The Analysis of Physiological and Psychological Responses to Environmental Stimuli in VR horror games

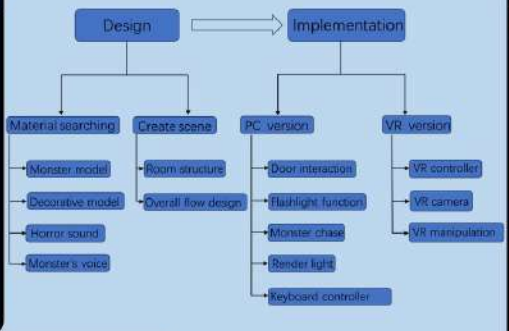
Supervisor name : Fangyu Wu, Qilei Sun
Team Member: Zeren Tao, Xiaohan Wang, Shengqiao Wu, Binwei Lei, Yibang Zhao, Zuoqing Yang
School of Advanced Technology, Suzhou, China
SURF Code: 2024-0203

SURF
Summer Undergraduate Research Fellowship

1.Abstract

Virtual Reality (VR) already meet a certain level of usability and functionality [1] and it can offer a realistic game experience for player [2]. Game manufactures need to know which element makes player more fearful if they want to make their VR horror games more immersion [3] but there is little research on which factors have the greatest impact on immersion. This study aims to find out the most influential factor to fill this gap, and it is tested via a contrast experiment. This study provides valuable information for the design of VR horror game.

Workflow



2.EXPERIMENT DESIGN

Figure 4: The overview of scene used in three different groups. (a) is the scene used in control group. (b) is the scene used in atmosphere group. (c) is the scene used in monster group.

This experiment aims to investigate which element in a VR horror game(atmosphere or monster)induces a stronger fear response in players. Participants will be randomly assigned to one of three groups: a control group (no monster or atmosphere), an atmosphere group (With horrible lights, room decorations and sounds), and a monster group (There will be a monster chasing the player. Another monster will terrorize the player from the ceiling).

Figure 5: Horrible lights, room decorations in atmosphere group

Figure 6: Monster chasing the player and the monster from the ceiling in monster group

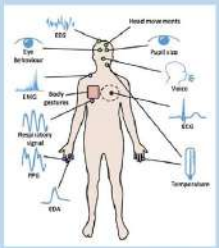


Figure 7: Common human physiological signals

The experiment will record physiological responses, including respiration rate, ECG(Electrocardiogram) and EDA(Electrodermal Activity), while participants play the game.

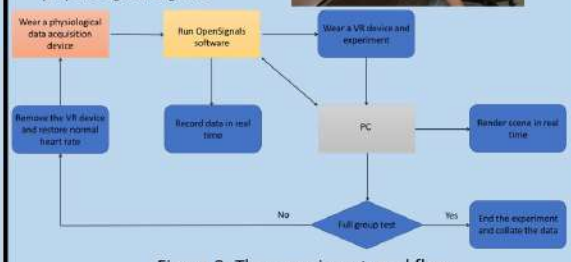


Figure 8: The experiment workflow

Figure 1: Picture of Quest3

Figure 2: The Quest3 workflow

Figure 3: The monster

3.EXPERIMENT RESULT

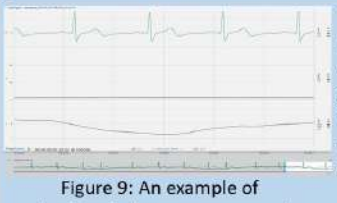


Figure 9: An example of physiological responses record.

The final data analysis by a mathematical model which will compare the physiological response among the three groups to find out the differences and determine which element provides a stronger fear response.

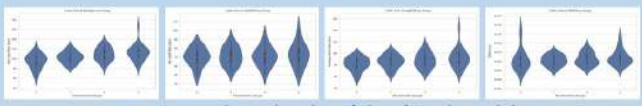


Figure 10: The violin plot of the physiological data

Generally, in the analysis of physiological response data, there is a significant correlation between the monster group and the maximum heart rate in the physiological data.

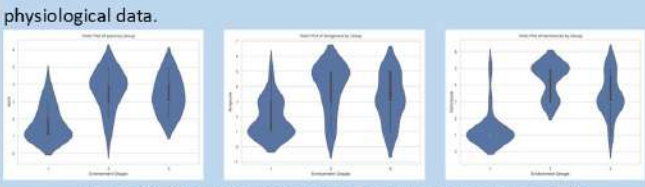


Figure 11: The violin plot of the psychological response data

Significant correlations were found between each environment and the experimenters' scores in analyzing the psychological response data, indicating mutual influence among the control group, ambient group, and monster group.

Figure 12: The bar charts of the psychological response data

Both the control group and atmosphere group showed notable performance in experimenter's liking score; furthermore, there was a nearly significant difference (0.08) between the control group and monster group. Experimenter's fear score responses differed significantly between the control group versus both ambient and ghost groups; additionally, there was a marginally significant level (0.08) when comparing atmosphere to monster groups.

4.CONCLUSION & DISCUSSION

For conclusion, we compared body measurements from different scenes and come to a conclusion. The heartbeat measurements from monster group have more obvious lift than atmosphere group. monster can create more stress and fear than atmosphere.

For weakness, the samples size of the experiment is small. The age of the subjects is mainly concentrated between 21 and 25. This study still needs further follow-up research

5.REFERENCE

[1] Zhang, H. *et al.* (2023) 'Decoding Fear: Exploring User Experiences in Virtual Reality Horror Games'. Available at: https://search.ebscohost.com/login.aspx?direct=true&db=edsarx&AN=edsarx.2312.15582&site=eds-live&scope=site (Accessed: 23 August 2024).

[2] Hsu, C.-F. and Lin, K.-W. (2023) 'Research on Morals and Ethicals Issues in VR Games - A Case Study of Religious Worship Video Game', *2023 IEEE 3rd International Conference on Social Sciences and Intelligence Management (SSIM), Social Sciences and Intelligence Management (SSIM), 2023 IEEE 3rd International Conference on*, pp. 263–266. doi:10.1109/SSIM59263.2023.10468780.

[3] Zaib, S.E. and Yamamura, M. (2022) 'Using Heart Rate and Machine Learning for VR Horror Game Personalization', *2022 IEEE Conference on Games (CoG), Games (CoG), 2022 IEEE Conference on*, pp. 213–220. doi:10.1109/CoG51982.2022.9893723.