Effects of Similar Environments on Presence and Learning in Virtual Reality:
Applications for Tsunami Preparedness

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Introduction

• Within the next 50 years, there is a 30% chance that a **major** earthquake will hit Vancouver Island, bringing a tsunami

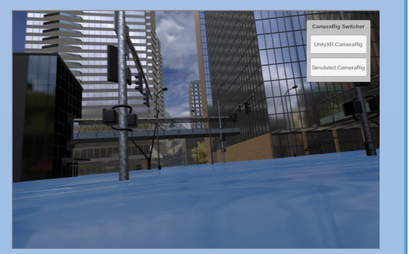
• Despite early education and community awareness programs, much of the public has misconceptions about the impact of a tsunami in greater victoria

• In this study, we immersed participants in a first-person view of a sped-up tsunami simulation based on a modeled 9.0 magnitude Cascadia Subduction Zone earthquake

• Two virtual reality environments were used to see if using a familiar environment affected presence, behavior change or understanding

Environments

- The familiar environment was created by using a 360 photo of the downtown waterfront
- The fully virtual environment was of a street in a fictional city, including signposts and other objects that would allow the participant to judge the height of the water
- Both environments used the same water type, included a hand model on each controller and the sound of rushing water to increase the initial presence
- The water would rise above the participant to ~5 meters above sea level and then stop rising
- By ducking and jumping participants could move underwater which triggered postposing to create underwater effects



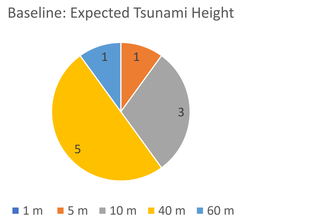
Methodology

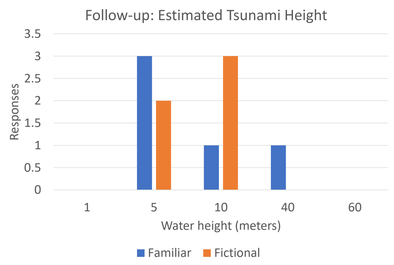
Baseline measurement → VR adjustment → Tsunami simulation → Presence inventory → Follow-up measurement

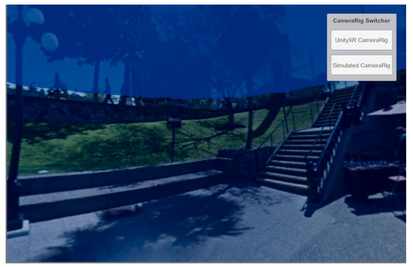
- Participants were gathered from friends, acquaintances, and relatives and randomly placed into two groups.
- Participants came from a range of backgrounds and age groups, and a majority of the participants had no experience with virtual reality.
- After a briefing, participants took a survey that measured their current knowledge of tsunami structure
- Before the simulation participants adjusted to virtual reality in the Steam VR Home, where they could try moving and adjust the headset to ensure clear vision
- After the simulation participants completed the Slater, Usoh and Stead Presence Inventory and revaluated their tsunami knowledge

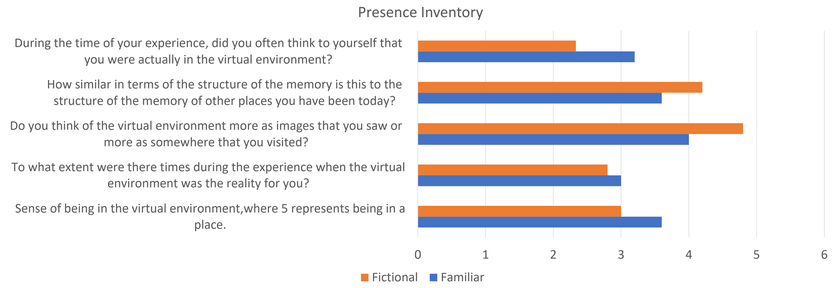
Findings

90% of participants overestimated the height of a tsunami in the Langford and Greater-victoria area before the simulation









Fictional environment participants were more likely to respond that the experience positively affected the likelihood of them developing an earthquake/tsunami emergency plan

The use of a familiar environment increased participants' ability to accurately assess the impact of a local tsunami compared to the fictional environment.

Presence:

The perception of being physically present in a non-physical world.

Increased with:

- **High-resolution consistent information across sensory stimuli**
- **Ability to interact with the environment in an apparent manner**
- **Consistent self-representation within the environment**

Conclusions

- A familiar environment helped participants judge the level of the water and how it would impact them at home. In turn, this reduced their fears of a local tsunami such that they not spurred to create an emergency plan or thought that they no longer needed one
- Participants in the fictional environment struggled to measure the impact of a local tsunami; height estimates were reduced compared to their initial estimate, but misconceptions about tsunami height persisted as they continued to overestimate based on previous media exposure.
- We found no difference in presence between the two environments, but interestingly, participants in the familiar environment were more likely to have a very high or very low presence. This may have been due to the structure of the enviroment, some participants commented that the background was not well integrated with the environment.

Future Work

- This study was conducted with a small sample size, it would be interesting to see if results are statistically significant with a larger sample size.
- Furthermore, Greater-Victoria is only expected to sustain a small tsunami, meaning that this study aimed to align expectations and reality. But if this comparison was done in an area of Vancouver Island where a tsunami would reach greater heights then the different environments may have very different effects on behavior change or understanding.
- Finally, perhaps the structure of the environments had a greater effect of presence then anticipated, I would like to explore the effect of a familiar environment that is fully recreated with virtual assets.

References

Scan to learn more about:

- References in this poster
- Assets used in the creation of the simulation

This research was supported by the Jamie Cassels Undergraduate Research Awards, University of Victoria