

How does Realism Impact Human Emotions in Virtual Reality?

Introduction

Virtual Reality (VR) is becoming more accessible through affordable technology with new platforms such as the Meta-verse. This surge in VR adoption compels developers and creators to build VR applications and VR games for the wider public. It is therefore important to understand the effect of design choices and their emotional responses towards the user. Our study focuses on this crucial aspect, exploring how varying degrees of realism in Virtual reality environments can influence user emotions like calmness, relaxation, anxiety, and fear. Our findings aim to provide essential insights for VR creators, guiding them in designing experiences that resonate authentically with users in this new, virtual frontier.

Objective

This study aims to investigate the impact of realism in virtual reality on emotional responses, specifically focusing on calm and fear reactions. The research explores four environments: Low realism calm, high realism calm, low realism scary, and high realism scary. By examining participants' responses in these varied settings, the study seeks to understand how the level of realism in VR affects user experience. This includes measuring reported emotional states and observing the participants' reactions in person. Ultimately, the objective is to contribute to the broader understanding of how virtual realism influences human emotions and to inform the design of more effective VR experiences for various applications, ranging from entertainment to therapeutic interventions.

Methodology/Participants

The study was conducted on 10 participants in the form of an experiment. Four distinct VR simulations were created, comprising of two environments designed to induce fear, and two to evoke calmness. The distinguishing factor between the fear-inducing and calm environments was the level of realism and graphic quality, with two environments featuring realistic graphics and the other two adopting a more cartoonish style. To enhance immersion, participants experienced consistent ambient audio stimuli within each category.

Procedure

After consenting to participate in the study, each subject was guided to a silent and vacant room. The participants were instructed on how to navigate the environments using the hand controllers. They were asked to walk around and discover the worlds they were in. In the spooky environments, participants were asked to find the abandoned cabin. In the calm environments, they were asked to walk around the fields. Each participant experienced the four environments in random order, for about one and a half minutes per environment. Participants were then instructed to take an online survey through a computer after trying each environment. A final survey was then given after trying all the environments to compare their experiences between the four.

The study was conducted using Meta Quest headsets and hand controllers and the environments were designed using Unity and Quick VR library.



Figure 6: High Realism Calm Environment



Figure 7: Low Realism Calm Environment

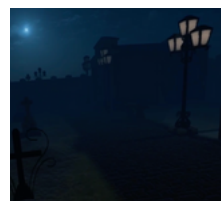


Figure 8: High Realism Scary Environment



Figure 6: Low Realism Scary Environment

Discussion

Evidence points to the fact that a more realistic environments tend to provide a stronger emotional response and higher degree of immersion for users. Additionally we believe, based on the questionnaires, that elements such as sound, color scheme, and details have had an impact on the feelings evoked by the virtual worlds. The low realism scary environment is colorful, whereas the highly realistic one was darker and had much less colors. It is therefore important to address this challenge in future studies, by making the both the environments have similar color scheme. Alongside that, the level of details in each environment were also found to have a significant impact on the responses, as for example the fog and gloomy sky was said to have made the environment scarier while the sunlight without sun visible made the high res environment less calming and real. Moreover, the audio elements have had an impact on evoking the feelings of uneasiness and calmness, and thus should be taken into consideration in further implementations of this study.

Related literature

Slater, Mel, et al. "How We Experience Immersive Virtual Environments: The Concept of Presence and Its Measurement." ResearchGate, Sept. 2009. www.researchgate.net/publication/228751198_How_we_experience_immersive_virtual_environments_the_concept_of_presence_and_its_measurement.

Llobera, Joan, et al. "Evaluating Participant Responses to a Virtual Reality Experience Using Reinforcement Learning." Royal Society Open Science, vol. 8, no. 9, Sept. 2021, p. 210537. doi:10.1098/rso.210537.

Preliminary Results

We can see (Figure 1,2,3) that the perceptions of immersion and realism are about the same for each environment, which was surprising to us. We expected the immersion and realism levels to be lower in the less realistic environment, due to the lower quality of the visuals in the environment. Many of the written responses to these refer to the sounds in the environments, which indicates that it may have interfered with the results of our experiment. The calmness and uneasiness ratings are about what we expect to see in each environment.

The results of the comparisons (Figure 4, 5) fall more into what we expected to see as results when conducting this experiment. All users felt that the highly realistic environments were the most immersive and "realistic". While users tended to rate all environments highly in these two categories, they still felt the more realistic environments were more immersive and realistic. The surprising point was that there was almost a 50/50 split between the highly realistic and low realistic scary environments on which was the scariest (fig.5). Upon closer inspection of the written responses, they detail that the sounds in the less realistic environment where more impactful in evoking a feeling of uneasiness. This again shows that our sound effect used might have influenced the users and thus impacted the data. Moreover, from the tabulated raw data, we can see that there does seem to be a trend that more realistic-looking environments have a greater impact on a user's emotional response evoking higher feelings of uneasiness and calmness and a higher perception of immersion and realism.

Average Ratings for Each Environment	High Realism Scary	Low Realism Scary	High Realism Calm	Low Realism Calm
Immersion Rating	4.7	4.2	4.2	4
Calmness Rating	1.8	2.1	4.2	3.7
Uneasiness Rating	4	3	1.6	1.9
Realism Rating	4.3	4.2	4.5	4.2

Figure 2: Average Ratings per Environment

	HIGH REALISM SCARY ENVIRONMENT										MEAN	MEDIAN
Immersion Rating	5	5	4	4	4	5	5	5	5	5	4.7	5
Calmness Rating	1	2	1	1	2	1	1	3	4	1	1.8	1
Uneasiness Rating	5	4	5	4	4	5	3	2	5		4.1	4
Anxiety Rating	1	4	5	4	3	4	4	1	4	5	3.8	4
Peace Rating	1	2	1	3	1	1	1	2	4	1	1.8	1
Realism Rating	5	4	2	5	4	5	5	4	5	5	4.3	5

Figure 1: Raw High Realism Data Response

Average Ratings for Each Environment

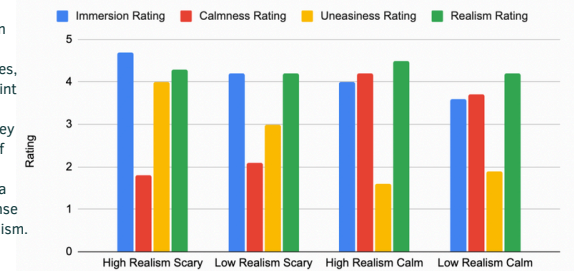


Figure 3: Visual Graph of Average Ratings per Environment

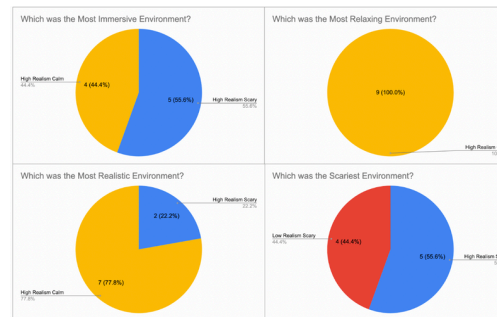


Figure 5: Visual Pie Chart of Main Tested Variables

OVERALL ENVIRONMENT RAW DATA				
Most Immersive Environment	High Realism Scary	Low Realism Scary	High Realism Calm	Low Realism Calm
Environment	5	0	4	0
Count				
Most Relaxing Environment	High Realism Scary	Low Realism Scary	High Realism Calm	Low Realism Calm
Environment	0	0	9	0
Count				
Scariest Environment	High Realism Scary	Low Realism Scary	High Realism Calm	Low Realism Calm
Environment	5	4	0	0
Count				
Most Realistic Environment	High Realism Scary	Low Realism Scary	High Realism Calm	Low Realism Calm
Environment	2	0	7	0
Count				

Figure 4: Overall Environment Response Count