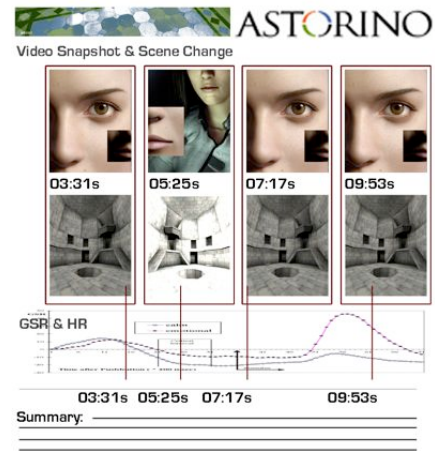
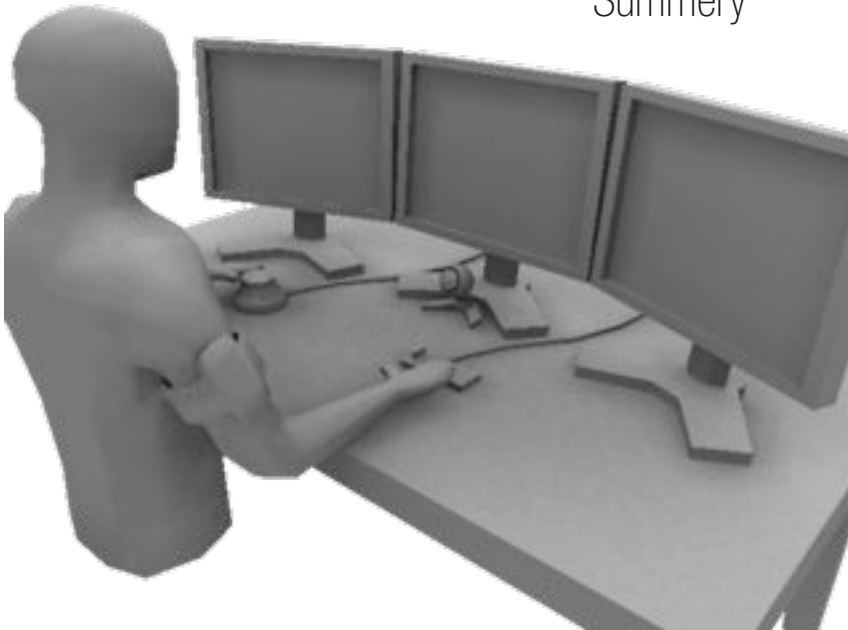


Conclusions & Findings

Summery



This project has been focused on process and system integrity, not perfection in data or analysis of that data. Because the team has little to no scientific background, focusing on such things as generalities seen between users, and general function of the system is the limit to these findings and conclusions. This is not to say that these points are misleading or incorrect, they are just general observations that come from observed commonalities within each test with every user.

Hypothesis

Conclusions

Key Discoveries

Additional Relevant Discoveries

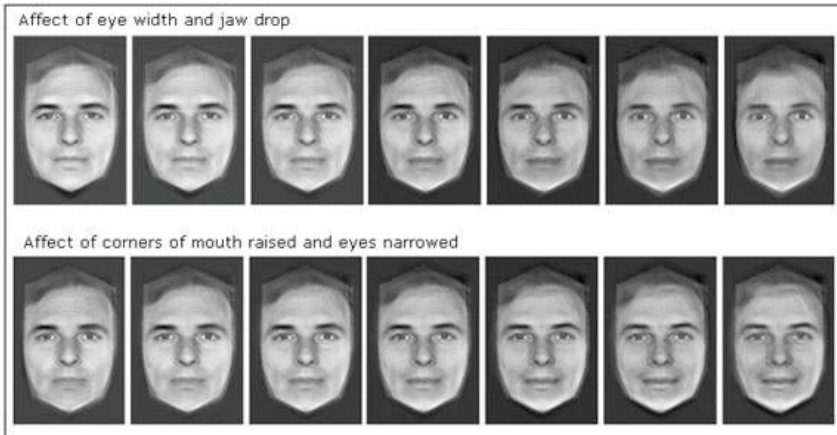
Hypothesis

ETC Team: The ETC's data-gathering system will be able to capture data within a virtual cave. This data will be useable for further analysis by Astorino.

Conclusion

Main Conclusions: The ETC's data-gathering system can reliably gather data, but the data itself cannot be reliably isolated as relating only to space design. This project has however proven that it is still possibly to gather data, and the potential to gather reliable data can be achieved with refined testing methods & equipment.

Key Discoveries



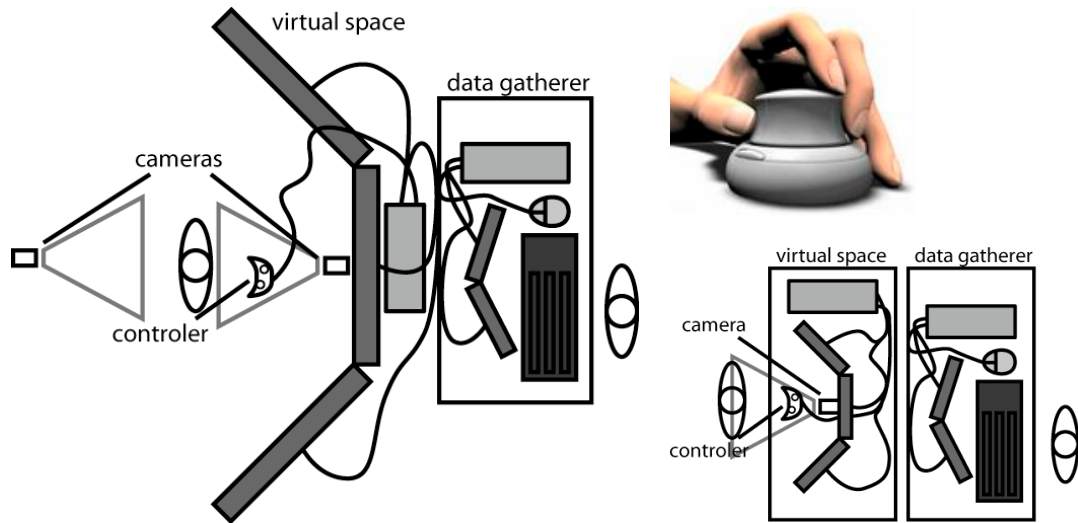
facial recognition training software

- Facial Micro-expressions** This system can reliably gather facial expression data while a guest is in an immersive virtual cave. However, we cannot assert that this data can be reliably attributed as reactions to architectural space design.
- Some guests simply show no reaction or emotions.
 - Facial expressions were identified to be reactions to factors outside of testing & architectural space, the most prominent cause was nausea caused by the virtual cave.

- Galvanic-Skin-Response** This data had more application and usefulness than we had initially considered prior to production & testing. This data can be reliably attributed to identify and mark when a guest is having a reaction within our system. However, it too suffers from the fact that we have not been able to isolate this data as relating only to architectural space design, though to a much lesser degree.

Whether or not the GSR data is related to space design or outside factors is actually less relevant, and is actually useful for systems testing. This data allowed the ETC team to identify and scrutinize sections of a given testing session, and raised the correct questions in regards to the other data streams.

What we learned



Small VS Large Displays

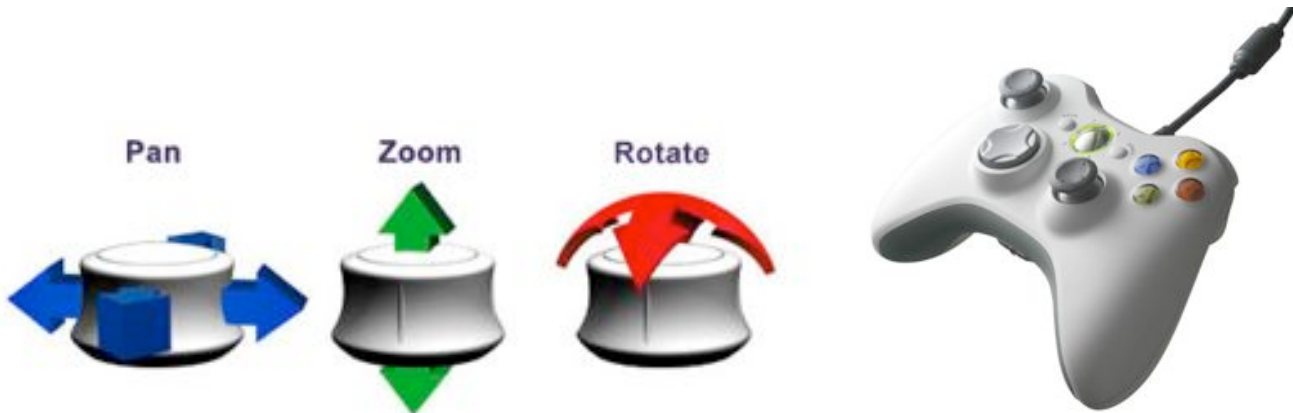
Larger displays created a greater “buy-in” to the experience itself, meaning that guests were more receptive to giving their feedback by simple virtue of being in the system for longer periods.

A given testing session is slated for 15 minutes. Using the small screens, the ETC experienced sessions that were terminated after only 3 minutes with the reason being that the guest had experienced everything. With large screens, our testing sessions were never shorter than 10 minutes, and this was even after we had shortened our testing sessions to 10 minutes.

Input device experience

In the development of this system, 3 separate and different control systems were devised with 2 actually being tested. The first being a 3d mouse usually designed for 3d modelers and sculptures to easily maneuver around their models inside a 3d program. The second device that was implemented was the use of an Xbox 360 controller, used by gamers on the popular system of the same name. The third device that was conceived but proved difficult to implement was the use of a Wacom tablet as a top down blueprint, commonly used by artists to get a more traditional feel for digital art.

Control devices



The 3d mouse as a control device was implemented early on, as an input device that was different than a mouse. It was hypothesized that this would separate the user from thinking of this experience as a simple fly through, and immerse the user more within the environment. As well the user would think that this device was a more intuitive way of navigating a space due to its ability to maneuver in 3 dimensions. This device only proved to be more difficult to control, making looking around more of a side note, and moving forward an extremely difficult chore. This difficulty only clouded the data that the system gathered, so the next input device quickly replaced it.

The Xbox 360 controller proved to be the most adaptable control device implemented into the system. It was hypothesized that the user would become familiar with a control device that has already had a company (Microsoft) investigate the best and most intuitive way of controlling a camera in 3d space. This device became more of an after thought to the user. Many users would state that they weren't very good at video games, but quickly became comfortable with the control layout, and were able to adapt to the stick layout. Many suggested that the look direction be inverted (as many modern games and a setting to do so) but each guest was actually able to compensate for this drawback. This device made gathering data the easiest, and only got in the way when the user became stuck in the space, in a corner, against a wall... The GSR rarely reflected this, but more so the spoken comments from the user.

Control devices and Personal way of exploring



The third, but untested device was the Wacom tablet. Using this device was hypothesized that the user would have the most intuitive experience, being able to see the entire space at once, and letting them pick and choose a room or hall at a glance. By using this device it was hoped that the user could forget about the difficulties of navigating a space, and focus on exploring the architecture.

An early experiment was to also have the user self evaluate the space, but it was observed very early that even with constant suggestion, the user just simply forgot that the input device was already there. The decision was made to eliminate the self-evaluation device. It was hoped that the device could capture the dichotomy of what the user was truly feeling (deciphered from the GSR and facial expressions) and their stated feeling (gathered from the peripheral self evaluation device). It was discovered that a person is only capable of keeping track of 2 things in such an impressive rig (impressive in the fact they are standing in towering TVs).

All of these control devices were devised to solve the problem of giving the user the easiest way of controlling the camera within the virtual space. This problem rose out of a need to give the user freedom within the space, where in any other case (camera on a rail, user warping to different scene changes, etc. It was thought that giving the user complete freedom was the best way to gather data, and that data would give the clearest idea of what the user would actually feel within the space if it were actually built. A person has complete control over their exploration in a real life space, so limiting a user's movement in a virtual space would inhibit their experience of the space. This was not proven with our sets of data, and in fact would need a much more dedicated experiment, but general commonalities in the data seem to point to the user preferring to move on their own, rather than be warped to different locations with the push of a button.

Nervous/conscious

A great risk to the data, that was raised early on, was that the user would become aware of the recording devices, and thus the data would become corrupt. This idea is almost unavoidable, so the system was designed to function with as little interference from the test giver/researcher as possible. A general observation has been that the user becomes more comfortable with the system as the test goes on, and thus starts to forget about the recording devices watching them. This idea is a common issue with many experiments, and getting around it has been a difficult task for many years. By narrowing our scope to just include whether the data that was being gathered was remotely useful, we were able to limit our concentration on the consciousness of the user of the testing, and focus on the viability of the system.

An early question raised about the system was whether or not the data that it gathered was even useful to distinguish a user's true emotional response. This idea has generally been proven, the system was able to gather data about the user's true responses to a virtual space, but because of a lack of cognitive psychology or human computer interaction experience on the team only general results can be analyzed. The team in its current configuration cannot generate a true statement of whether or not this system gathers the true response of a user to a virtual space. The team was more concerned with the integrity of the system than collecting data that could actually decipher the true response of a user within a virtual architectural space.

Data gathering may not be useful

Comfort Zone A general observation within the data gathered in the system is that a common user becomes more comfortable with the system as the test goes on. The hypothesis is that the user needs to be primed to the system/rig (the grandness of seeing 3 large screen TVs in front of the user) so that the data that is gathered has a better baseline, and thus when a reaction happens during the interactive experience, the data is not skewed by the user being awed or impressed with the rig itself. This primer was introduced part of the way through the process to experiment whether this hypothesis was true or not. Most of the data points to a steeper/more rapid decline in the baseline GSR of the user, thus pointing toward the idea that the user becomes more comfortable with the system with this priming.

Within the experience of the immersive space, each user achieves a comfort zone, where the best and most accurate GSR and facial data. Once the user enters the space, the user's GSR had risen slightly from their normal comfortable level because of the stress of entering a testing environment.

Photo-realism & Detail This project was focused on whether or not data could be recorded while a guest was being shown space design. Our architectural spaces were bare, with no textures or colors and the only aesthetic dimension included in our testing spaces was the use of lighting to create a sense of space. We conducted tests using photos of famous architectural spaces, and we believe that testing should be done with photo-realistic designs, or provide some model of detail for guests. Our photo tests generated very consistent GSR data that could be reliably attributed to the system and not outside factors.

Input Devices & Guest Interaction This is an important finding that can determine how future systems succeed & fail irrespective of whether the system remains in its current state or receives further iteration & changes. The average guest can only cope with two tasks at any given time. Any more than two tasks/interaction modes, and a guest will simply ignore any additional interactive elements. The ETC team highly recommends that these interactions are related only to movement/navigation & looking.

Real-life specifications for virtual designs will offer a challenge For 3D video games, levels & buildings are not designed with realism in mind; this is an intentional act created to provide a focused, easy-to-follow scenario. Even games, which provide levels that are supposed to confuse & challenge a player's navigation & place tracking abilities, design their levels with the player goal in mind. A driving factor behind this design philosophy is the limitation created by the in-game camera. It simply takes up space and cannot negotiate space that a human in an actual environment can. For full navigation, 3D virtual environments designed and modeled after real-life specification will hinder guest navigation. It is recommended that navigation & freedom of exploration be limited if real-life spaces & specifications are being represented.