Minmin Escapes from Disaster: An Oculus Rift Disaster Simulation Game

Tim DUMOL University of the Philippines – Diliman Quezon City, Philippines <u>tim@timdumol.com</u> Patricia LASCANO Joan MAGNO Rico TIONGSON Ateneo de Manila University Quezon City, Philippines carillontea@gmail.com magnojoan@gmail.com jetplanetiongson@gmail.com

ABSTRACT

The thrust of this study was to take a look at responses of young people to the Oculus Rift-based disaster simulation game *Minmin Escapes from Disaster*. This paper was a proof of concept that aims to further explore the value of a virtual reality disaster game. The game was created with the Unity Game Engine and tested on young adults (ages 19-21) and children (ages 4-8). Responses to the prototype were used to gauge how effective a fully developed disaster simulation game would be to young people as an immersive, educational tool. Overall, results showed that young adults responded well to the game while young children had a difficult time understanding the game mechanics. These results are evaluated to see how a fully developed game using virtual reality will be received by its target audience.

Keywords

Virtual Reality, Disaster, Simulation, Games

1. INTRODUCTION

Free and accessible web-based games such as *Stop Disasters!* by the UN International Strategy for Disaster Reduction (UN/ISDR) have been created because games are an effective way to educate [8]. Aside from *Stop Disasters!*, the UN/ISDR has also invested in creating other games such as *Riskland*, an educational Q&A board game about reducing the impact of disasters, and *Magnitude*, a board game where players act as national ministers in furthering national development. Aside from the efforts of the UN/ISDR, there are very few or no disaster preparedness games in the market. The PS3 only has *Disaster Report* (2003), a Japanese survival action-adventure video game. On the Wii, Nintendo published *Disaster: Day of Crisis*, an action-adventure third-person survival game.

Similar to the games mentioned above, *Minmin Escapes from Disaster* focuses on survival against natural disasters such as fires and earthquakes. The goal of the game is to teach children about what to do during a disaster in such a way that it is fun and educational. To do this, *Minmin Escapes from Disaster* uses virtual reality. Virtual reality is a "three-dimensional, computer generated environment" which the player can interact with and explore. The player is commonly immersed, becoming part of this virtual world and allowing him/her to manipulate objects within the world. Virtual reality has several benefits, notwithstanding the ones that are already included with the benefits of designing a game for disaster preparedness such as its "improve[d] knowledge acquisition and retention" [17]. In essence, virtual reality offers another dimension of learning for the individual.





Minmin Escapes from Disaster is a virtual reality disaster simulation game for young people. The research group focused on young people because knowing how to prepare for a disaster should be learned as early as possible. *Minmin Escapes from Disaster* places the user in a first-person situation under a simplified disaster. It takes place in a tree full of fairies, not humans. In this light, the user is able to learn more about how to face a disaster by being placed in a fantastical situation. This paper is a proof of concept that aims to explore the possibility and design of such a game.



Figure 2. Disaster Report (2003) is a post-disaster survival game. Source: ign.com

2. HARDWARE COMPONENT

The Oculus Rift is a virtual reality head-mounted display developed by *Oculus* VR [13]. The Oculus Rift is ideal for virtual reality disaster simulation because it can create a truly immersive experience. Many games and even movie start-ups are taking advantage of the Oculus Rift. *Zero Point* is a movie planned to be both 3D and 360 [11]. Oculus Rift games can even generate real fear. The game *Breach* lets the player explore a ship while an unknown entity follows. Since the sound is immersive and you cannot see anything of the real world, one is placed in a seemingly real situation. The Oculus Rift can even let players *feel* virtual limbs, such as in the game *Don't Let Go*. The real-world impact of the Oculus Rift has been showcased in the game *Smow World* which has been shown to have an anesthetic effect [1] and the game *SMS Racing* which simulates driving while SMSing.

The Oculus Rift device detects the user's head orientation and will then change the view in the ocular screen to match head movement. *Sensor Fusion* is the term used to describe the integration of information from the gyroscope, accelerometer and the magnetometer. It helps determine the player's orientation in the real world and synchronizes this in real time.

- X is the positive up direction
- Y is the positive right direction
- Z is positive to the back
- **Pitch** is rotation around X, positive when pitching up.
- Yaw is rotation around Y, positive when turning left.
- **Roll** is rotation around *Z*, positive when tilting to the left in the XY plane.



Figure 3. Oculus Rift movement Source: Oculus_SDK_Overview.pdf

The function of the Oculus Rift as immersive with 3D and headtracking functions fits well with the game's purpose. Using the Oculus Rift, we can create an immersive disaster preparedness game. By making players see the disaster happening around them, we can better teach children about how to survive in a disaster.

3. GAME DESIGN

This segment takes a look at the game design of *Minmin Escapes* from Disaster.

As a first-person dungeon escape game on the Oculus Rift, its main objective is to teach children and teens about surviving disasters using a childlike and non-realistic environment. The researchers do this by having the player play as Minmin, a fairy in a cartoonish world. The game takes place in a fantastical setting to make the game more attractive to children.

3.1 Game Rules

- 1. The player wins if he or she reaches the door before his or her health bar depletes.
- 2. When the player's health bar depletes, the game is over.
- 3. The player's health bar depletes over time.
- Acting in dangerous ways will make the game end, prompting the player to restart the game. Ways to make the game end includes:
 - a. Going near windows, which is dangerous during a disaster;
 - b. Being hit by falling objects;
 - c. Touching flames.
- 5. Some dangerous actions will only reduce the player's health instead of instantly ending the level.
- 6. Picking up a first aid kit will increase the player's health.



Figure 4. This in-game screenshot shows a depleted health bar and shelves falling due to the earthquake. Players may also go underneath tables to protect themselves from falling objects.



Figure 5. This screenshot shows the house engulfed in fires. On the left is a first aid kit, which players can pick up to heal health.

3.2 Level Design

There are five levels. When the player finishes one level, she can unlock the next level. There are different disasters for each floor. Floors 1 and 2 are in an earthquake. Floor 3 displays a house engulfed in fires. Floor 4 combines both an earthquake and a fire.



Figure 6. Getting to the door before the player's health bar depletes gives them access to the next level.

3.3 Look and Feel

3.3.1 Camera System

The camera is in the first-person point of view. This means that when the player puts the Oculus Rift on, he or she sees through the eyes of *Minmin* the fairy. The game uses the keyboard (WASD) to move the player around.

3.3.1 Aesthetics

The look and feel of the game is generally simplistic and childlike. Cell shading will be used to create a cartoonish look. These are non-realistic in design. The aim of the aesthetics is to make the player feel less fear despite the disasters happening.



Figure 7. This aerial shot shows the game aesthetics. Cell shading and simple shapes are used to make the environment cartoonish.

4. TEST PLAN

4.1 Test Objective

The objective of the test was to see (a) how immersed target players are with the game and (b) how much they learn from the game. There were two tests done. The first test was done with a young adult group with a survey administered directly after the gameplay session. The second test was done with young children. Instead of administering a survey, the researchers asked the children what they liked and did not like about the game.

4.2 Sample Profile

The alpha test was conducted among an older age group consisted of five individuals with the following profile:

- 1. Male;
- 2. Between 19-22 years old; and
- 3. Has had experience playing an FPS.

We chose males who have had experience playing first-person player shooters (FPS) because the controls for FPSes are the same ones used in our game. This removed the obstacle of the player having to get used to controls in order for us to better measure how effective the pedagogical aspects of the simulation is.

The observation test with the young age group consisted of three children with the following profile:

- 1. Between 4-8 years old; and
- 2. Interested in games.

4.3 Testing Methods

These rules were followed for the alpha test with the older age group:

- (a) Each player will have a cap of 10 minutes, or until they reach level 4;
- (b) Briefing will include the game objective and movement controls; and
- (c) The test administrator will take observations.

Each game tester answered a survey after ten minutes of play. Aside from measuring the level of fun and whether or not the player was able to learn the important concepts for each level, the survey asked for standard feedback (features to start, stop and continue).

These rules were followed for the younger age group:

- (a) Briefing will include the game objective and movement controls; and
- (b) The test administrator will take observations.

5. TEST RESULTS 5.1 Alpha Test Results

The first question asked participants to rate their experience from based on the statements given. Responses vary between 5 tiers: not at all, slightly, moderately, fairly and extremely. Here is a summary of the results:

Statement	General Result
I felt bored	Not at all-Slightly
It was aesthetically pleasing	Moderately-Fairly

I felt challenged	Fairly-Extremely
I felt skillful	Slightly-Extremely
I felt absorbed	Fairly-Extremely
I thought it was fun	Fairly-Extremely

We asked participants what they learned from the minigame and received these responses:

Hide under tables during an earthquake	5	19%
Stay away from windows during fires and earthquakes	2	7%
Stay away from shelves during an earthquake	3	11%
Stay a safe distance from fires	5	19%
Bring first aid kits	4	15%
Be wary of falling objects	3	11%
Act quickly during a fire	5	19%

We asked testers the question, "Before playing the game, do you think you know how to respond when a disaster hits?" and received responses between having "some knowledge of [response]" and knowing "[full] well how to respond."

We also asked the testers where they gained their knowledge of how to respond to a disaster (previously) and received these responses;

School drills	5	26%
Publications	4	21%
Curricula, modules and presentations	2	11%
Performance and the Arts	0	0%
Games and Competitions	2	11%
Audio and Video Materials	2	11%
Web Resources	2	11%
Social Media	2	11%
Telecommunications	0	0%
None	0	0%

Responses averaged a 4.4 / 5 when we asked testers whether they are more prepared to respond to a disaster after playing the game.

Where:

1 - I felt no effect on my capability to respond to a disaster;

3 - I felt that the game slightly helped my ability to respond to a disaster; and

5 - I felt that the game improved my capability to respond to a disaster.

Lastly, we asked testers what they liked and did not like about the game, as well as what they would like to see for the next iteration.

5.2 Observation Test Results

General Observations from Children

- 1. The children had a hard time finding the door;
- 2. Without guidance, the children would not know what to do with the game;
- 3. The children had a difficult time with the controls; and
- 4. The children were confused by the different elements happening simultaneously in the game.

General Feedback from Children

- 1. The timer was too fast;
- 2. Jumping and crawling should be enabled;
- 3. The game should look better visually; and
- 4. The game is confusing.

6. DISCUSSION OF RESULTS

This segment looks at the results of both tests and what it means for the research objective. As a proof of concept, the objective of this study was to look at how young people respond to an Oculus-Rift based disaster simulation game. Would a disaster-based simulation game be feasible on the Oculus Rift? With two test groups, the results varied.

6.1 Alpha Test Discussion

The alpha test was the test done with the older age group. This portion will be discussed in three aspects (a) fun, (b) pedagogical success and (c) improvements.

In general, the game was fairly fun for players. From our test data, the game was absorbing. Feedback ranged from "not at all" to "slightly" boring as well as "extremely" and "fairly" absorbing. In general most thought it was "fairly" fun. The game was also "extremely" challenging to most testers. Meanwhile, there was a varied response to the statement "I felt skillful." Response to this varied because the testers had different levels of FPS experience. One had only played FPS once and was not used to the controls (he was also the only one who gave stated that he felt extremely skillful).

In this regard feedback from players showed that what they liked most was the "overall feel" of the game. From the music to the decreasing health bar, the game made them feel the sense of urgency during a disaster. According to a tester, the "time based component increased pressure and willingness" to escape the floor. The falling debris and fire also added to the game ambiance. This is exactly the kind of game situation and environment we wanted to simulate. In a disaster, one is also under duress because of what is happening around them.

We can also conclude that the players learned slightly. Their response to the *whether or not the game helped their ability to respond* was *above average*. They felt that the game improved their capability to respond to a disaster, even if it was only slight. They were able to learn the basic response to fires and earthquakes such as hiding under tables or staying away from flames (although these are already common knowledge). Perhaps when more features have been included, especially ones that are less common knowledge, responses to this question will be better.

In response to making players feel more challenged, we can add more features to the game or provide varying levels of difficulty (hard and easy mode). Players' negative response was mainly due to bugs, the limitations of the Oculus Rift and need for better graphics. For example, some tables were floating while they were playing. Meanwhile, one of our testers felt nauseated because the Oculus Rift was not calibrated to his eye properly. The game only scored an *average* in being *aesthetically pleasing*, because we used free assets for the prototype.

Finally players suggested adding features that were already in our game design plan (but not implemented in the alpha test prototype). This further fortified the necessity of such unimplemented features in succeeding versions of the game. For example, many suggested crouching, running and crawling features to get under tables and to cover space faster. They also suggested adding more objects in the scene such as falling chandeliers and electronic devices. Other suggestions were about the user interface and user experience such as more sound effects and better font for messages.

6.2 Observation Test Discussion

Overall, the children did not like our game. They were enticed by the idea of the Oculus Rift, but when they were already playing, they were too confused to truly be "immersed." We observed that the children had a hard time using the controls and understanding the purpose of the game. They had a difficult time using the keyboard, the Oculus Rift and the mouse at the same time. They had a hard time finding the door to go to the next level without the observer's help. As a result, the observers could not gather data about how much they learned since they were struggling with the game.

7. CONCLUSION

Games are an effective means of raising awareness about disaster preparedness. Our study aimed to see whether or not virtual reality could become an educational tool to teach young people about disasters. It also wanted to determine how effective a virtual reality simulation game could be to teach young people.

Our study showed that an Oculus Rift-based game is a good means to educate young adults. Everyone was interested in virtual reality and wanted to try the game, yet only the older age group was properly responsive to the game. With complicated devices like the Oculus Rift, an older age group should be targeted because children did not possess the dexterity and mindset to deal with the disaster game.

If virtual reality games using the Oculus Rift are targeted towards children, then the researchers recommend simplifying gameplay and controls. Using an Xbox controller will reduce complexity by making the controls more intuitive.

In conclusion, the researchers recommend further study to be done with a more complete and comprehensive game aimed solely at an older target audience. Virtual reality as an educational tool did not fully show itself since the game was oversimplified. Without being limited by simplifying the game for children, more complex concepts and learning points can be taught using virtual reality.

You need to include an acknowledgements section. Thank everyone who helped make the work possible.

8. ACKNOWLEDGEMENTS

We thank the following for their direct and indirect support in making this project a success: the Department of Information Systems and Computer Science, the Ateneo Laboratory for the Learning Sciences, ByImplication and Kalibrr. We express our sincerest thanks to Ma. Mercedes T. Rodrigo, Jessica O. Sugay, our mentor Philip Cheang, Marlene de Leon and the technical assistants at DISCS. Lastly we thank all our friends and family who have supported us in this endeavor.

9. REFERENCES

 Arcega-Dunn, Maria. Virtual-reality game 'Snow World' used as pain-management aid. Q14Fox.com. q13fox.com/2012/11/29/virtual-reality-game-snow-worldcreated-to-aid-in-pain-distraction/#ixzz2DgFB9xfG

- [2] Ceridian Corporation. 2005. Steps to Take After a Flood, Fire or Other Disaster. 2013. http://www.wfm.noaa.gov/pdfs/Ceridian/After_Flood_Fire_ Other_Disaster.pdf
- [3] Chaumont, Kriss. 2013. *How to Prepare for Disaster*. The Seattle Times. Accessed Dec 12 2013. http://med.stanford.edu/somsafety/forms/EP Home.pdf
- [4] Dabe, Alan. 2013. A Machine for Fear: Ben Spent Hours Playing Oculus Rift Horror Games and Hated It. The PA Report. http://www.penny-arcade.com/report/article/amachine-for-fear-ben-spends-hours-playing-oculus-rifthorror-games-and-ha
- [5] During an Earthquake. 2011. Center for Disease Control and Prevention. http://www.bt.cdc.gov/disasters/earthquakes/during.asp
- [6] Fact Monster. 1999 National Events Wrap-Up.
 © 2000–2006 Pearson Education, publishing as Fact Monster. http://www.factmonster.com/ipa/A0765967.html
- [7] Holden Link. 2013. Holden Link. http://holdenlink.com/project/sms-racing/
- [8] IFRC.org. 2011. Public Awareness and Public Education for Disaster Risk Reduction: A Guide. International Federation of Red Cross and Red Cross Crescent Societies, Geneva.
- [9] McElroy, Griffin. 2013. Creator of Oculus Rift cover-based shooter whips up a tower defense RTS. Polygon. http://www.polygon.com/2013/9/2/4685556/creator-ofoculus-rift-cover-based-shooter-whips-up-a-tower-defense
- [10] Miller, Tony. 2011. Tony's Time: Disaster Doesn't Make For a Fun Experience. Nintendo Okie. http://nintendookie.com/2011/05/23/tonys-time-disaster-doesnt-make-for-afun-experience/
- [11] Newman, Lily Hay. Zero Point is the First 3D, 360 Degree Movie for the Oculus Rift. Gizmodo. Gizmodo.com/zeropoint-is-the-first-3d-360-degree-movie-for-the-oc-1466147151
- [12] Oculus Rift Virtual Reality Headset for 3D Gaming | Oculus VR. Oculus VR Home Comments.
- [13] Oculus Rift VR Development Kit Thoughts So Far and Its Future. 2013. TweakTown News. http://www.tweaktown.com/articles/5723/oculus-rift-vrdevelopment-kit-thoughts-so-far-and-its-future/index.html.
- [14] The Museum of the Microstar. 2013. RUST LTD. http://rustltd.com/projects/the-museum-of-the-microstar
- [15] UNICEF. *Disaster Risk Reduction and Education*. 2011. Untied Nations Children's Fund, New York.
- [16] UNIDSR. 2013. www.unisdr.org/we/inform/publications/33253
- [17] Virtual Reality. 2009. www.vrs.org.uk
- [18] *What to do in a Fire*. KidsHealth, The Nemours Foundation. http://kidshealth.org/kid/watch/er/fire_safety.html