen time with the VR experience exists. A VR experience can provide the much-needed change of space for a student who is working for long hours at a stretch and might need to get away from the academic environment for a few minutes. Thus, the results and analysis of this study can contribute to future research and discussions on the capabilities of VR in alleviating mental health concerns among students.

2 Methodology

This section presents the methodology employed to design and conduct the experiment to study the effectiveness of VR in an academic environment.

2.1 User survey

A survey was floated across the student community to understand their background, needs and choices. The survey was focused on understanding how students utilize their break time in college. This was followed by asking them about their past VR experiences if any. The survey received 149 responses, out of which 62.4% of people were aged between 18-25. The survey showed that the majoxrity of break time in college was used for either eating (66.4%) or on their digital devices (65.8%). A realistic space theme was chosen for the virtual experience by most people which was created for the experience.

2.2 Development of the virtual and physical space

A storyboard was created to show the space environment. Blender™ software was used to create the assets like the nebulae inspired by various images [2] and for composing the virtual space. An actual image of space was used to create the background of the virtual environment. Each frame was rendered and exported at a high resolution (4K) to make the experience seamless and realistic. The frames were combined using Adobe After Effects® and the frame rate was customized according to the Head Mounted Display (HMD) to create the video. Music interventions were used for stress reduction [3]. The initial 10 seconds of the video showed a dark screen so that the user would not be taken in the virtual environment suddenly but had time to get adjusted to it. The overall video was combined in Adobe Premiere Pro®. software as a single 360-degree (video link) output. The video was played on Vive Portal in the HTC Vive Pro™ HMD. A physical space was set up in the dark area to perform the experiment. A dark area was chosen to compliment the visuals in VR and also to cut off the user from the surrounding environment for a more immersive experience.

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2.3 Mapping users' emotions

The users' emotions before and after the experience are measured using two different ways. One is using Russell's Core Affect Model. The participants were asked to look at the model and state whatever they were feeling at that moment. They were allowed to choose multiple emotions [4]. The other is by measuring the EDA levels of the users. The participants wore the Empatica E4™ wristband which recorded their physiological data. The EDA graph is used to determine the changes in skin conductance throughout the experiment.

2.4 User journey

56 participants from the age 19-39 with an average age of 24.21 years from IIT Hyderabad volunteered for the study. A brief of the experiment was given and consent to participate in the research study was taken from all the participants. The participants entered the holding area where they wore the wristband and answered a few pre-test questions. The participant then walked into the experience room where they were mounted with the HMD. They were given around 2-3 minutes to get adjusted to the VR where they walked inside a virtual static environment. Once comfortable, they were asked to sit on the couch. The experience video of 3.5 minutes was played. After the completion of the video, the HMD was removed, and the participant walked out of the experience room into the holding area. A post-test survey was done, and the wristband was removed.

3 Results and Analysis

Out of 56 participants, data of 46 participants is shown and analyzed since the EDA data of 10 people was either incomplete or lost.

3.1 Result and observation of Russell's Core Affect Model

The participants were allowed to mark more than one emotion in Russell's Core Affect model. The first and the fourth quadrant show the emotions on the pleasant side whereas the second and the fourth quadrant show the emotions on the unpleasant side. The values on the y-axis show the number of times each emotion was selected by the participants. Each participant marked their emotions before and after the experience and the combined results of all the participants is shown in Figure 2. Many participants mentioned the reason for their excitement to be the upcoming experiment. The ratio of pleasant to unpleasant emotions, before the experience, is 2.95 and after the experience is 19.25. This shift from unpleasant to pleasant emotions, from 2.95 to 19.25, indicates that VR was able to induce positive emotions effectively in the users.

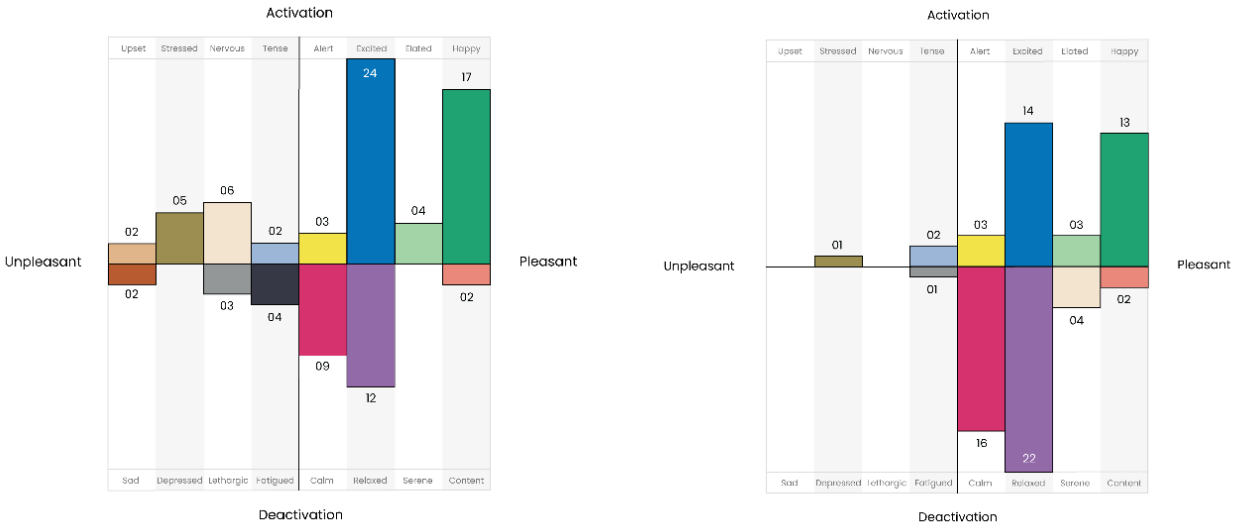

Figure 2: Russell's Core Affect model containing the pre-test result (left) and post-test result (right).

3.2 Result and observation of EDA data

EDA graphs of all the 46 participants are extracted. The first 50 data points are removed since that is the average amount of time taken by the device to reach a constant value and create a baseline for each participant. All the graphs are normalized and denoised for comparison. The graphs of all the participants are shown in Figure 2. The values on the x-axis show the data points throughout the experiment while the person is wearing the device. Since each user took a different amount of time to complete the experiment, this value varies for each participant giving distinct endpoints for every graph. The values on the y-axis show the normalized value of EDA which lies in the range of -1 to 1 where 0 is the starting point for every user. An increase in the

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final baseline for most of the participants can be seen as compared to the initial baseline showing an emotional arousal. The graphs of all the participants were segregated based on the similarity in their patterns and analyzed further.

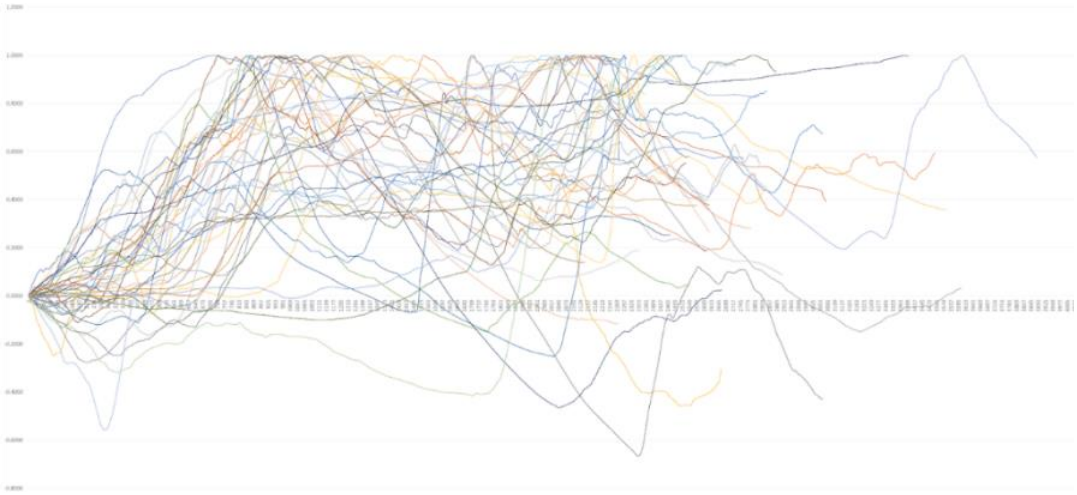

Figure 2: Normalized and denoised EDA graphs of 46 participants during the experiment

3.3 Post experience survey results

The users were asked to rate the virtual environment and the overall VR experience out of 10, 1 being bad and 10 being good. The virtual environment is given an average rating of 8.15 by the users whereas the overall VR experience is given an average rating of 8.59. Participants shared their discomforts and suggestions.

4 Conclusion and Future Work

In this work, we have designed and conducted an experiment to understand the effectiveness of VR to relax a student in an academic environment. An immersive VR environment was created based on the primary and secondary research and two methods were used to understand the changes in the users' emotions. The first method was to mark the emotions on Russell's Core Affect model by the participants which showed a substantial increase in the ratio of pleasant to unpleasant emotions from 2.95 before the experience to 19.25 after the experience. The second method was to normalize and denoise the EDA graphs of all the participants to analyze and compare their results. The baseline at the end of the experience is higher than the initial baseline for most participants indicating an emotional arousal. Some participants experienced discomfort which was reflected in their graphs. Correlations between the participants' emotions as stated by them and their EDA level could be seen in many cases and contrast could be seen in others because of various factors which were highlighted.
VR experience varies for each person due to the individual differences in adaptation to the VR content, ergonomics of the HMD, interactivity, personalization and the physical space. Constant feedback could be used to iterate the experience and experiment with various visuals, music, volume and physical space, creating an optimal experience for the users. A higher resolution video would make the experience more immersive without causing any distractions due to pixelation. Personalization and interactivity could be provided to the users giving them higher control and engagement. The effectiveness of VR is not just defined by the content in the virtual environment but also by the ergonomics of the headset and the physical space. Such measures will help to create a more powerful and effective experience.

Video link: https://youtu.be/B0lITLZb7Vk?list=TLGGmqRhADEQP2AwMzEwMjAyMg

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