



Designing for Social Interactions in a Virtual Art Gallery

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Motivation and Goals

COVID helped us realize the importance of virtual and social collaboration tools more than ever.

It has motivated us to reimagine the way we collaborate and more importantly focus on how to use users existing habits and knowledge about online collaboration tools and interaction to create and improve virtual spaces.

This lead us to implement a virtual metaverse more specifically an ART Metaverse because ...

- We wanted to model a space where people can relax, entertain, create, and collaborate
- We wanted to make it easy for creators to get feedback, for users to experience the product better - in a way that might not be possible in a non-virtual setting
- We wanted bridge the distance and accessibility gaps in experiencing art

Process

- Problem Statement
 - User studies and Observations
 - Research
 - Ideation
 - Requirements
 - Design
-

Background

Research about Virtual Social Interactions

- Social presence
- Scaling a virtual environment
- Layered heuristic participation



Research about Virtual Spatial Interaction

- Virtual Reality and Augmented Reality
- Browser format helps users navigate with ease
- 'Gamifying' a virtual space
- Curators combine spatial elements to positively affect their art

Survey

To build a social interaction system, we decided to study the ways users:

- **Interact**
- **assign privileges**
- **prefer one feature over the other**
 - in some of the commonly available collaboration tools like *Netflix Teleparty, Prime/Disney/Hulu Watch Parties, Zoom, and Discord*

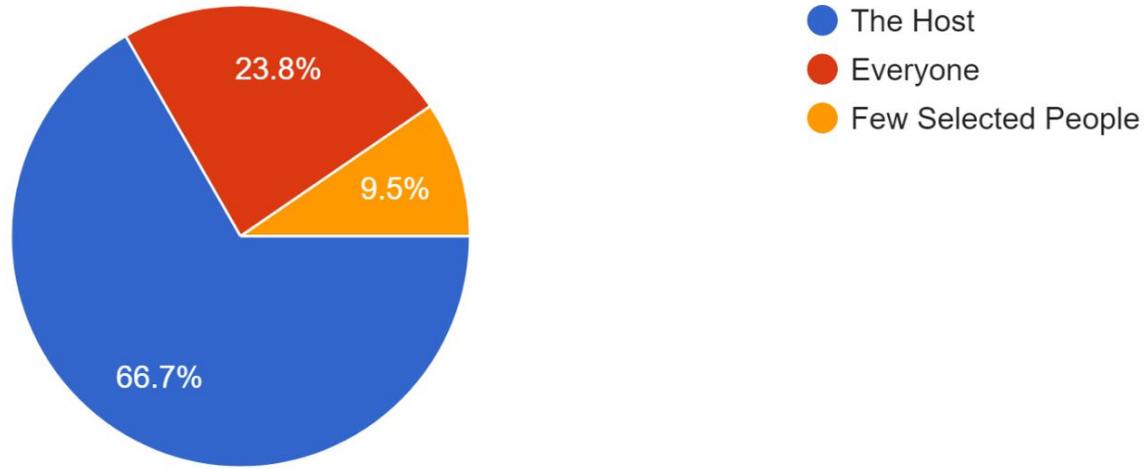
Survey of 31 undergraduates exploring Co-Presence

Survey

- **Primary Control**
 - Situation-based privilege
- **Communication Methods**
 - Text
 - Audio
 - Video
- **Points of Frustration**
 - Poor UIs
 - Only sharing w other clients

During your experience who had primary control over the remote?

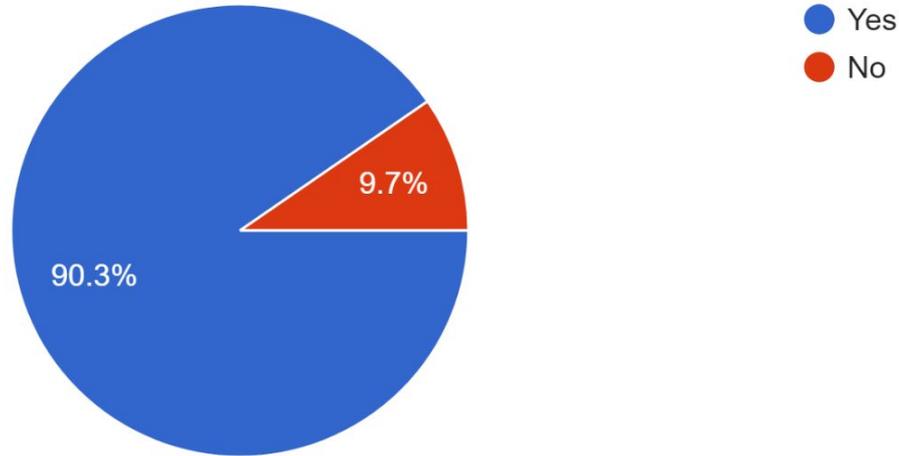
21 responses



Situation-based privilege

Do you think this privilege option is fair? (Like restricting you to share screen, create channels, and so on if you are not the host)

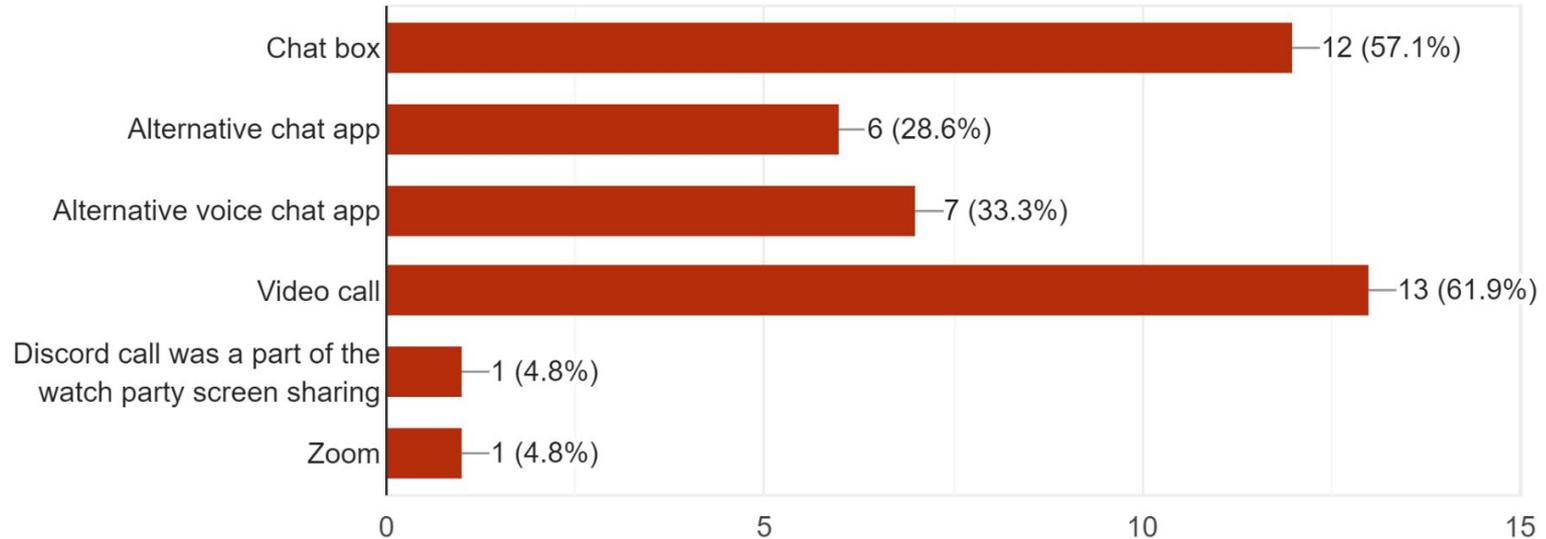
31 responses



Situation-based privilege

How did your group communicate with one another through these applications?

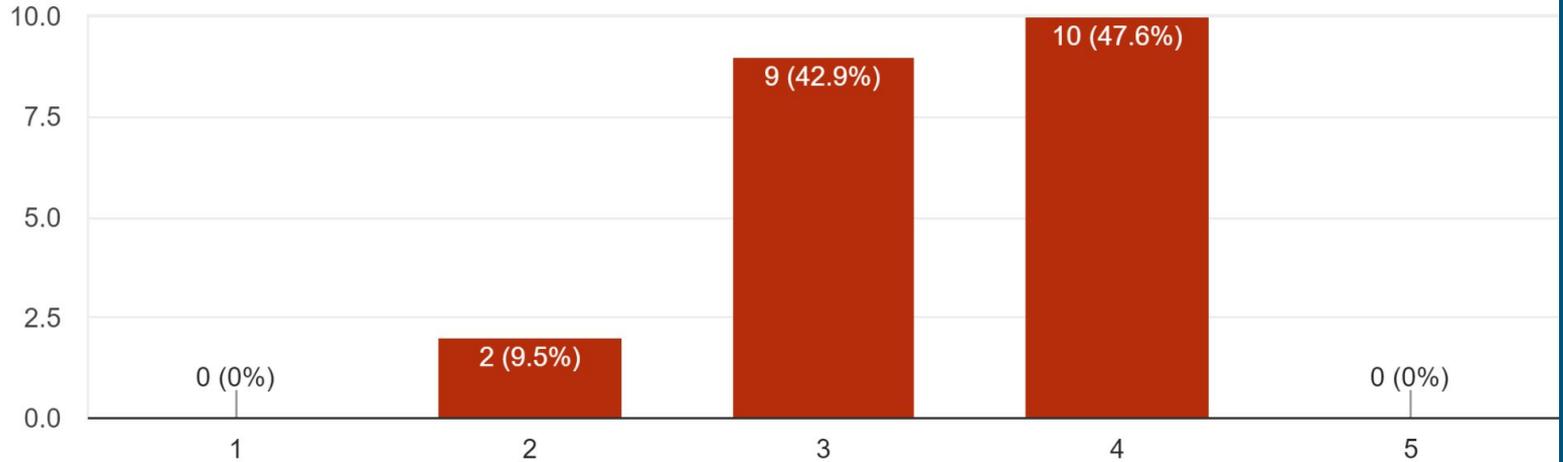
21 responses



Communication Methods

Rate your satisfaction with the chat display of the application. (1 - very dissatisfied, 2- somewhat dissatisfied, 3 - neutral, 4 - somewhat satisfied, 5 - very satisfied)

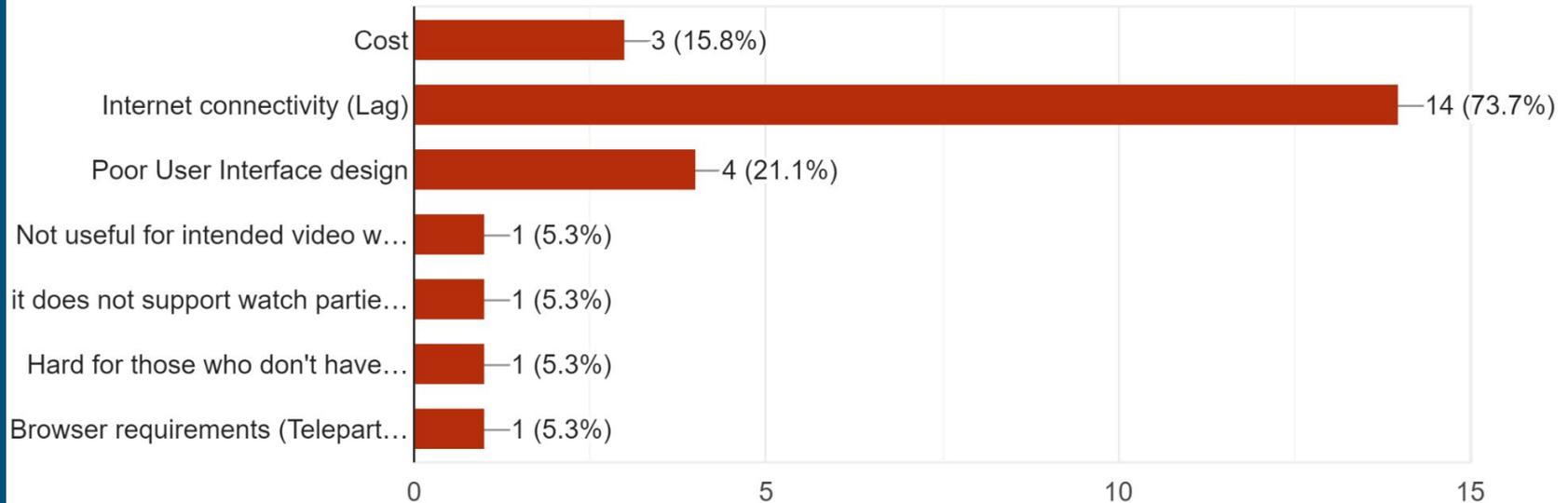
21 responses



Points of Frustration

What, if anything, keeps you from using the application?

19 responses



Points of Frustration

Observations

Visiting At Moss Arts Center (MAC)

- **Moss Arts Center**
 - Virginia Tech's campus center for the performing arts, and visual arts. This was a **key point** of observation for project
- **Goal**
 - Understand how people interact with a physical space

Visiting At Moss Arts Center (MAC)



Left image is of the stairs in the Moss Arts Center. Middle image is the Hallway outside of the auditorium. Right image of the entrance of The Shape of Distance exhibit.

Ideation

Personas



Vilma Louise

Age: 57

Location: Crystal Cove, CA

Hobbies

- ★ Reading mystery novels
- ★ Solving crossword puzzles
- ★ Loves escape room games
- ★ Enjoys playing her ukulele
- ★ Watchings Ice Hockey on TV
- ★ She also practices various forms of martial arts

Desires

After Vilma and her partners at work retired, they all decided to go their separate ways to explore the world on their own. She wishes that they could still participate in more events with each other even when they are far apart. She does not want to lose the connection they have built together through their shared job experiences.



Jessica Smith

Age: 27

Location: New York, NY

Hobbies

- ★ Painting
- ★ Photography
- ★ Eating
- ★ Traveling
- ★ New Languages

Desires

Jessica wants to travel and keep learning about more art. For her research she needs more in-depth knowledge about the environment for which she needs to visit the galleries and museums where they are displayed.

Personas



Caleb J. Thames

Age: 30

Location: San Francisco, California

Hobbies

- ★ Photography
- ★ Cooking
- ★ Baking
- ★ Nursing
- ★ Reading
- ★ Volunteering

Desires

Caleb wants to be a good parent and provide everything he can for his five-year-old daughter, Cara. At the same time, he wants to reconnect with his college friends.



Jennifer "Jenny" Salcedo

Age: 20

Location: Brooklyn, New York City, New York

College: Pratt Institute

Major: Digital Arts & Graphic Design

Hobbies

- ★ Visiting Museums
- ★ Making Her Own Clothing
- ★ Teaching Drawing/ Painting to Children
- ★ Thrift Shopping
- ★ Watching Disney Films
- ★ Visiting New Restaurants (Foodie)
- ★ Baking

Desires

Jenny enjoyed interning at the Museum of Modern Art (MoMA). During her time, she helps create pamphlets and virtual advertising platforms for the various exhibits at the Museum. To her, the experience reaffirmed she was in the right field. She hopes to continue working for the Museum, and bringing art to more and more people.

She also hopes to see some of her art at a museum exhibit one day. While it certainly is not at MoMA-level, she wants a platform where she can display her creativity to the world.

Ideation and Critique

- We had two rounds of ideation and critique
- First round
 - Each team member came up with 10 ideas
 - We grouped together similar ideas and identified themes
- Second round
 - Each teammate came up with 15 ideas
 - Followed the critique and grouping method
- End Results
 - 12 categories with a total of 100 ideas
 - We narrowed these 12 categories to primary 5 categories

Ideation Categories

1. **Information Directions**
2. **Social/Object Interaction**
3. **Audio**
4. **Exploration**
5. **Profile/Privilege**

Derived Requirements

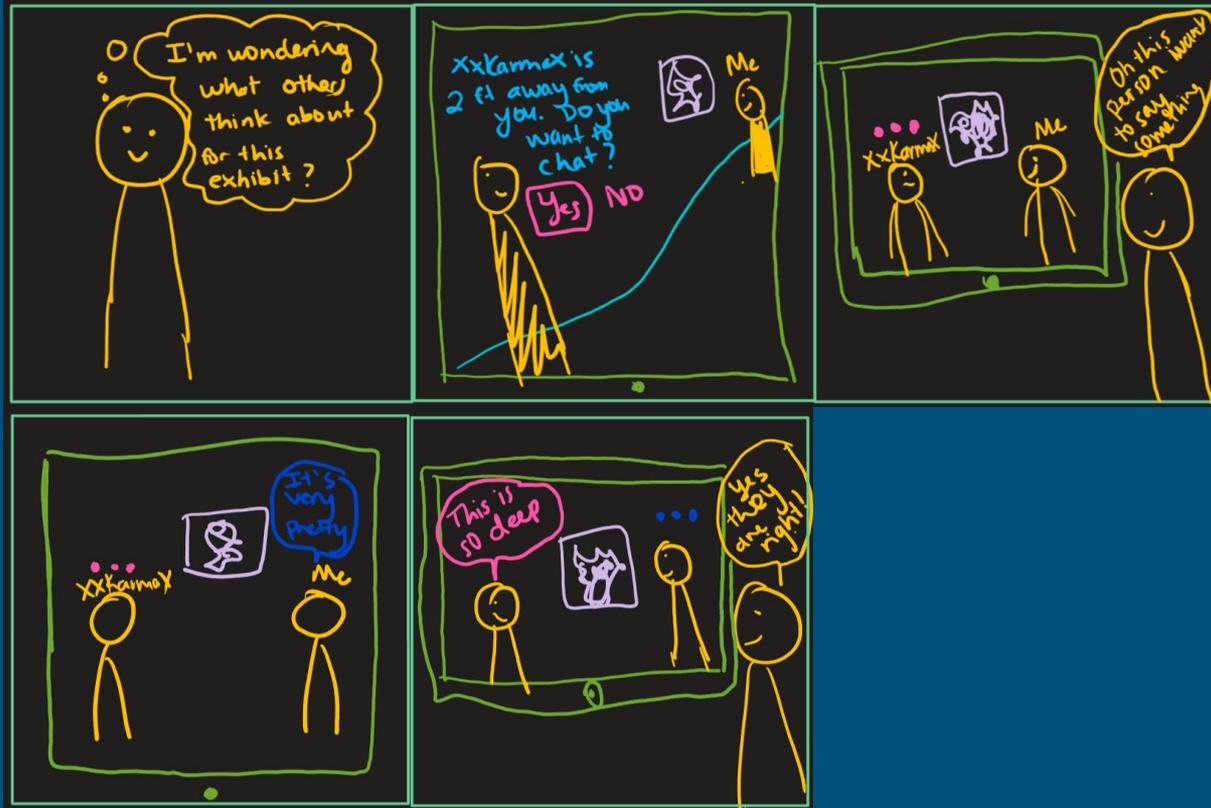
Derived Requirements in Priority Order

1. **Information Directions:** Users shall click on checkpoints to go to exhibits
2. **Social/Object Interaction:** Users shall be able to create proximity group chats
3. **Audio:** Users shall be able to listen to audio from an artwork and control it
4. **Exploration:** Users shall be able to view a globe and explore exhibits around the world
5. **Social/Object Interaction:** Users shall use private chatting with other attendees
6. **Social/Object Interaction:** Users shall be able to leave interactions on pieces of artwork for artists and other users to see
7. **Profile/Privilege:** Artist users shall be able to see number of views and length of time people stay within exhibits that they have created
8. **Social/Object Interaction:** Users shall use audio chatting instead of texting
9. **Profile/Privilege:** Users shall look at their liked exhibits and art works

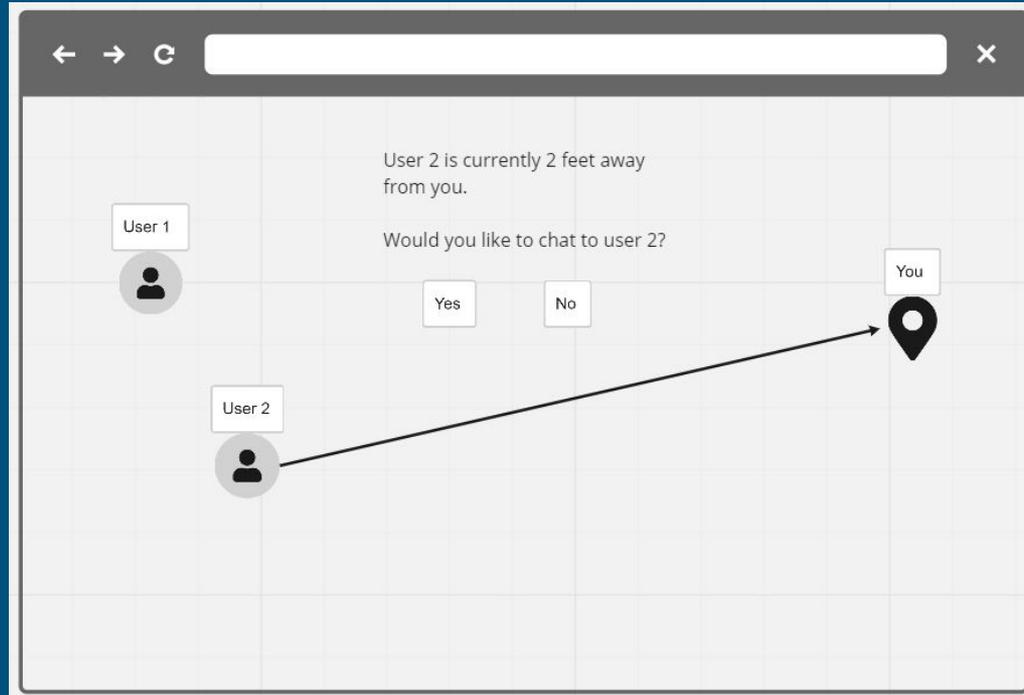
Requirements Selected to Prototype

- **Information Directions:** Users shall click on checkpoints to go to exhibits
 - prioritize easy and understandable navigation
- **Social/Object Interaction:** Users shall be able to create proximity group chats
 - Needed a way for users to communicate and express themselves with one another.
- **Audio:** Users shall be able to listen to audio from an artwork and control it
 - Prioritize user interaction with items in real time and create context within a space

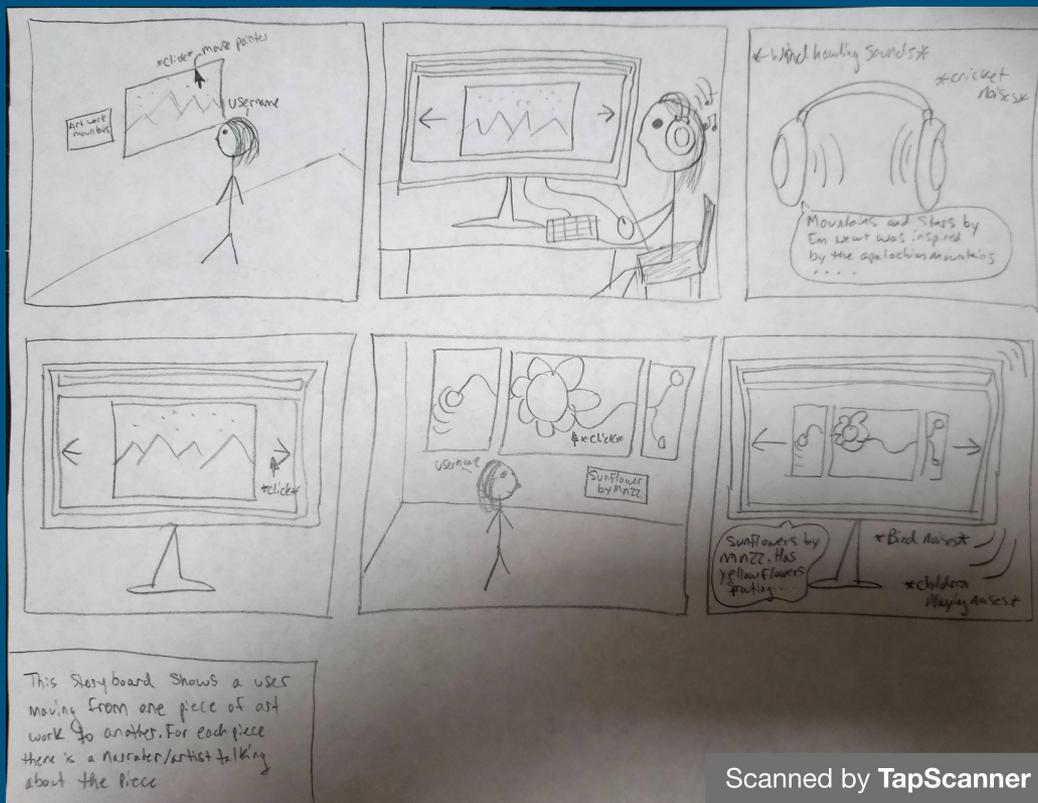
Proximity Chat Storyboard



Proximity Chat Wireframe

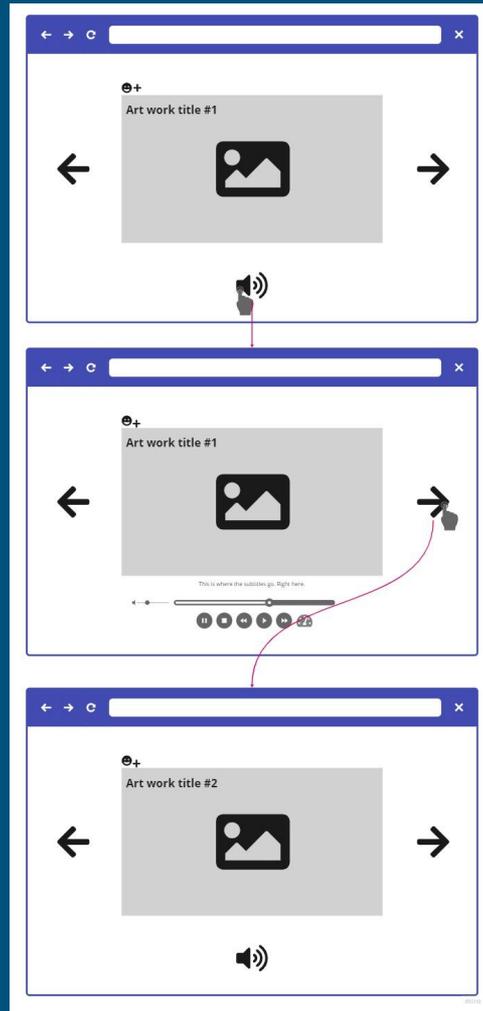


Audio Storyboard



Audio Wireframe

- User clicks on the audio icon button
 - The narrator/artist will begin speaking
- There will be subtitles provided as the narrator speaks
- There will be options to pause, play, and speed up the audio
- User clicks on either of the arrows going left and right on the sides of the art work
 - It will move on to the next piece of artwork in that direction within the virtual space.



Designs

Features

- Browser accessible
- Teleportation capability using checkpoints on a map
- Allow users to view pieces of art in a 3D space with narrations
- Users will be able to control the audio for each artwork
- Users will be able to communicate with one another through a proximity or private chat box

Implementation and Software

Technical Tools Used

- Fusality Server software written at Virginia Tech
 - node.js service for publishing and subscribing to various events in the Mirror Worlds
- Two X3D spaces to test our designs
 - X3D model of our Moss Arts Center
 - X3D model of the Sponza courtyard model
- A set of 6 simple artworks (images) and their audio narrations

Prototype

Prototype feature solutions

- Users can navigate around in first person, or use map view to teleport to other locations.
- Users can start and stop embedded media in the 3D world
 - Users can listen to a narration of an artwork and control it
- Can capture text notes at a location and save them for later.
- A text chat channel is supported as well a salient drop down list and button to invite other users to a private text chat based on proximity.
 - Users can create proximity group chats.

Navigate Around in First Person



People currently observing this model:

Savvy's observing at: 8.75426841678345, 3.9682146158756474, 8.35345213062971

Emily observing at: 0, -1, 2

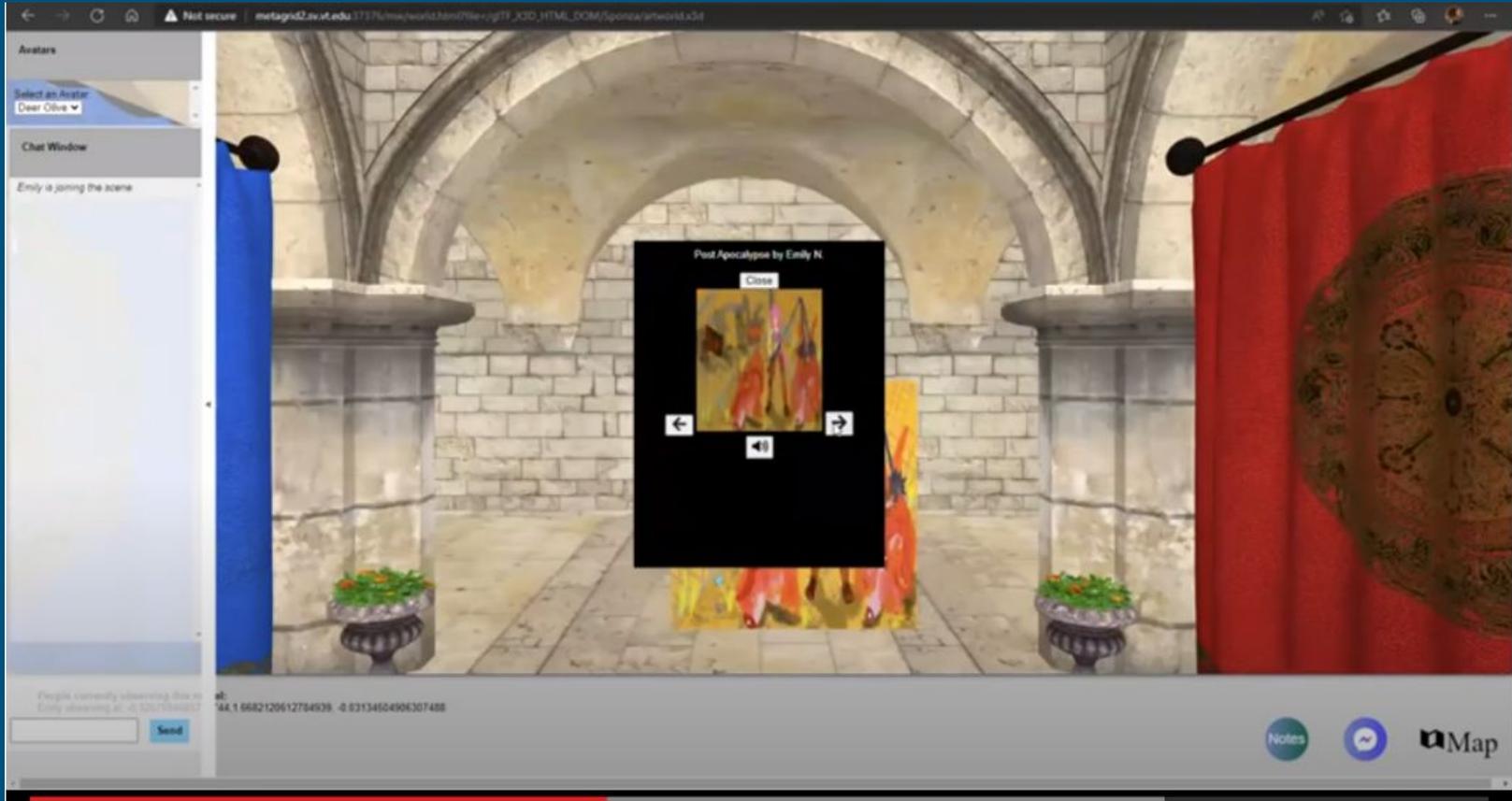
Nukassn observing at: 5.3301483563357705, 0.8507228303755418, 0.255008593025885

Lily observing at: 8.351201436840302, 2.554420343025096, 0.7984514730620773

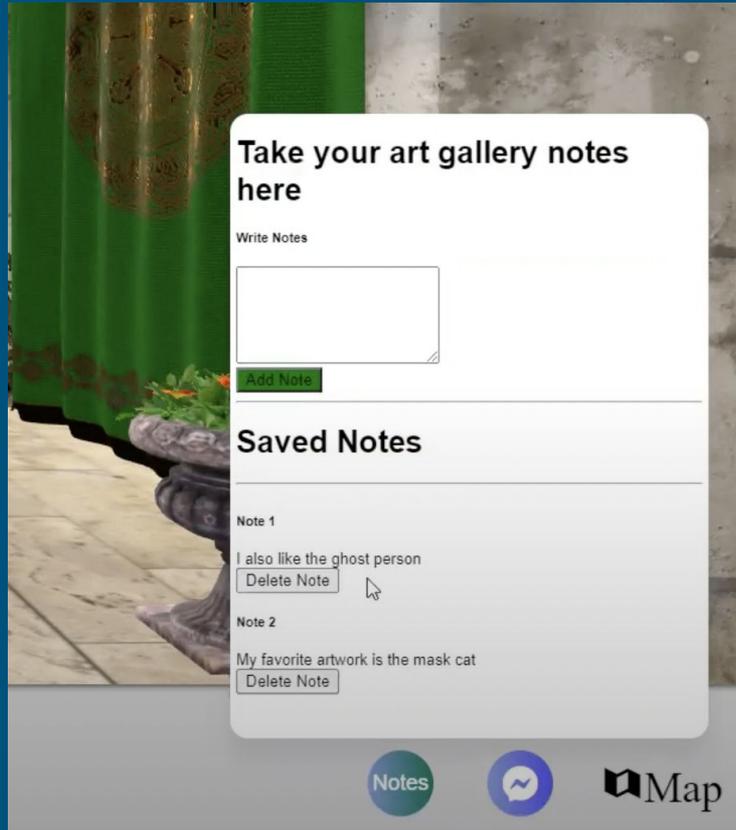
Map View to Teleport



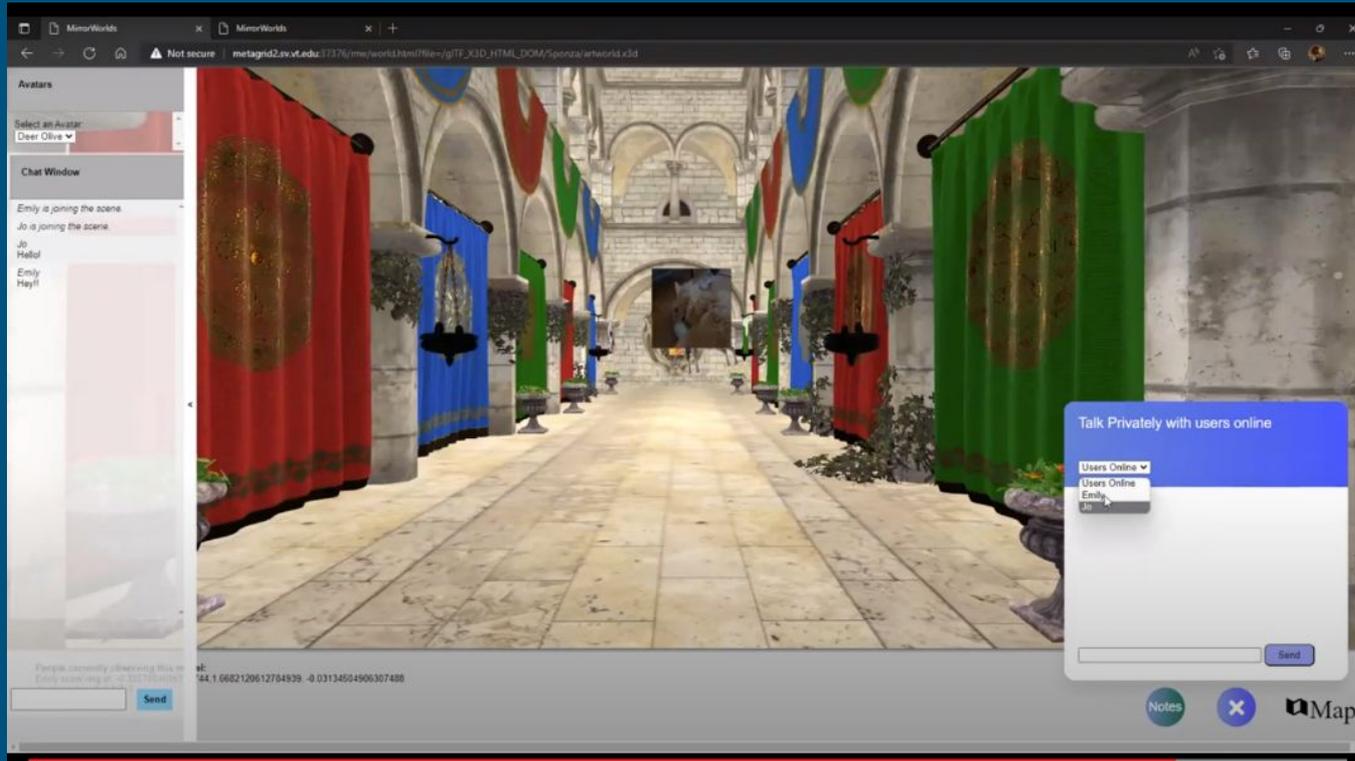
Start/Stop Embedded Media in The 3D World



Capture Text-notes



Text Chat: Invite Users to a Private Text Chat Based on Proximity



User Testing and Evaluation

Users Testing

- One on One interview setup w 4 users
- Qualitative & Quantitative measurements
 - Observe ability to do tasks by timing them
 - Ask them to measure their ability to navigate and intuitively understand the system

Tests Performed for Evaluation

- Map/ Navigation - ability of users to use map to travel to checkpoints
- Art/ Audio Usage - ability of users to look at art & additional features
- Proximity chats - ability of users to use chat with users nearby
- Notes - ability of users to find and use notes feature

Statistics of Testing

Quantitative Analysis Results

Table Columns: (see below)

- *Feature*: The feature being evaluated
- *Average Ease of Use*: Mathematical average of the ratings received by all the users

Results Interpretation:

- **Map Navigation** Feature and **Proximity Chats** were relatively more difficult to understand and use for the users

<i>FEATURE</i>	<i>Average Ease of Use (out of 5)</i>
Map/ Navigation	3.25
Art Audio	4.75
Proximity Chats	3.87
Notes	4.63

* Sample size = 4

2. Qualitative Analysis Results

See the paper Appendix for Nielsen Heuristic Tests and conclusions.

Future Work

We implemented a set of features that we thought were the most important to being with, but there are several other designs that we think can be a great next step:

- A pop-up after *clicking on an avatar* - with features like private chat, teleport or view art together
- Modifying the *list of online users* to include only a subset of users (maybe based on the room or proximity)
- Adding secure *file and picture sharing* feature to the chats.
- Enable the artists to collaborate so a *virtual art collaboration space* with a canvas, color palette tools, lighting, and more. A virtual setting opens up several possibilities for experimenting with lighting, color, position, and more in low cost before displaying it in an art gallery!