

# Design Document



## Loci House

A VR Educational Experience of the Brain

CMPE 297

Design Document

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# Table of Contents

<b>Overview/Description</b>	<b>3</b>
Application Objectives	3
Rules	3
Experience Walkthrough	3
<b>Targeted platform</b>	<b>5</b>
<b>Story and Research Elements</b>	<b>5</b>
Game Theoretical Foundation	5
Designing the “Loci House”	6
Initial UX Research	6
Secondary UX Research/ Usability Study	8
<b>Audience</b>	<b>9</b>
<b>Application Objectives</b>	<b>9</b>
<b>Game Mechanics</b>	<b>9</b>
<b>User Interface</b>	<b>10</b>
<b>Minimum Viable Product (MVP)</b>	<b>11</b>
<b>Detailed Roles and Responsibilities</b>	<b>12</b>
<b>Asset List</b>	<b>13</b>
Unity Purchases	13
Developed by Lauren	14
<b>Development and Management Tools</b>	<b>16</b>
<b>Future Plans</b>	<b>16</b>
<b>Appendix / Backup Material</b>	<b>17</b>
Storyboard	17
3D Model Development	23
Props	24
Particle and UI Elements	29
Animation	31
(Visual/Audio) Displays	33
Graphics and Animation	33
Dialogue Script	34
Task Delegation	37

IRB Application	39
User Research - Survey	45
User Research - Survey Responses	47
Interaction Design Conceptual Model	54
Design Heuristics (VR)	58
Marketing - Logo/Branding	59

## Overview/Description

We developed an educational Virtual Reality experience for the HTC Vive that helps students learn about different brain parts and their associated functions through memory association techniques.

### Application Objectives

Purpose of the game is to teach students about the brain through an interactive and fun game to improve one's own understanding and memory association techniques.

### Rules

There are no particular rules to the game. You simply interact with what's there.

### Experience Walkthrough

The player comes upon a floating brain which begins to speak and sets the scene. It explains that it is missing two of its parts and directs the user to walk through the house to find the missing pieces. It tells them that the missing pieces are next to objects that are associated with their respective function.



*Scene in Main Hall*



*Scene with Temporal Lobe*



Scene with Occipital Lobe

## Targeted platform



. HTC Vive

## Story and Research Elements

This game was based on memory association techniques and initial user research-- detailed below.

### Game Theoretical Foundation

Students are often required to remember a lot on a daily basis. There are many methods to remember things. From reading, repetition, writing notes, flash cards, teaching a friend, or chunking items together. When it comes down to it, your brain is better at remembering things when you actively engage in remembering it. The Loci Method or The Journey Method, popularly known as “The Memory Palace”, are great memory association techniques. **They require you to imagine a scene in which you’re interacting with the items you want to remember.** For example, if my goal is to memorize a long grocery list, I’d close my eyes and imagine a *vivid* scene of myself

putting the item I want to remember away in my kitchen. Our brains **favors information that is engaging, living, active, vivid, and colorful.**

A study published by The American Physiological Society showed that 92.9% of students participating in the study experienced an improvement in information recall after only three 60-min sessions of training in the Loci Method. The students came from various fields of study, and better results were claimed to be achieved with longer training. The premise of this method is simple. You have to try to **associate each item you're trying to remember with a specific image and a place.**

Instead of *imagining* yourself walk through a house to interact with objects, **technology like virtual reality allows that to be reality.** Virtual reality provides an immersive experience with a 3D visual world with auditory and tactile stimulation, making it a great place to study using the technique of association.

## Designing the “Loci House”

**Playing off of the Loci Method and Memory Palace, we designed a virtual reality experience for students to learn about different brain parts and their associated functions by walking through and interacting with objects in a virtual home.** The house we used in our project was purchased from the Unity Asset store. In this experience, the user comes upon a floating brain with missing brain pieces. In a panic, the brain tells the user to go through the house to find the missing brain pieces. The brain speaks to the user and through the dialogue, the user learns about the missing brain's functions.

The user's task is to walk through the house to find the missing brain piece's function. To decide which objects are associated with the missing brain piece, we conducted UX research to understand what people associate with certain brain pieces. We also wanted to know what motivates students to study, and their feelings behind exams and studying. We decided to design interaction for two missing brain pieces for our Minimum Viable Product (MVP) for this project.

## Initial UX Research

To figure what students normally associated with certain brain part, we conducted a survey that was sent to psychology students at San Jose State University. Here are some questions of the UX Research I conducted and the results we found:

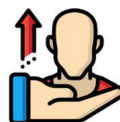
What motivates you to study?



Achieving Goals  
and  
Consequences

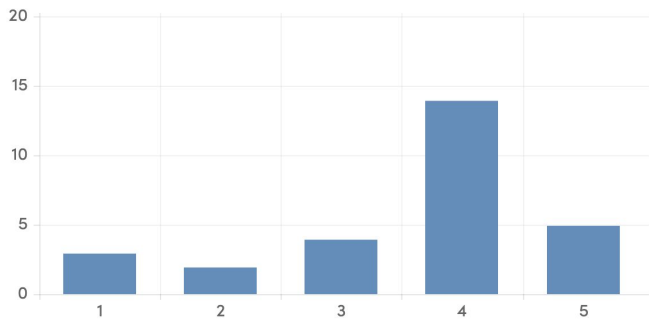


Passion for  
Subject

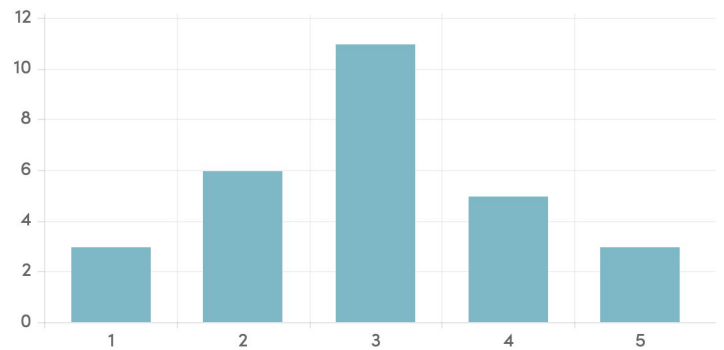


Personal &  
Professional  
Growth

**In general, how anxious do exams make you feel?**



**How enjoyable do you find studying?**



We also asked the following questions:

The Occipital Lobe of the brain is responsible for your ability to see. What object would help you remember this part of the brain and its function?

The Temporal Region of the brain is responsible for hearing. What object would help you remember this part of the brain its functions?

The following interaction matrix was built using the information gathered from the survey results:

Brain Parts	Brain Function	Associated Objects	Feedback	Location in House
Occipital Lobe	Vision	Glasses	Blurry Vision caused by particle effect	Bathroom
Temporal Lobe	Hearing	Headphones	Audio	Bedroom
Somatosensory	Physical Feeling	Homunculus Figure	Patterned Vibration	Living Room
Wernicke's area	Language	Books	Visual	Dining Room

Interaction Matrix Derived from initial UX Research

For this MVP, we only created interactions for the Occipital Lobe and the Temporal Lobe.

## Secondary UX Research/ Usability Study

We conducted a second round of UX research and usability testing to see if our experience is usable and also helps retain memory of the brain parts and their associated functions.

### Control

Five people were told about a brain part and its function. A day later, participants were asked if they remembered the brain and its function.

**1 out of 5 people were able to recall the brain part and its function**

### With Loci House

Five people walked through a usability study of Loci House. A day later, participants were asked if they remembered the brain and its function.

*This study was conducted in the middle of the design phase. Participants saw a video of*



*the VR experience and audio was played during appropriate interactions to give the effect of the game put together.*

**4 out of 5 people were able to recall the brain part and its function**

**The Loci House succeeded in its intended purpose.**

### Usability Study Results

The usability study was run through five participants. The study revealed that the audio was not clear in some interactions. The users also felt that the way the brain floated into new location was “creepy.” They also noted that the colors of the brain were “dull” and the lighting of the house was “dark and gloomy”. They liked the idea of the game, but four out of the five participants reported wanting more interaction and stronger storyline that gave life to the characters more. They described a “hide and seek” interaction with the missing brain pieces and their associated objects. They also expected grand colorful interactions that would want them to stay in the environment.

## Audience

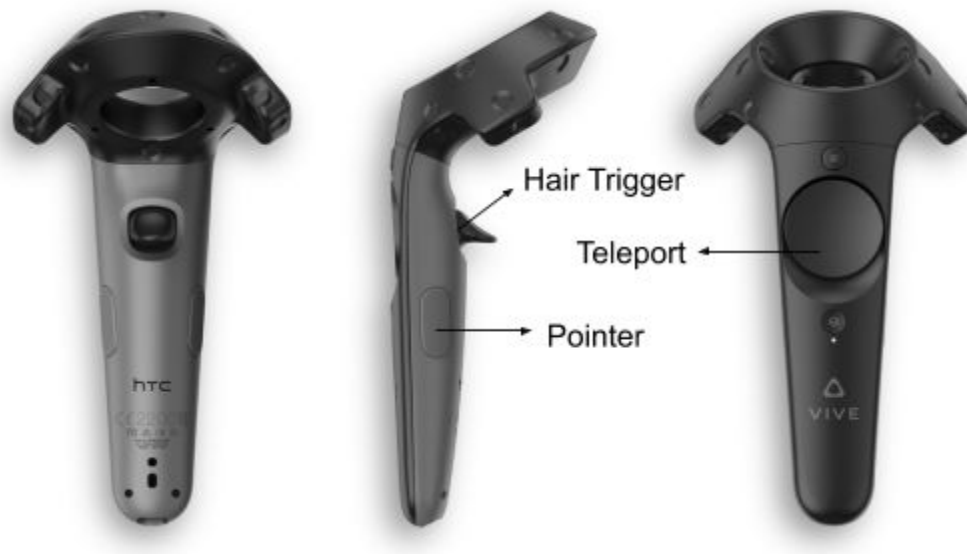
This experience is aimed for students learning about the brain and its basic functions. This would be best suited for students that have not had much exposure to the anatomy of the brain.

## Application Objectives

Purpose of the game is to teach students about the brain through an interactive and fun game to improve one’s own understanding and memory association techniques. We predict that going through this experience will yield higher memory retention compared to regular study techniques.

## Game Mechanics

- a. Teleportation
- b. Picking up objects
- c. Hovering over object to check intractability
- d. Physically Pushing down buttons and keys



#### Left Controller:

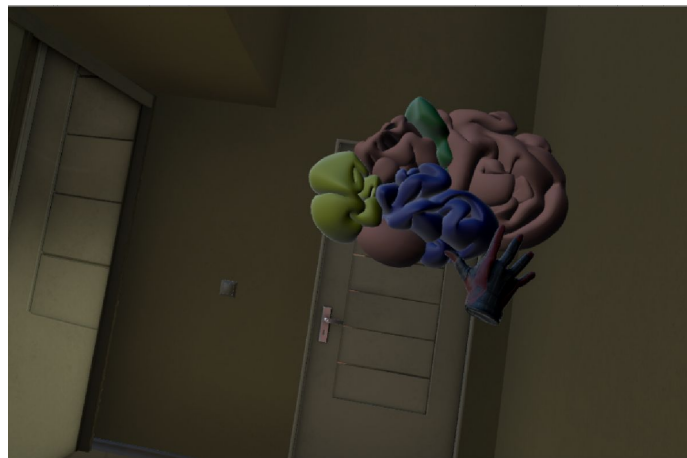
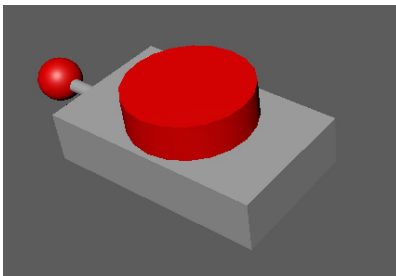
- Hair Trigger: Pick up interactables objects
- Touchpad: Teleport
- Pointer

#### Right Controller:

- Hair Trigger: Pick up interactable object
- Touchpad: Teleport
- Pointer

## User Interface

The user interface is accessible via the **HTC Vive** for the user. The interface will display the environment, characters, and displays that guide the user through interactions.



## Minimum Viable Product (MVP)

This product is meant to be a series beyond the MVP. Because of limited time and resources, this project has been scoped to a single part in the series: perceptual

functions of the brain. Below is a list of requirements for the proof-of-concept as the MVP:

Research	Design	Development	Marketing
IRB Application	Brainstorming	Animation	Poster
Literature Review	Storyboards	Navigation System	Website
User Research	Interaction Model	Dialogue System	
Usability Testing	Dialogue	Interactable	
	User Flow	Objects	
	Sketches	Color Filter Effect	
	Illustration	Audio Effect	
	Animation		

**Final Product:** An educational VR experience/game for the HTC Vive developed with Unity

**Part I: Perceptual functions of the brain**

- Temporal Lobe
- Occipital Lobe

**Environment**

- House with a loft-style layout
- Furnishings

**Associated Objects**

- Headphones
- Glasses

**Feedback**

- Visual (UI, particle effect)
- Auditory (dialogue, sound)

## Detailed Roles and Responsibilities

Akshaya Natarajan

**UX Interaction Designer / Researcher**

- Design Interaction
- Conduct Mind Mapping Session for Brainstorming
- Research Psychological foundation story is built on
- Design for dialogue

Victor Cortes

**UX Researcher and Designer**

- IRB application
- Literature review
- User research
- Interaction design
- Usability testing
- Marketing (poster)

- Initial UX Survey and Secondary Usability Testing

Lauren Chun

**General Designer/Artist**

- Design “Level” Layout
- Look Development of Project
- Game Development
- Animations of All Parts
- Recording Audio and Script
- Modeling of Brain, Occipital Lobe, Temporal Lobe, Piano, Musical Notes, Vision Controller
- Design and Creation of Particle Effect
- Design and Implementation of Piano Component

Kevin Ta

**Software Engineer**

- Brain navigation system
- Dialogue system
- Recording Audio and Script
- Audio, Model, and Animation Integration
- Functionality for vision and audio controller
- Interaction triggers

## Asset List

### Unity Purchases

Loft Asset from Unity: <https://assetstore.unity.com/?q=loft&orderBy=0>



Glasses from Unity:

<https://assetstore.unity.com/packages/3d/props/clothing/peace-glasses-70513>



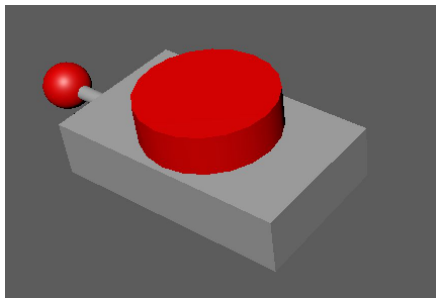
Headphones from Unity:

<https://assetstore.unity.com/packages/3d/props/electronics/stylish-headphones-29291>

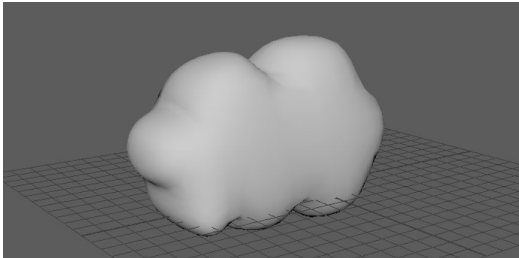


Developed by Lauren

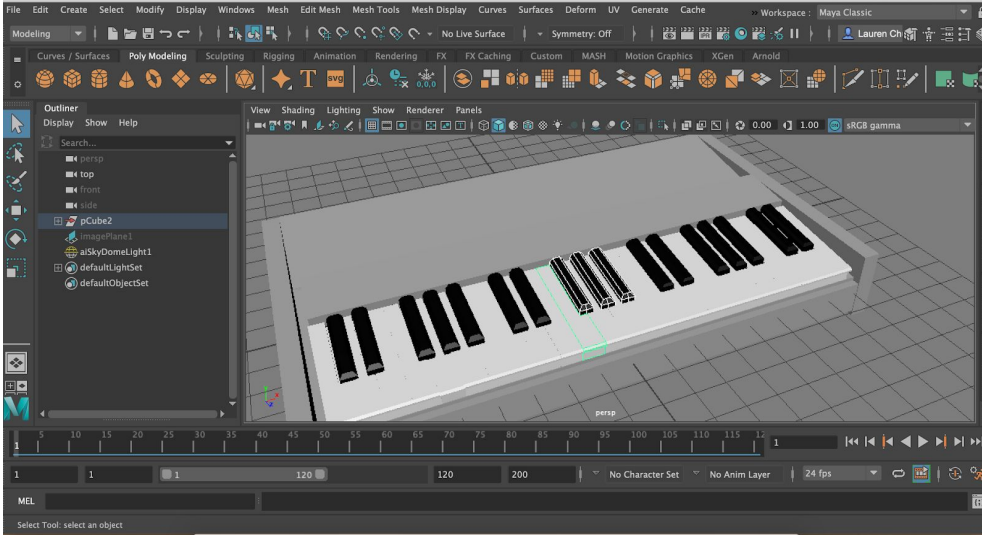
Version Two of the Controller



Musical notes float around the keyboard.



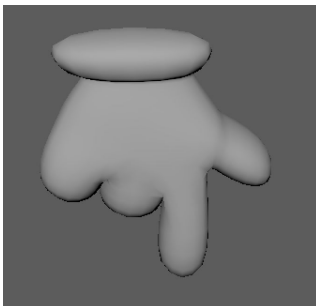
The Speech Bubble floats next to a character when it's speaking.



Piano



Brain Pieces



Pointer hands use to show user to press the red button on the remote on the dining table.

## Development and Management Tools

- Unity
- Google Docs
- Lucidchart
- Picsart
- Trello
- Gmail
- Maya
- Substance Painter
- Photoshop
- Illustrator

## Future Plans

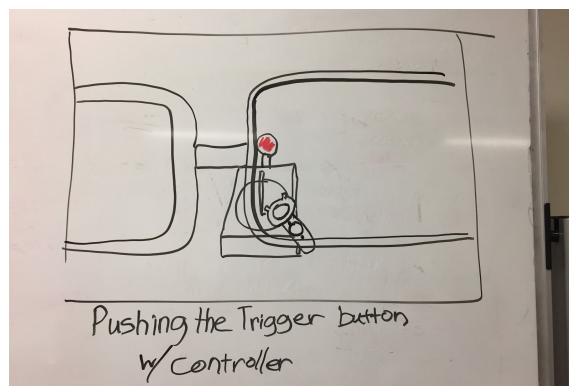
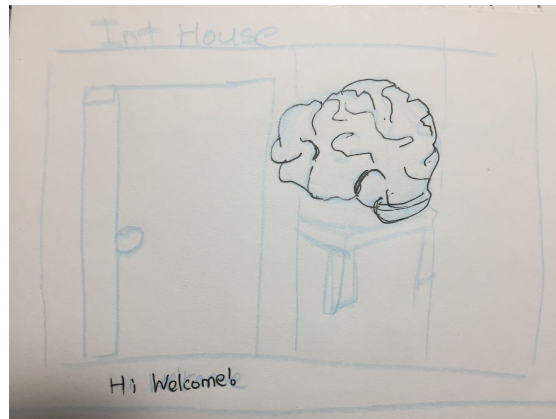
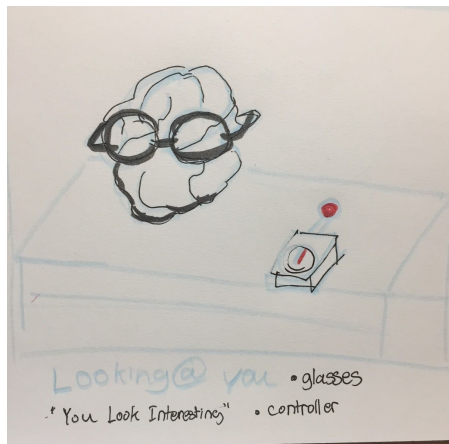
- Menu to start the game
- More interactions:
  - Current the game is set up so you find the missing brain piece with the associated object already next to it. In future editions, the user's first task should be to find the associated object and then find the missing brain piece as that creates a better story and more interactions lead to greater memory associations.
  - More brain parts and objects need to be added in future editions
  - More animations
  - Fix dialogue timing
  - Add more interactable notes to the piano
  - More creative story lines and character development



# Appendix / Backup Material

## Storyboard

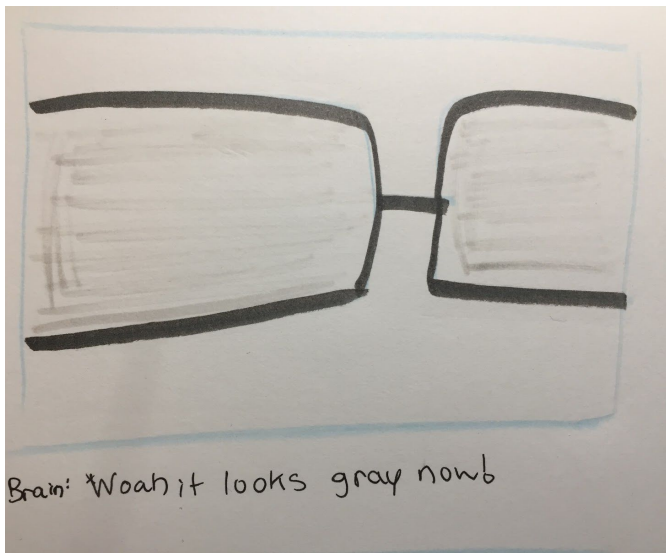
<b>Tasks</b>	Watch Introductory Video	Find Occipital Glasses	Find Occipital Lobe	Watch Task Completion Video	Find Temporal Headphones	Find Temporal Lobe	Watch Game Completion Video
<b>Location</b>	None	Entrance	Living Room	Living Room	Piano	Kitchen	Kitchen
<b>Feedback</b>	Audio-Visual Film	UI/Visual, Audio	UI/Visual, Audio	Audio-Visual Film	UI/Visual, Audio	UI/Visual, Audio	Audio-Visual Film





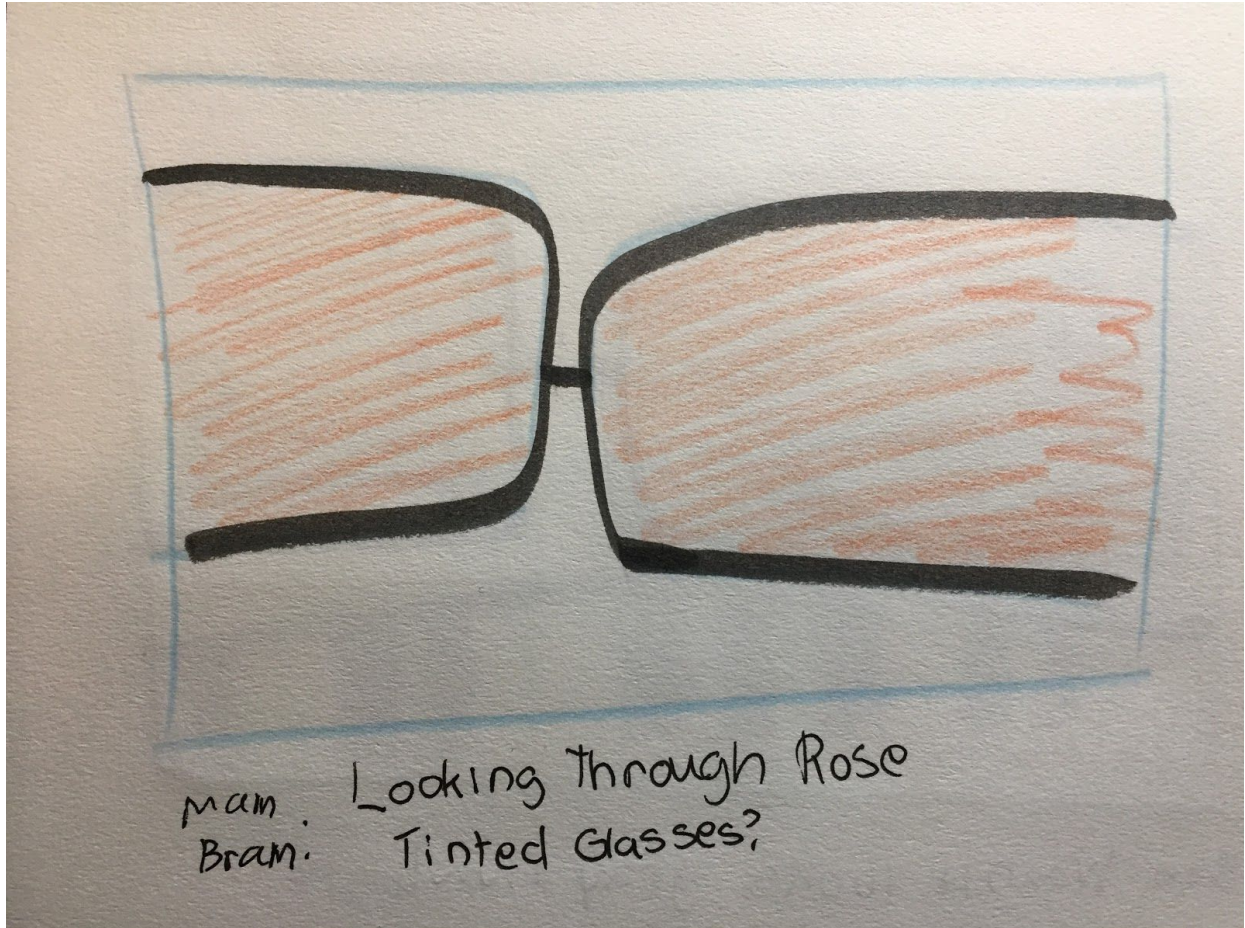
- You took my glasses!  
- the player is wearing the glasses

After taking Occ's glasses



Brain: \*Woah it looks gray now\*

After Using the Controller



After using the controller again the lens turns red-tinted

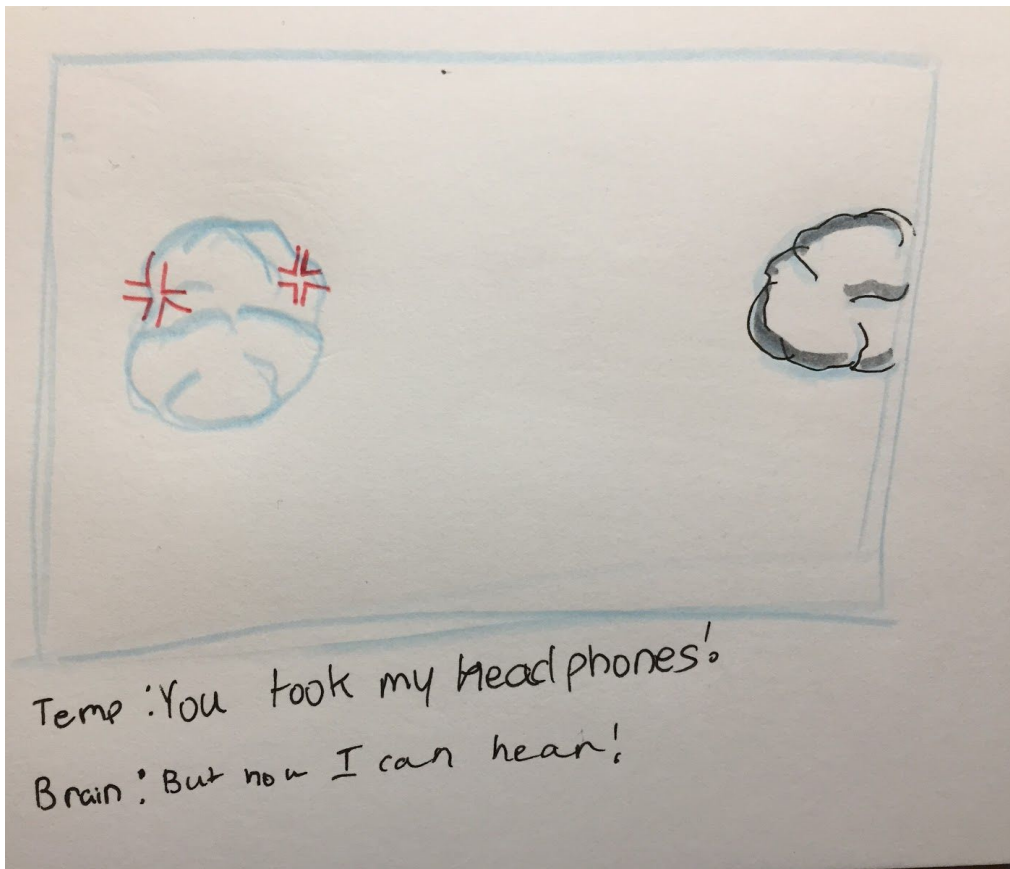
The brain talks with the occipital lobe and they rejoin together to be one



Scene 2: Temp



Temp listening to music and not paying attention

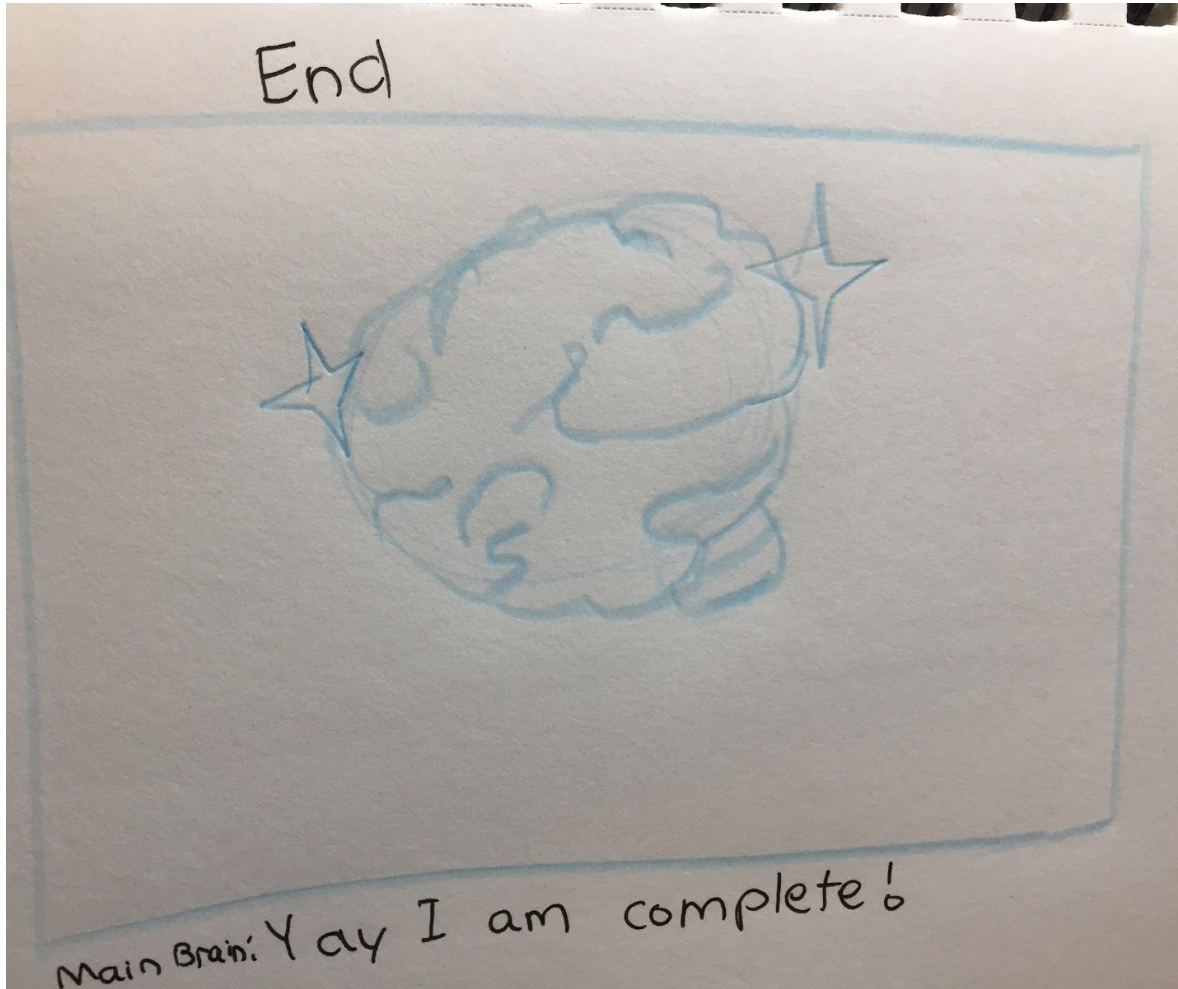


When the player takes the headphones from temp....



When the player starts pressing down piano keys

After the player plays something the temporal piece comes to join the main brain



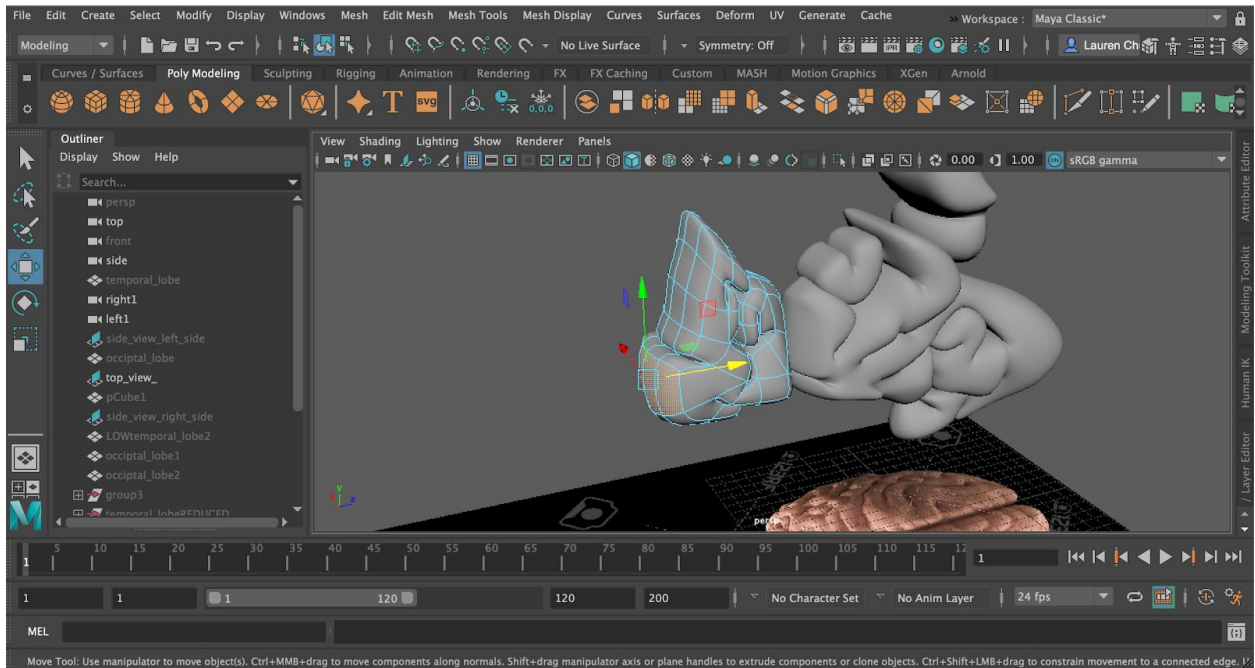
Once the brain is together with the lobes again



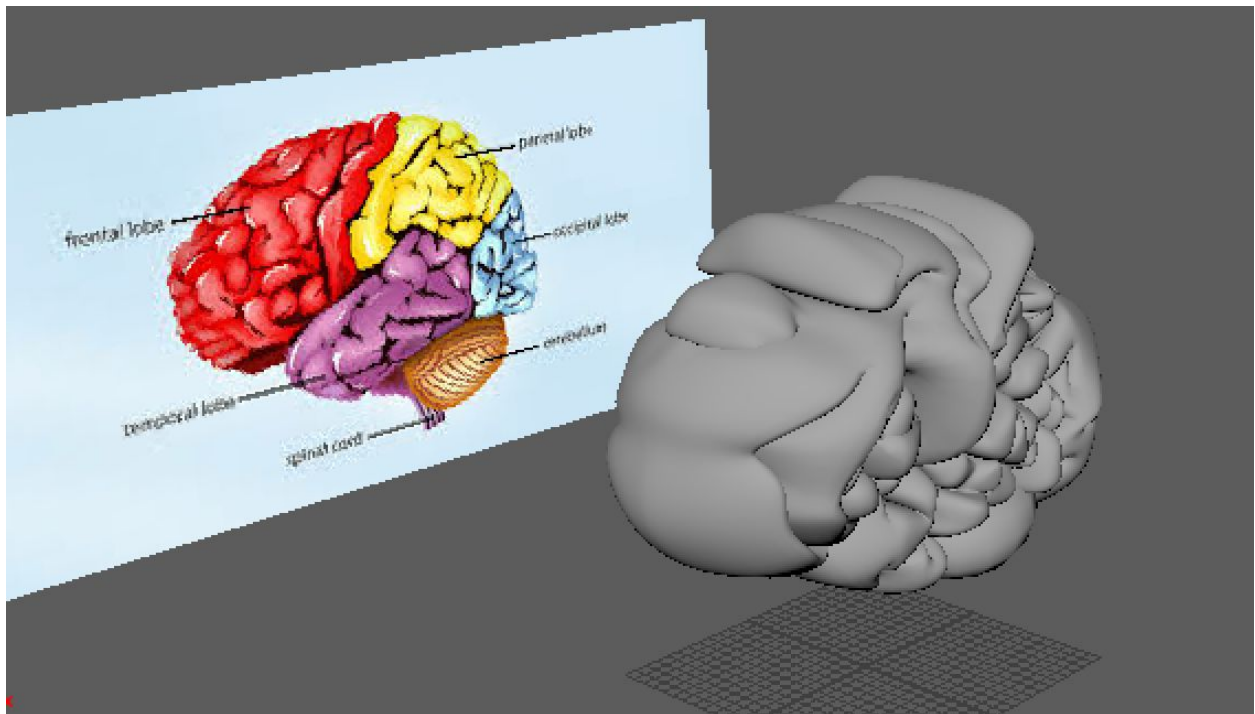
## 3D Model Development

Searching for a reference

Starting with primitive shapes and extruding out the faces to create a brain like shape



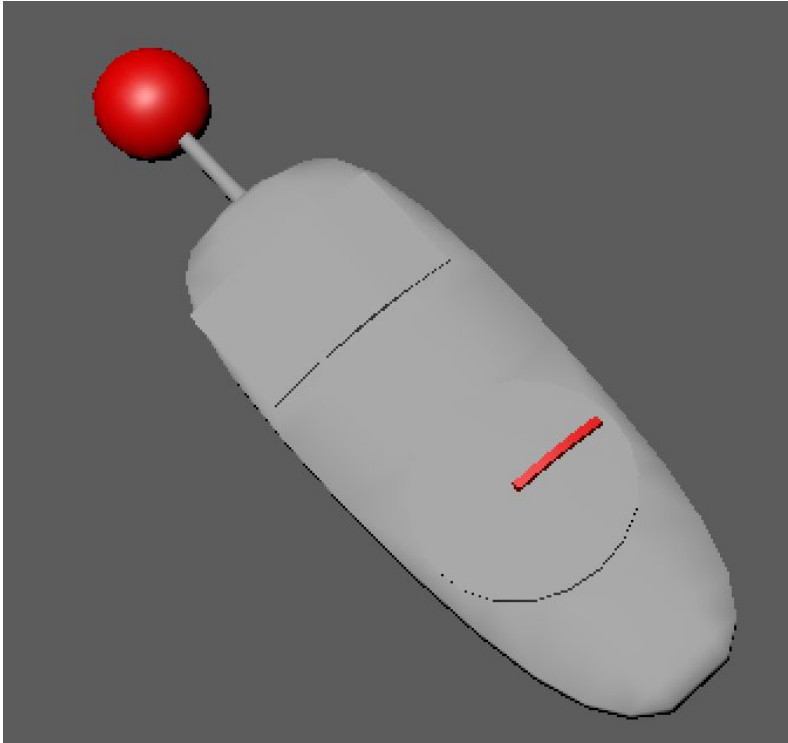
Refinement and reduction of poly count



Development of Essential Props:

## Props

Version 1 of the controller

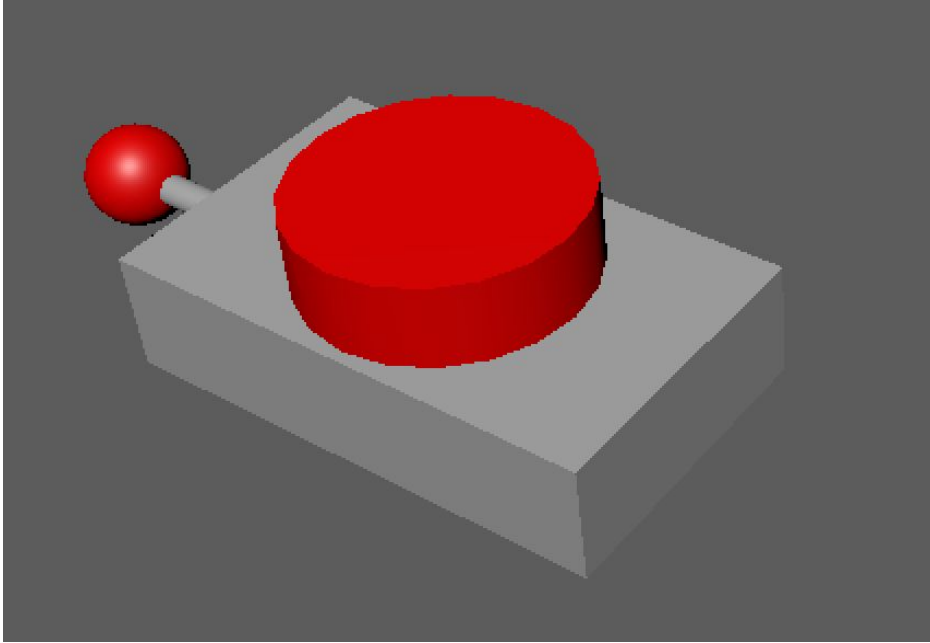


Using primitive shapes and extruding a cube for the main body.



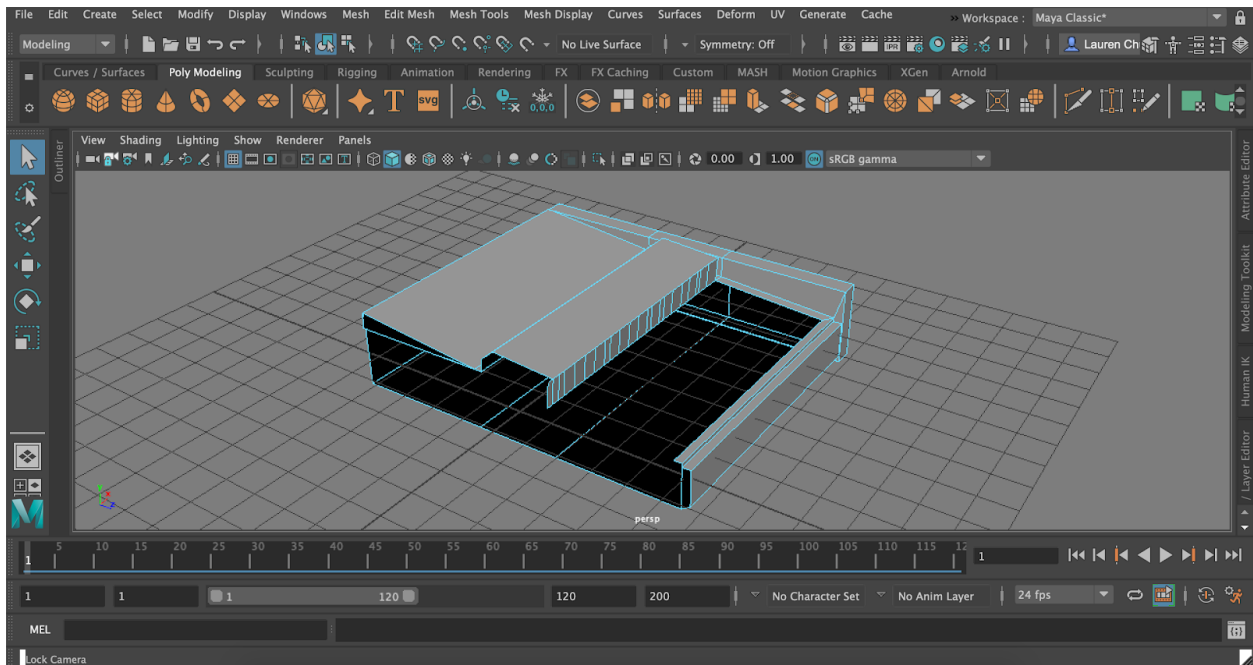
(The model was changes as we a giant red button makes more sense to press than to figure out a dial)

Version Two of the Controller

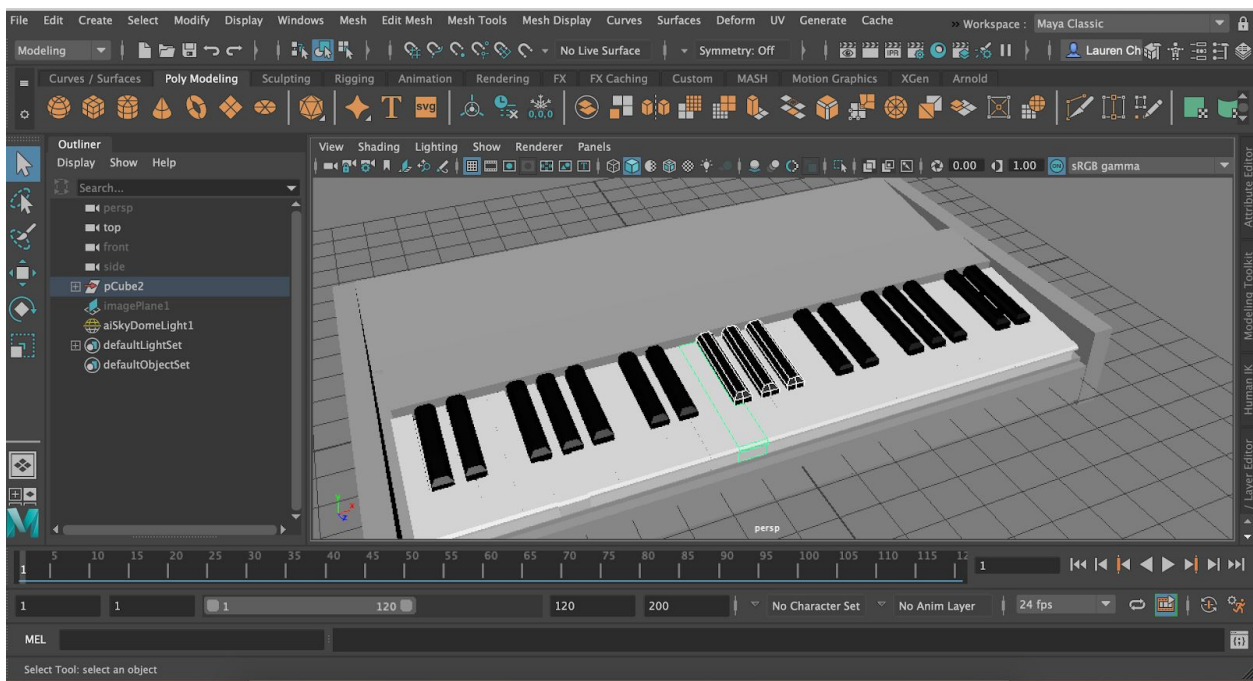


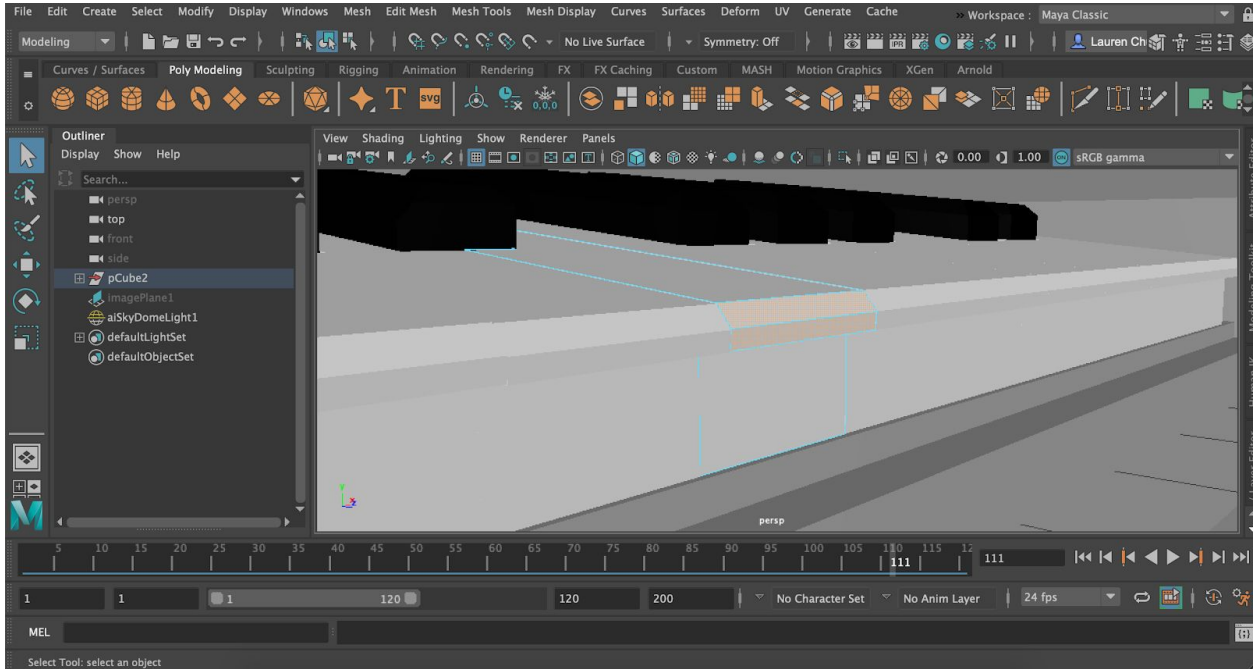
### Creating the Piano:

Created the body of the piano then mirrored the half I created to be uniform.



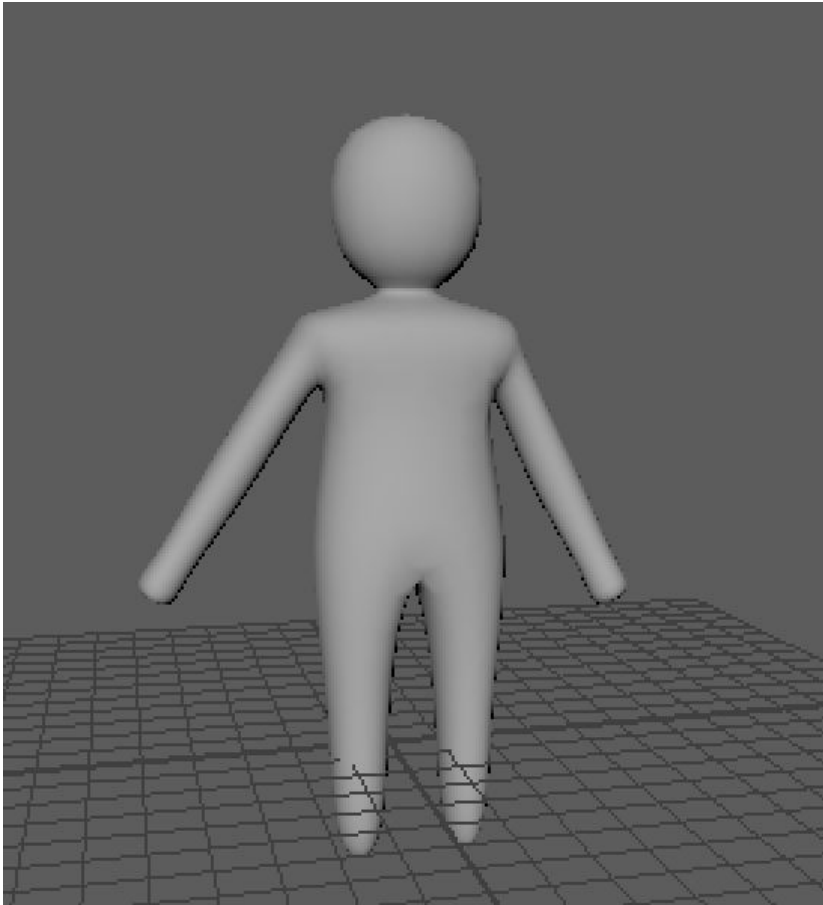
Starting with a primitive cube and extruding it out to look like a piano key. Curving the edges to look more like actual piano keys then put a lip on the white keys. After that I created a set then duplicating them to look unified.

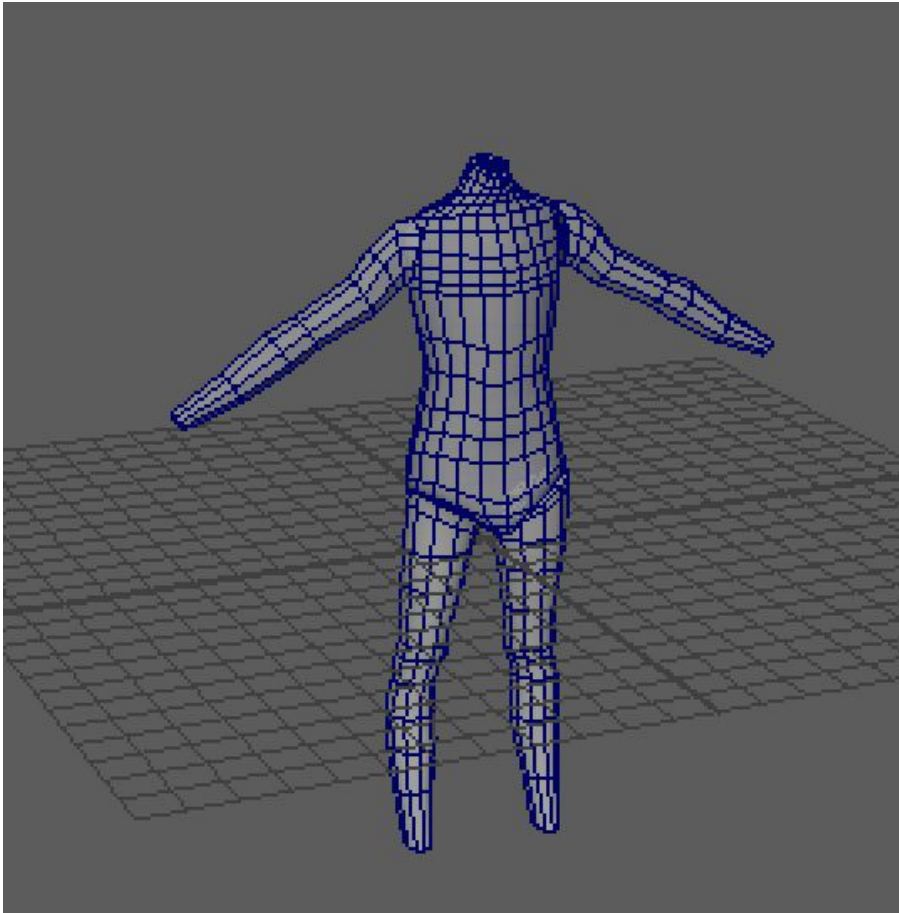




An up-close look at the piano key edge.

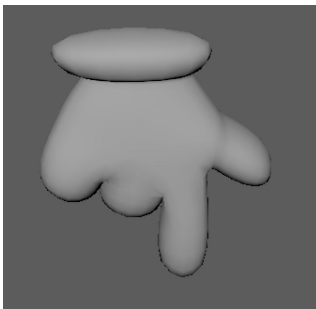
Creating a Player/Homunculus:





This idea was scrapped for the time being as we did not have time to implement it. This would be for later development.

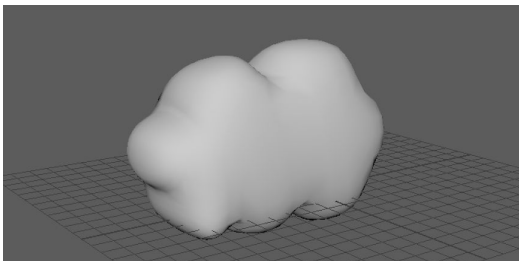
### Particle and UI Elements



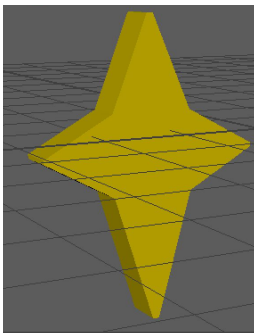
Pointer hands use to show user to press the red button on the remote on the dining table.



Musical notes float around the keyboard.



The Speech Bubble floats next to a character when it's speaking.

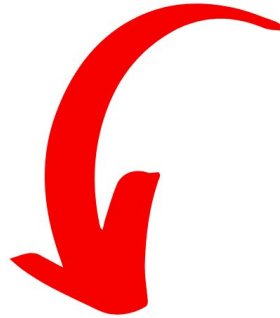


The shine particle was not incorporated into this MVP, but was created to add additional effects when the user puts on the glasses.

All similar methods of modeling the objects out starting all with cubes and smoothing, refining, and extruding.

Press the **RED** Button!

Take the **glasses** off Occ!



Play the **piano**!



**Congratulations!**  
**You're done!**

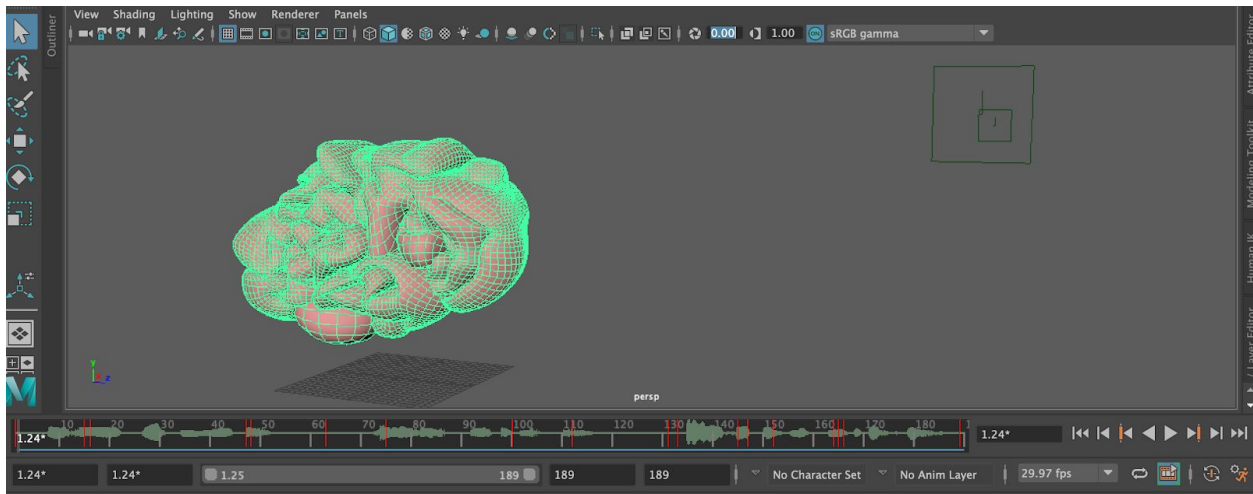


UI directional elements that were not included in final product.

## Animation

The animation was done in maya using keyframes and adjusting with the graph editor. Following the voice lines that I recorded, I animated the sequence to be floating in place mostly as we did not want the brain to enter the personal space of the player.

I followed a simplistic style not using joints as there were issues getting them to function correctly in unity.





### (Visual/Audio) Displays

Visual and audio displays will be used to guide the user through feedback and feedforward at specific points in the interaction.

See [dialogue script](#). All audio files are stored in Google Drive.

Speech bubble hovers around floating brain to indicate that dialogue is playing.

### Graphics and Animation

Graphics will be designed and animated to support interactions and user goals.



*Scene with Occipital Lobe*



*Scene in Main Hall*



*Scene with Temporal Lobe*

## Dialogue Script

### **Intro:**

A Narrator speaking.

As you fall into a deep slumber all you can remember is a big flash of light. Your head a splitting headache and the loss of memory unable to feel anything, you can't see or hear

anything. When you wake up you are standing in the entrance of a house. Is this your house? Where am I?

INT Loft

Main Brain: Oh! Hello! Welcome. This place is a bit of a mess right now. sorry its a bit difficult to greet you with my full hospitality without my other lobes assistance. If it's not too much trouble, can you get them to cooperate together? They're like playing around the house.

\*the player walks down the hall into the room\*

### **Scene 1: Eye Glasses**

\*when the player approaches kitchen area\*

Main Brain: My occipital lobe is over there messing around with those glasses. I wonder what they look like through them.

\*when the player comes closer to the occipital lobe\*

Occ:mhmm...

Main Brain:Occ seems to be having fun with those glasses but I kinda need him back in my brain. Can you convince him to come back?

Occ:Not now, I'm currently observing things that make up color. I will not return until i'm finished

Main Brain: You know, we can see more together

Occ: Fine I'll come back, but you better see some fantastic sites for me

\*general idle\*

Main Brain: Hmm... what is he looking at?

Scenarios:

\*prompts the player to take the glasses away\*

Main Brain: Occ is being difficult. He just keeps looking through those glasses. lets see if we can convince him or take something away

\*when the player takes the glasses off of the occipital lobe\*  
Occ: Hey give those back...

Main Brain: Let's see if we can adjust this with a vision controller

\*when the player changes the color of the lens\*  
Main Brain:Hey wait.. why does everything look gray now

Occ: That's because you messed with the settings

\*when the player turn the glasses red\*  
Main Brain: Oh it looks like you're looking through rose colored glasses

Occ:indeed the color nostalgia

## **Scene 2: Headphones**

\*approaching the temporal lobe\*  
Main Brain: Temporal Lobe?

\*getting closer to the temporal lobe\*  
Main Brain: Temp! Can you hear me? Cuz I can't hear you

Main Brain: I always loved music, I wonder what Temp is mixing. I wish I could mix music like temp, I wish I could mix music like temp.

Main Brain: Hey, yeah, I know you want to finish your mix record, but can I join in too?

Temp:I can do better

Main Brain: I bet you can mix something better than or just as good as temp. Try playing something on that piano

Temp: Not bad

Main Brain: Can you come back here? I want to hear something too

Temp: Guess I would not mind seeing what you can do with my help. One condition, I take lead when it comes to music

\*when temp goes back to the brain\*

Main Brain: Oh I can finally hear! Nice.

### **Scene 3: Misc Moving Around:**

\*when the player goes around where it shouldn't be\*

Main Brain: Where are you going?

Main Brain: Maybe we should go check this room out

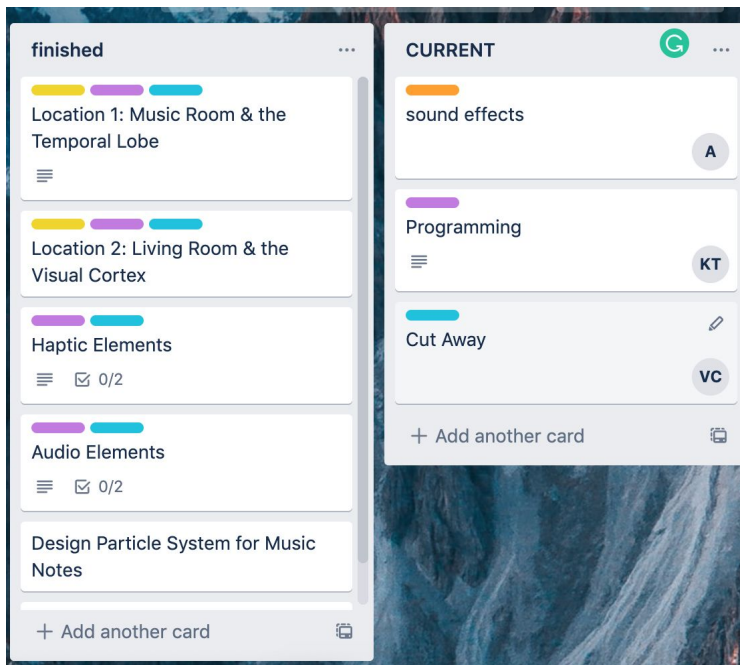
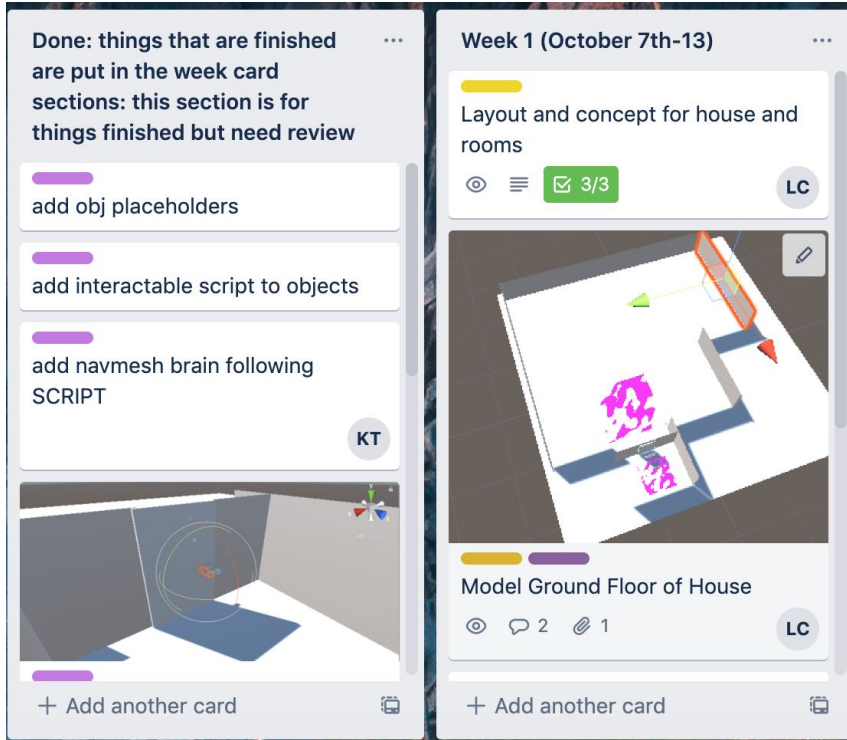
### **Final:**

Main Brain: Awesome! You got occ and temp to come back to me! You're so much help. Let's see what else we can do.

Main Brain: Congratulations!

## Task Delegation

### **Early Phases: Trello**



**Late Phases: Google Docs**

As of 11/9/19, and beyond		Who it is issued		Deadline	
Lists of Tasks Left	Tasks	Details	Comments or Notes:	Date Issued:	Date Finished:
<b>Marketing</b>					
	Poster	intial design	Akshaya	11-9-19	11/15/19
		finalized poster	Victor	11-15-19	12-1-19
		print the poster			
	Promo Video		Akshaya	11-9-19	Not done
	Presentation (powerpoint)		everyone	12-1-19	12-3-19
	Presentation general (posters and such)				
design document			Akshaya	11/20/19	?
Play Testing			Akshaya	11/20/19	?
	Questionaire		Victor	11-9-19	?
	Feedback		Akshaya	11-9-19	?
<b>Personify the brain</b>					
	Voice the Audio of the Brain		Lauren and Kevi (not assigned)		11-15-19
		Script	Kevin and Laure (not assigned)		11-15-19
<b>UI Elements</b>					
	Creating a UI for equipping the items				
		design menu look	Akshaya	11-20-19	11-20-19
		canvas menu buttons	Akshaya	11-20-19	11-20-19
	Creating Particle Effects				
		music notes	Lauren	11-20-19	11-27-19
		shine	Lauren	11-20-19	11-27-19
<b>Animate the Brain</b>					
	Animate each brain piece		Lauren	11-20-19	11-29-19
	Animate the main brain		Lauren	11-20-19	11-29-19
<del>Find-Audio-</del>	<del>music-background</del>		<del>removed</del>		
<b>Particle System</b>					
	Audio Particles				
		create 3d model for the particle	Lauren	11-19-20	11-29-19
	Visual Particles				
		create png for particle			
			Lauren	11/20/19	11-20-19
<b>Menu and End Screen Design</b>					
	Find the ttf for the font		Akshaya	11-20-19	11-20-19
	Create a png buttons		Akshaya	11-20-19	11-20-19

**IRB Application**



### IRB Exclusion Decision Tool: Does My Project Need IRB Review?

**Instructions:** Use this decision tool to determine whether a complete protocol application needs to be submitted for your proposed project to the Office of Research. This worksheet is designed to help investigators find out whether their project constitutes human subjects research, according to the definitions provided by [the federal regulations](#) for the protection of human subjects. This worksheet is NOT designed to determine whether a research project involving human subjects is exempt. [Exclusion and Exemption are not the same thing](#). Please fill out the information in the exact prescribed order to ensure accuracy. **Students:** Complete this worksheet in the exact prescribed order with your faculty supervisor. **All:** Retain this worksheet for your records. A copy of this worksheet does not need to be submitted to the Office of Research.

Victor Cortes

Completed By: \_\_\_\_\_

10/07/2019

Date: \_\_\_\_\_

Signature of Faculty Supervisor (if applicable): \_\_\_\_\_

Date: \_\_\_\_\_

Project Title: A Virtual Reality (VR) system to teach fundamental "Psychology 101" concepts through memory association (Part 1: The Brain and its Parts and

#### Does It Meet the Federal Definition of "Research"?

1. Is your project a *systematic investigation*, including research development, testing, and evaluation?

A *systematic investigation* refers to a strategy of study involving a methodical procedure or plan that is theoretically grounded, specifies a focused and well-defined research problem or question, is informed by the empirical findings of others, is analytically robust, and provides a detailed and complete description of data collection methods. A study that is systematic allows conclusions to be drawn from the results. Although some qualitative research projects are exploratory in nature and may not have specific aims or hypotheses at the outset, these may still be systematic investigations if their purpose is to compare results to other assessments or to draw conclusions.

- Yes, or Not Sure? Continue to question #2.
- No → STOP. A protocol submission is not required even if you answer yes to questions on the remainder of the worksheet. Projects that are not systematic investigations do not meet the



federal regulatory criteria for oversight. **However, please read the section below "Not Human Subjects Research: Additional Information and Restrictions" prior to beginning your project.**

**2. Is the project designed to develop or contribute to generalizable knowledge?**

**Generalizable knowledge** means a set of conclusions, facts, or principles that enhances scientific or academic understanding by applying broadly to a whole category, such as a population or field of knowledge. Generalizable knowledge is produced when investigators make the components of their research design (procedures, methods, and instruments) as well as the analyzed findings/results available for other professionals or academics to peer review, replicate, and utilize. Traditionally this occurs when publishing or presenting at a professionally refereed venue, conference, or competition, but it may also occur through new media methods of discourse. In qualitative research, generalizable knowledge may emerge when the research generates detailed descriptions of phenomena which may be transferable to like situations or when new theories, principles, or statements of relationships are developed as a result of the data collection. Master's theses are published and made available outside SJSU and are usually considered research that contributes to generalizable knowledge. However, projects which are disseminated exclusively at SJSU and are not intended for dissemination beyond the instructional setting are typically not designed to contribute to generalizable knowledge. Likewise, research projects which are designed as common biographical research, oral histories, and journalism are typically not designed as a systematic investigation to contribute to generalizable knowledge. The purpose of these activities is often to create a record of specific historical events or persons, and findings are usually not generalized to a broader population or group.

- Yes, or Not Sure? Continue to question #3.
- No → STOP. A protocol submission is not required even if you answer yes to questions on the remainder of the worksheet. Projects that are not designed to develop or contribute to generalizable knowledge do not meet the federal regulatory criteria for oversight. **However, please read the section below "Not Human Subjects Research: Additional Information and Restrictions" prior to beginning your project.**

**Does It Involve "Human Subjects"?**

**3. Will the research involve *interaction* or *intervention* with living individuals or the collection of *individually identifiable private information*?**

**Interaction** includes communication or interpersonal contact between the investigator and the subject that solicits personal information. Examples of interaction may include collecting personal data through questionnaires, interviews, tests, and performance evaluations. Persons involved in a research activity are not considered to be human subjects when the person interviewed/surveyed is asked to provide information specific to his/her expertise or

institutional information as opposed to personal information (examples of personal information include opinions, thoughts, perceptions, performance metrics, and private data about the individual). For example, welders asked to describe the composite of shielding gas, shielding gas flow rate, and formation of the weld bead are not disclosing information about themselves and, as such, are not research subjects in this context. Likewise, when investigators wish to collect information about institutions or social processes from individuals, such activities do not constitute research involving human subjects when the focus of the research is not on the characteristics or personal views of the informant. There is often a fine line between what is defined to be "human subjects research" and research that collects information from people in order to understand institutions or social processes. For example, asking the same welders in the above example how industry consolidation has affected the safety practices in their work environment would constitute research involving human subjects. Research on institutions or social processes, the purpose of which is to create generalizable knowledge about the attitudes, beliefs, or behaviors of individuals or groups (e.g., voters, prisoners, employees) as being representative of these institutions or social processes, is human subjects research.

**Intervention** includes both physical procedures by which data are gathered and manipulations of the subject or the subject's environment that are performed for research purposes. The researcher need not collect personal information in order for the work to qualify as an intervention that involves human subjects. For example, an experiment that tracks participants' eye movements across a screen would still involve human subjects, even if no personal information is recorded.

**Individually identifiable private information** means that the identity of the human subject is or may be readily ascertained by the investigator or associated with the information collected. This includes information about behavior that occurs in a context in which the subject can reasonably expect that no observation or recording is taking place, as well as information which has been provided for specific purposes by an individual and which the individual can reasonably expect will not be made public (e.g., medical/clinical records, academic records, social services records, new media forms of disclosure which are not made public but which you may have access to by accident or privilege).

- No → Continue to question #4.
- Yes, or Not Sure? The research requires review. Please read the section below "Human Subjects Research: Expectations for IRB Protocols" prior to submitting your research protocol to the Office of Research.

**4. Will the research utilize *existing or secondary data* which contain *individually identifiable private information*?**

**Existing or secondary data** include records as well as tissue, organs, fluids, and other biospecimens that were not originally collected for the research or will not be collected specifically for the research in the future.

*Individually identifiable private information* is defined in #3 above.

Yes, or Not Sure? The research requires review. Please read the section below "Human Subjects Research: Expectations for IRB Protocols" prior to submitting your research protocol to the Office of Research.

No → Continue to question #5.

**5. Is there any possibility that the researcher or collaborators (e.g., student assistants, professional partners) could ascertain the identity of a living individual from the existing or secondary data utilized at any point during the course of the research?**

Yes, or Not Sure? The research requires review. Please read the section below "Human Subjects Research: Expectations for IRB Protocols" prior to submitting your research protocol to the Office of Research.

No → STOP. A protocol submission is not required. Using non-identifiable information does not meet the federal regulatory criteria for oversight. If your research utilizes data which are irrevocably de-identified or have already been coded by a third party in such a way that the researcher and collaborators cannot ascertain the identity of a living individual, the project does not need to be reviewed by the IRB and is not subject to oversight by the Office of Research.

### **Not Human Subjects Research: Additional Information and Restrictions**

Some activities, though they may be deemed "not human subjects research," **may still pose risks** if they:

- Involve protected or vulnerable populations
- May cause participants harm (e.g., psychological, physical, legal, educational, social and/or economic)
- Pose risk to you as the researcher.

Regardless of whether a project needs to be reviewed by the IRB, the rights and welfare of the participants involved in a project must be protected. Investigators may need to consult discipline specific guidance. The general principles of respect for persons, beneficence, and justice outlined in IRB educational materials posted on our website can also be applied to activities that do not meet the federal regulatory criteria for IRB review.

**Student Research:** Faculty members should engage their students in a discussion about whether their goals include conducting research that contributes to new scholarly knowledge. Students should only be routed to the IRB if they have indicated, using this worksheet, that

their project is a systematic investigation designed to contribute to generalizable knowledge involving human subjects. No procedural requirement or verification with the Office of Research is needed if the work is determined to not meet the criteria for oversight. However, SJSU policy imposes limitations on student work that does not meet the federal definition of human subjects research:

- Student work must be minimal risk and may not target special populations or include sensitive subject matter. Minimal risk means that participants will encounter no harms or discomforts greater than those that are part of their daily lives.
- A project specific consent form may still be appropriate in many circumstances. While students may refer to the informed consent handbook posted on our website for information on best practices, the consent form used may not indicate that the University approved the work, and it may not include contact information for the Office of Research.
- Participants should not be led to believe that the project constitutes a formal research endeavor.
- A faculty member is still responsible for direct supervision of student projects and ensuring that the work is conducted ethically and follows best practices within the discipline.

### **Human Subjects Research: Expectations for IRB Protocols**

If you have completed this worksheet and determined that your research requires submission of a protocol to the Office of Research, please visit the [IRB website](#) to view the steps for submitting a protocol. The basic expectations for all IRB protocols are as follows:

- The purpose of the study is clearly identified.
- A rationale is provided for the study that builds on previous research and includes appropriate citations.
- The research team has made every effort to optimize meaningful informed consent/assent and voluntary participation. Consent/assent language is simple; straightforward; appropriate for the level of literacy, education, developmental and cognitive capacity of the participants; and culturally appropriate.
- The protocol is well-written and has been proofread.

The [review criteria that IRB members use](#) provide more details about the expectations for each protocol.

## User Research - Survey

### Survey: Study and Memorization Techniques

Thank you for taking the time to complete this questionnaire. The following questions will ask you about the study and memorization techniques you may use. Please answer each question to the best of your ability.

[https://docs.google.com/forms/d/1fyafb4mK1Mp3a6-c6wr\\_2vXn-tN7OXN3hGjXHx8-5wk/edit](https://docs.google.com/forms/d/1fyafb4mK1Mp3a6-c6wr_2vXn-tN7OXN3hGjXHx8-5wk/edit)

1. What is your age?
2. What is your major and year? (e.g. Psychology, freshman)
3. On a scale of 1-5 (5 being the highest), how anxious do exams make you feel?
4. On a scale of 1-5 (5 being the highest), how enjoyable do you find studying?
5. What motivates you to study? \_\_\_\_\_
6. When you study for an exam or quiz, which of the following study techniques do you use?
  - a. Mnemonics
  - b. Chunking
  - c. Memory association
  - d. Note transcription
  - e. Other: \_\_\_\_\_
7. On a scale of 1-5 (5 being the highest), how effective are memory association techniques for memorization?
8. How often do you create stories to memorize or understand concepts?
  - a. Very frequently
  - b. Frequently
  - c. Occasionally
  - d. Rarely

e. Never

9. The Temporal Lobe of the brain is responsible for your ability to hear. What object would help you remember this part of the brain and its function?

\_\_\_\_\_

10. The Temporal lobe in the brain is responsible for your ability to hear. Which of the following household items would best help you remember this brain part and its function (through memory association)?

- a. Speaker
- b. CD/music album
- c. Q-tip
- d. Headphones
- e. Other: \_\_\_\_\_

11. The Occipital Lobe of the brain is responsible for your ability to see. What object would help you remember this part of the brain and its function?

\_\_\_\_\_

12. The Occipital lobe in the brain is responsible for your ability to see. Which of the following household items would best help you remember this brain part and its function (through memory association)?

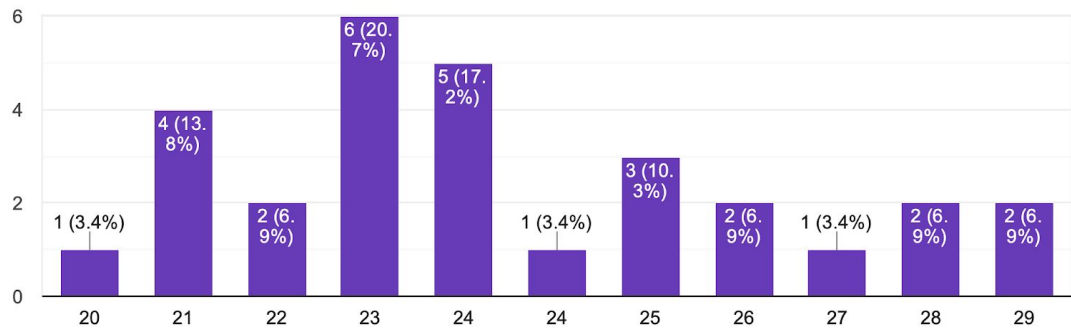
- a. Glasses
- b. Eye contacts
- c. TV/screen display
- d. Window
- e. Painting
- f. Other: \_\_\_\_\_

## User Research - Survey Responses

1.

What is your age?

29 responses



2. What is your major and year?

Statistics, Junior

Digital Media Arts, Senior

DMA, senior

Digital Media Arts Senior

DMA Senior

Psychology, 2014

Psychology

Ms in hfe

HFE, 1st

Human Computer Interaction- graduate 1st tear

Human Factors (1st year of Master's)

Biology, graduated undergrad in 2017

HFE, Graduate

HF/E, first year grad student

Electrical Engineering, Graduate

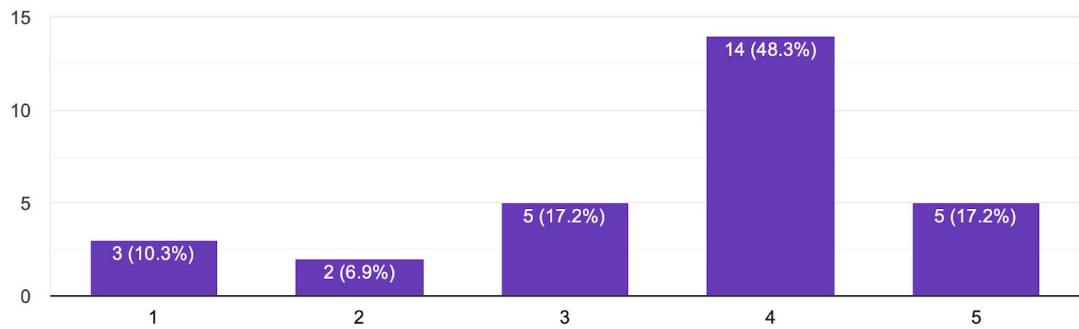


First year master's student, HFE  
Human Factors/ Ergonomics (1st Year)  
HFE; First year grad  
Psychology grad student  
Anthropology. Junior  
Behavioral science, senior  
anthropology  
Anthropology, Junior  
Human Factors/Ergonomics, Freshman  
Human Factors/Ergonomics, 1st year  
Psychology, senior  
HFE, Senior  
HFE MS 1st yr  
Human factors, 1st year graduate

3.

In general, how anxious do exams make you feel?

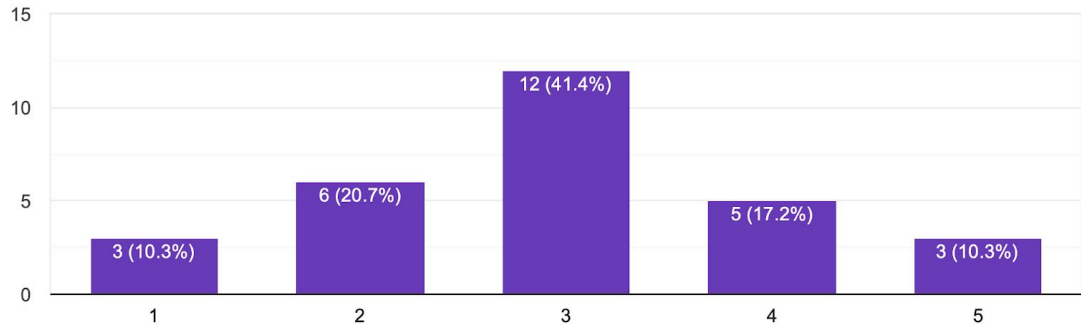
29 responses



4.

How enjoyable do you find studying?

29 responses



5. What motivates you to study?

Consequences

Learning

Interest in subject

My future career

My passion for the subject

Getting my degree to be able to work in a field I care about.

My future and doing well

To do well on tests, get good grades. Help me stand out from my peers. To be successful.

To avoid the feeling of being unprepared

Exams and getting good grades

Better understanding of the class material that will then help me in my career

Success in classes

Grades/GPA

Wanting to have practical knowledge of the information

To graduate

The fact that passing or not passing the class is on the line

good grades

Not fail tests (and hopefully learn something)

A Phrase, God help those who help themselves.

When I think about the future

Grades

The outcome of getting a reputable degree that I can use to take care of my family.

intrinsic motivation of desire to learn

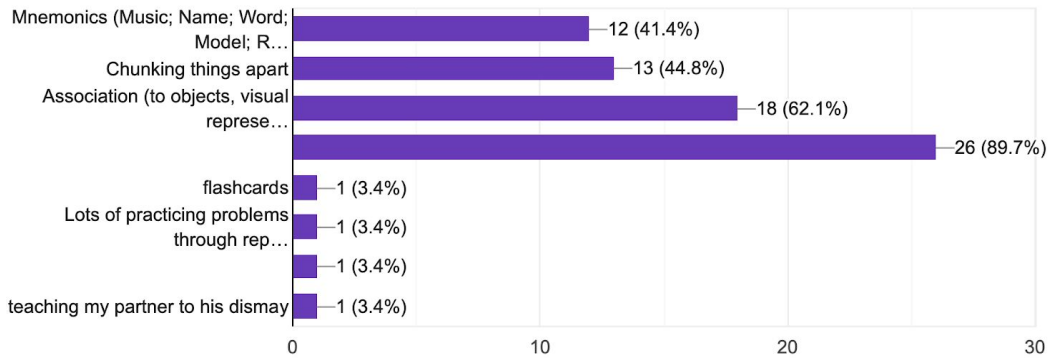
Find a job

6.

When you study for an exam/quiz, which of the following memorization techniques do you use?

Select all that apply.

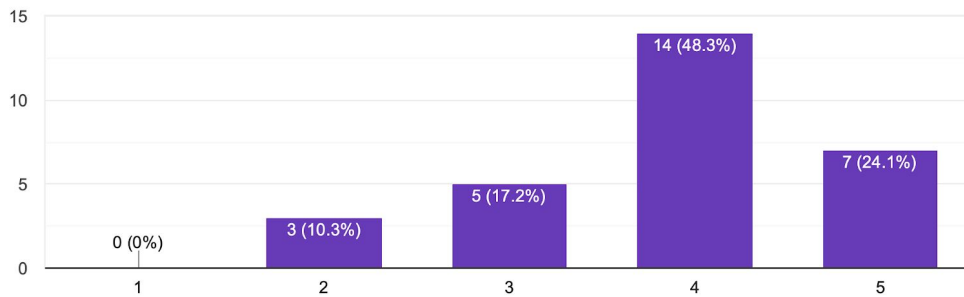
29 responses



7.

How effective are memory association techniques for memorization?

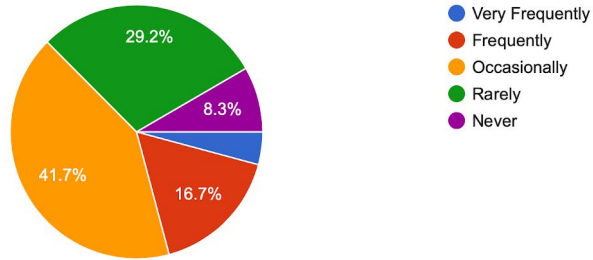
29 responses



8.

How often do you create stories to memorize or understand concepts?

24 responses



9. The Temporal Lobe of the brain is responsible for your ability to hear. What object would help you remember this part of the brain and its function?

Tempo. Like hearing.

An instrument

TL- temporal lobe /to listen ..

Headphones

Tempo is associated with music- so i will connect it with hearing.

Tempo (Temporal) Music Tempo associated with Music + hearing sounds.

Drums

I don't know

Trumpet, both start with T

Trumpet

i would think of the word "tempo", so music in general

headphones

Associating "Temporal" has "Tempo" within the word, which is a musical term, which is then associated with hearing

Hearing Aid

None

Earphones

temple is by the ear, hear

ear buds

Headphones with surround sound mode

Earrings

Metronome

Temples since it's near my temples.

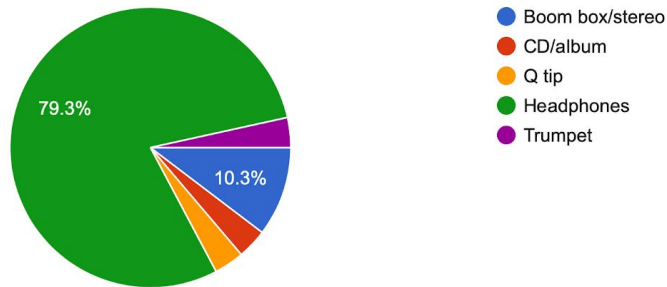
music = hearing = tempo (of music) = temporal lobe

Visuals

10.

The Temporal lobe in the brain is responsible for your ability to hear. Which of the following household items would best help you remember thi...t and its function (through memory association)?

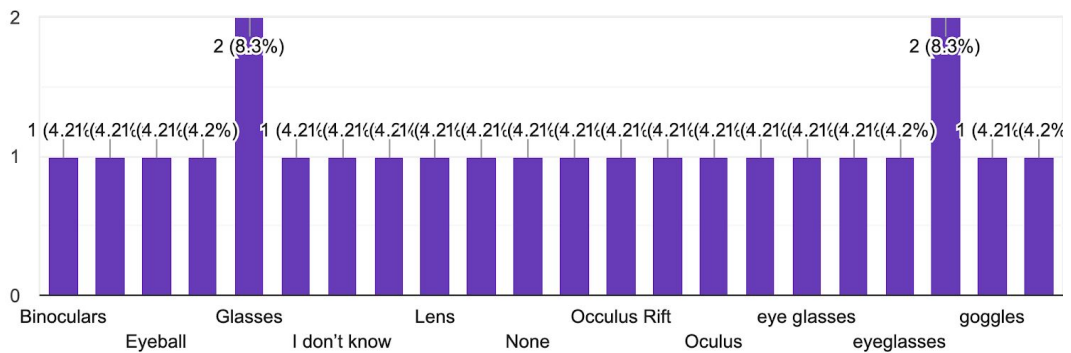
29 responses



11.

The Occipital Lobe of the brain is responsible for your ability to see. What object would help you remember this part of the brain and it's function?

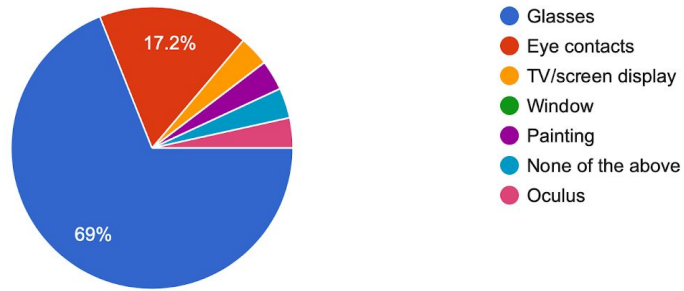
24 responses



12.

The Occipital lobe in the brain is responsible for your ability to see. Which of the following household items would best help you remember thi...t and its function (through memory association)?

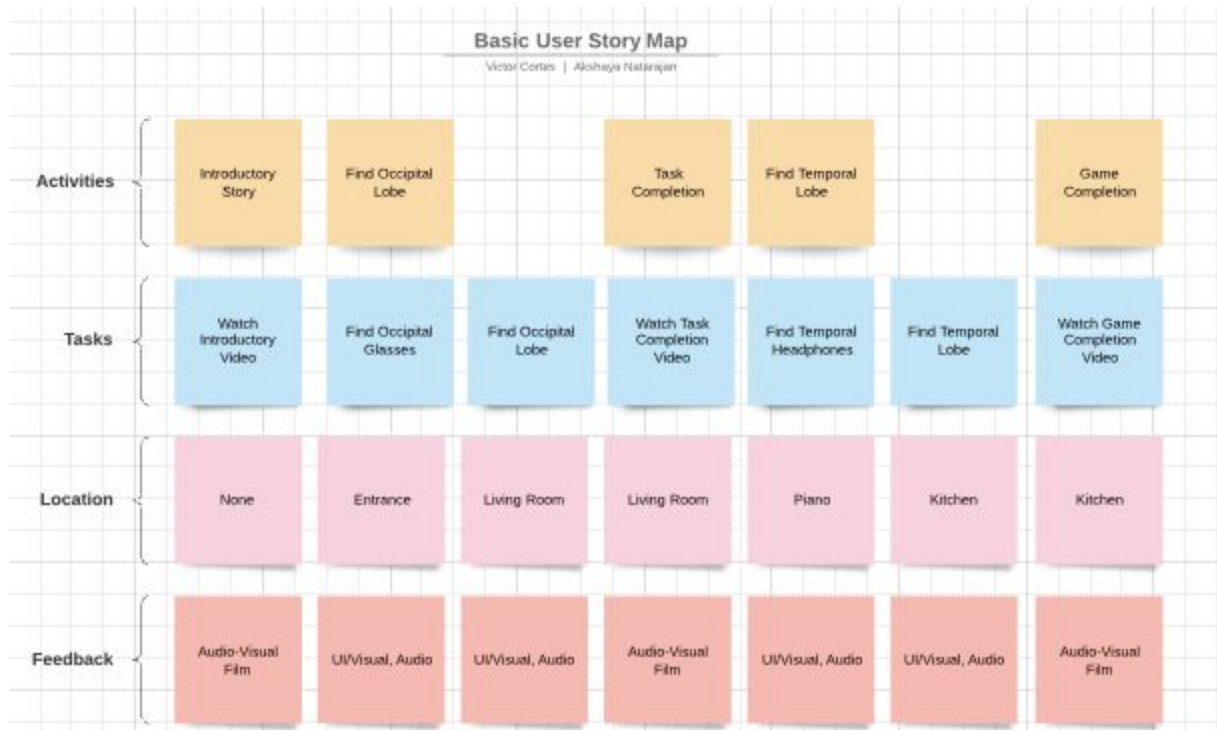
29 responses



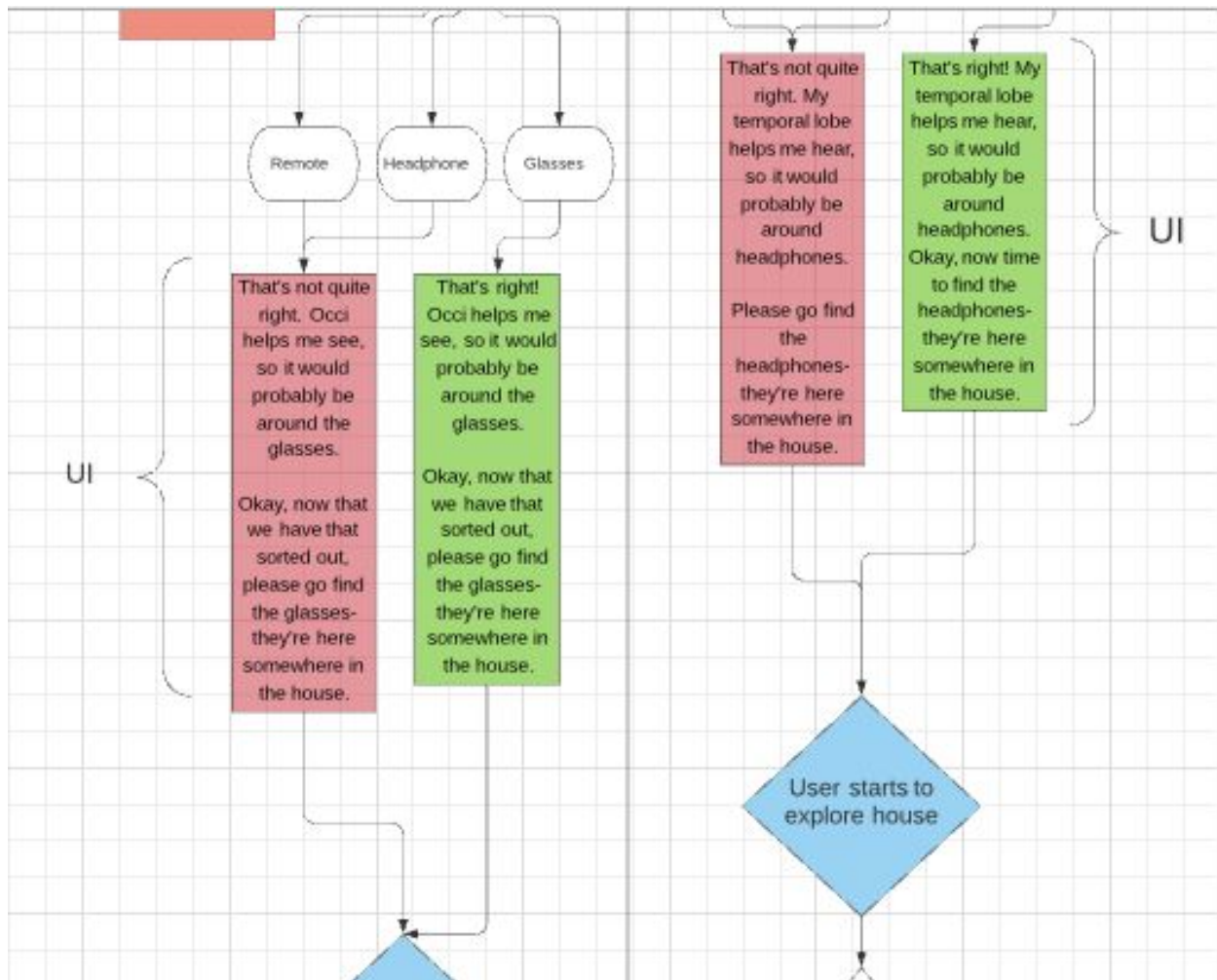
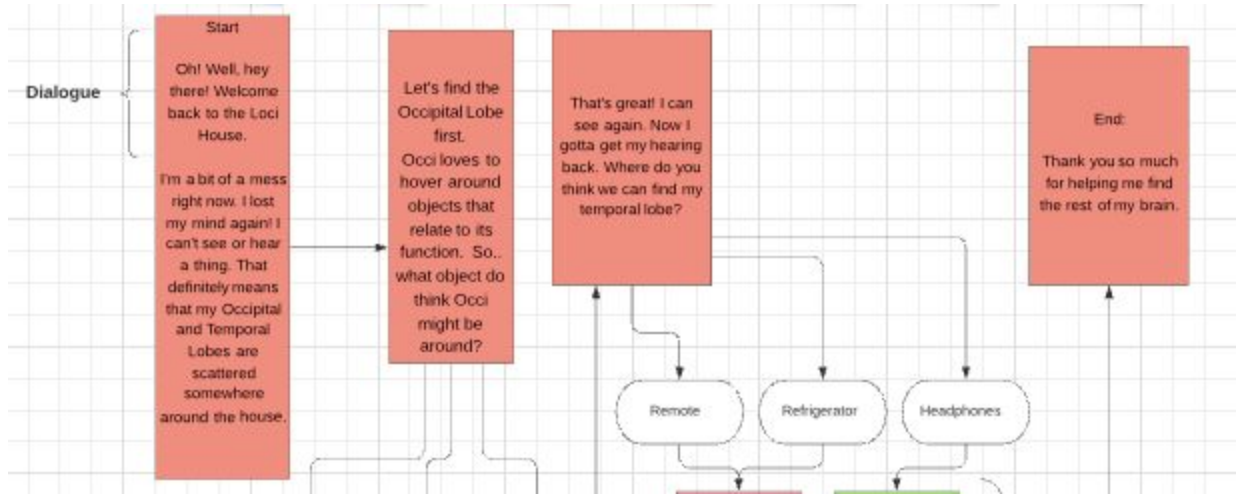
## Interaction Design Conceptual Model

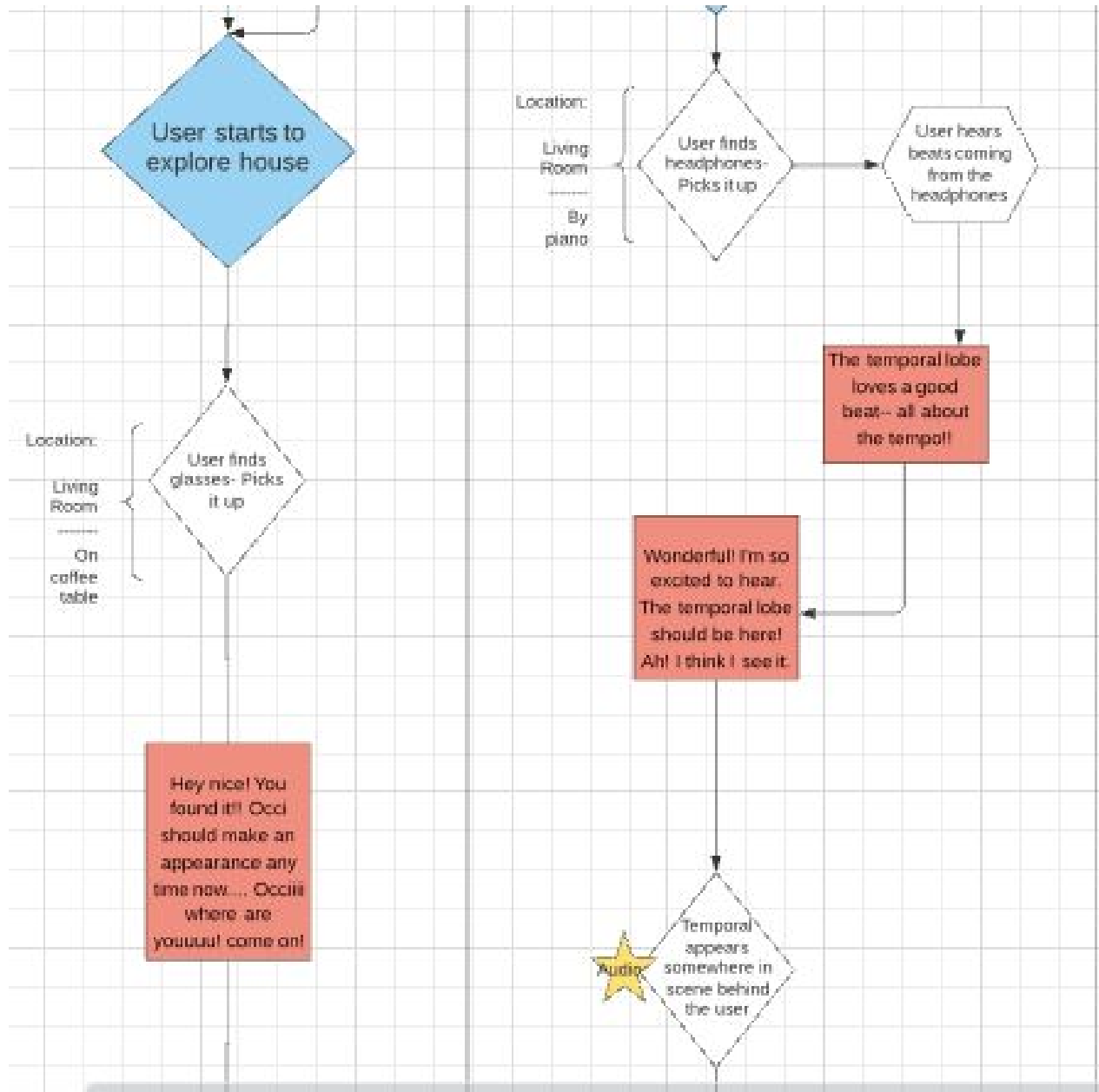
Objects		Actions		Objects							
House	Map	House Objects (Associated)	House Objects (Unassociated)	Brain	Brain Parts	House	Map	Associated Objects	Unassociated Objects	Brain	Brain Parts
House	Walk					x					
Map	Pick Up						x	x			x
House Objects (Associated)	Scan										
House Objects (Unassociated)	Drop Off					x	x	x	x	x	x
Brain											
Brain Parts											x

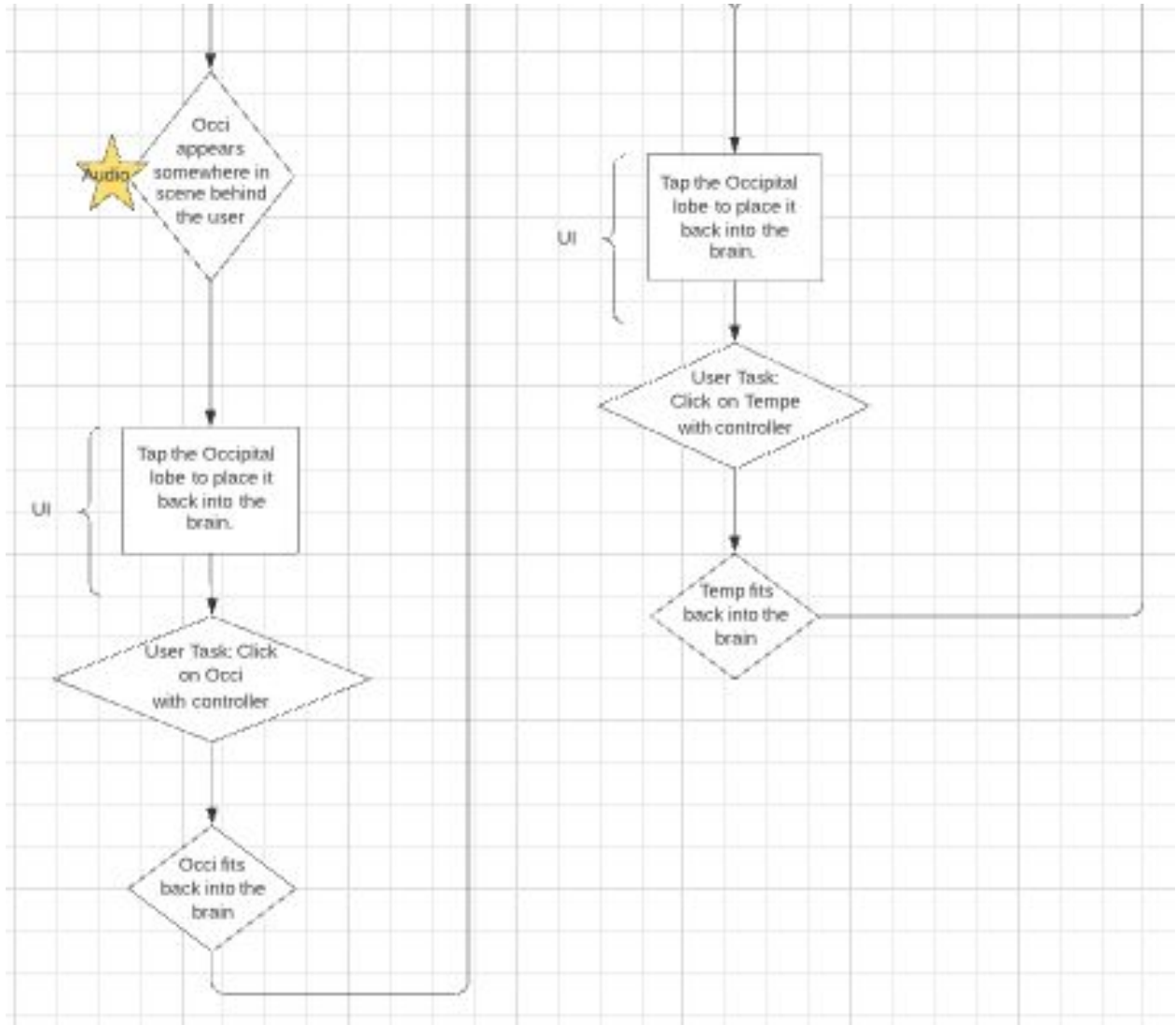
Objects-Attributes						
House	Brain Parts	Brain Function	Map	Associated Objects	Feedback	Effects
Room 2: Living Room	Occipital Lobe	vision	Room Labels	Glasses	highlighted	Blurred Vision- Canvas Method
Room 1: Music Room	Temporal Lobe	hearing	Player Location	Headphones	highlighted/ Audio	Muffled Hearing
Room 3: Living Room	Somatosensory	Physical Feeling		Homonculous	Patterned Vibration/ highlighted	Haptic vibrations











## Design Heuristics (VR)

**VR Heuristic Short List For Practitioners**

<i>Virtual Reality Heuristics</i>
<b>1. Synchronous Body Movements.</b> <i>The system and interface should stay in synchrony with human head &amp; body movement in real time to prevent lag.</i>
<b>2. Physical Space Constraints.</b> <i>The system should account for the real-world physical space users' occupy when interacting with the system.</i>
<b>3. Immersion.</b> <i>The system should immerse the user in virtual reality, specific to visual realism.</i>
<b>4. Glitchiness.</b> <i>The system should promote a streamlined experience by keeping systematic glitches low.</i>
<b>5. Switch between real and virtual world.</b> <i>The system should be able to rely on itself for all usage; that is, keep all necessary user tasks and information within VR, instead of creating tasks that the user may only be able to execute when VR headset is taken off or information that can only be accessed by taking headset off.</i>
<b>6. Cord Design.</b> <i>The cord of the system should be designed such that VR usage requires minimal maintenance, e.g. providing adequate length and mobility to keep entanglement to a minimum.</i>
<b>7. Headset Comfort.</b> <i>The headset of the system should be designed to be comfortable for prolonged wear.</i>
<b>8. Mental Comfort.</b> <i>The system should be designed to prevent sensations of physical illness during use, by preventing jarring movement lag, increasing realism of visuals, and so on.</i>
<b>9. User Interface Design.</b> <i>The system's interface and hardware controls should have an intuitive design and navigation, adhering to usability conventions.</i>

Marketing - Logo/Branding

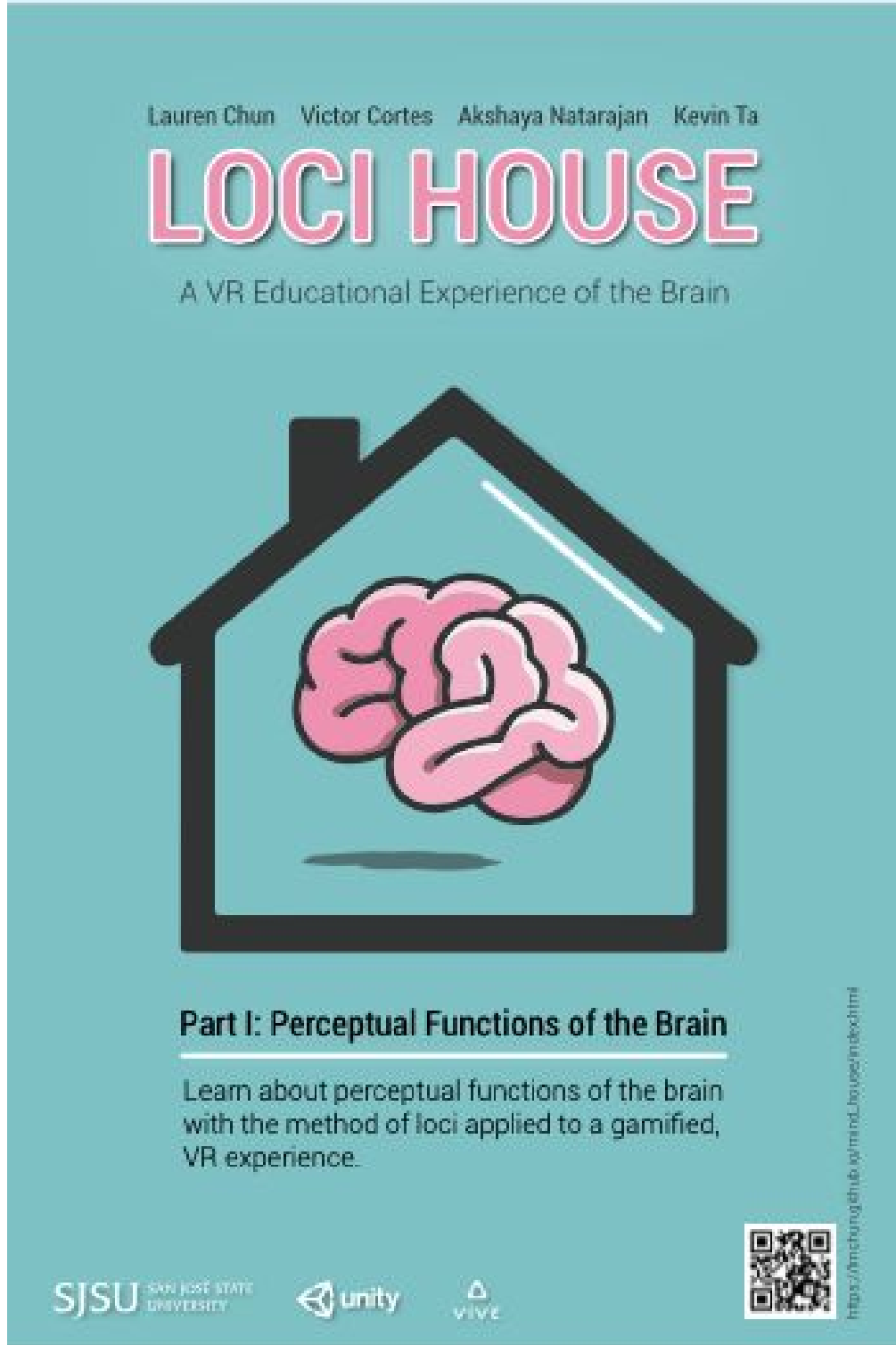
Lauren Chun Victor Cortes Akshaya Natarajan Kevin Ta

# LOCI HOUSE

A VR Educational Experience of the Brain



Logo



Poster