

Abstract

AfterDay Horizon is a collaborative VR and web-based multiplayer game that aims to raise awareness of global warming and demonstrate the potential consequences if we fail to address this issue soon. Our game presents a world where civilization has collapsed due to global warming. People have taken refuge in bunkers to protect themselves from external dangers such as extreme temperatures, radiation, food and water shortages, and more.

Keywords: Multiplayer Game, Virtual Reality, Survivor Game, Collaborative Game, Global Warming, Unreal Engine

1. Introduction

Our world is on the brink of a critical turning point. The Intergovernmental Panel on Climate Change (IPCC) warns that any further delay in global action to slow climate change and adapt to its impacts "will miss a brief and rapidly closing window of opportunity to secure a livable and sustainable future for all." By 2100, about 50-75% of the global population might face "life-threatening climatic conditions" caused by extreme heat and humidity, leading millions to acute food insecurity and reduced water security.

Everyone in the world contributes to global warming, whether a little or a lot. Thus, it is also our responsibility to mitigate this problem for future generations. Based on our expertise, we propose "AfterDay Horizon," a collaborative VR and web-based multiplayer game designed to raise awareness about global warming and highlight the potential consequences of inaction.

2. System overview

AfterDay Horizon is a two-player game that emphasizes collaboration between a VR player and a web-based player. A compatible VR headset, such as the Meta Quest 2 (also known as Oculus Quest 2) or a more advanced model, is required.

In *AfterDay Horizon*, players take on the following roles:

- **Caretaker:** A player who engages with the game using a VR headset.
- **Leader:** A player who resides in the bunker, providing the caretaker with necessary information and guidance through a web-based manual.

Together, they must ensure the survival and well-being of the bunker's inhabitants by completing four critical tasks within a limited time frame:

- Growing crops to increase the food supply.
- Repairing the oxygen system.
- Fixing the plumbing system.
- Restoring the electrical system.

The *AfterDay Horizon* screenshot is shown in Figure 1. The success of each mission directly affects the well-being of the people in the bunker. For example, failing to replenish the food supply on time could result in a 50% decrease in the bunker's population.



Figure 1: Example of *AfterDay Horizon* game-play

3. Experiments

Several experiments were conducted with 8 participants, consisting of 3 males and 5 females, with an average age of 20.75 ± 0.433 years. They were asked to complete the gameplay at least once to evaluate our game based on the following three objectives:

- 3.1. **Promotes collaboration:** Players must collaborate to complete the game, so we measured the completion time to assess this.
- 3.2. **Enhances strategic thinking:** The game requires strategic planning to overcome challenges within a limited time. We used the completion rate to evaluate this aspect as well.
- 3.3. **Offers enjoyment:** Participants rated their enjoyment on a scale of 1 to 5, with 1 being "hate it" and 5 being "love it".

4. Experimental results

The experiment with 4 pairs of participants reveal that:

- 4.1. **Promotes collaboration and enhances strategic thinking:** *All* participants successfully completed the missions, with an average completion time of 27.10 ± 4.36 minutes. While every pair finished the missions through effective collaboration, the average completion time exceeded our expectations, surpassing 20 minutes. We suggest that the complexity of the game necessitates a more strategic approach.
- 4.2. **Offers enjoyment:** Our game achieved a satisfaction score of 3.75 out of 5, indicating that participants generally leaned toward positive feedback.

5. Conclusion

Based on the experimental results, we suggest that *AfterDay Horizon* demonstrates satisfactory performance. While the game effectively fosters collaboration among players, it slightly underperforms in enhancing strategic thinking. To address this, we plan to introduce additional hints for efficient planning. Despite the positive feedback from participants, as reflected in the satisfaction scores, we aim to further improve these scores and benchmark them against a strong baseline in the near future.