INJUSTICE Interactive Live Action Virtual Reality Experience

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Abstract
Injustice is a three to five minute interactive virtual reality (VR) experience themed around racially motivated police brutality. In Injustice, guests witness an act of racial discrimination happening in front of them, forcing them to make moral and ethical decisions on the spot. The guest comes face to face with the characters of the story, filmed with live action, and interacts in the space with them directly using gaze interaction and voice recognition. Injustice is an experience aimed at exploring the emotional impact of VR space versus traditional film.

Author Keywords
virtual reality; game design; storytelling.

Concepts
Computing methodologies~Virtual reality, Social and professional topics~Race and ethnicity

Introduction
Injustice was created by Kalpana, a project team of graduate students from Carnegie Mellon's Entertainment Technology Center. Kalpana worked together for the Fall 2015 semester to explore interactive storytelling in virtual reality and build an effective pipeline for it. The focus of the project became to create an experience that told an interactive story with live action footage in 360°. For the experience, the

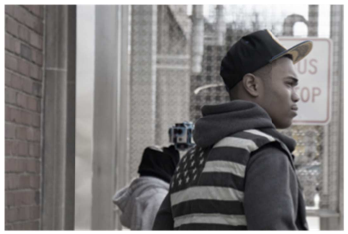

Figure 1. *Image of "Injustice"*

team wanted to write a story that could use the immersion and freedom provided with this medium to shed new light on current social justice issues.

Background

In America, racial discrimination and police brutality are problems at the forefront of awareness and concern, particularly in recent years by young men and women of racial minorities suffering unjust treatment, serious injury, and even death at the hands of law enforcement. Much of this discrimination is rooted in implicit racial biases held in American society, with media reporting and fictional representation of racial minorities shaping people's view through negative association.

However, there have been multiple psychological studies performed whose results find that participants who take on an African American avatar in virtual reality can reduce this implicit racial bias. In 2009, Stanford psychology researchers put participants in head-mounted displays (HMDs) to see themselves with a black avatar in a mirror. [2] A similar study was conducted at the University of Barcelona in 2013. [3] Both studies tested participants' implicit racial bias through Implicit Association Tests (IATs), and both found that participants who saw themselves with black avatars had decreased implicit racial bias immediately after the virtual experience.

Kalpana saw an opportunity to shed light on the situation experienced by a disproportionate amount of young African Americans in the country by leveraging the immersive power of VR, creating a level of empathy for the issue only possibly through personal experience. Rather than situation the experience entirely in exploring an avatar of a racial minority, we decided to use story to both enhance immersion and emotional investment in the issue. Kevin Brooks wrote in 2009 that three attributes of narrative greatly enhance an audience's immersion: time, context, and participation. [1] In creating Injustice, we decided to heavily leverage participation as our method for immersing the guest in the situation. Having the guest be a part of the story and make a difference in events through their actions would allow themselves to see themselves in the situation in reality, thus creating a new level of empathy and awareness of the issue.

Experience

When you put on the head mounted display to experience Injustice, you are placed on the side of the street, waiting at a bus stop. You encounter a young black man, greeting you on his way to the gym. He speaks directly to you and Injustice pauses, providing you with dialogue responses that you can say aloud, detected by voice recognition technology, to continue the conversation. The conversation and experience flows around how you respond.

You also have the option of looking at icons attached to real objects in the scene, prompting characters to comment and act according to your gaze. As he leaves the bus stop, the man is approached by two police officers, who stop and frisk him. The situation quickly escalates, and you have the power to call out, comment, observe, or do nothing at all. The situation adapts to your actions. In the end, Injustice's story is told by you.

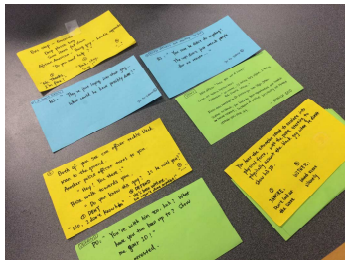

Figure 2. *Index cards used for playtest.*

Story and Playtest

The purpose of this game was to tell compelling interactive story in virtual reality. In order to make a realistic story, we dedicated 6-8 weeks to research about story and user playtest. Since interactive live-action storytelling games in VR is a unique medium, we thought this pre-production was very important for our game.

For the story, we had lots of personal interviews with African Americans at school and watched viral videos from Youtube. We also looked at TV shows 'What would you do' and 'Lost in Translation' to create a realistic story.

For the interaction, We started with writing a simple experience where the guest witnesses an act of racial profiling and let them choose whether to intervene or not. And then we added parts where users can interact with the main character before the incident happens, and kept interacting in the story. We had several versions of story going back and forth. After that, we mapped our story on index cards and Twine, which is an open-source tool for interactive storytelling. Using these index cards and Twine, we had 30 to 40 playtesters. From the result of these playtest, we tried to make options neutral so that the story doesn't lean to one specific end.

Shooting

The team experimented with the new heros 360 rig + 10 go pro cameras and a tripod during multiple test shoots. The purpose of the test shoots was to familiarize team members with the 360° video pipeline. Kalpana eventually built a humanoid tripod (Figure 3) for the final shoot, which acted as an in-universe player avatar.

Figure 3. *Heroes 360 rig, Humanoid tripod*

The final shoot took place over the course of a single morning and afternoon, with the team marking blocking points and locations to match up diverging interaction points. Audio was recorded and mixed from microphones on the actors as well as audio captured by the go pro cameras on the rig.

Post Production Pipeline

After shooting the footage from 10 go pro cameras, we used Autopano software for stitching the 10 individual videos and rendering panoramic videos. These videos were then imported into Photoshop and After Effects. The team composited and retouched the footage to remove stitching lines in Photoshop. The image file was then imported into After Effects to mask out stitching lines and animate the mask using key frames. Color correction and the final cut was done in Premier Pro.

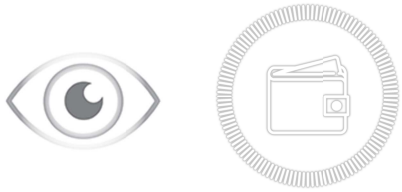

Figure 4. *Gaze interaction UI*

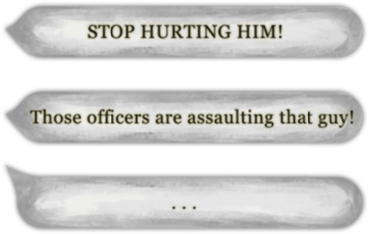

Figure 5. *Voice recognition UI*

Figure 6. *UI design development*

UI Design & Art development

We have two types of user interface in our experience:

1. Gaze interaction UI that appears when users look at certain objects. (Figure 4)
2. Voice recognition UI that shows dialog trees users can choose between saying. (Figure 5)

We wanted to cover jump cuts between scenes we shot in live action, especially for interaction points. For that purpose, we created an illustrated world effect that we combined with the user interface. We took screenshots of the 360° live action panoramic view, applied a filter in Photoshop, painted the main characters in the scene (Figure 6), and added the user interface.

Setup

As a standalone installation, Injustice is a straightforward and relatively lightweight setup. All that is required is the head mounted display, headphones, a microphone, and a Windows machine to run the executable on. Guests navigate their way through the experience by speaking aloud to respond to character conversations and looking at objects in their live action environment to incite character reaction. Two members from the team would be present at any given time. Team members will give guests a small introduction of Injustice and help them put on the microphone and head mounted display (Oculus DK2). Team members can see what the guest is viewing at all times. The experience can be stopped or paused at any point if the guest feels uncomfortable.

Conclusion

Interactive VR experiences have thus far almost always been created completely with computer graphics, with VR games all requiring 3D artists to render everything a player might see. Injustice's design, since the very beginning of their production process, instead used live action 360° video in order to immerse you in a real life situation, but incorporate interactive storylines with guiding graphic cues into the process. Injustice's many storyline branches were filmed with multiple edited takes, marking actors' locations and relative positions to the 10 GoPro camera rig used to stand in for the guest and creating integrated transitions with each guest choice.

References

[1] Brooks, 2009. There is nothing virtual about immersion: Narrative immersion for VR and other interfaces.

[2] Groom et al., 2009. The influence of racial embodiment on racial bias in immersive virtual environments. https://vhil.stanford.edu/mm/2009/groom-racial-embodiment.pdf

[3] Peck et al., 2013. Putting yourself in the skin of a black avatar reduces implicit racial bias. http://www.sciencedirect.com/science/article/pii/S1053810013000597

Website

http://www.etc.cmu.edu/projects/kalpana/

https://www.youtube.com/channel/UCdinLSXYaIxjPZ36F7AU-cg

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