Tech Portraying Emotion: Designing Augmented Reality Assets for *Moon Man Walk*

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Introduction

Augmented Reality (AR) is a media form that adds virtual elements to our reality without completely replacing our perception in real-time. The liveness of this medium inspired me to combine it with another live art medium: theater.

Augmented Reality has recently been used in performing arts to enhance choreographers' creativity while working with intermedia art (Brockhoeft et al. 2016) and to make theater more accessible to deaf and hard-of-hearing people through American Sign Language interpretation (Garrett et al. 2022). The ALICE Project allowed AR to be controlled by the performer in a production of *Alice in Wonderland* by Lewis Carroll (Lisowski et al., 2023). An adaptation of *What the Moon Saw* by Hans Christian Andersen enabled audience members to have more interaction and agency over their viewing of a performance (Lisowski et al., 2023). I am exploring how augmented reality can enhance the storytelling of a play. In this production, the AR elements are meant to accentuate and reflect the protagonist's perspective.

In the first part of my thesis project, I focus on designing the augmented reality elements with theatermakers and audiences in mind. The AR elements were implemented in my Theater, Dance, and Performance Studies thesis through a production of *Moon Man Walk* by James Ijames. *Moon Man Walk* is about a man named Spencer, the only child of a single mother, who relives moments of his life with his mom while planning her funeral. Along the way, he discovers a new meaning of family. This story includes science fiction elements, as Spencer was always told that his absent father was an astronaut on the moon. The characters in the show are Spencer, Esther (his mother), Petrushka (his love interest), and the Astronaut (his father). This paper will detail the process of creating the AR elements.

Technologies

I used the web-based augmented reality (WebAR) platform Niantic 8th Wall for the development of the AR elements. This platform is made for both Apple and Android devices as long as they are connected to the internet. WebAR optimizes the AR experience for audience members because they do not need to install a new app, which could be a deterrent to using the AR. It optimizes the development experience, so developers do not have to design specifically for both Apple and Android devices. Audience members can view the augmented reality elements on a website after scanning a QR code or following a link.

As Niantic 8th Wall is WebAR, the primary coding languages were web development languages HTML, CSS, and JavaScript. Assets created for this project consisted of photos, videos, and 3D

models, which were PNG, MP4, and gITF files, respectively. Adobe Premiere Pro was used to edit the Box of Multitidues video. Blender was used to create the 3D models for the other assets.

Augmented Reality Asset Creation

I proposed creating four to six augmented reality assets for this production: a "box of multitudes," the sky, the caskets, the map of the solar system, the funeral frame, and the astronaut suit. If I did not have enough time, I would not do the sky and casket AR elements. The sky ended up being better as projections in the show because the scene where it happens is over five minutes long. Holding the phone for that length of time could cause audience members physical strain, so it was better suited as scenic projection. I was unable to make the casket AR element due to the steep learning curve of learning how to use Blender and the time constraints. In the end, four augmented reality assets were created.

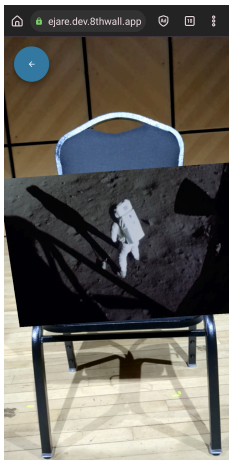
Box of Multitudes

In the play, Spencer picks up a box that "contains multitudes" (Ijames, 2018). I edited a video with archival footage from Philadelphia from the 1980s, the 1969 moon landing, and different scenes in nature. I used an image target so the video could only be seen when the phone was held up to a specific image that was designated in the code. The image target for this asset was a physical wooden box.

Figure 1

Box of Multitudes

a) 

b) 

a) is the physical box that the video was mapped onto. b) is a still image from the Box of Multitudes video covering the physical box

Astronaut Suit to Astronaut Helmet

Initially, I was going to create a whole astronaut suit to replace the physical jumpsuit that the actor playing the astronaut wears. However, after interviewing the costume designer, it made more sense to just create an astronaut helmet. I used a YouTube tutorial by Render Studios to create the helmet. I included it in the app as a face effect so the helmet would only appear once the program recognizes a face. The attachment point, or part of the face that the asset would anchor onto, was the forehead.

Figure 2

Astronaut Helmet

This is a picture of the Astronaut Helmet on Layla Felder, who played the Astronaut in *Moon Man Walk*, before the asset was adjusted to fit their head correctly.

Map of Solar System

In the script, the Astronaut draws a map of the solar system, so I want to create assets of planets, moons, and other parts of space that pop out as the Astronaut draws the map. Initially, I planned to use planet models from Poly by Google on poly.pizza, which were free to use with attribution under the Creative Commons Attribution. However, when I input them into Niantic 8th Wall, they were too big and could not be scaled down to a viewable size on a phone. So, I created the map in Blender

from scratch. I did not have time to animate the map, but audience members we able to pan around the room and switch the orientation of their phones to see the whole map.

Figure 3

Map of the Solar System

a) 

b) 

a) is the whole solar system b) is a picture of the solar system during the performance while Felder draws it

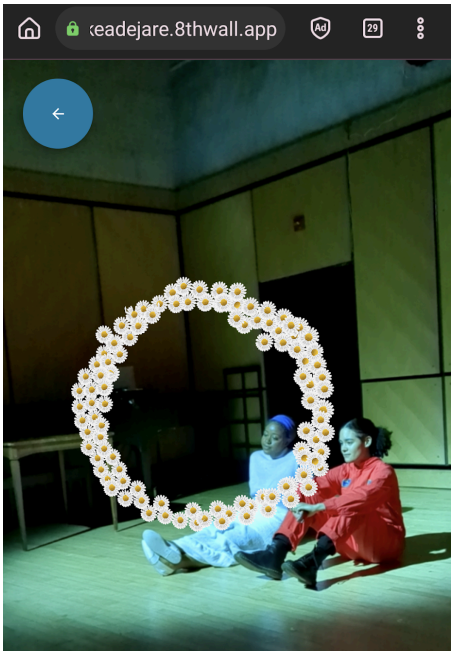
Funeral Frame to Daisy Wreath

I drew inspiration from Kehinde Wiley's portraits to create the frame that would surround Esther as Spencer delivers her obituary. Initially, I aimed to make a picture frame with daisies, vines and in the frame. However, I struggled to make the vines look full, create realistic-looking hydrangeas, move the frame into the y-axis, and get the frame to render correctly once put into Niantic 8th Wall, so I decided to make a wreath of daisies. Artistically, I also made this decision because at some funerals, a wreath of flowers is put around a picture of the deceased person. The script also mentioned that daisies were Esther's favorite flower, hence the choice of flower.

I used a Blender tutorial on YouTube to create one daisy and then put a 2D circle on the y-axis. I then put the daisy on the circle and copied it, moving the rest of the copies around the circle. When I was done, I deleted the 2D circle and adjusted daisies to make the wreath look fuller.

Figure 4

Daisy Wreath



The Daisy Wreath over Aabi Whyte-Spence (Esther) during a performance of *Moon Man Walk,*

Putting it Together

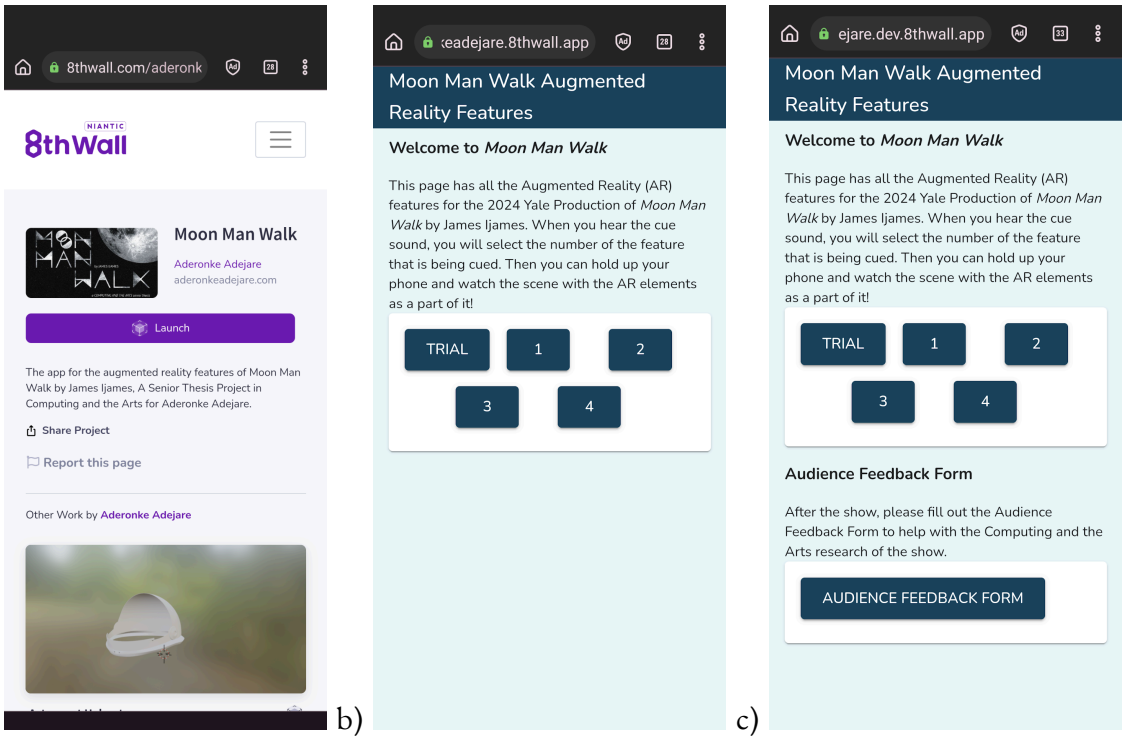
Once all the assets were done and working in their own Niantic 8th Wall Project, I focused on putting them in one web app so audience members did not have to repeatedly scan a QR code. All the elements were in the same order as they appeared here and labeled 1 through 4.

I also used the Astronaut Helmet as the Trial element but instead with the camera defaulting to the front facing camera. During the introductory speech about how to use augmented reality preceding the show, I tell audience members to click on the Trial button to practice using the AR. The audience member would then see themselve with the Astronaut Helmet on their face. Since the Astronaut Helmet was a static GLB file, it could not dynamically change the size and shape of the astronaut helmet to the size and shape of the audience members' heads, including their hair.

After the first two performances, I added a button to the app that linked to the Audience Feedback Form, so it was easier for audience members to access and fill it out. This led to a significant increase in immediate responses to the form.

Figure 5

The Moon Man Walk *App*



a) b) c)

a) is the first web page the audience is taken to when they scan the QR code. b) is the home page for the first version of the app. c) is the home page for the app after the Audience Feedback Form link was added.

Cast and Crew Interviews

I interviewed the cast and crew members three times throughout the process: before trying the AR, after trying the AR, and after the show. For this essay, I will discuss the first and second rounds of interviews. Interviews were conducted over Zoom. The consent questions were asked at the beginning of every interview.

Table 1

A table of the interview questions

Consent Questions	**Initial Interview Questions**
• Do you consent to being recorded? • Can your comments be used for academic purposes? • Do you want to be identified or anonymized in my academic research?	• What do you know about Augmented Reality? • Have you interacted with any AR before? • *Cast Only:* Would you like to practice with the AR? If so, how often would you like to practice with it? • *Crew Only:* Do you think AR will affect your role in the production? Where in [costumes, sets, props] do you think AR elements work best? • What questions do you have about AR?
First Time Trying AR Interview Questions	**Post-Show Interview Questions**
• How does it feel to interact with the AR? • How is it different or similar to acting without it? • What are ways to improve interacting with it?	• How did it feel to be watched by the audience through a phone at some points during the show? • Would you work on a show with AR again? Why or why not? • What advice would you give to actors/crew members working on a show with AR?

Initial Responses

Cast Responses

I interviewed all the actors: Prentiss Patrick-Carter (Spencer), Aabi Whyte-Spence (Esther), Ruth Ogunribido (Petrushka), and Layla Felder (Astronaut). All of the cast did not know much about AR but Felder knew about how some filmmakers are experimenting with virtual reality. After describing

augmented reality to them, I asked if they had previous interactions with AR. One interacted with AR by watching someone play PokemonGO and another played PokemonGO and used AR in a museum. All actors wanted to practice with AR before the show and listed different frequencies as to how much they would want to practice with it, ranging from spending half of the rehearsal time with it to a few rehearsals closer to the show dates. All said they would like to practice with it during "tech week" which is the week of the show when the production is in residency in the theater, all design elements are added, and full runs of the show occur.

Crew Responses

I interviewed the costume designer (Zara Belo), dramaturg (who wanted to remain anonymous), scenic designer (AJ Laird), and props designer (Sam Fisher) about AR. The dramaturg and Laird did not previously have experience with AR. Belo had used the Nintendo 3DS AR cards where you could scan them and Nintendo characters would pop up but there was no interactive element of it. Fisher used AR to see Civil War photos at an American Battlefield Trust exhibit.

Belo suggested making an AR helmet for the astronaut helmet instead of replacing the whole suit. An actual helmet could be clunky, expensive, muffle the voice of the Astronaut, and mess up the actor's hair so an AR could immerse the audience while combating these issues. Laird said AR could be good for quick set changes. For example, instead of getting cast members to quickly put tons of plants onstage for the flower shop scene, audience members could be transported to the flower shop through AR. Fisher recommended using AR sparingly for props. Props should feel natural to the play and audience members should only have to pay attention to them if there is a special prop. Instead, there should be one or two moments for novelty. The designers' feedback is invaluable to ensuring this project runs smoothly.

Feedback

I presented my thesis progress to the graduate students and faculty of the Yale Social Robotics Lab at the weekly lab presentation "Lab Lunch" and my peers, Head of College, and Dean at the Saybrook College Mellon Forum. In both presentations, people tried out the Box of Multitidues video with a test image target on the screen. Viewers were excited and gasped as they viewed the video in AR. People from further away had difficulty viewing the video on screen and if people moved it became hard for them to keep the video on screen. Some watched the video through other people's phones during the demonstrations.

Important questions audience members asked me were, “How far away does someone have to be to see something, (how) can we circumvent someone being blocked by other people’s phones during the show, and how do we allow for freedom for actors while the audience is viewing an AR asset?”

I did a test run of a Niantic 8th Wall sample project in the Underbrook Theater early in the fall semester, and I was able to see assets from all parts of the theater on my phone. For the second question, I expect the tiered seating of the theater will help to alleviate part of this problem. A peer, who previously co-directed a production with me, also helped me think of a solution after viewing my Mellon Forum. She suggested demonstrating to the audience how to hold their phones to best experience the AR moments before the show. An example is finding a window between two seats in front of you to put your phone. With the last question, the actors will practice with the AR and their input can help allow them to still be free in their movements while audience members interact with the AR.

The presentations garnered a lot of interest in the project and excitement to participate in the experience when the show happens.

Cast Tries Out AR

The cast also first tried out the Box of Multitudes AR element in a rehearsal on January 18, 2024. First, we practiced the scene where Spencer holds a box then we tried the scene again with Patrick-Carter holding my laptop as a stand-in for the box. The other actors and stage manager (Alicia Deng) brought out their phones and watched the video by pointing them at the box and tapping on the screen.

Patrick-Carter said he “never imagined tech portraying emotion.” Two actors mentioned how this was a unique way of bringing stage directions to life. Multiple actors noted how the attention of the audience shifts to their phones (and the AR) and then waiting for the audience to react is a big difference to their experience acting. Patrick-Carter also said he felt “normal”: He was just holding another prop and did not feel hyper-conscious of the AR element.

The actors' feedback on AR was very helpful in improving it. Similar to the feedback from my Mellon Forum and Social Robotics Lab presentations, they worried about the audience members’ views being obstructed/obscured and being able to see the image from the back of the audience. On the technical side, they noted that the box should be big and well-lit enough so the target image can be seen well. A new suggestion from the actors was the ability to zoom in on AR elements.

The next time the cast tried out the AR was the Astronaut Helmet and Map of Solar System AR elements. Once again, we rehearsed the scene where the AR would be used before including the AR in it. Felder, who played the astronaut, recited their monologue while the rest of the cast and stage manager watched her through their phones. This time, the first version of the astronaut helmet actually blocked Felder's face. the actors thought that this could distract from watching the performance. This trial helped me adjust the astronaut helmet by deleting the back of the helmet so you can see the person's face and increasing its size so it could fit Felder's head.

Figure 5

Version 1 of the Astronaut Helmet

An image from the first time the Astronaut Helmet was used in rehearsal.

Felder has previously worked in film and noted that even though they were used to cameras watching their acting, it felt very different to have multiple phone cameras pointed at them. They said that they "felt very perceived," but then got used to it.

During this trial, Patrick-Carter noted how instead of watching a video through the phone, you are watching a person acting with the AR. He noted that this added a bit of separation between the audience and the actor. Deng also pointed out the seperation and added that " it changes the relationship you have as a viewer of the entire story." Typically, there are no dividers between audiences and the action, but here the audience is watching the action through their phone. Whyte-Spence

agreed that it adds some separation and added that she felt more focused on trying to get the AR to work than paying attention to the story.

Future Directions

In the second semester of my thesis, I focused on putting on the production and getting cast, crew, and audience feedback on the experience of working with or viewing augmented reality in a theater production. There were four performances of *Moon Man Walk* between February 29 and March 2, 2024. After each performance, the audience was asked to fill out a digital survey that was distributed via QR code on the program, near the exits of the theater, and inside the AR viewing web-app. The questions are:

1. What do you remember the most from the show?
2. Did you try to use the Augmented Reality (AR) features of the production?
3. Which AR features worked for you? (Check all that apply)
4. How did the AR features affect your viewing experience of "Moon Man Walk"?
5. Did the AR features enhance your understanding of the story?
6. How did the AR features affect your understanding of the story?
7. Did you enjoy using the AR features?
8. Would you go to an AR theatrical production again in the future?
9. Any other comments?
10. Why did you not use the AR elements?
11. What could cause you to use AR features in a theatrical production in the future?

Questions 2, 5, 7, and 8 are Yes/No questions, 3 is a multiple-select question, and the rest are open-ended responses. Audience members will only answer questions 3 through 9 if they select “Yes” to question 2. They will answer 10 and 11 if they answered “No” to question 2. There is also a section at the end that allows audience members to leave their contact information if they are open to being asked more about their experience, but it is not required.

I will complete my Theater, Dance, and Performance Studies essay, which will discuss the implementation of the AR in the show, how the AR affected actors' performances, analyze the audience responses to the audience feedback form, and contextualize my work in the greater context of technology's integrations into theater.

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