A maze-game which enhances feelings of presence

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Virtual environments come in all shapes and sizes. One goal they all have in common though is that the user should have a strong sense of presence. Many factors affect whether or not this holds true. According to Witmer and Singer, presence and effectiveness go hand in hand. Presence is a combination of involvement, which requires focus, and immersion, which requires seamless engagement. Contributing factors can be empirically measurable, such as FPS, FOV, meaningfulness, and enjoyment among many others. Most of these can be divided into control, sensory, distraction, and realism factors, as is discussed later. Witmer and Singer also developed a questionnaire that aims to measure feelings of presence in systems.

An i3D system was subjected to the Witmer and Singer presence questionnaire. The system is an integration of the Oculus Rift headset with the Razer Hydra for control and Half Life 2 (system D). Figure 1 depicts the mean scores for the system.

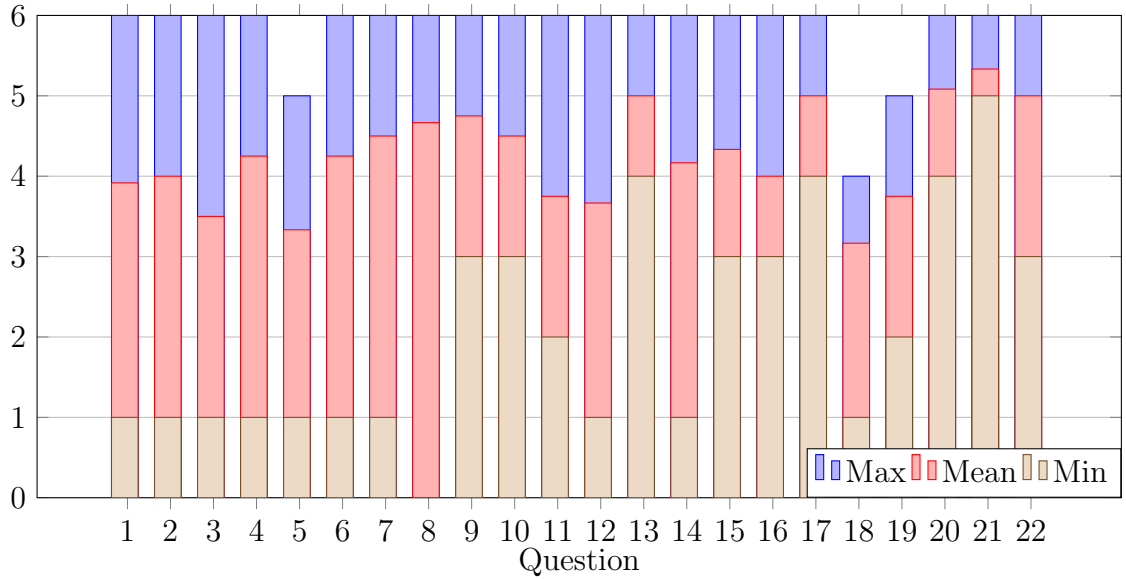

Figure 1: System D Mean Scores

What is immediately noticeable, is that due to the sample size, one overly negative person or one overly positive person will skew the results. Similarly, people who do not really take the questionnaire seriously (such as the one person who was giving haptic scores to a system with no haptic feedback whatsoever) will also skew the results. Ideally there should be many more participants than there are questions.

That being said, most of the other questions scored reasonably well which was surprising given the disruptiveness of the Oculus Rift. The exception was question 18 (sense of moving; part of *quality of interface*) which was almost unanimously considered bad. A

reason for this were perhaps not the Razer Hydra controllers themselves but rather the way they were made to control the player which was counter-intuitive to say the least. The interface and its use (questions 18 and 19) fared badly while the in-game audio was well received and made an impact on total scores (see dataset and summary for more details).

At any rate, this information will aid in the improvement of the maze-game to further enhance feelings of presence. By focusing specifically on the factors that made a difference with system D, improvements to the maze-game can be explored in three paradigms: computer graphics, artificial intelligence, and human factors.

Improvements from a Computer Graphics Perspective

Since the Witmer paper, as well as the scoring system, indicate that the factors that affect realism have the greatest effect on the feeling of presence, the maze-game would need to use computer graphics techniques to make the virtual scene appear more realistic. These techniques include: Normal mapping to give the ground and wall a greater level of detail A skybox to give the player a sense of atmosphere High fidelity enemy monster models to invoke a sense of fear in the player High fidelity enemy monster animations to give them an organic feel Lighting effects, such as dim point lights to simulate an actual eerily dingy maze More cramped corridors and props to induce claustrophobia

Improvements from an Artificial Intelligence Perspective

Realism is also achieved by having excellent AI. In the maze-game, this means having smart monsters. Rather than wandering aimlessly for instance, the monsters could use A* pathfinding to pursue the player – their only percept next to the navigation mesh – intelligently. In addition to that, the monsters could each behave differently to make it even more unpredictable. At the same time, they should not go beyond simple model-based agency or else they would be too smart and start guarding critical paths or inciting riots.

Additionally, the audio aspect of the feeling of presence is especially important here. The monsters should ideally emit some kind of sound to contrast environmental or player step sounds, and make the player figuratively quake with fear. For example, if you hear a growl around a corner in your left ear, you would behave differently than if you did not.

Improvements from a Human Factors Perspective

Ideal feelings that the player should have in the best case would be a sense of claustrophobia, dread, disorientation, and fear. They should feel like Theseus entering the Cretan Labyrinth, except with no means of defending themselves against the Minotaur. The player should forget that they are still seated on an office chair and the only way that this can happen is if the human factors are in check.

This is arguably the most important element of presence enhancement. It encapsulates the quality of the interface, the possibility to act, and by proxy the possibility to examine.

For the maze-game, improvements would be more fluid controls (such as WASD + mouse) and the freedom to roam for example. Additionally, it would make more sense in this case to switch to a first person view, as opposed to a third person view. These improvements would enhance *immediacy of control* and *mode of control* directly, and others factors indirectly. However, as is evident by the results of the questionnaire, there is absolutely no need for the Rift and Hydra combo, let alone any HMD system. In fact, it could be detrimental to the experience and actually reduce presence.

The questionnaire is nonetheless a useful tool in measuring presence. If the maze-game were to be tested with the aid of the questionnaire first now then after the aforementioned improvements were implemented through, feelings of presence would be enhanced guaranteed.