Healing Zone: A Virtual Reality-Based Meditation Assistance System

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Abstract. Meditation is becoming more and more popular as an effective way to relax. For novices in particular, meditation demands the necessary discipline and practise. Healing Zone is a virtual reality (VR) system that uses virtual natural environments and interactive elements to encourage users to regulate breathing and assist in meditation exercises to relieve anxiety. In order to give people a peaceful, natural atmosphere for meditation, this study shows how a virtual environment and guided animation might work together. A trial with 8 volunteers confirmed its effectiveness as a meditation aid and anxiety relief, and revealed the need for a richer aesthetic experience. The Healing Zone offers a fresh viewpoint for upcoming study and innovation in related sectors, as well as demonstrating the potential of virtual reality in human-computer interaction and mental health.

Keywords: Virtual Reality, Meditation, Respiratory Rate, Unreal Engine.

1 Introduction

Meditation is a form of attention training in which the practitioner focuses their attention exclusively on the here and now while ignoring any and all other potential sources of distraction. Numerous scientific research have demonstrated the efficacy of meditative practises in alleviating stress, bringing about positive emotional regulation, enhancing concentration, and fostering positive attitudes **[1, 2]**. Even while "meditation" as a concept and its benefits have gained more mainstream, the actual practises of meditation have not. Studies have revealed that the setting **[3]** in which one meditates as well as the method used to meditate are key aspects that affect the experience of meditation. This is a difficulty for most people who are just starting out with the practise. As a consequence of this, a great number of novice meditators are forced to enrol in traditional classroom settings in order to acquire the knowledge and experience necessary to meditate effectively; this unquestionably raises the barriers that stand in the way of their having their first meditation experience.

In the practise of meditation, regulating one's breathing is essential to maintaining a contemplative state. Anxiety is alleviated and more positive thought is encouraged all via the use of breathing as a kind of interaction. When compared to physiological signals such as heart rate and brain waves, the frequency and depth of breathing are able to be controlled and regulated by human autonomy, and the changes in these parameters are intuitively sensed by

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humans. Because of this, the technique is user-friendly for beginners. As a result, our group came up with the concept of Healing Zone as an assisting system, with breathing control serving as the primary focus.

Healing Zone is an virtual reality (VR) system that, as can be seen in **Figure 1** , transports the user to a synthetic natural setting and encourages them to control their breathing rate as well as the depth of their breaths. This is a two-pronged strategy that facilitates the development of a meditative practise. There are a number of important works related to meditation support **[4-8]**, however, the number of examples that integrate the development of virtual environments and animation instruction is rather few.

Healing Zone has provided users with a unique experience that enabled them to meditate in a natural, beautiful, and distraction-free environment in a cost-effective manner. Additionally, the objects in the virtual environment incorporated regular movement mechanisms that helped awaken the user's visual focus and self-regulation mechanisms without disrupting the user's concentration. This piece has investigated how new forms of technology and digital art offered an alternative approach to dealing with anxious feelings.

Fig.1. Participants sat on the top of a high mountain and performed mindfulness tasks in a virtual natural environment.

2 System Description

2.1 Construction of Virtual Environment

Owing to the immersive, interactive, and conceptual qualities that virtual reality technology possesses, it has been evaluated as a potential new method to encourage positive behaviors and physical activity [9]. Our group constructed a virtual environment more conducive to meditative practice for our users by utilizing Unreal Engine 5 software. The influence of the users' actual surroundings on the quality of their meditation was effectively mitigated through the use of appropriate virtual environments, which also served to eliminate distractions and make concentration easier for users.

Forests, rivers, mountains, and cloudscapes have been examples of natural features that were shown to exert a calming effect on people in studies conducted within the fields of nature psychology and environmental psychology. These types of environments have been considered to assist individuals in feeling more at ease. However, it should be noted that, according to the anti-biological nature hypothesis, as humans have adapted to the urban high-rise and street environment, extended and comprehensive exposure to the wild might instead weaken one's sense of security, thus generating anxiety. This consideration has been taken into account. The majority of the team's work on the scene was performed in a semi-open style, with the goal of avoiding the dilemma described above. The scenarios that have been conceived and developed up to this point are displayed in **Figure 2.** In Scene A, which depicts a bamboo forest environment, participants are positioned within a gazebo. They are presented with the tranquil sight of bamboo trees gently swaying with the breeze, a scenario that promotes relaxation and mindfulness. Scene B transports participants to an elevated loft amidst the clouds, offering an immersive experience as clouds drift around them. In Scene C, the setting shifts to a mountaintop vantage point, allowing participants to situate themselves and observe the dynamic movement of clouds, as they coalesce and disperse. Lastly, Scene D situates participants within a snowy mountain landscape, where they can stand and engage with the serene ambiance of gently falling snowflakes.

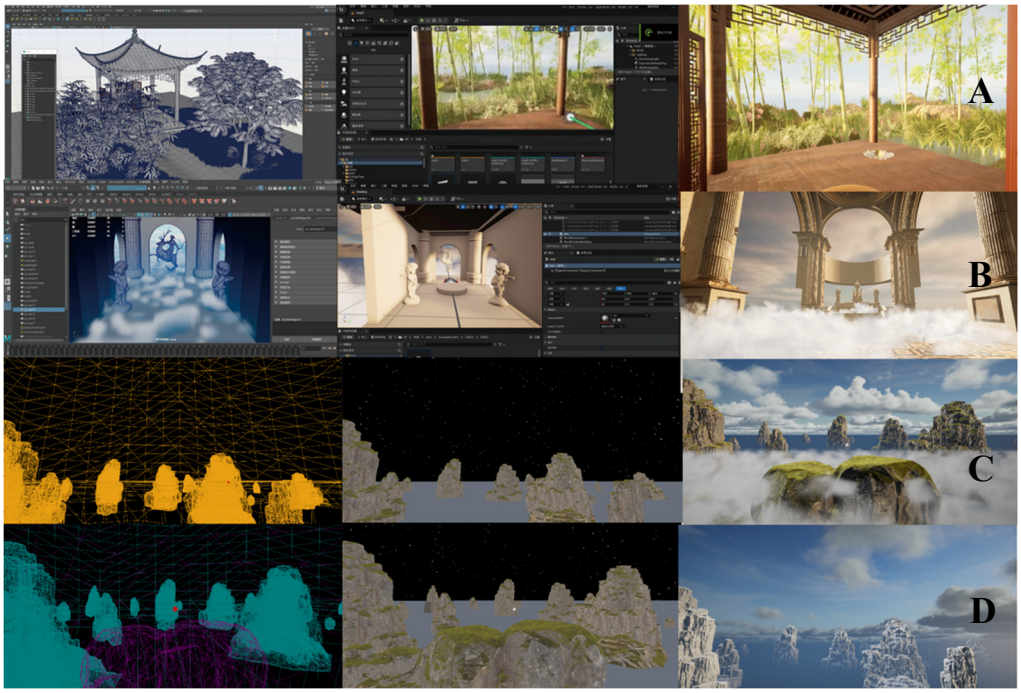

Fig.2. All scenes have been carefully researched and produced in 3D by our team.(Scene A-Bamboo forest; Scene B-Sky Pavilion; Scene C-Clouds and Mountain Peak; Scene D-Snow Mountain)

2.2 Coding

A rate of 6 breaths per minute has been identified as the optimal rate **[10]**. Utilizing this interval as a reference point, we implemented a regular motion mechanism in C++ to the image of the object, with the intention of guiding the user through the process of adjusting their breathing pattern. Prior to commencing a meditation session, users were given the option to customize frequency values to better suit their individual needs, or they could adhere to the program's predetermined settings. Consider, for example, the alpine cloud layer scene depicted in **Figure 3;** the dynamic changes of the cloud layer corresponded to the user's breathing patterns. When the cloud began to gather, the system guided the user to inhale, and as the cloud slowly unfolded, the system prompted the user to exhale gently. As depicted in **Figure 4,** the virtual reality system's interactive elements undergo systematic and regular alterations throughout the entirety of the meditation sequence. These coordinated changes serve to guide the user's breathing patterns, engendering an awareness of self-regulation, and thus assisting in facilitating a more optimal entry into the meditative state.

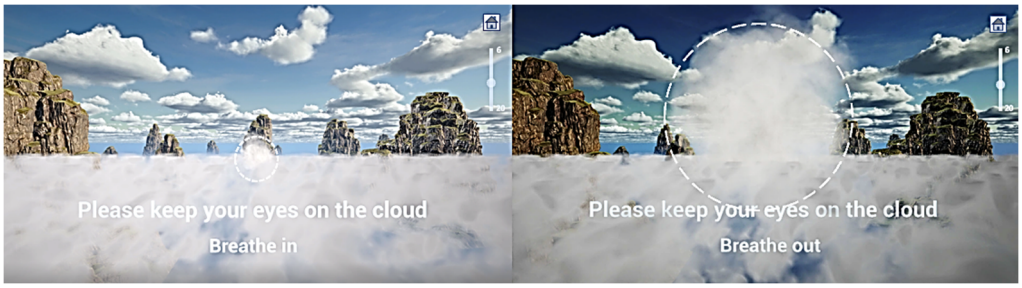

Fig.3. Code-driven clouds are interactive elements. Its dynamic adjustments match the user's breathing patterns. The user is reminded to breathe in as the cloud gathers, and is instructed to do so as it progressively expands out.

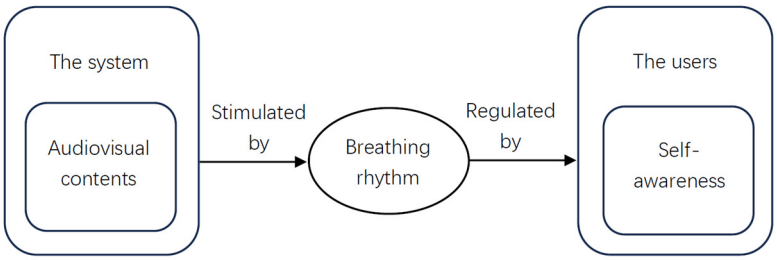

Fig.4. The schematic of the system's assistance during user meditation.

3 User Test

Our team invited 16 volunteers to participate in the system trial, all of whom were aged between 21 and 28 and had recently experienced symptoms of anxiety or irritability. The average experience time per participant was 20 minutes, as illustrated in **Figure 5**. Before and after the

experience, each volunteer completed a standardized scale, reflecting their actual feelings. Concurrently, we conducted interviews with each volunteer post-experience, and have subsequently recorded and analyzed the content of these interviews.

3.1 Value Evaluation

The Physical Activity Scale (PAAS), generally used to measure the momentary experience of affective states. Participants responded using a 5-point Likert scale ranging from 0 = "feeling nothing" to 4 = "feeling very strongly". The PAAS has 12 items and consists of 4 subscales: Positive Affect, Tranquility, Fatigue, and Negative Affect. The convergent validity and internal consistency of the factor structure of the PAAS and its subscales have been supported by research **[11]**. Before and after the experience, each volunteer completed the scale. Our team collected this data to record their state changes before and after the experience, and thus evaluate the use value of the system. As shown in **Table 1**, compared with before the experience, the positive affect and tranquility of the volunteers were significantly enhanced after the experience, and the fatigue and negative affect were significantly reduced. This preliminarily shows that using this system for meditation assistance is effective.

Table 1. Means and Standard Deviations (in parentheses) for Physical Activity Affect Scale (PAAS)

	Before	After
Positive Affect	2.59 (0.65)	3.03 (0.49)
Tranquility	2.07 (0.81)	2.85 (0.96)
Fatigue	1.38 (0.43)	1.03 (0.17)
Negative Affect	0.46 (0.67)	0.32 (0.38)

3.2 Qualitative Feedback: Virtual Environment or Real Environment

Compared with real environments and scenes, users have generally preferred the meditation experience in virtual settings. The virtual environment has offered a controllable and customizable space, enabling users to adjust the meditation scene and background in accordance with their personal preferences and needs. This degree of freedom may have augmented user satisfaction and engagement relative to the limited choices present in the real world. Moreover, the virtual scene has provided users with a completely distraction-free meditation space. Factors such as noise and interruptions, which might exist in the real environment, were eliminated in the virtual space, aiding users in entering the state of meditation more effortlessly and enhancing the overall quality of experience.

Healing Zone has created a visually appealing meditation space through regular motion mechanics and picturesque virtual natural environments. This design has potentially rendered the meditation experience in the virtual environment more attractive than that in real settings, thereby increasing user affinity. The flexibility to practice at any time and place through meditation experiences in virtual environments may also have enhanced users' preference for virtual scenes.

In summary, the advantages of meditation experience in a virtual environment, including controllability, uninterrupted focus, visual appeal, and convenience, have made users generally

more inclined to select a virtual scene for meditation practice. Healing Zone has successfully harnessed these strengths, offering an innovative and effective approach to aid in meditation. This finding has also yielded valuable insights for further research in the field of human-computer interaction (HCI), particularly concerning the application of virtual reality in mental health.

3.3 Qualitative Feedback: Effectiveness of Animation Guide for Relaxation

Healing Zone's animated guides have played a crucial role in facilitating the user's meditation experience. These animated guides have not only enhanced the visual appeal of the virtual environment but also offered users intuitive guidance on the rhythm and depth of meditation.

The gentle movement and consistent rhythm of the animation have helped guide users into a state of relaxation, simplifying their engagement in meditation practice. Furthermore, the animation has been able to form a visual synchronization with the user's breathing and heartbeat, potentially enhancing the user's awareness of their bodily state and further promoting the meditative effect. Proper animation guidance has contributed to the realism of the virtual scene, allowing users to immerse themselves more easily in the meditation experience and thereby improving the overall meditation effect.

In summary, animation guidance has played an essential role in enhancing the meditation experience in the virtual environment. It has strengthened the advantages of the virtual scene and provided new possibilities for virtual reality technology in meditation and relaxation assistance. The Healing Zone project has demonstrated a promising and innovative meditation assistance program by effectively amalgamating virtual reality technology with animation guidance, offering a valuable reference for future research and practice.

3.4 Future Work

We intend to persist in the iterative enhancement of the Healing Zone system to refine both its aesthetics and user experience. Our roadmap includes the execution of a series of formal studies to more accurately assess the potential of this system. We are designing experiments that encompass more extended durations and include a more rigorously selected group of participants, aiming to formally evaluate the system's capacity to augment synchrony during and following interactions, as well as its effects on social bonding and connection to nature.

Concurrently, we will explore additional functionalities of Healing Zone, such as synchronized biofeedback. Our plan incorporates the integration of the system with a Polar breathing chest strap, where abdominal movement can be detected and the breathing rate visualized **[12]**. By understanding their breathing rate, trainees will be empowered to regulate their breathing to achieve a slower pace. An augmented source of visual feedback, in conjunction with self-awareness, is projected to provide users with an enriched immersive experience. Our preliminary hypothesis suggests that this approach may further assist users in enhancing their focus, sensing the present moment, and fostering self-regulation.

Healing Zone also holds the potential to be transformed into a remote virtual reality device, allowing meditation enthusiasts globally to congregate for distant practice sessions. For meditation novices who may lack strong execution skills, this feature might facilitate the development of beneficial practice habits.

While delving into these potentialities, our focus will remain on the perpetual improvement of the system from an aesthetic standpoint. We are dedicating research to understand how to enable the system to adapt and yield optimal aesthetic results during interactions, how to render the dynamics of interactive elements more diverse and visually appealing, and even how to incrementally become an integral part of the virtual environment, thereby crafting a more enveloping immersive experience.

4 Conclusion

Healing Zone is a virtual reality (VR) system that has demonstrated how emerging technologies and digital art can converge to furnish an innovative approach to anxiety alleviation. This system has not only seamlessly integrated the creation of a virtual natural environment with animation guidance but has also forged a novel space for users to concentrate on meditation practice by modulating breathing rate and depth. Preliminary pilot results from this study have revealed that Healing Zone has been widely acknowledged by users as an efficacious instrument for anxiety relief and meditation assistance. This underscores not only the potential of virtual reality in the field of human-computer interaction (HCI) but also its tangible applicative value in mental health care.

However, the project has also unearthed some areas that require enhancement. Although users have not reported any discomfort with the scene and interactive elements, their desire for more aesthetically rich representations signals an avenue for further system development. A portion of future work may center on augmenting the visual allure and aesthetic merit of the virtual environment, aspiring to render the system not only functionally mature but also to elevate the level of visual and sensory experience.

In conclusion, the Healing Zone project represents a valuable exploration that illustrates the prospective use of virtual reality technology for meditation support, while also introducing a novel, user-centered design paradigm for the HCI field. Future research endeavors should persist in probing the nexus of VR and mental health for a more expansive and profound impact. Our team will continue to optimize and broaden the Healing Zone system, aiming to furnish richer and more effective alternatives for individuals to meditate in a serene, natural, and undisturbed environment that may be challenging to access in real life.

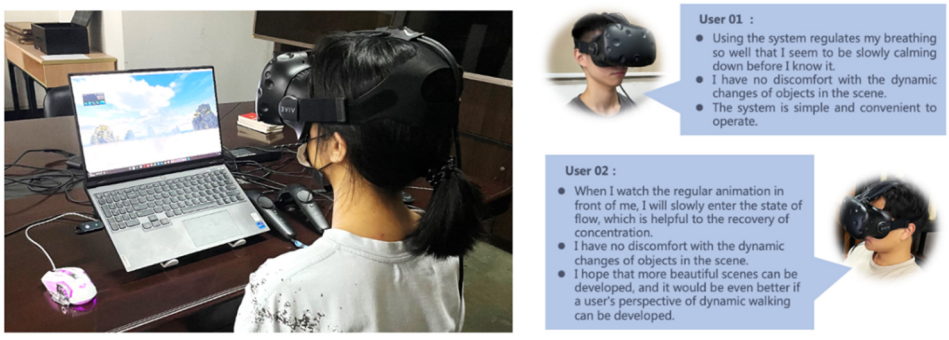

Fig.5. Participants engaged with the virtual reality system and subsequently provided their subjective experiences and recommendations to our research team following the trial.

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