Serenity: An AR Audio and Tactile Experience

Application of Technology for Stress Management in College Students

Emily Subr
The Ohio State University, Department of Design
subr.1@osu.edu

Shivam Patel
The Ohio State University, College of Engineering
patel.3063@osu.edu

Figure 1. Main Model Visualization in Autodesk Maya for Serenity, 2020

ABSTRACT

Through the capabilities of audio and tactile tools, we have proposed that AR applications, like *Serenity,* can be created to offer management of everyday stress more effectively and conveniently than typical mediums such as guided meditations or music. College students every day are facing the pressures of adapting to living independently, completing their education, working jobs, and handling the unexpected. With COVID-19, stress has been increasing as people are being forced to stay inside, which means a lack of communication with their peers and the outdoors. *Serenity* is a phone app developed to manage stress and promote the mental health of college students through an augmented extension of one's surroundings. Based on studies and products created on the healing capabilities of VR and AR, this experience challenges and explores the space in which AR can integrate into daily life. It also considers what tools are needed in AR, and shows success in implementing visual and audio uniqueness when considering immersion.

CCS CONCEPTS

• Applied Computing ~ Law, social and behavioral science Psychology

KEYWORDS

AR, Audio Immersion, Meditation, Stress, Binaural

1 Introduction

With COVID-19, people around the world have an additional layer of stress added onto their daily lives. College students, especially, are finding it increasingly difficult to balance this new way of life combined with the unpredictable, everyday challenges of their education [12]. As the world adapts to this new way of living due to the limiting factors of the pandemic, technology is becoming more important than ever. However, instead of technology as just a tool to complete work, how can we utilize it to benefit the mental health of students, which is an increasing concern with college students and the rise of suicide rates in universities [5]. Isolation and lack of communication with the outside environment can cause students to feel stress and anxiety especially with school. We believe with AR it is possible to bring the natural serenity of the outdoors into our enclosed environments. AR still has yet to be utilized in

many scenarios compared to VR, and we feel it has qualities that can be just as beneficial for mental health purposes. Our goal with this project is to provide students a user-friendly and accessible interface that creates a unique experience for quick stress and anxiety management. By creating an application that gives control to the user, they can ground themselves in a time that is uncertain and hard to control. Through things like meditation and audio exploration, we want to create an all inclusive strategy that factors in already used stress management resources and desired resources.

The primary question we are proposing is how can we properly visualize the meditative process through a form of nature in AR to create an effective user experience? The second question we are asking is can you develop a successful immersive environment outside VR in an AR world? In this paper, we are hypothesizing that with the use of AR, like *Serenity,* users can successfully immerse themselves with meditative visual and audio queues that can positively reduce stress levels more than they could with alternative methods, such as pure audio or meditation.

2 History of AR and Stress Relief

To understand where to go with AR, it was important to first start to understand its opposing and most often selected technology: virtual reality (VR). Because of its ability to easily immerse users, more studies are geared towards the potential healing properties of this application over AR. In terms of the environments created in VR for stress relief, many take place in the natural world. One study demonstrated the success of a forest atmosphere that utilizes image realism and aids to reduce stress and improve health [4]. While AR does not have the same spatial and immersive environments and scenarios, key components that can be drawn from the VR space include the natural world, breathing exercises, auditory simulation, and timed experiences [4, 13]. In order to figure out the best method to execute our hypothesis, we looked at applications created with AR for stress management. Our findings showed that many were utilizing breathing guidance done by 3D human avatars or guidance based on gathering biometric data [1, 8, 14]. During the course of market research, we also noticed that these factors also created limitations with AR stress management due to accessibility issues or user discomfort. While applications that use 3D virtual human guided programs do help to add a sense of personability to the situation, there are potential issues of the uncanny valley with many of the models demonstrated [9]. As a result, instead of developers creating a personal trust and inclination to utilize the application, it creates more problems with a lack of interest and discomfort for the users [9, 10]. In terms of biometric use with stress relief apps, this provides one of the most effective ways to track levels of stress and track progress of the application. Applications, like *Helium*, have in fact created a way for users to combat stress and found much success in treating veterans with post traumatic stress disorder (PTSD). It utilizes the heart rate to generate the augmented world and was seen to reduce symptoms in as little as four minutes [1]. However, the problem with this is that it requires users to have additional equipment and oftentimes means granting additional access to more sensitive and private information. This then leads us back to our research questions of how to properly visualize in AR and how to create immersion like VR. By considering the tactile and auditory properties, these implementations give an added layer of immersion that follows VR and goes against the grain of its AR app counterparts.

3 Implementing *Serenity*

3.1 Application and Hardware

Serenity is conceived and structured from information gathered from studies related to AR and stress, principles for effective user interactions in AR, and college student personas to create the most impactful experience. While our target audience is college students, we began by narrowing the study to The Ohio State University campus. This allowed up to target a certain technology which is easily accessible to students in this scenario. As a result, the project is done with iOS because of the mass use of iPad and iPhone users on campus. In order to execute the rest of the deliverables for *Serenity*, Autodesk Maya was chosen for the modeling and texturing, and Unity, Vuforia, and Xcode were utilized for UI design and interactivity.

Going into development, the goal was to focus on audio and tactile engagement guided by visuals, so AR can be a space that allows control and peace in times of stress as a student.

With a basis of how many augmented reality applications were being utilized in the field of stress, we referred back to the idea of escapism, a concept of removing oneself from the real world into an imaginary world [2]. While the idea is sometimes controversial, it presents similar concepts to the way we currently utilize VR to enter new spaces that are far beyond the real world. Having this idea of escapism in mind, the design is meant to both recall different components of the real world, like the Japanese garden, but have whimsical, child-like shapes that feel safe and inviting. Multiple iterations were designed prior to the 3D development process to examine possible directions for user interactions.

3.2 User Interface

In consideration to the user interface, we wanted it to be both approachable and easy to maneuver. If the application had any points of confusion, we know it would increase the stress

level of the user instead of helping to decrease and regulate it. All users also have access to additional resources that can allow them other healthy alternatives besides the app. Right away upon loading, a home screen allows new users to access how the space works. It includes written text and infographics on how to navigate *Serenity*. With an awareness of studies done towards comfort when utilizing technology, we paid careful consideration in guiding the user towards proper techniques for setting up the app for maximum results [7]. It was important not to put additional stress on the physical body by making the AR map so far out of reach that users have to hold their arms up for long periods of time.

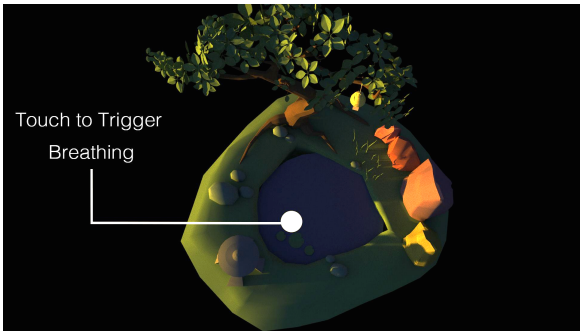

Figure 2. Part 1 of Garden Map Instructions from *How to Use* in *Serenity*, 2020

Once the user has selected the start screen, the phone camera opens up. By touching the screen, the AR scene maps to that point through Vurforia's ground plane recognition. The application can be slightly picky and by having a surface with distinct markings it keeps the scene from sliding.

Since we were focused on ways to create immersion in AR, audio became a huge focal point for achieving similar effects to virtual reality. The map has four sound points located on the front two colored rocks, the bell, and the pagoda. Each object is scripted to link to an audio that provides a unique and calming property when the object is touched. Users are encouraged to use headphones for a more immersive experience; however, the application can be used without them. Research was done on past studies that analyze the effects of sounds on the mind. One sound is based on the idea of binaural beats, which utilizes two different frequencies in each ear to create a new frequency that triggers a positive response in the brain. The frequency we are utilizing is theta. Theta beats are recognized for prompting relaxation and creativity [11]. Another is associated with a study done by neuroscience that showed a certain song could reduce stress by as much as sixty-five percent. The reason is that the song was constructed with the help of a sound therapist, so it has tones that are meant to make a user's heartbeat slow down [3]. Since many students enjoy listening to music to feel a sense of calm, we thought a scientifically backed audio might be beneficial to include and have easy access to. The other two audio choices are centered around outdoors. Since our application is partly focused on bringing nature into the home space, we wanted to make sure this was included and it made the most sense with the visuals. Our audio selections were carefully chosen to make sure the intensity of the outdoors wasn't overbearing and the different components outdoors were not competing with each other [6].

One component that many students look to experiment more with is meditation; however, many do not know how or where to start. This is a built in feature done in Unity through an animation and touch trigger. Upon clicking the center pond, the pond begins to expand and contract to mimic breathing. Originally, the breathing started out as one done in 2 second in-and-out increments; however, box breathing was implemented because of the control needed and the focus on the body.

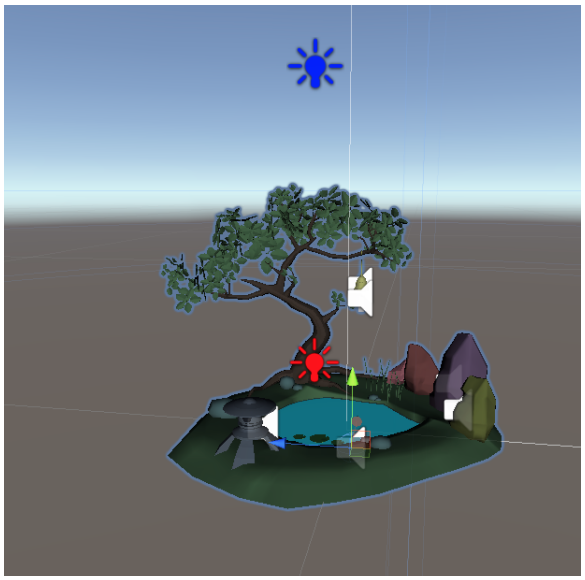

Figure 3. Day and Night Color Controls in Unity for Serenity, 2020

Another important feature that was added at the end of the development process was a day or night mode. Located at the top of the screen, a simple touch of a button activates alternating lights to enhance immersion. The point is that *Serenity* can be an app used any time of the day so it should be able to mimic the surroundings for an effect similar to VR.

By the time the user either finishes an audio, the breathing exercise, or a combination of their choosing, they are able to feel a sense of control over their stress or anxiety. The goal is even with a busy schedule, the user is able to have a quick, easy, and effective system that integrates into their schedule.

4 Outcomes & Results

4.1 Participants

In order to test the effectiveness of *Serenity*'s design, it was examined by two groups: Group A composed of three users and Group B composed of two users. All of them were of varying years of college education and backgrounds. This allowed us to interact with our target audience, which is college students. All users had experience with AR prior to this examination. Due to social distancing, all users were introduced to the application via a Zoom call.

4.2 Procedure and Results

Figure 5. Demo of *Serenity* application on iPhone, 2020

Group A and B were provided a demonstration of the application features in Unity on a Mac computer and iPhone. The features shown were the home screen, the set up, and the breathing and audio features. More than half of the users gave positive feedback on the visual components stating that it created a sense of calm, but it was unique enough to create interesting engagement. Two users, one from Group A and Group B, stated that the homescreen helped to generate a calm mood before entering the application. In terms of the negative feedback, the focus was on the attention drawn to stress and the limiting factors of additional resources. One user in Group A stated that only using stress management resources from The Ohio State would create limitations for who is utilizing the application. Three of the users, composed from Group A and Group B, pointed out the use of a survey before and after the use of the meditation app retracts from the experience of users.

As a result, changes were made to the resource page and the survey was removed from the start and end of entering the AR mode. Resources were updated to include a variety of college resources, like podcasts, exercise, meditation, and additional contacts and studies. By removing the survey in the app, *Serenity* returns to its purpose as a fun and engaging app that is meant to immerse the user and not feel like they are a part of invasive or nagging research.

5 Conclusion and Future Work

This paper's current examinations have taken considerations in pushing AR to the forefront next to VR in terms of meditative and stress-reduction tools. While there is still much to test and discover, *Serenity* has shown some successes in potential benefits in stress reduction through the use of engaging calming techniques and audio immersion. It has also proven to have a unique interface that visually begins to create stress relief. Some further points of interest include testing the effects of syncing breathing rates to the rhythm of a song or beat.

With a focus in creating stress reduction for students in an AR space, challenges still lie in accessibility and lack of additional interactivity features. As a result new questions pertaining to how real the setting needs to be have been developed, like the motion of water. In addition, how can the application become more collaborative, especially in times of COVID-19, where distance from other people becomes a factor in stress.

Future focuses include adding interactions, like a Japanese sand garden or a party mode, suggested by a user in Group B. In addition for things like collaboration, we are considering a shared music feature to connect users, like a shared Spotify playlist. Additional aspects would be expanding the platform to include other devices outside the iPhones, like Android and tablets. We want to continue to discover the impacts of AR and the ability to create successful immersive environments for the user.

References

[1] "The Augmented Reality App Helping Veterans Manage Anxiety." *Apple Newsroom*, 4 Dec. 2020, www.apple.com/newsroom/2019/11/the-augmented-reality-app-helping-veterans-manage-anxiety/.

[2] Coster, Alia. "The Power of Escapism: Imagination, Mental Health and the Benefits of Distraction." *Coster Content*, Coster Content, 12 Apr. 2019, www.costercontent.co.uk/blog/writers-block-power-of-escapism.

[3] Curtin, Melanie. "Neuroscience Says Listening to This Song Reduces Anxiety by Up to 65 Percent." *Inc.com*, Inc.,

30 May 2017, www.inc.com/melanie-curtin/neuroscience-says-listening-to-this-one-song-reduces-anxiety-by-up-to-65-percent.html.
[4] Daniel, Mohd, et al. "Design Considerations for a Virtual Reality-Based Nature Therapy to Release Stress." *IEEE*, 2020, pp. 1–4., doi:10.1109/AECT47998.2020.9194175.
[5]David, Eden. "Rising Suicide Rates at College Campuses Prompt Concerns over Mental Health Care." *ABC News*, ABC News Network, 2019, abcnews.go.com/Health/rising-suicide-rates-college-campuses-prompt-concerns-mental/story?id=66126446.
[6] Fajardo, Micah. "5 Calming Sounds to Relieve Stress and Anxiety." *Pangea*, Pangea, 9 Sept. 2018, www.joinpangea.com/resources/5-calming-sounds-to-relieve-stress-and-anxiety.
[7] Kim, Jeong Ho, et al. "Evaluation of the Biomechanical Stress in the Neck and Shoulders during Augmented Reality Interactions." *Applied Ergonomics*, pp. 1–9. *Elsevier*.
[8] Kyselova, Valeriia. "How Virtual Reality and Biofeedback Can Improve Meditation Experience." *Jasoren*, Jasoren, 13 Dec. 2017, jasoren.com/how-virtual-reality-and-biofeedback-can-improve-meditation-experience/.
[9] Lal Khan, Muhammad Sikandar, et al. "Action Augmented Real Virtuality: A Design for Presence." *IEEE Transactions on Cognitive and Developmental Systems*, vol. 10, no. 4, Dec. 2018, pp. 961–972.
[10] Pallavicini, Federica, and Stephane Bouchard. "Assessing the Therapeutic Uses and Effectiveness of Virtual Reality, Augmented Reality and Video Games for Emotion Regulation and Stress Management." *Frontiers in Psychology*, vol. 10, 11 Dec. 2019, pp. 1–3., doi:10.3389/fpsyg.2019.02763.
[11] Serani, Deborah. "Binaural Beats Music Can Reduce Depression." *Psychology Today*, Sussex Publishers, 23 May 2020, www.psychologytoday.com/us/blog/two-takes-depression/202005/binaural-beats-music-can-reduce-depression.
[12] Shastri, Devi. "As COVID-19 Continues to Disrupt Life, Young Adults Face High Stress, Isolation and Grief." *Milwaukee Journal Sentinel*, Milwaukee Journal Sentinel, 30 Oct. 2020, www.jsonline.com/story/news/education/2020/10/29/college-students-face-mounting-mental-health-challenges-during-covid-19/3670905001/.
[13] Siu, Lorika. "How VR Helps You Deal with Your Stress during COVID-19." *Medium*, AR/VR Journey: Augmented & Virtual Reality Magazine, 11 May 2020, arvrjourney.com/how-vr-helps-you-deal-with-your-stress-during-covid-19-31d230bf1257.
[14] Wayne State University. "STARC Lab Develops App to Help Alleviate COVID-Caused Stressors." *School of Medicine News*, today.wayne.edu/medicine/news/2020/06/13/starc-lab-develops-app-to-help-alleviate-covid-caused-stressors-37570.