Seismic Preparedness for the General Public Using Virtual Reality

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Our Team

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Motivation

- Earthquake can cause mass damage to the local area.
- People get injured from Earthquake.
- Many initiatives on raising earthquake awareness.
- Few initiatives focus on object hazard identification.
- Therefore, we built a VR application, aiming for teaching people hazard identification concepts.

Project Goals

Effectiveness of Training: Identify the effectiveness of learning between VR training and reading a guide.

How do properties of game objects impact their behaviour during an earthquake simulation

Related work

- Majority of VR earthquake simulator work focused on:
- Evacuation in the case of an earthquake
- Safety precautions
- Complete immersion, experience an earthquake without the physical injuries

What we did differently:

- Specific object interactions during an earthquake

Research

Multiple experiments conducted within Unity to determine an objects behaviour during an earthquake. Some experiments include the interactions between:

- Cuboid based structures and cylindrical based structures
- Objects of different densities
- Objects placed on top of different heights
- Objects placed on top of stacked or non stacked objects
- Objects with varying heights

Mobile Virtual Reality Application

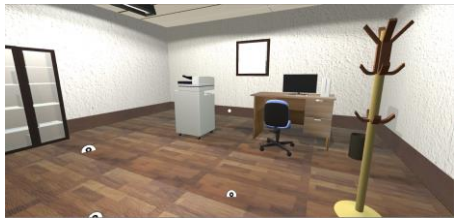
Training in the virtual reality application comes in three stages:

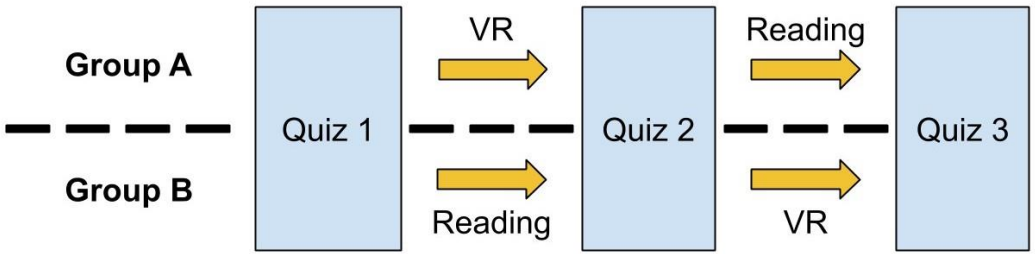
1. Object hazard analysis
2. Earthquake simulation
3. Object hazard evaluation

Mobile Virtual Reality Application

Mobile application consists of 3 stages for the user to be immersed in

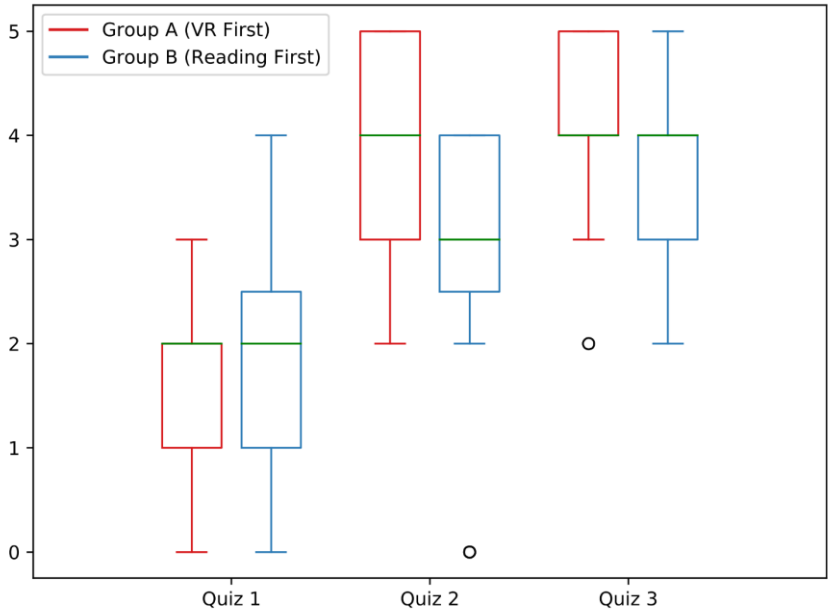
- Office scene
- Living room scene
- Hospital scene





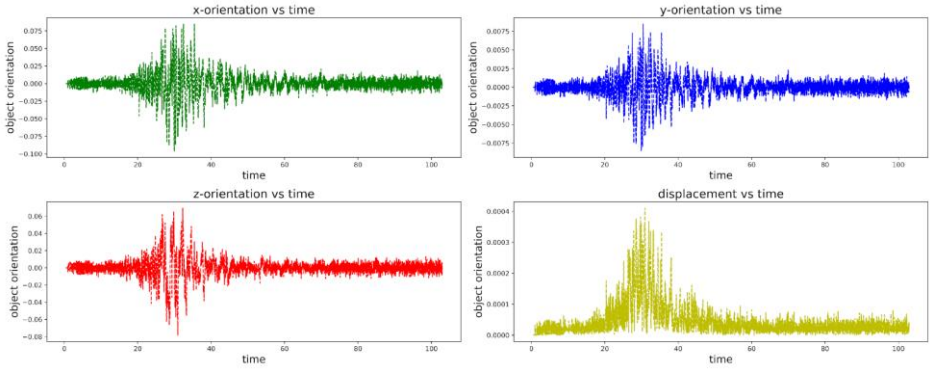
User Evaluation Overview

- Users are split into 2 groups, reading first and VR training first
- Statistically analyse the differences in learning effectiveness of users between the 2 groups
- The last quiz acts as an opportunity for everyone to try VR and compare whether or not people have genuinely learnt how objects behave under an earthquake.



User Evaluation Result

- Both Groups have improvement on learning
- Group A has greater improvement compared to Group B
- Both groups reach the same knowledge level eventually.



Research Result

- Cuboid structures are more stable
- Higher density objects are less stable
- Objects placed at a lower height are more stable than ones placed on a higher height
- Objects that are placed on top of multiple stacked objects are more unstable
- Taller objects are more unstable compared to shorter objects

Conclusion

Mobile VR application VS Reading Instructions

- Both Mobile VR and reading instructions are effective in teaching earthquake preparedness concepts
- But mobile VR applications are more effective in teaching earthquake preparedness concepts compared to reading instructions.

Objects with different properties interact with an earthquake differently, more specifically:

- Cuboid structures are more stable
- Higher density objects are less stable
- Objects placed at a lower height are more stable than ones placed on a higher height
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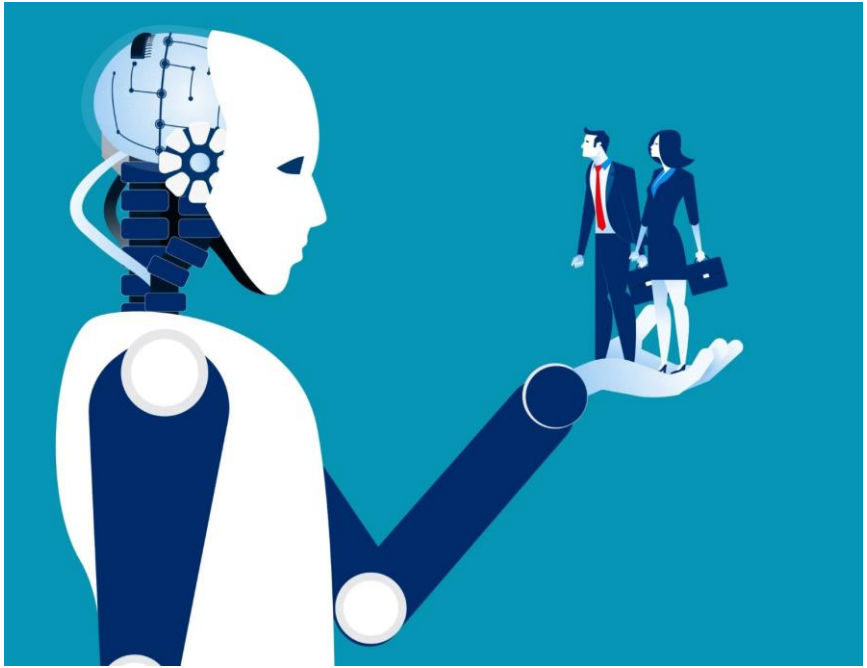
- Taller objects are more unstable compared to shorter objects



Future Work

- More variety of magnitudes of earthquakes
- Including breakable furniture models and immersive sound effect to the scene.
- Data analysis of user camera positions and rotations.
- To provide a better VR experience.

Questions

Thanks for listening. Any questions?