University of Washington
Information School

Info 490 / 491 - Capstone Project
Winter - Spring 2016

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Introduction

Problem Statement:

> How do we develop an effective user-centered platform for audio visualization so that students and teachers can use a tool for visualizing audio environments to further their understanding of the nature of sound?

Project Abstract:

Echo is an interactive sound visualization tool, designed to help students learn about sound design and audio engineering. Currently, students do not have the resources that they need in order to learn about audio engineering and acoustic environments. Most modern sound visualization tools are proprietary and require industry knowledge to discern meaning from them. Echo aims to help teachers keep their students interested and engaged in learning about sound design concepts by implementing a unique approach to sound visualization. We discovered that virtual reality is the ultimate medium to immerse someone in an acoustic environment, and will promote the highest level of understanding in all of our users. Our goal is to lower the barrier of entry into the professional sound design and audio engineering industry. This will effectively enrich the knowledge pool in the industry, therefore leading to greater insight and discovery for acoustic designers on all levels.

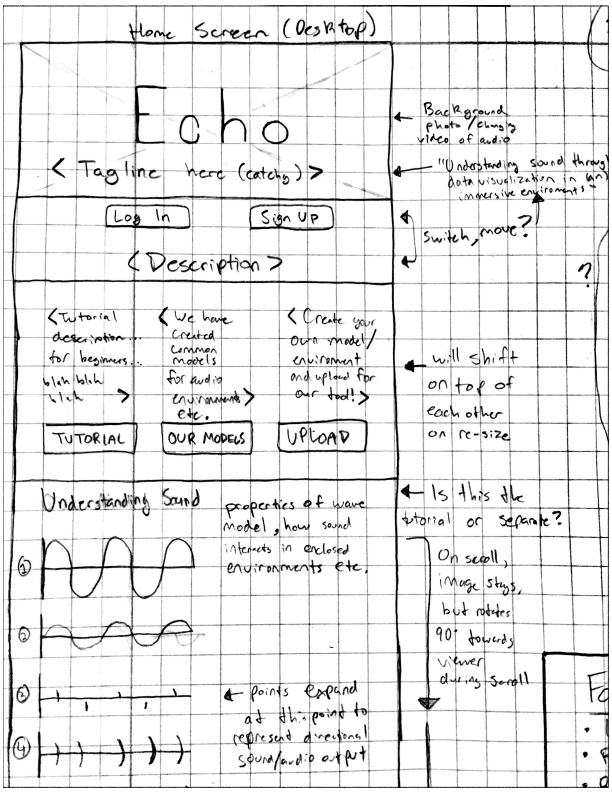
Project Context and Description:

During Fall quarter of 2015, we conducted a thorough literature review on the topic of designing user-centered audio visualization technology (Informatics 470). In addition to this, we proposed potential research methodologies in order to better understand the gap in research that we identified. Since then, our problem statement has shifted to more accurately solve a specific problem regarding the lack of standardization of audio visualization technologies in academia. Our literature review and proposed research methods can be found online here:

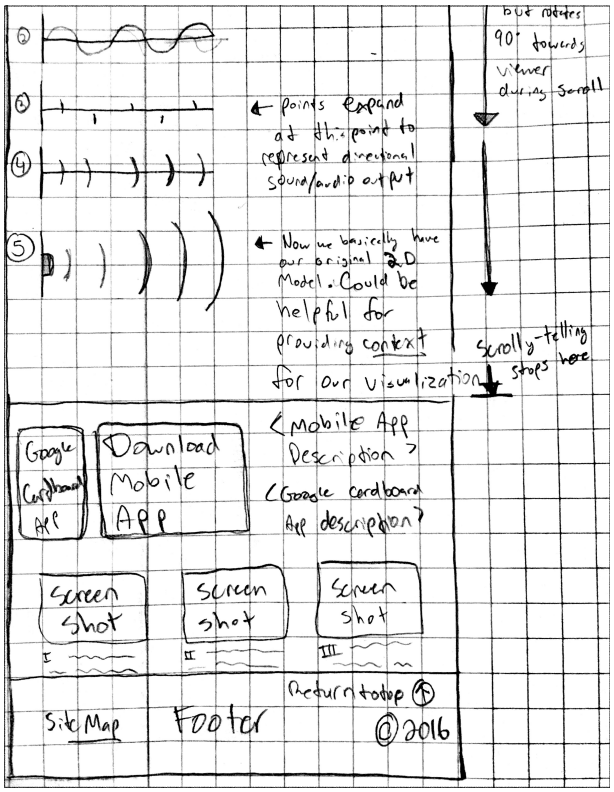
https://docs.google.com/document/d/11AJ_UHyurwUOlifYCgY0G4FZKjLoWaZAj6GMp8Mowi4/edit?usp=sharing

Sketches

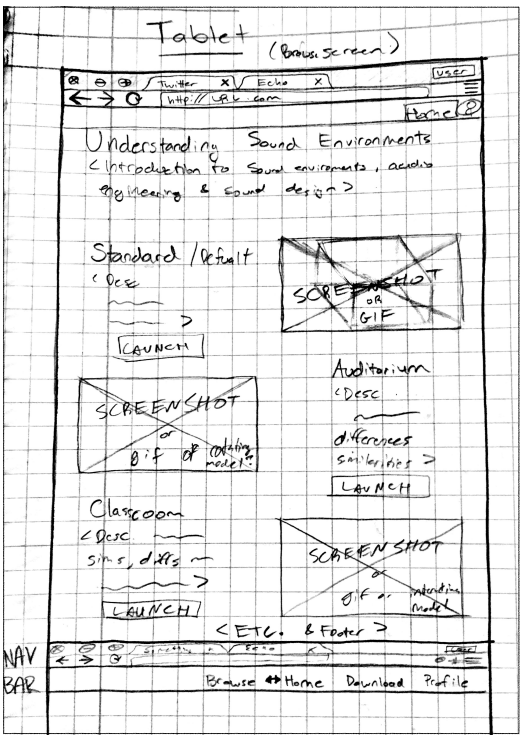
i. Home Screen Sketch I



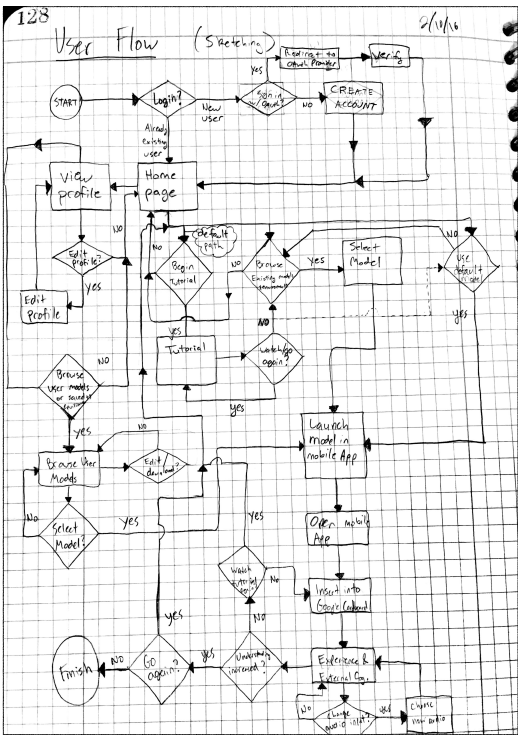
ii. Home Screen Sketch cont.



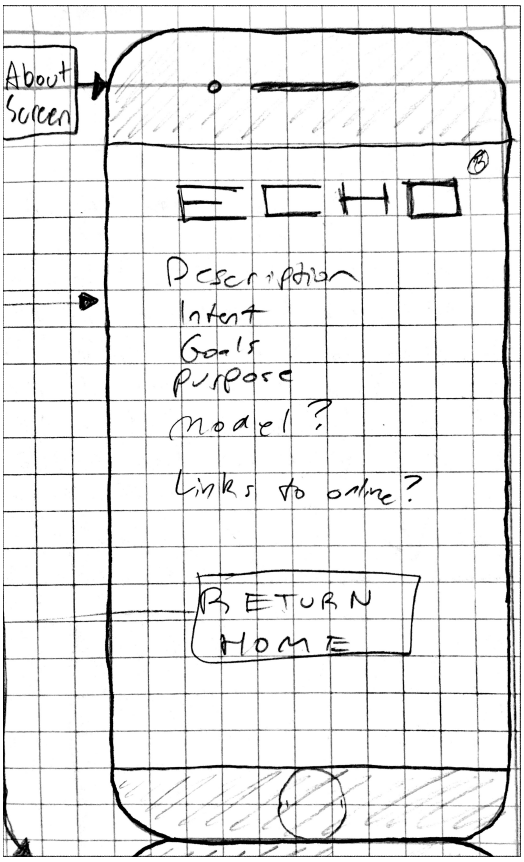
iii. Browse Screen Tablet View



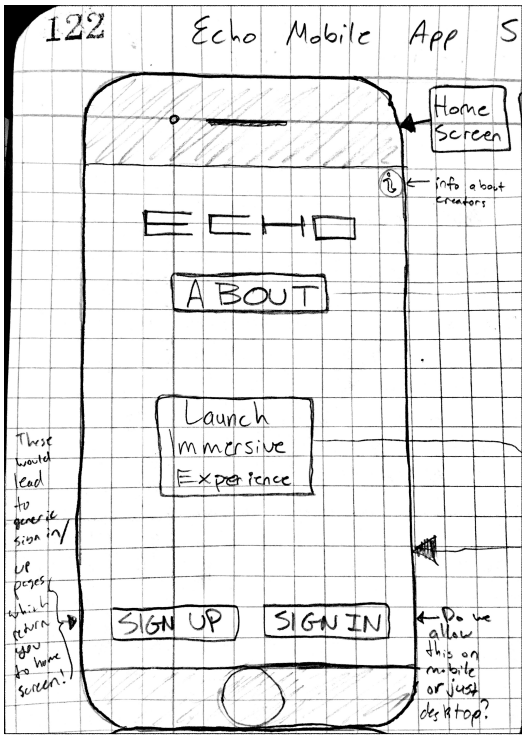
iv. User Flow Sketch



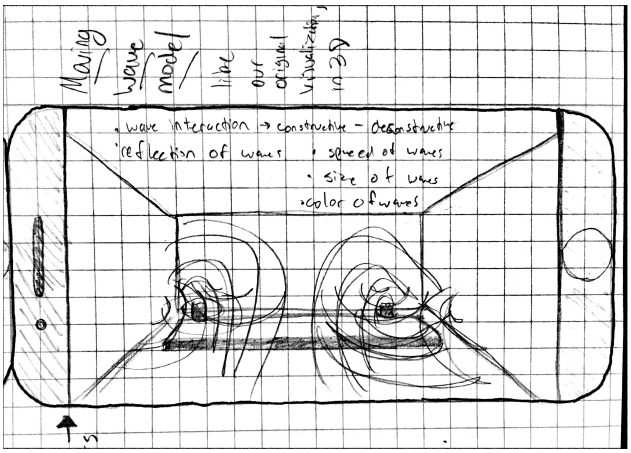
v. Mobile About Screen



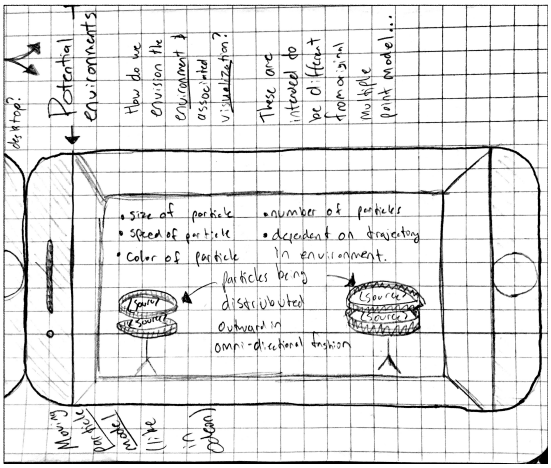
vi. Mobile Home Screen



vii. Virtual Reality Wave Model



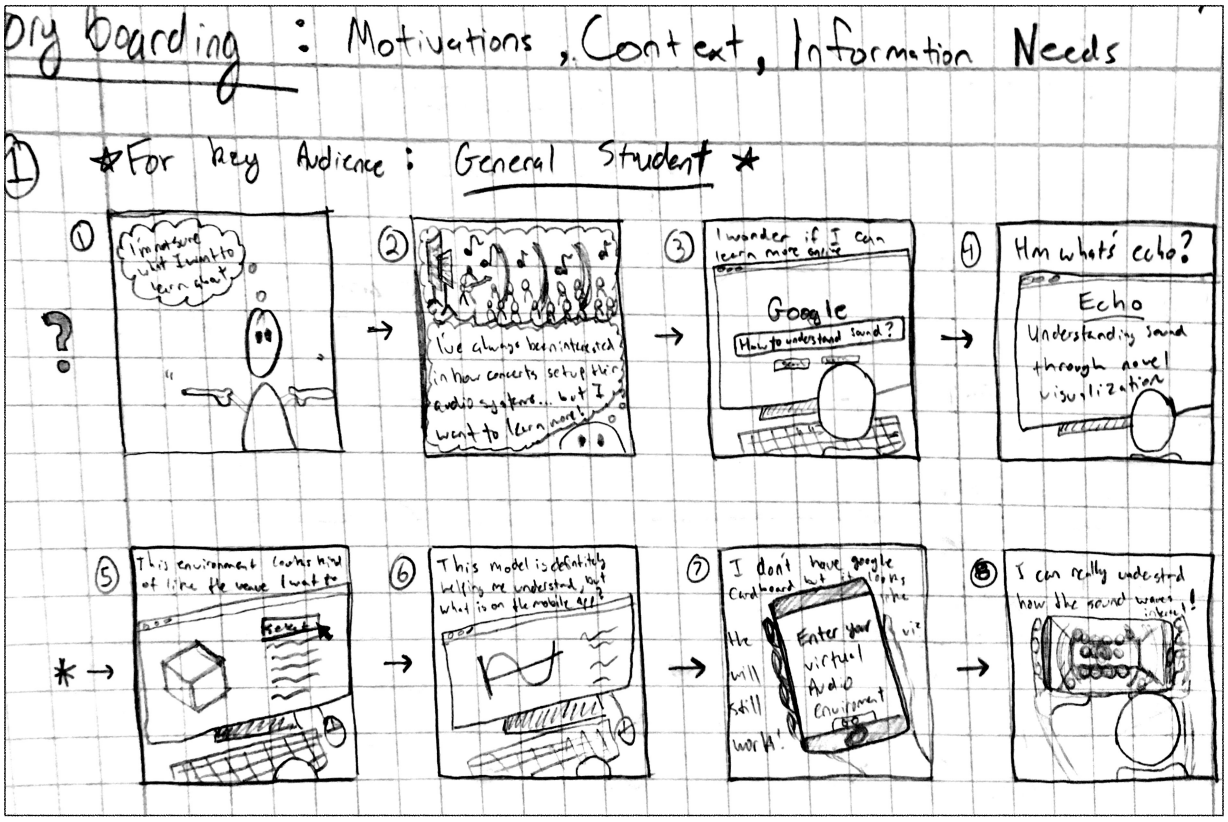
viii. Virtual Reality Alternate Model



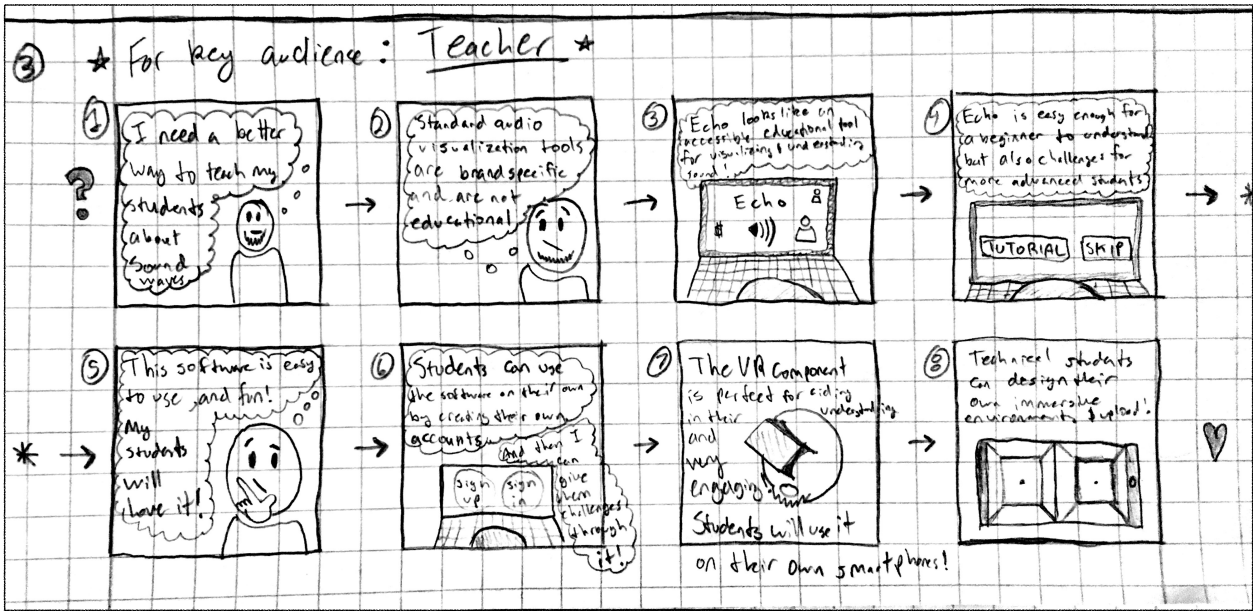
(See Annex for additional Sketches)

Storyboards

i. Storyboard - Student

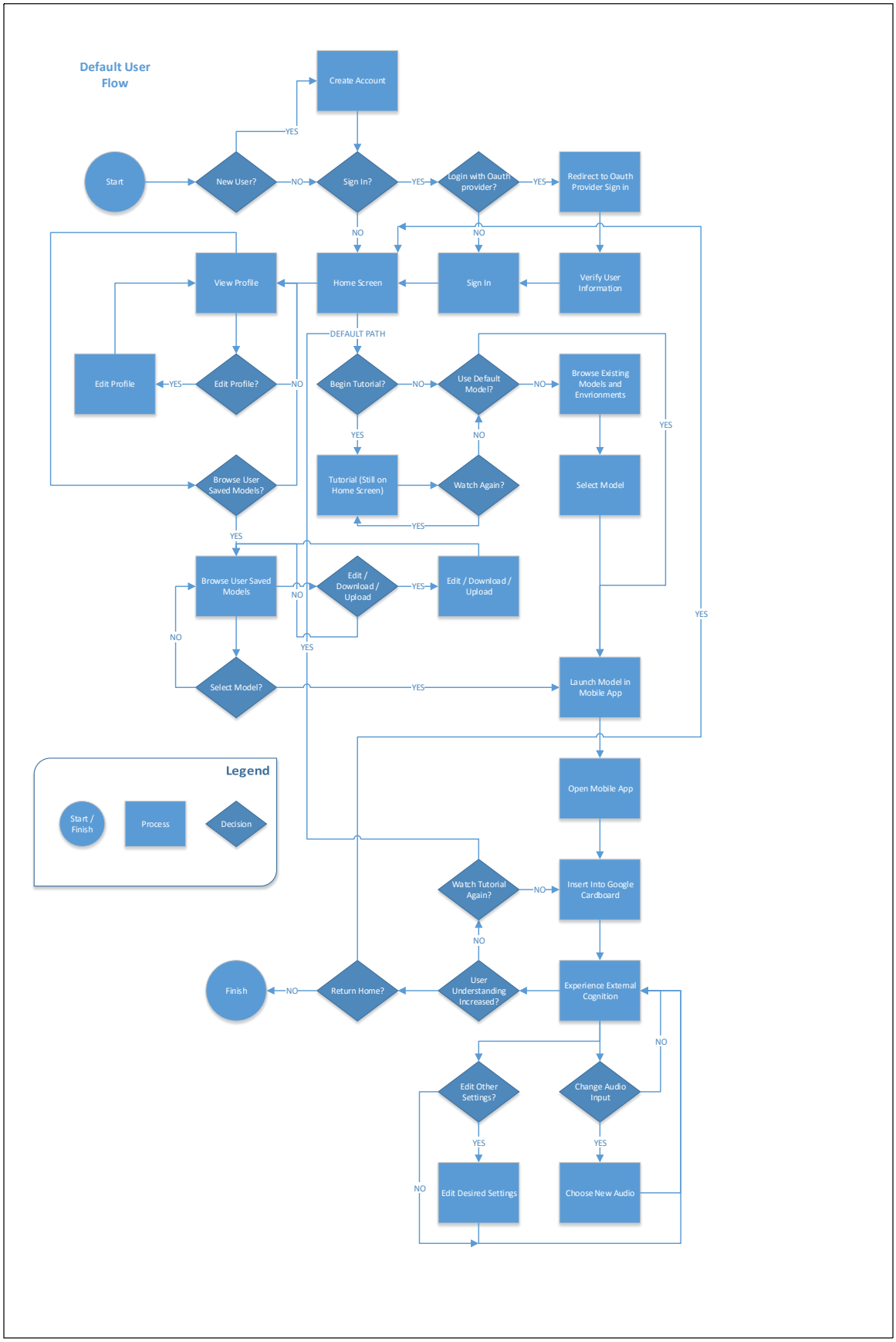


ii. Storyboard - Teacher

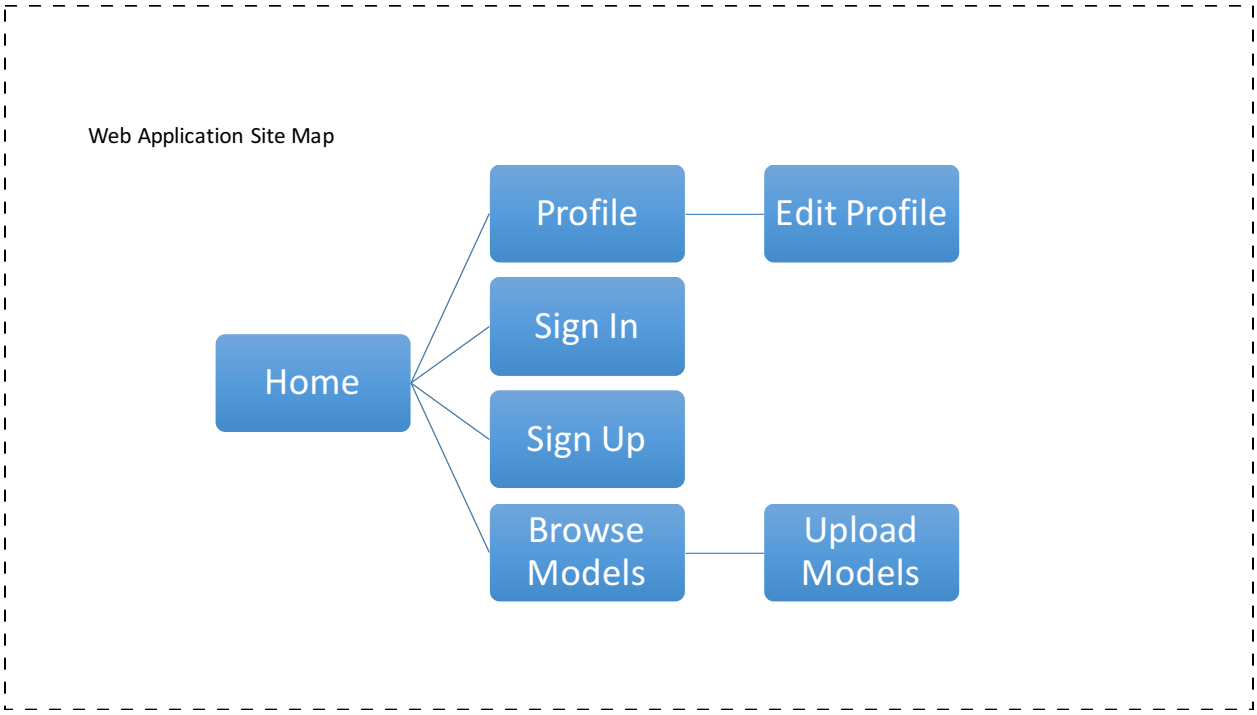


(See Annex for additional Storyboards)

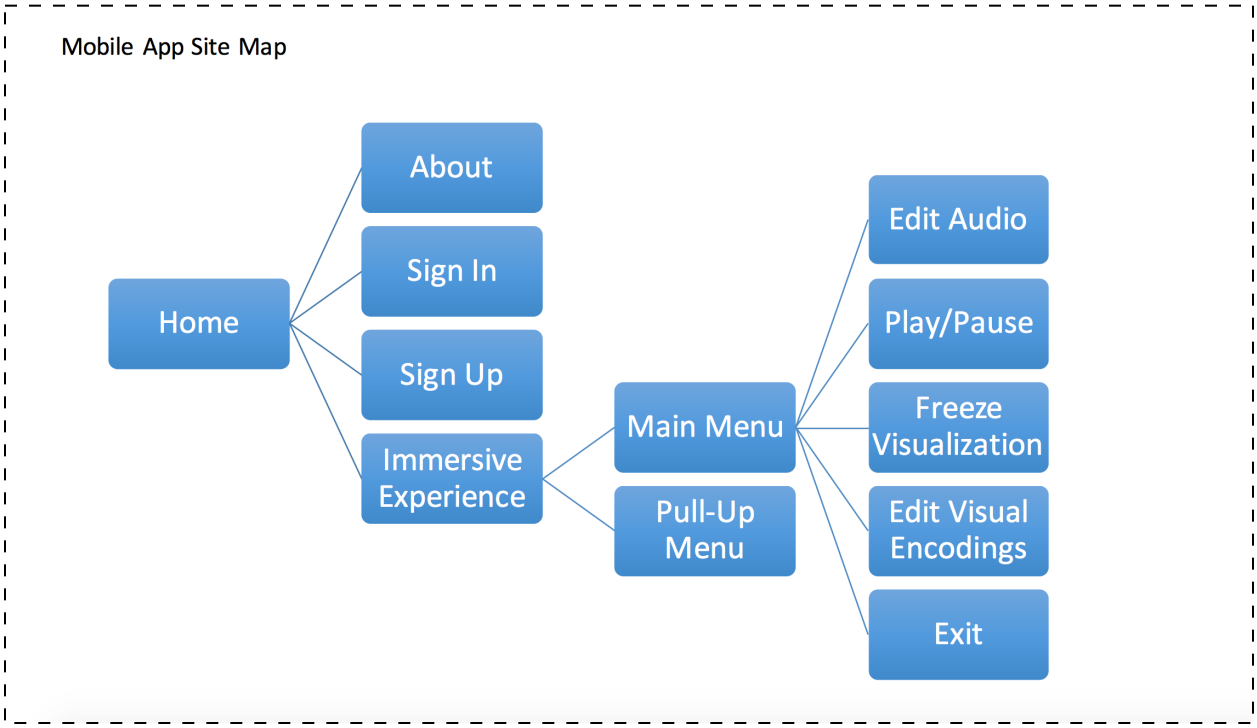
User Flows


Default User Flow
Create Account
YES
Start
New User?
NO
Sign In?
YES
Login with Oauth provider?
YES
Redirect to Oauth Provider Sign in
NO
NO
View Profile
Home Screen
Sign In
Verify User Information
DEFAULT PATH
Edit Profile
YES
Edit Profile?
NO
Begin Tutorial?
NO
Use Default Model?
NO
Browse Existing Models and Envrionments
YES
NO
YES
Browse User Saved Models?
Tutorial (Still on Home Screen)
Watch Again?
Select Model
YES
YES
Browse User Saved Models
NO
Edit / Download / Upload
YES
Edit / Download / Upload
NO
YES
YES
Select Model?
YES
Launch Model in Mobile App
Legend
Start / Finish
Process
Decision
Open Mobile App
Watch Tutorial Again?
NO
Insert Into Google Cardboard
NO
Finish
NO
Return Home?
User Understanding Increased?
Experience External Cognition
NO
Edit Other Settings?
Change Audio Input
YES
YES
NO
Edit Desired Settings
Choose New Audio

Site Maps



i. Web Application Site Map



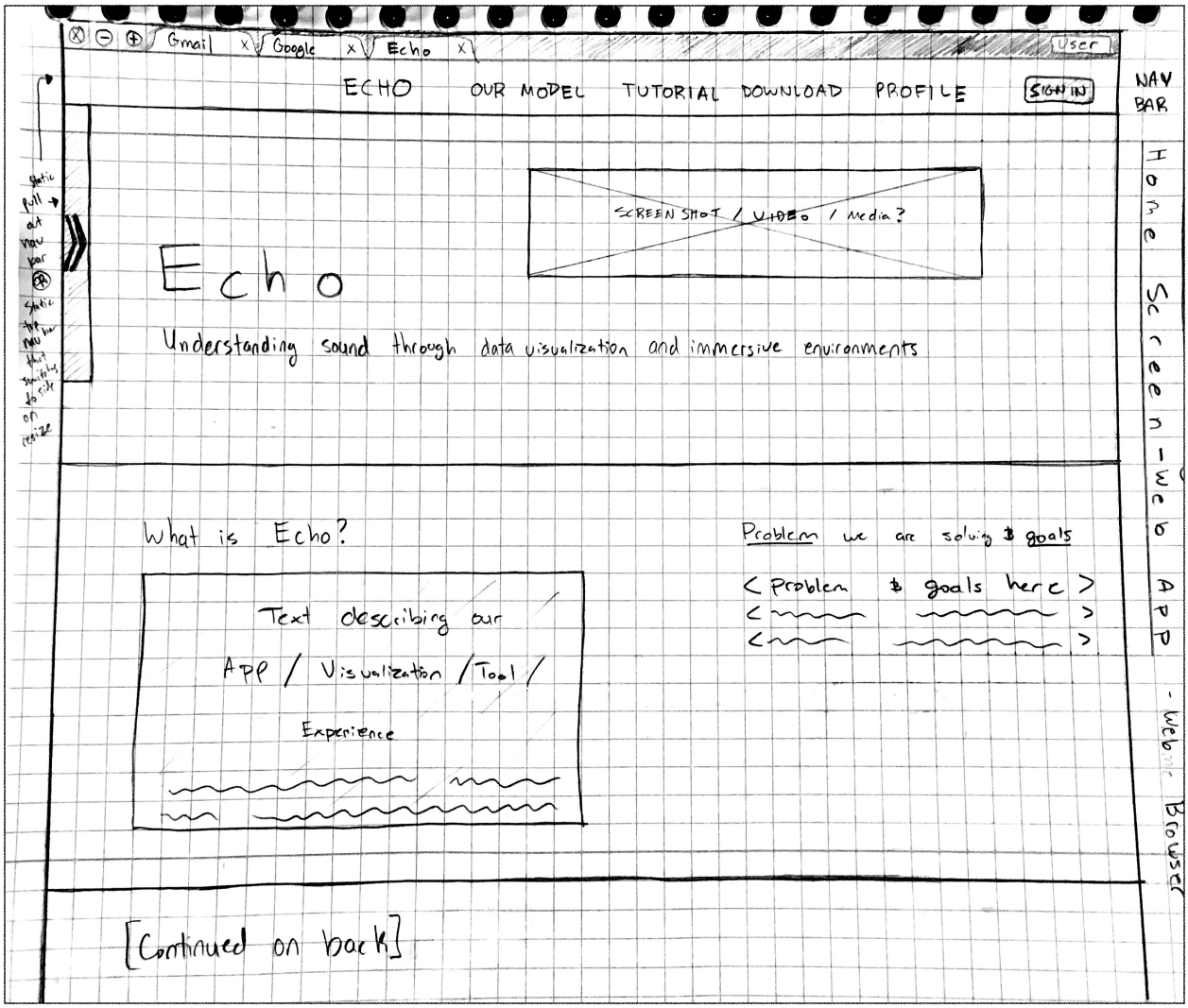
ii. Mobile Application Site Map

Moodboard

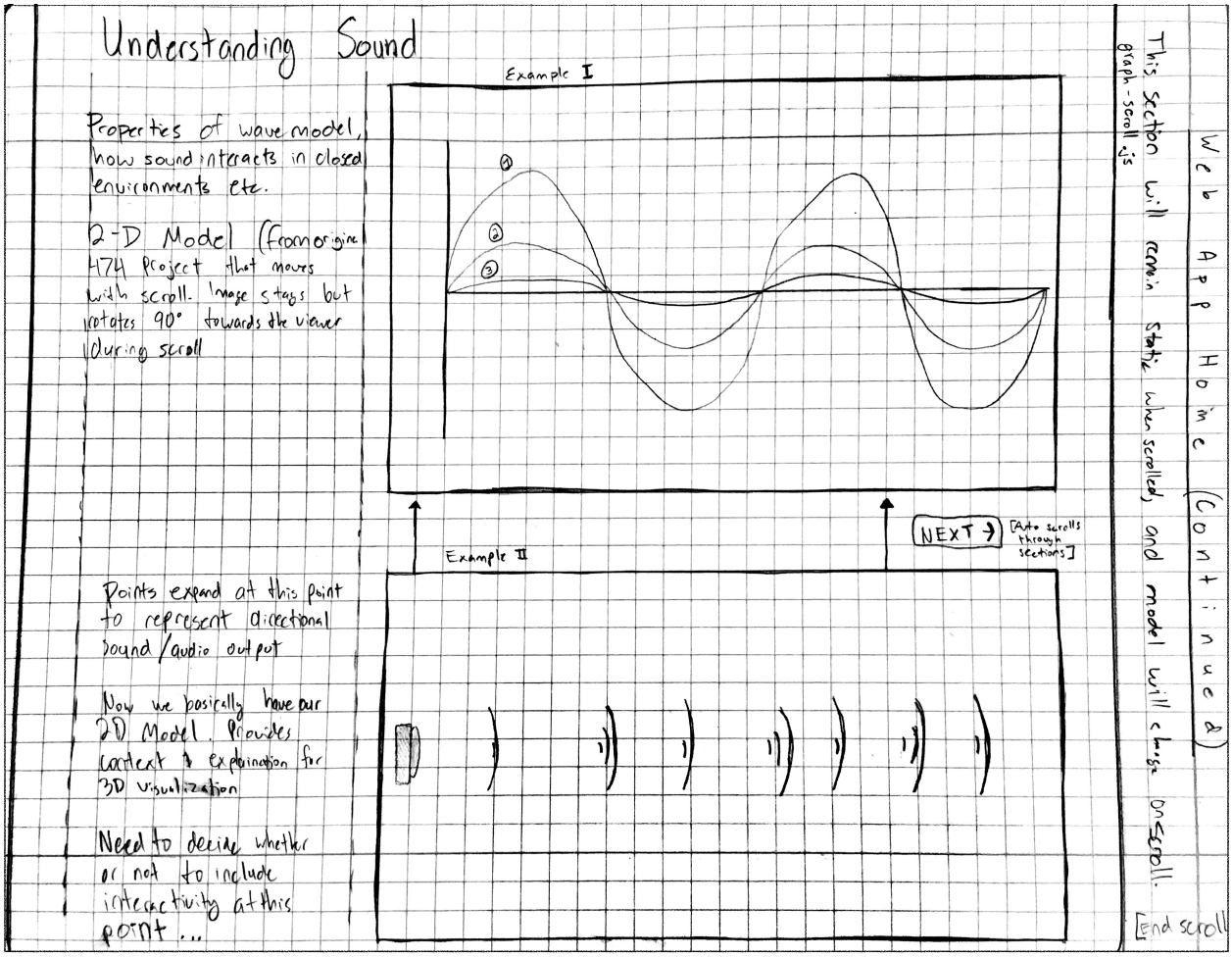
The following are primary colors we want to use for our web application and VR mobile app. The first 3 options are primary, secondary, and tertiary colors for the web site. These will be tested on our users to see how they respond and which color schemes they prefer. We chose blue and green schemes in order to promote learning in our users.

(See Annex for additional Moodboards)

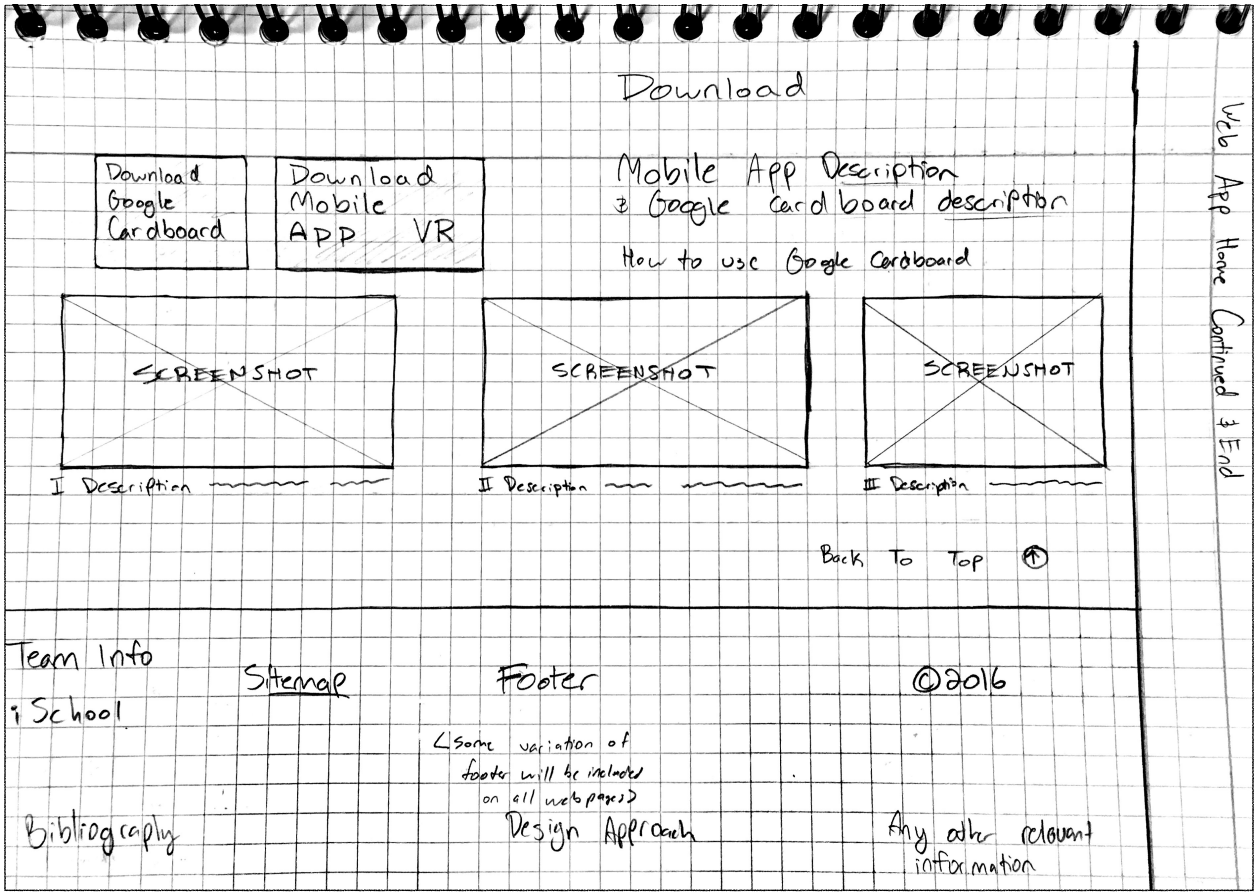
Paper Prototype



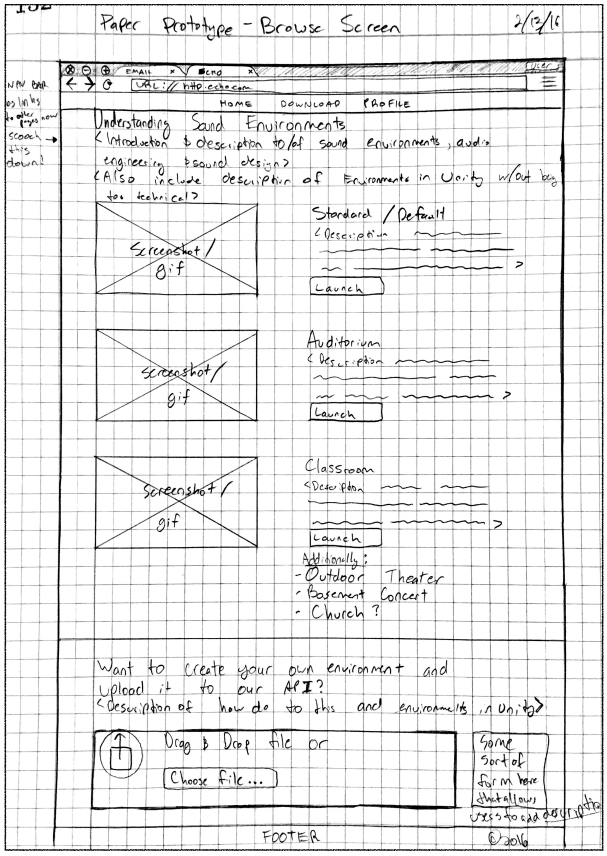
i. Home Screen pt. 1



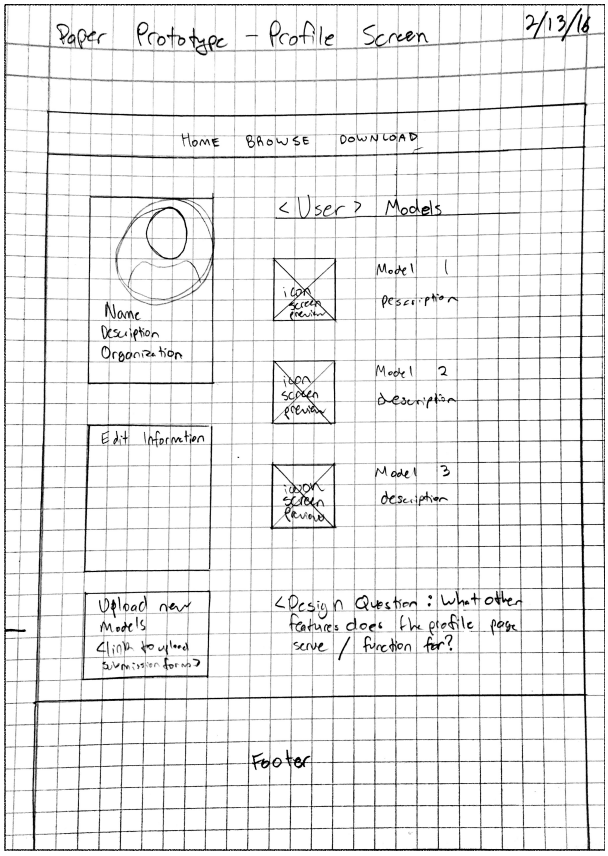
ii. Home Screen pt. 2



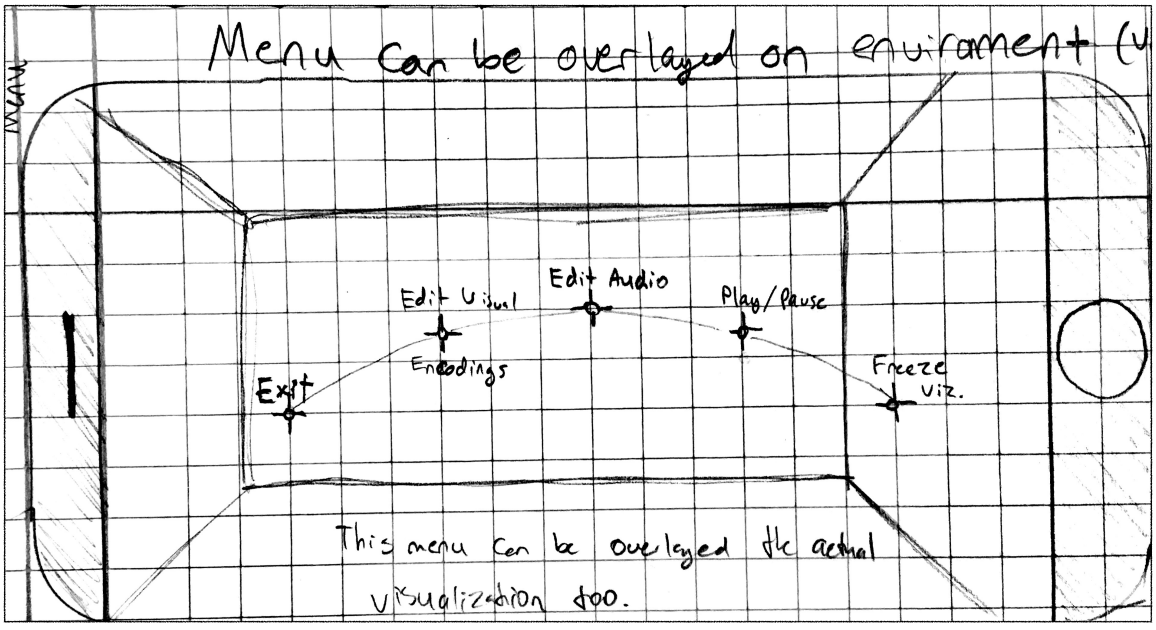
iii. Home Screen pt. 3



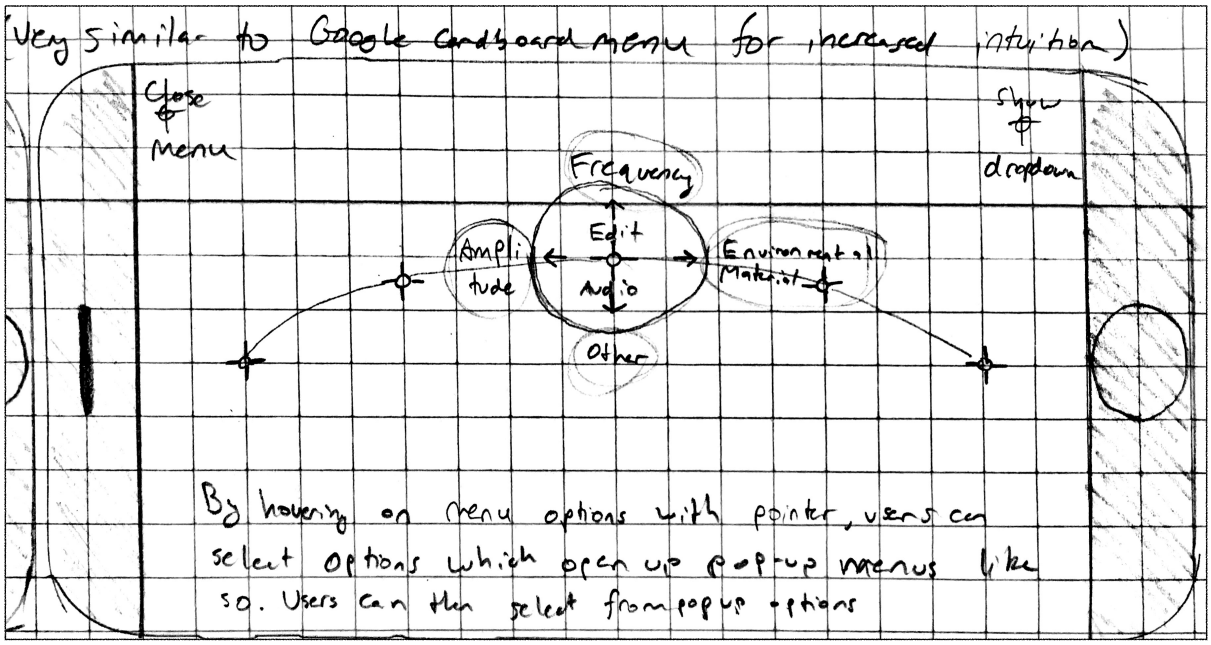
iv. Browse Screen



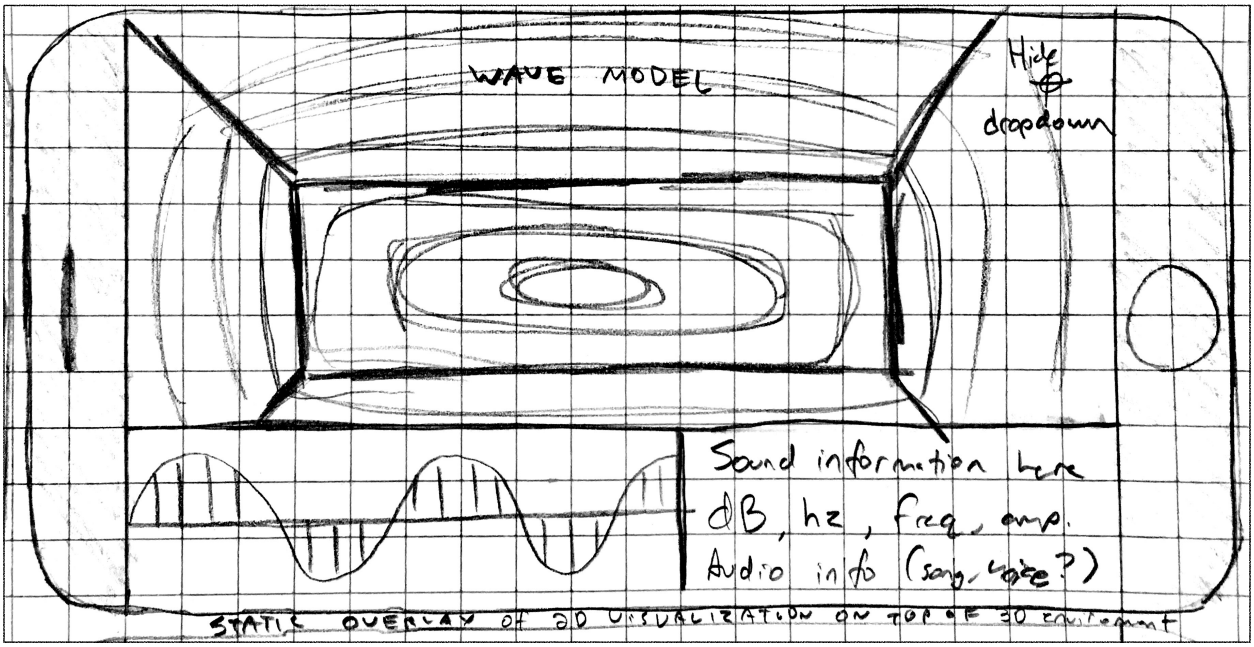
v. Profile Screen



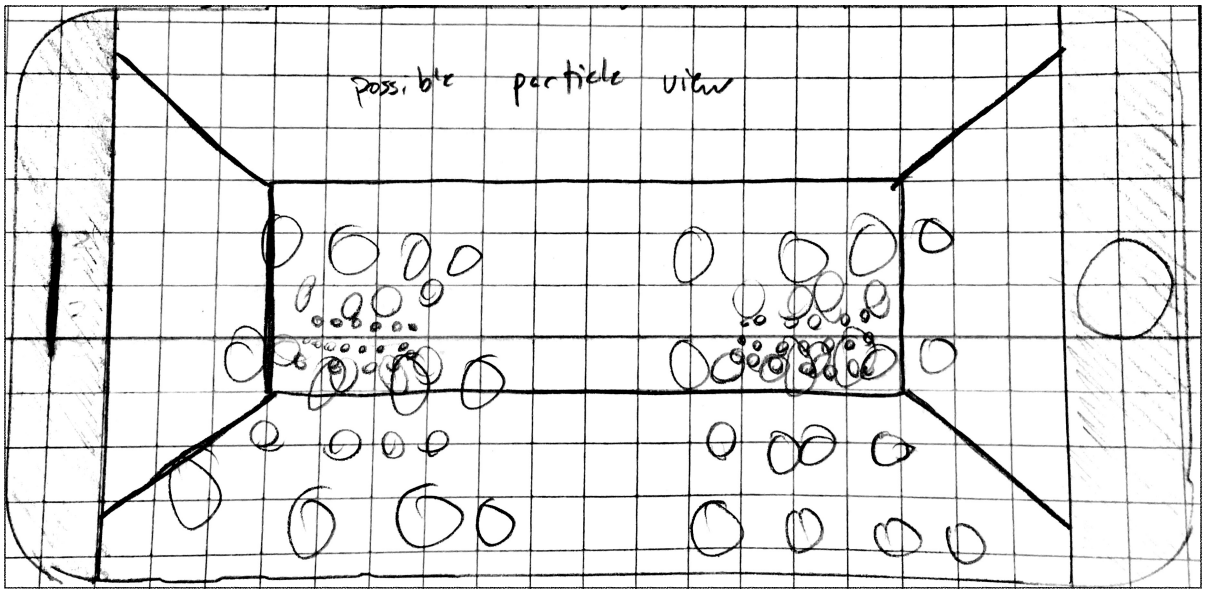
vi. Mobile Virtual Reality Menu Screen



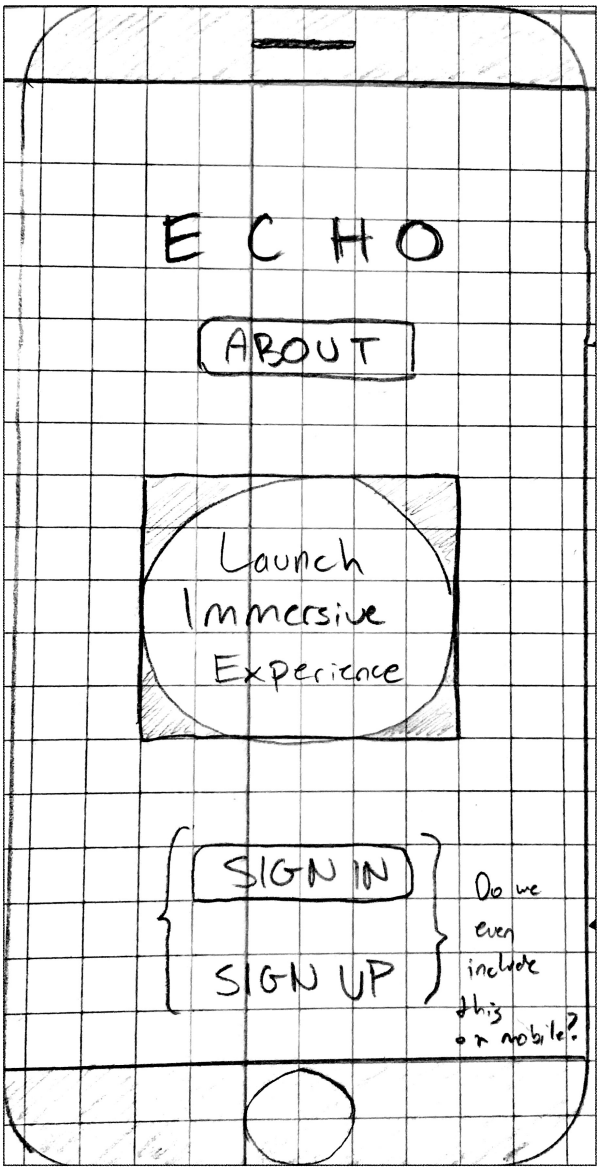
vii. Mobile Virtual Reality Menu Screen Pop-Up



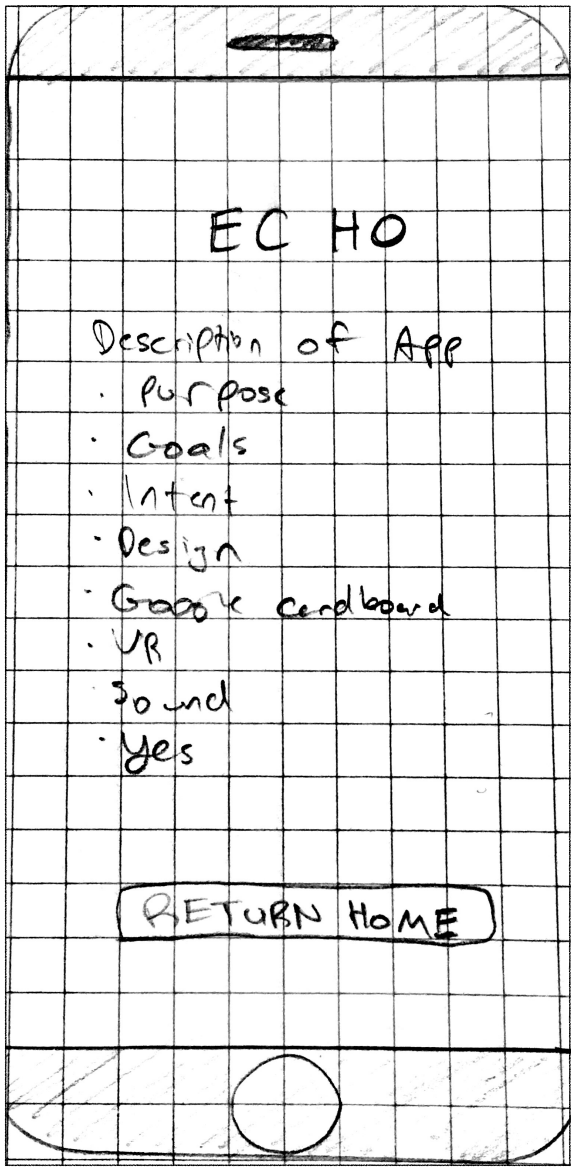
viii. Mobile Virtual Reality Wave Model with Static Menu Overlay (potential)



ix. Mobile Virtual Reality Particle Model



x. Mobile Interface Home & About



User Testing Profile Summaries

User Profile
Name: David
Academic Level: Senior
Major: Electrical Engineering
Additional Info: Some Sound Background
Important Takeaways:
Web App:
- Confused by about section immediately trailing landing page - hard to convey in paper prototype that pages are linked with continuous scroll.
- Some elements of the static menu could be worded differently - “our model” for instance.
- Confused by the understanding environments section.
- Missing create account on home screen.

Mobile App:
- Launching mobile app instance from web app doesn't really make sense.
- Menu choices not intuitive - visual encodings does not translate well.
- Edit audio also confusing - suggestion: make this called source?

User Profile
Name: Max
Academic Level: Senior
Major: Electrical Engineering
Additional Info: Live Sound Background
Important Takeaways:
Web App:
- In downloads section, should be additional instruction, why are there two downloads? Do I need cardboard AND echo?
- Does not make sense to launch the mobile app from a web app, what if app isn't open on phone?

Mobile App:
- Unclear about editable visual elements, wonders why this would be useful.

User Profile
Name: Eric
Academic Level: Junior
Major: Electrical Engineering
Additional Info: No Sound Background
Important Takeaways:
Web App:
- Wondered if the ‘our model’ section was the same as an about section (Consider revising name?)
- Didn't understand initial model of platform (Consider explicit explanation of Web app, VR app, cardboard combination outright?)
- Not intuitive that web app would launch tutorial in mobile app, suggested two dimensional visualization in web app, then ability to move to VR, or leave tutorial section entirely in VR, or higher level tutorial in web app.

Mobile App:
- Felt that changing the visual elements was not a relevant task, more important that the elements are encoded in the most effective way possible to increase understanding.
- Wondered what editing the audio source entailed, perhaps provide additional tutorial element?

User Profile
Name: Gianni
Academic Level: Junior
Major: Informatics
Additional Info: No Sound Background
Important Takeaways:
Web App:
- First instinct was to press button for download.
- Initial model was skipped by not scrolling first.
- Not made clear that platform was based on multiple application (Consider changing visual hierarchy on download page?)
- Launch button did not make sense on tutorial page, possibly launch tutorials in app.
- Felt that the profile page was unexpected for an application like this, didn't understand why credentials were necessary.

Mobile App:
- Only expected sign in / sign up option on home screen of app, then option to launch the visualization, about, load user models, etc.
- Visual parameters should not be changed by user, felt only most effective encodings should be used at all times.

Summary of Findings (from User Testing)

Our user testing proved to be an extremely effective exercise to confirm and question our expectations of user interaction with our first draft of a prototype. We consciously limited our pool of test subjects to individuals that require our platform's content in their academic pursuits, thus allowing their focus to be directed strictly to their interaction with our interface. We began our test with the landing page of our web application, then asked them to proceed through the pages of our prototype in whichever direction felt natural to them. We documented these personal user flows and extracted what we believed to be successes and confusions; comparing and contrasting their personalized flows with our initial expectations.

Across all of our subjects we found they deviated from our initial expectation of them to "sign in" or "sign up" and immediately began to dig into the content presented by the web application. All but one subject immediately began their journey by scrolling down the page, launching the animated visualization which explains the visual model our platform is based on. This was a bittersweet realization, on one hand it demonstrated a successful interaction with our web application where users discover important, foundational content at a very early stage. However, it showed that our attempt at cultivating a personalized user profile was an afterthought for our users. All of our users second steps were to visit the 'downloads' page. The users seemed to agree that the layout of this page was not as intuitive as other web app/download experiences and questioned the need for two download links. Since our mobile VR application actually requires two applications to run properly, proper instruction will be an issue we need to address in the next iteration of our prototype.

Following the visit to the downloads page, our users either visited the home screen of the mobile application and returned to the tutorials page of the web application or went directly to the tutorials page. Once on this page, every user seemed to understand the necessity of a tutorial element to guide them through the process of our visualization. The understood what the content on the page represented and saw the value in its perceived instruction. However, the existence of a launch button under each tutorial caused some confusion. All users expected a guided tutorial in the web app to launch upon pushing the button, however we had envisioned it launching the tutorial in the mobile app. Again, this is a serious

consideration we must face when revisiting the logical flow of interaction with our platform.

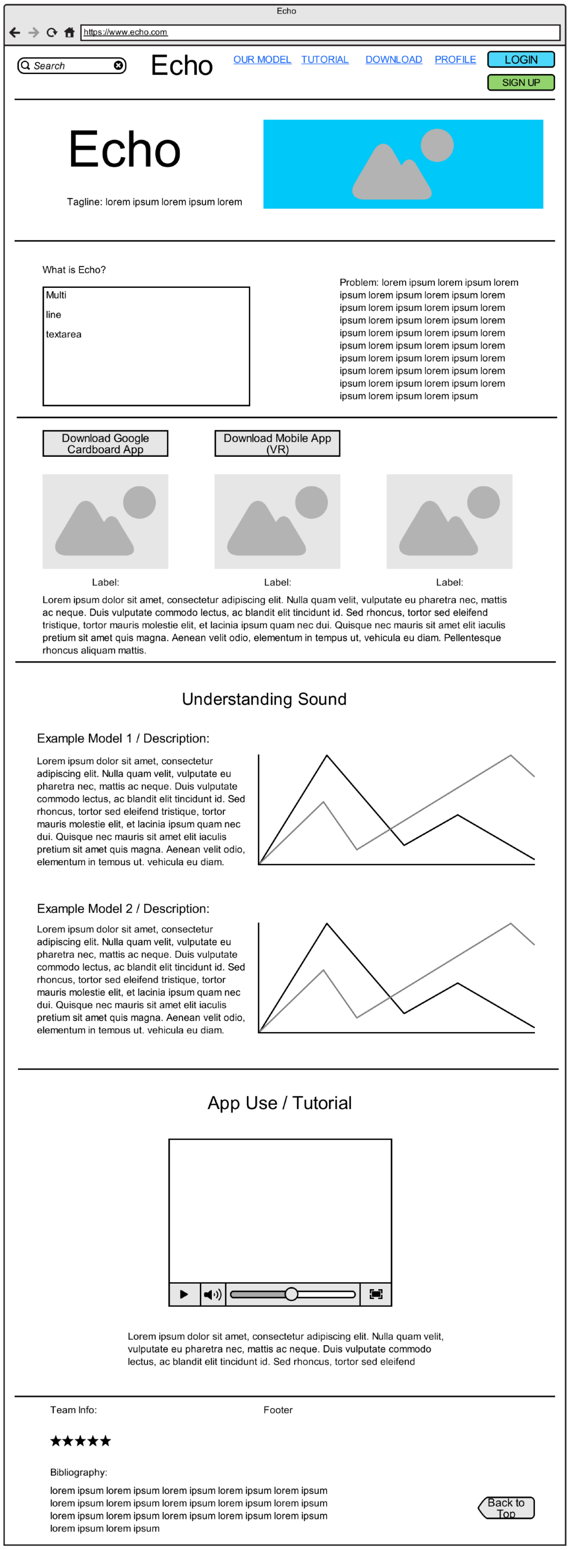
From here, users tended to access the profile page which sparked some additional confusion. Not all users understood why we had prototyped a profile page, arguably because ‘signing in’ was not a required step of the user flow. The purpose of our profile page is to contain the room models created and modified by our users, this was another step that caused some confusion. Upon explaining the process of creating and modifying models, our users seemed skeptical that there would be a large user base that desired to perform this action. Their almost unanimous reaction was that if the process was simpler - for instance a user uploading a photographic representation of a space and our system converting it to a usable model - the profile would be a much more useful and relevant feature.

Finally our users were directed to the mobile application. Initial impressions were very positive, they remarked on what they felt was an overall clean and efficient interface. The one critical comment of the home screen was that it might make more sense to require a login first before allowing a user to ‘launch’ or use any other feature. All users were very receptive to the overlaid menu interface and felt it was a smart and simple way to interact with the application without moving away from the visualization. However, most users were confused by some of the features of the menu. Notably, the ‘edit visual encodings’ option came off as counterintuitive in that what should be encoded visually ought to be the most effective method of visually representing the data. Giving this power to the user could lend itself to error or misunderstanding. The other menu options were generally well received especially the ability to edit the audio source, both in terms of spatial location and general control over the source material.

In conclusion, user testing with our paper prototype proved an extremely valuable exercise. It gave us some positive reinforcement of our perception of how we believed a user will interact with our platform as well as critical points that we will need to address moving forward.

Wireframes

I. Home Page (Desktop)



Notes:

'Understanding Sound' section is explained in greater detail later on. The current image is used as a placeholder on this page.

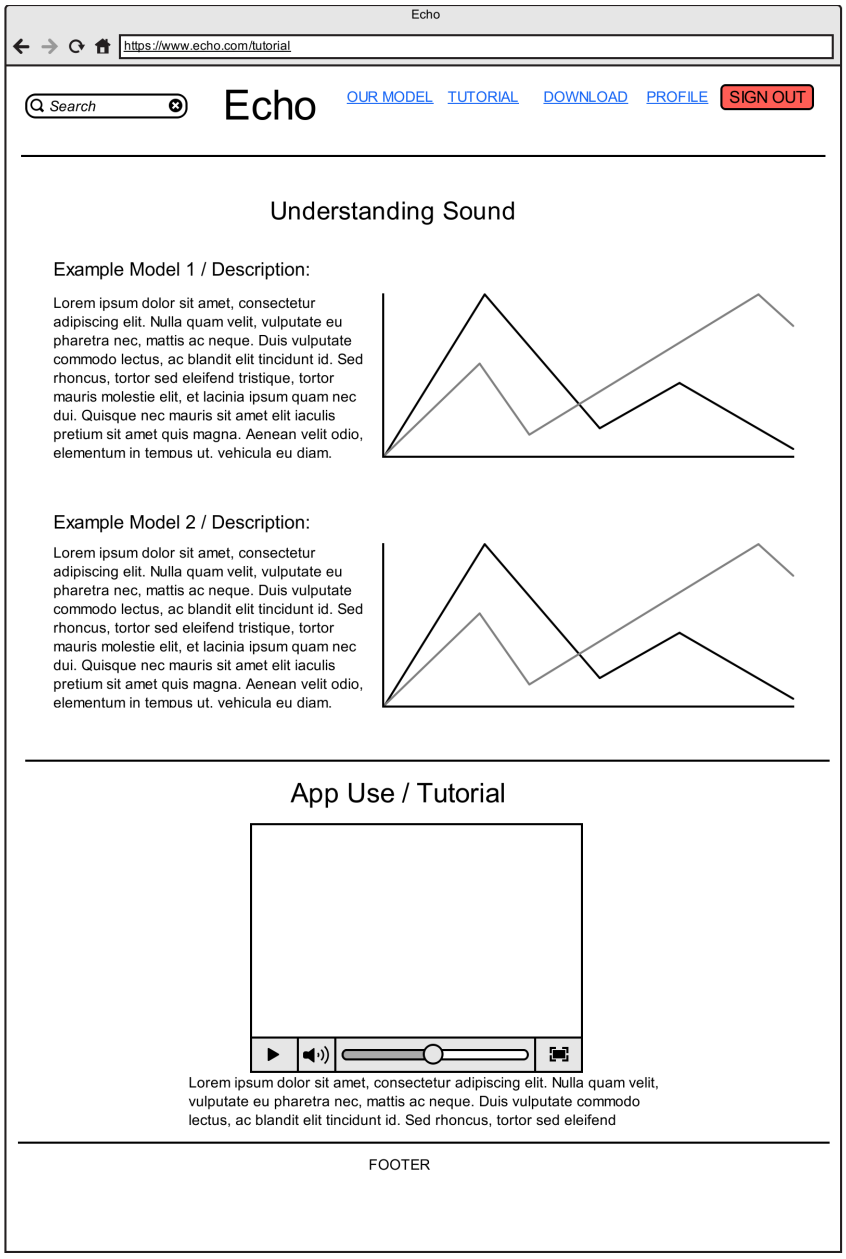
Navigation Bar at top of the page (Search, Echo, Our Model etc.) becomes static to the top of the screen on scroll down.

Notes:

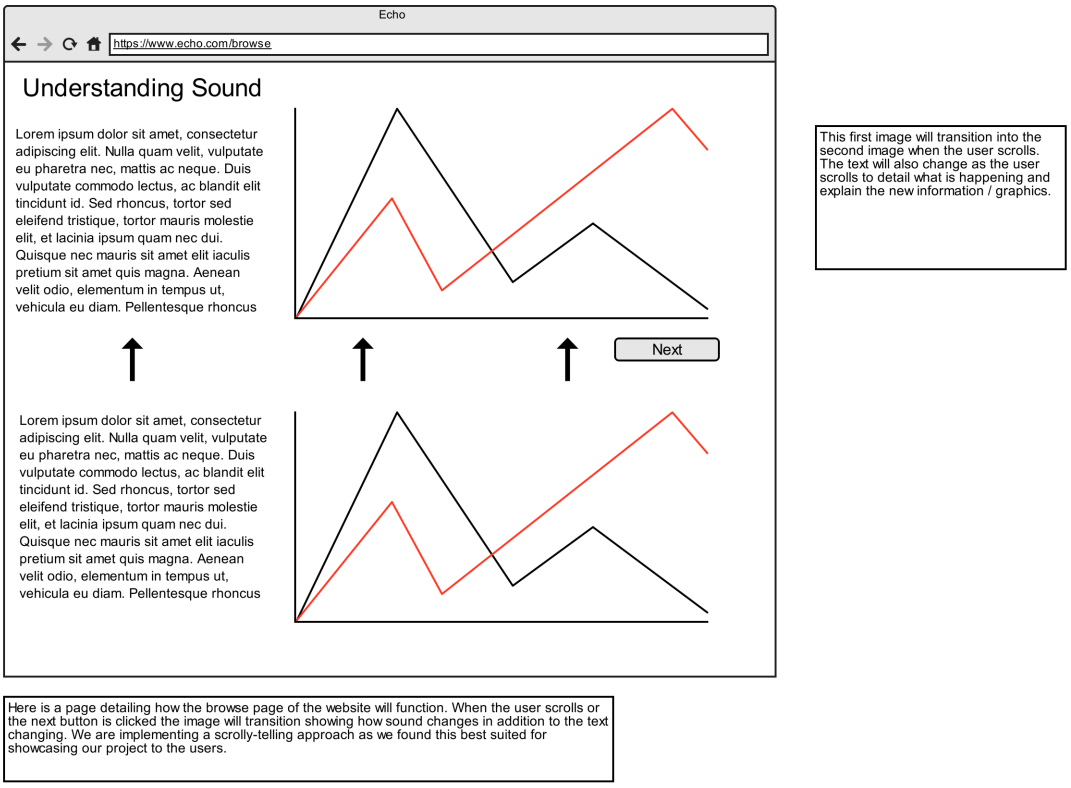
Navigation Bar at top of the page (Search, Home, Our Model etc.) becomes static to the top of the screen on scroll down.

Footer on this page will be the same as on all other pages.

II. Tutorial (Desktop)



III. Understanding Sound (Desktop)



Notes:

This first image will transition into the second image when the user scrolls. The text will also change as the user scrolls to detail what is happening and explain the new information and associated graphics.

Here is a page detailing how the browse page of the website will function. When the user scrolls or the next button is clicked, the image will transform showing how sound changes in addition to the text changing. We are implementing a scrolly-telling approach as we found this best suited for conveying information to our users in an intuitive way.

Graphics are purely placeholder for transformative SVG elements depicting audio interaction in closed environments.

IV. Browse Page (Desktop)

Echo

https://www.echo.com/browse-database

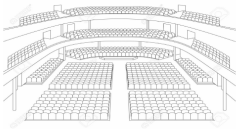
ECHO

HOME DOWNLOAD PROFILE

Understanding Sound Environments

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nulla quam velit, vulputate eu pharetra nec, mattis ac neque. Duis vulputate commodo lectus, ac blandit elit tincidunt id. Sed rhoncus, tortor sed eleifend tristique, tortor mauris molestie elit, et lacinia ipsum quam nec dui. Quisque nec mauris sit amet elit iaculis pretium sit amet quis

This section will be a paragraph describing the different environments and how to go about choosing which environment you would like to visualize.



Auditorium

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nulla quam velit, vulputate eu pharetra nec, mattis ac neque. Duis vulputate commodo lectus, ac blandit elit

Button

Bedroom

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nulla quam velit, vulputate eu pharetra nec, mattis ac neque. Duis vulputate commodo lectus, ac blandit elit

Button

Living Room

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nulla quam velit, vulputate eu pharetra nec, mattis ac neque. Duis vulputate commodo lectus, ac blandit elit

Button

Kitchen

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nulla quam velit, vulputate eu pharetra nec, mattis ac neque. Duis vulputate commodo lectus, ac blandit elit

Button

Want to Create your own environment or download other environments?

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nulla quam velit, vulputate eu pharetra nec, mattis ac neque. Duis vulputate commodo lectus, ac blandit elit tincidunt id. Sed rhoncus, tortor sed eleifend tristique, tortor mauris molestie elit, et lacinia ipsum quam nec dui. Quisque nec mauris sit amet elit iaculis pretium sit

Explanation for how advanced users can create a new room using specific software or can choose from rooms in the database that other users have created.

Drop file or load file here

Drag and Drop your created file to the left.

Check Pre-made Rooms

FOOTER:

V. Environment Database Page (Desktop)

Echo

https://www.echo.com/browse-database

ECHO

HOME BROWSE DOWNLOAD

Browse & Select Rooms to be Downloaded:

How to Download a new room:

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nulla quam velit, vulputate eu pharetra nec, mattis ac neque. Duis vulputate commodo lectus, ac blandit elit tincidunt id. Sed rhoncus, tortor sed eleifend tristique, tortor mauris molestie elit, et lacinia ipsum quam nec dui. Quisque nec mauris sit amet elit iaculis pretium sit amet quis magna. Aenean velit odio, elementum in tempus ut, vehicula eu diam. Pellentesque rhoncus aliquam mattis. Ut vulputate eros sed felis sodales nec

▾ Room Name	▾ Size of Room	▾ Creator	▾ Download
Classroom Auditorium	Large	John Snow	☐
Coffee Shop	Small/Medium	Bryan Gula	☑
Bedroom	Medium	Bryan Gula	☐
Car Garage	Medium	Zach Williams	☑
Bedroom	Small	David Gilluly	☐
Office	Small	David Gilluly	☐
Household Library	Small/Medium	Cody Bishop	☐
Bedroom	Small	Max Davis	☑

Room Size:
12ft x 17 ft

Height:
10ft

Created On:
2/16/2016

User Since:
1/13/2016

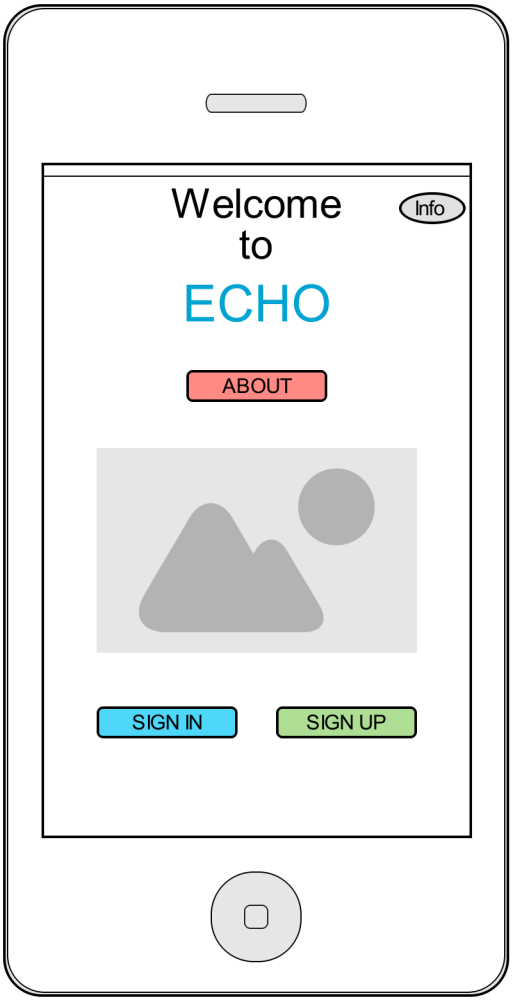
Download Selected Rooms

FOOTER:

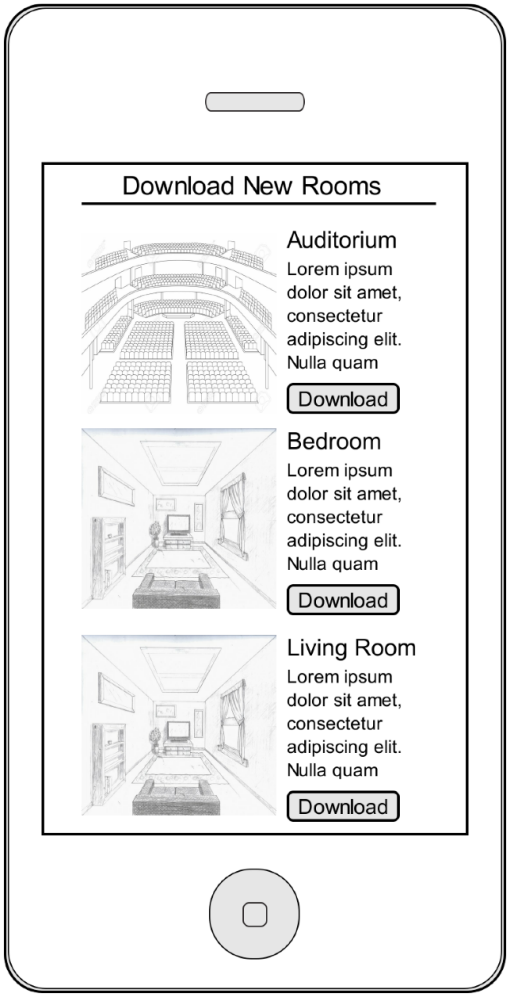
The Cells in the table will all be clickable links that show more detailed information. When a user clicks on each specific attribute in the cell a pop up box will be displayed showing more information. If the user wants to download a new room they can click on the check box for download and then click the download rooms button at the bottom of the page.

For Example, if the user clicks on the small link for the bedroom created by Max Davis, room details will be displayed.

VI. Home Screen (Mobile)

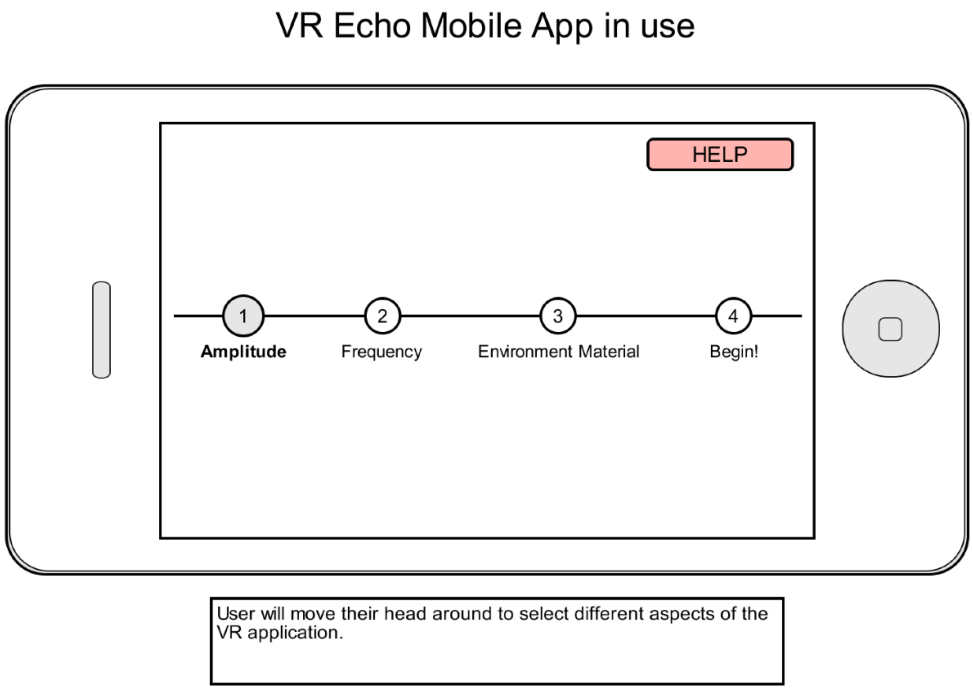


VII. Browse Screen (Mobile)

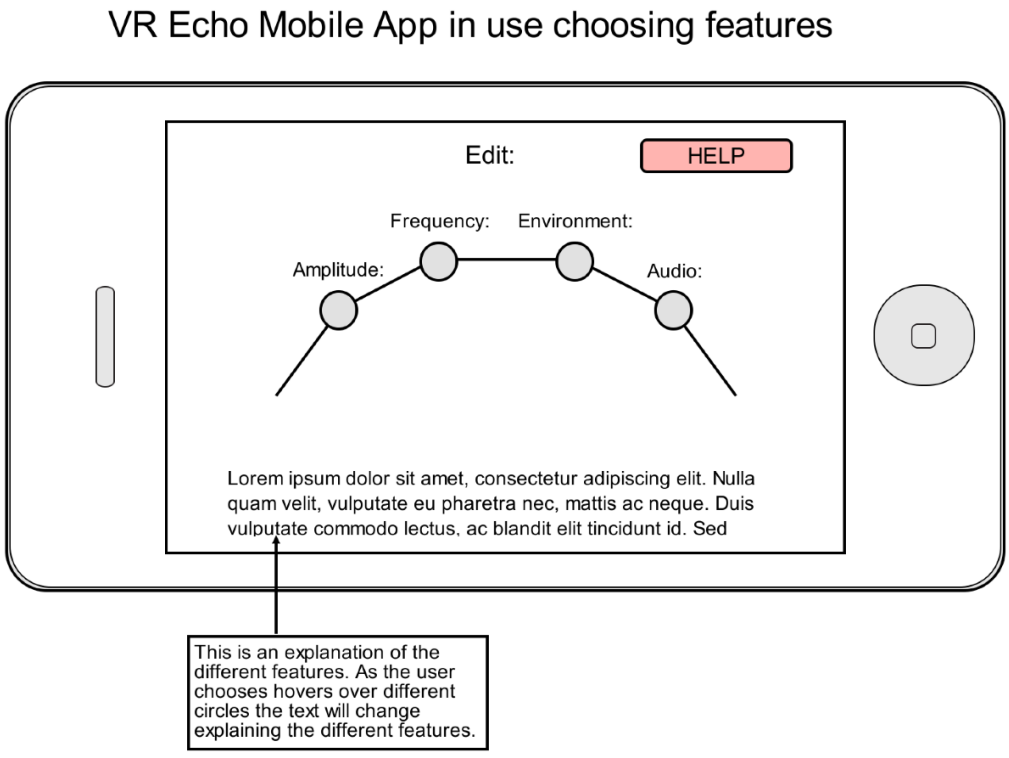


This is a mobile screen for the Echo mobile application where users can download new rooms from the room database. The database contains all of the rooms that other users have created and shared for others to use.

VIII. Virtual Reality Menu V1 (Mobile)

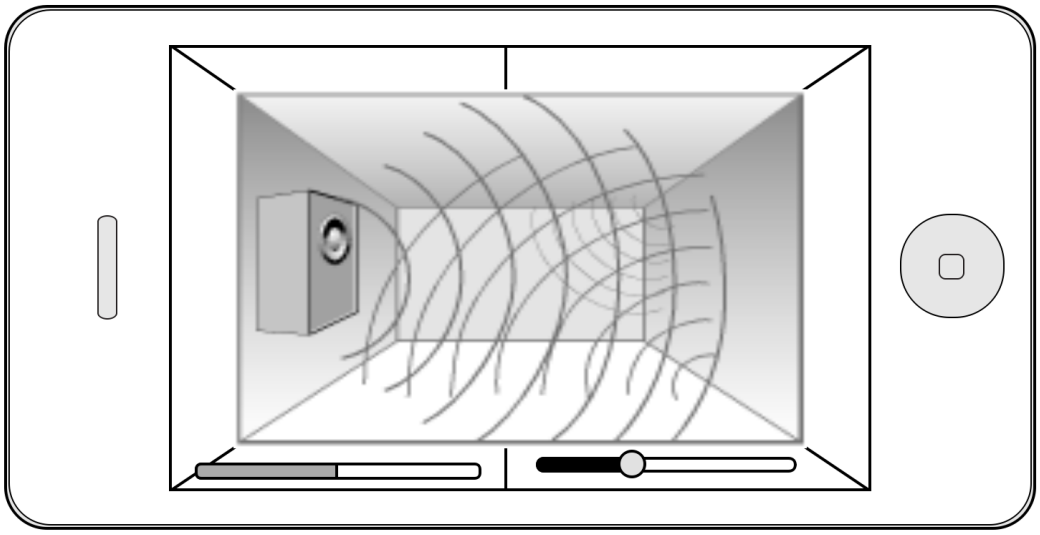


IX.Virtual Reality Menu V2 (Mobile)



X. Virtual Reality Application In Action (Mobile)

VR Echo Mobile App in use (with extra details)



This specific wireframe showcases how the app will look when in use.

The lines designate different attributes for the mobile application while in use. We have no specifically defined which attributes and features will be shown as we have not begun testing/developing the mobile application yet.

Usability Testing

Methodology

Our methodology for usability testing involved creating a realistic environment in which users would interact with our Web and Mobile Applications. We wanted to test the flow of use from first starting on the Web Application and transitioning into the Mobile Application since there is a disconnect between the two which is not necessarily intuitive. Since we are at the prototypal phase of our project, there is no use in testing the cognitive enhancement of the actual sound visualization because it currently does not produce any further understanding of the nature of sound for the user. We are instead testing the flow and interaction within our applications so as to create the best user experience as possible.
We chose to conduct our usability testing with college-level students of varying levels of experience with audio-related technologies. We chose to test with this range of students because our application aims to teach students of varying levels of experience and knowledge about sound design and audio engineering. Some of our users are students who have little to no experience with sound visualization, while some have a couple or more years of experience. Because of this, we chose to test with users of varying levels of experience so that we may attempt to cater to all of our users different design needs.

User Testing Script

Welcoming Script:
Hello, thank you for taking the time to perform some usability testing with our team. We would like you to keep in mind that we are not testing you, we are testing our application. We encourage you to think aloud and provide any sort of feedback that you wish, or that you think we might find useful.
This is a proof of concept stage for our application: we are not testing how well the visualization enhances your understanding of the subject, rather we are testing your interaction with the interfaces of the application, e.g. it's usability.
To provide some context: we have mapped volume and pitch of audio to size of the shapes (circles or rectangles depending on your orientation).
Background Questions:
Do you have experience with usability testing?
Do you have experience with acoustics or sound design?
Do you have experience with sound visualization technology?

Summary of Findings (from Usability Testing)

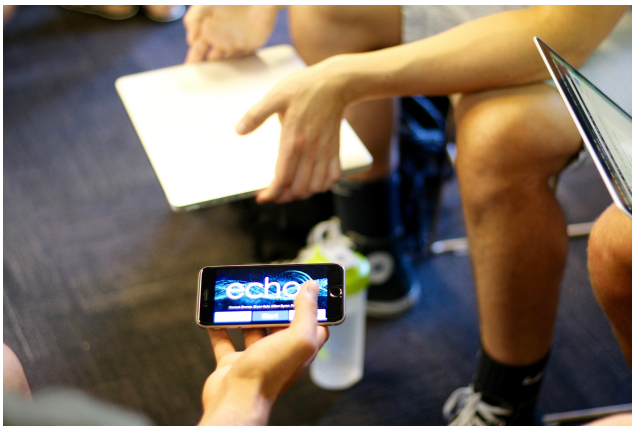
Key Findings

1. Our users did not find it intuitive to look down initially for the menu once immersed in the Virtual Reality environment.
2. Almost all of our users concluded that there is too much text on second 2 sections of Web Application; “What is Echo?” and “Our Model” should either be trimmed or have pictures added to them.
3. Download button for Mobile App should be right before the tutorial, but there should also be some sort of download option at the top of the page for returning users.
4. Purple and blue colors do not necessarily work well together, white text on Mobile App photo background is not legible. Some of our users said that an entirely new color scheme overall could be acceptable, while some of our users liked our current color scheme.
5. Most of our users were confused with the verbiage we used on the iOS landing page. Some users suggested that we change ‘Start’ to ‘Immerse’ and ‘Select’ to ‘Settings’, as well as add more options for changing overall preferences on the currently ‘Select’, soon to be ‘Settings’ page.
6. Multiple users noted that the Mobile App photo backgrounds do not add to overall user experience. They noted that a cleaner more solid background color would be preferred.

Recommended Improvements (correlates to Key Findings number)

1. Tutorial needs to include some indication to look down, or upon immersion users should be suggested to look down to find the menu. This is will be explicitly included in the Tutorial in the Web Application to eliminate this major confusion.
2. Reduce amount of text on Web Application, include more photos if possible.
3. Download button should be right before the tutorial, but there should also be fast-scroll link at the top of the page for returning users to quickly navigate to the download button.
4. Look for different background color schemes for Web App, and different text color for Mobile App. Unfortunately this is a design preference that will not be accepted universally by all of users, inevitably some users will prefer the old design. Since the majority of users we tested with agreed that the current design schema for the Mobile App was hard to understand, we will change the design from what it currently is, however it will be impossible to find a design schema that will be satisfactory for all of our users.

5. Change ‘Start’ to ‘Immerse’ and ‘Select’ to ‘Settings’.
6. Change Mobile App backgrounds to something else, experiment with typography.
This brings about the same sort of tricky situation with improvement #4, however for similar reasons we will change the current design to something else.



i. Introducing the Mobile Application

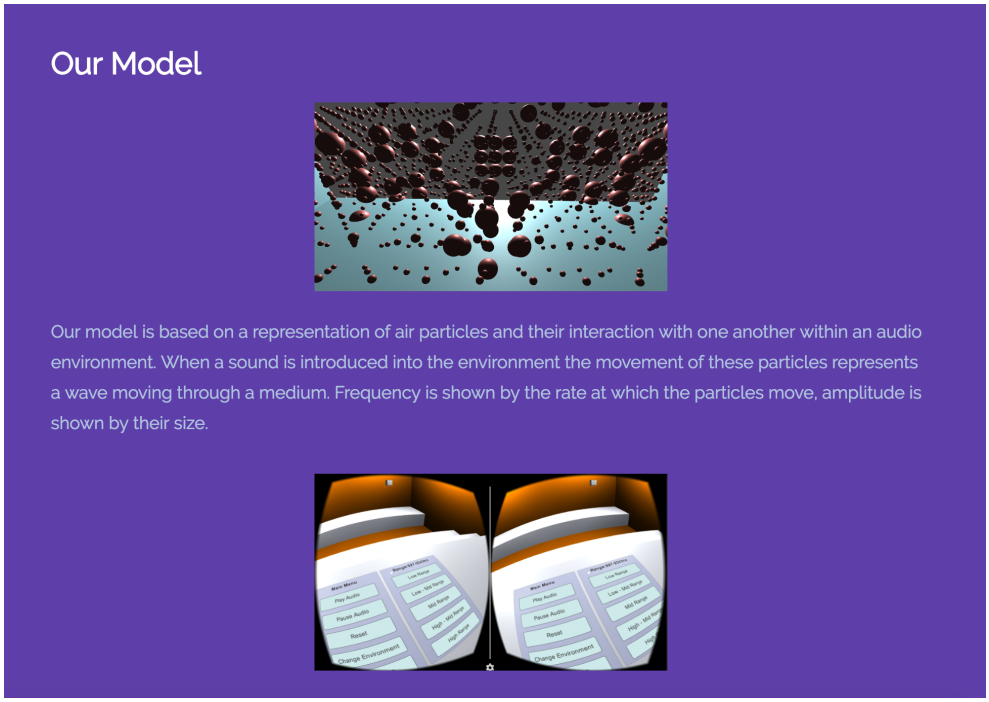
ii. Introducing Google Cardboard

iii. Observing user interactions

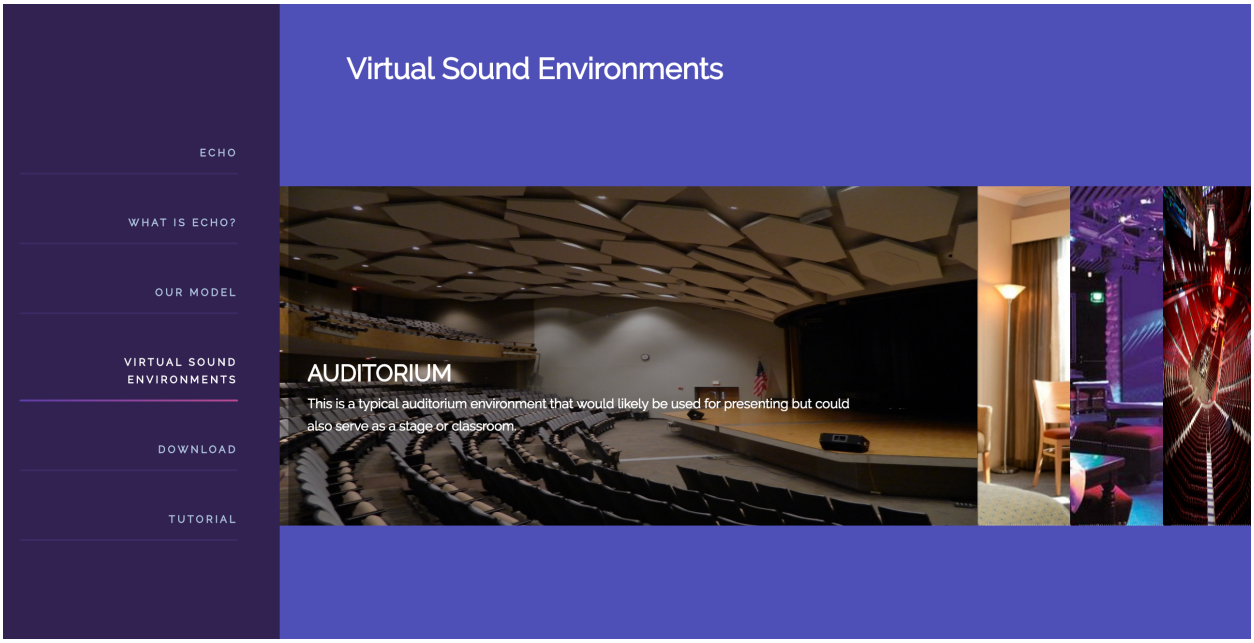
iv. Recording user feedback

Screenshots

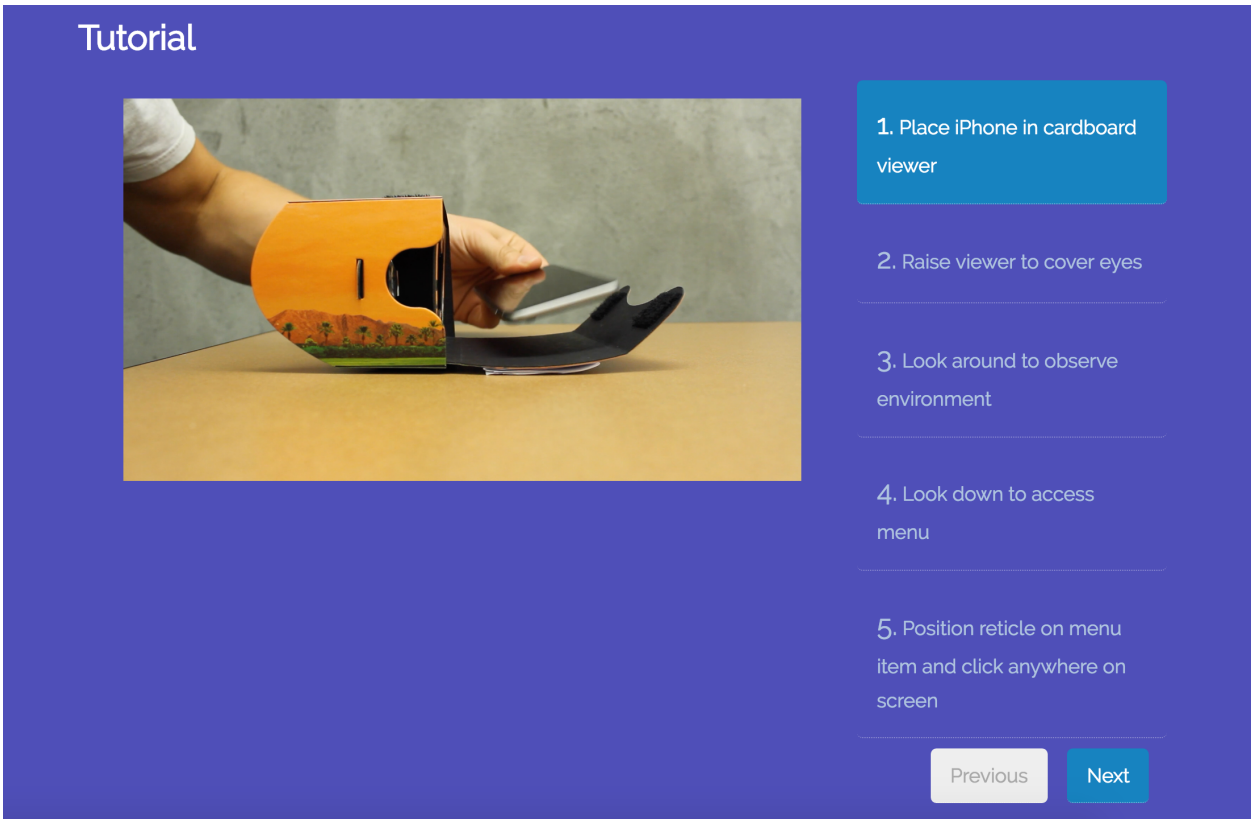
Web Application



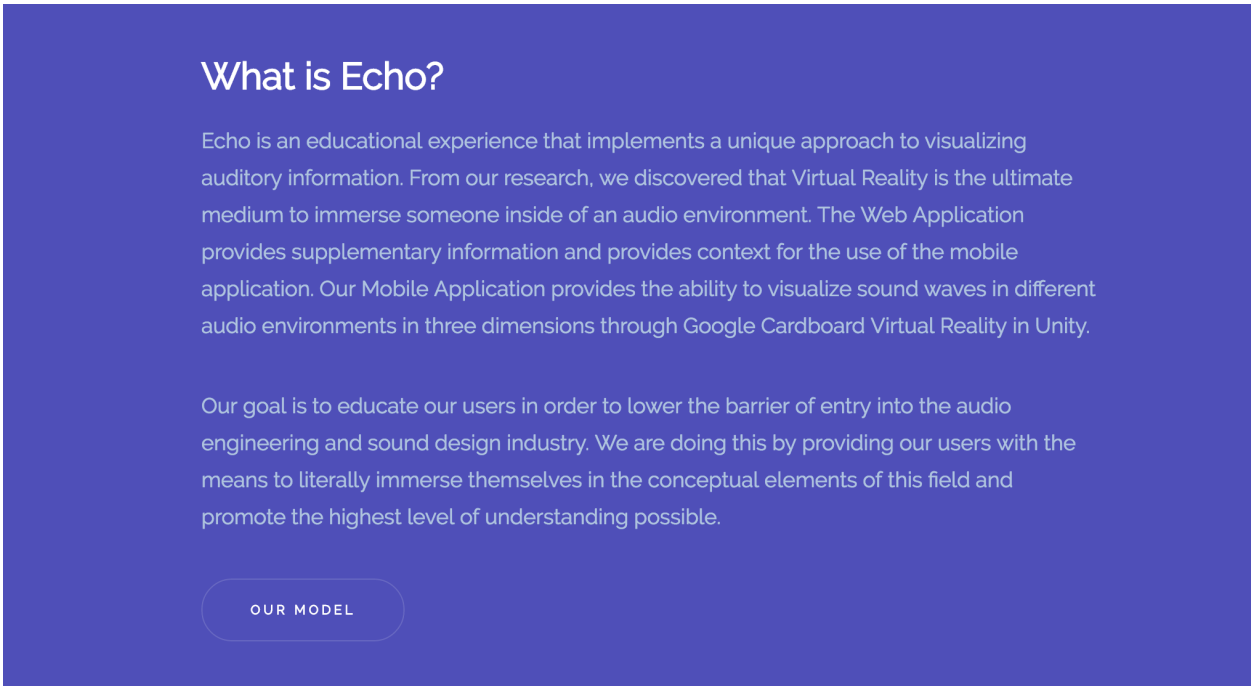
i. Our Model



ii. Virtual Sound Environments



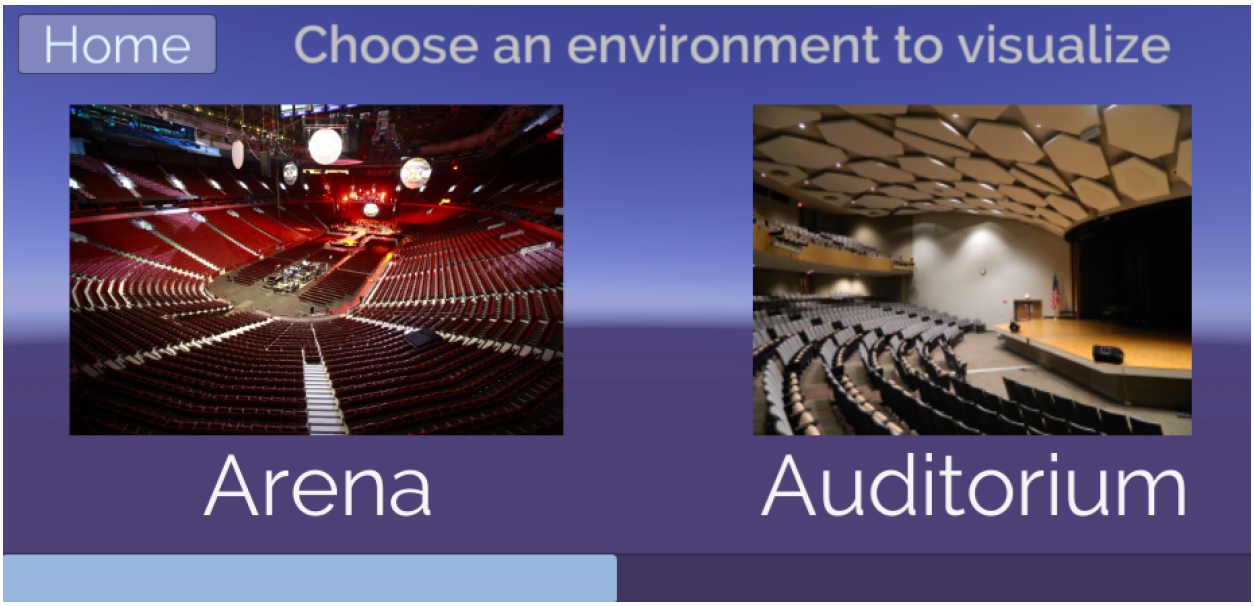
iii. Interactive Web Tutorial



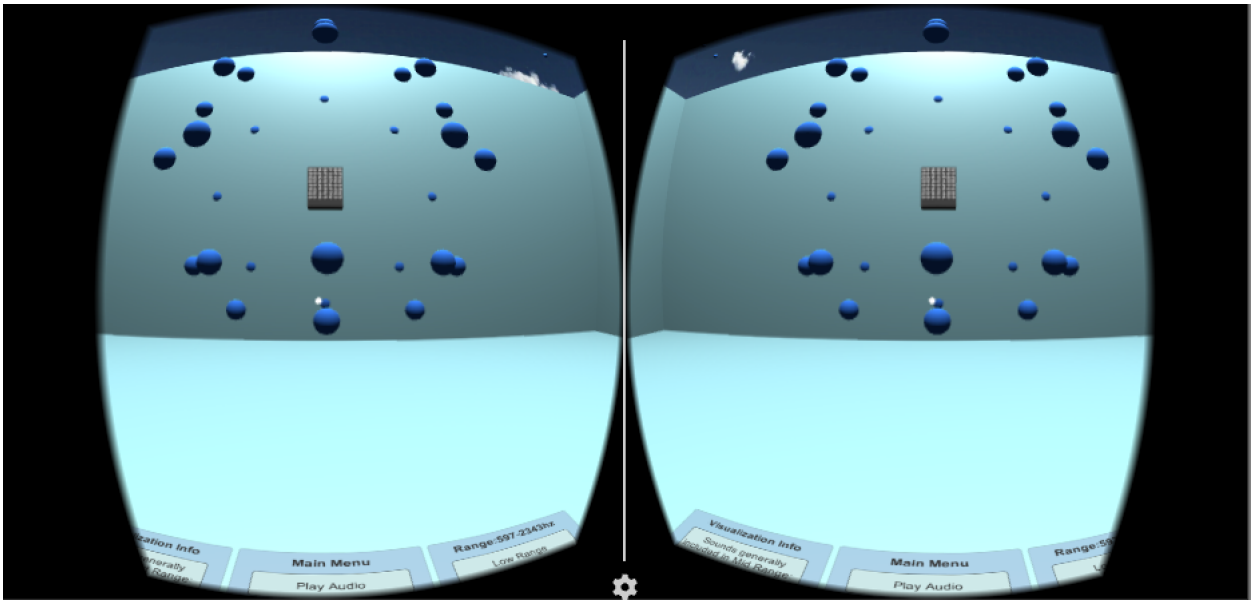
iv. What is Echo?

Mobile Application // Virtual Reality

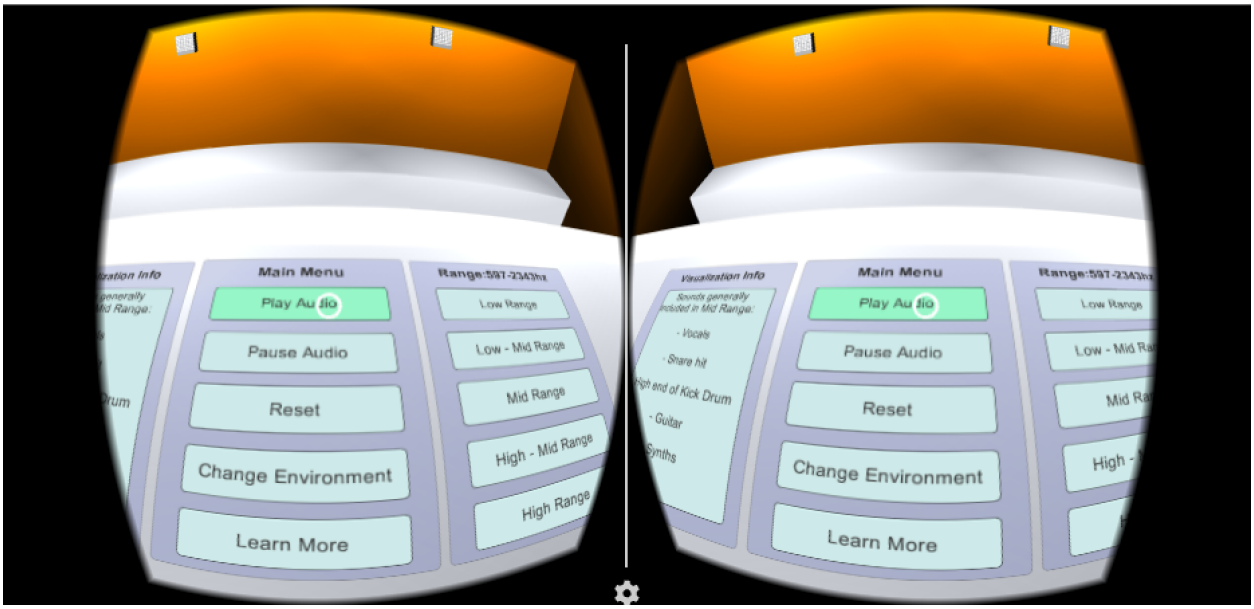
i. Home Screen



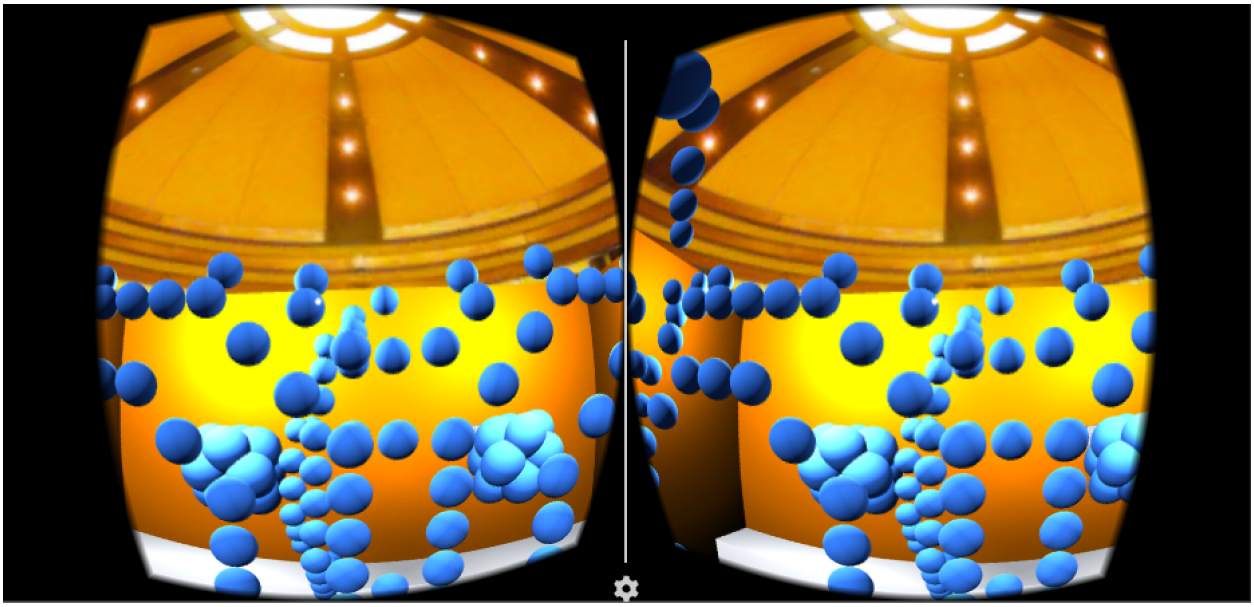
ii. Choose Environment / Settings Screen



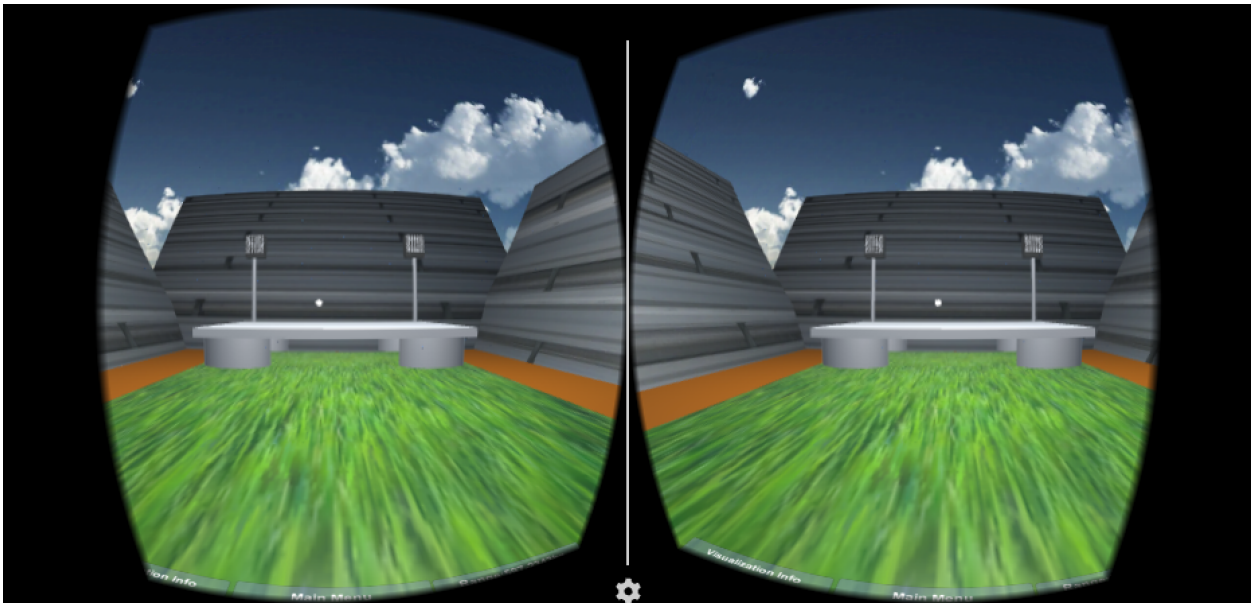
iii. Basic Room Environment Audio Visualization



iv. User Virtual Reality Menu and “in-visualization” Options



v. Auditorium Environment Audio Visualization



vi. Arena Environment without Audio Visualization

Website URL

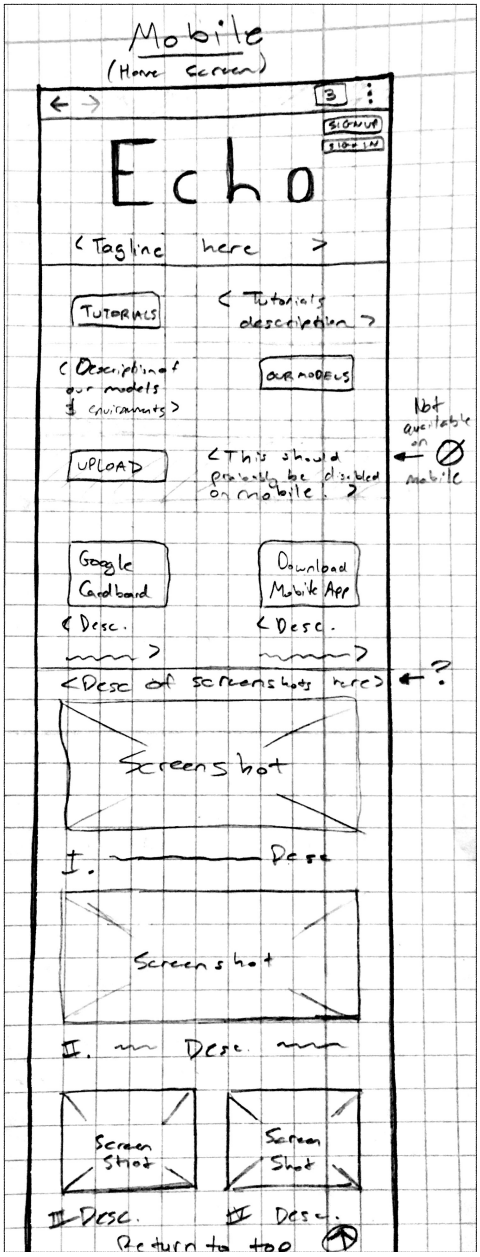
www.echocapstone.com

Project Video URL

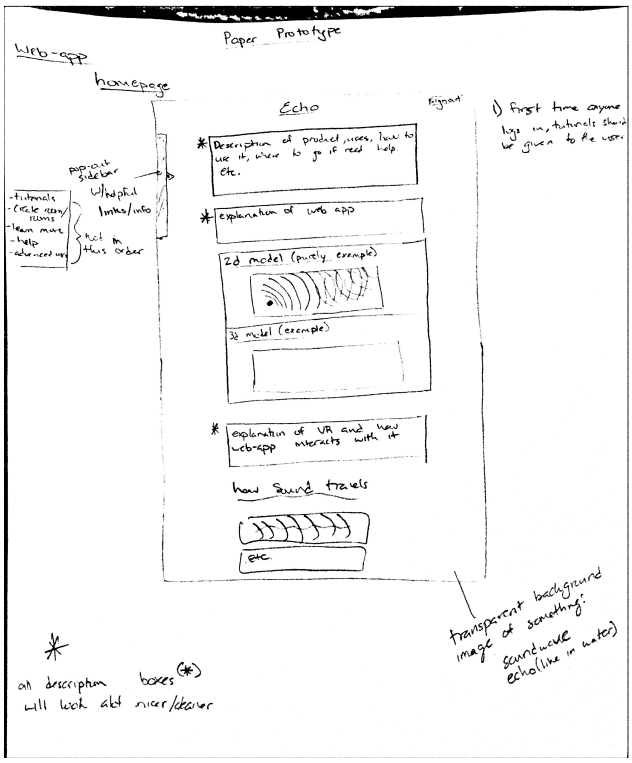
https://www.youtube.com/watch?v=7zpBTHuRL9s

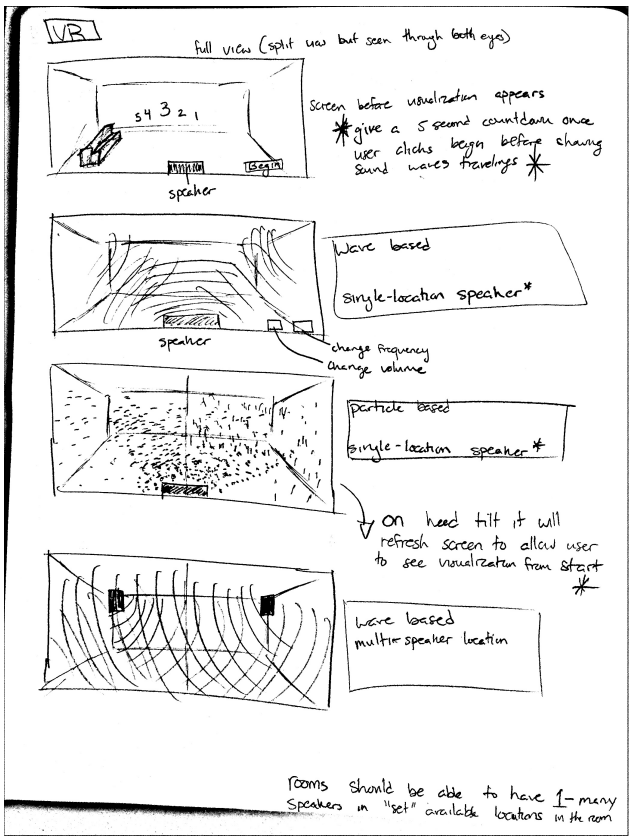
Annex

Additional Sketches

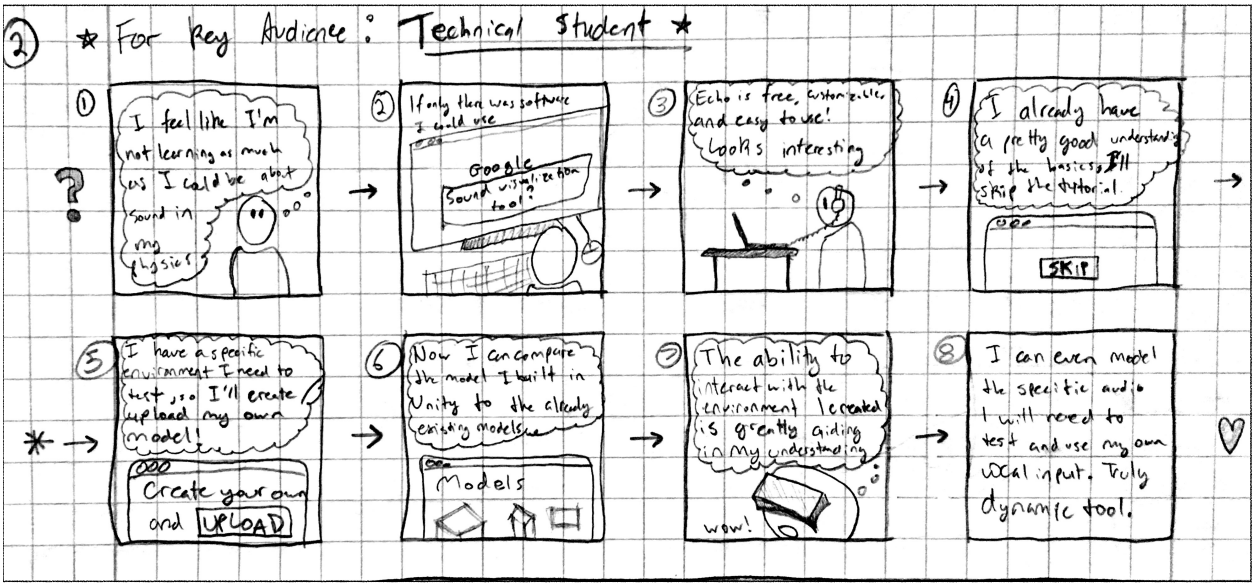


Mobile Home Screen &
Virtual Reality Sketches

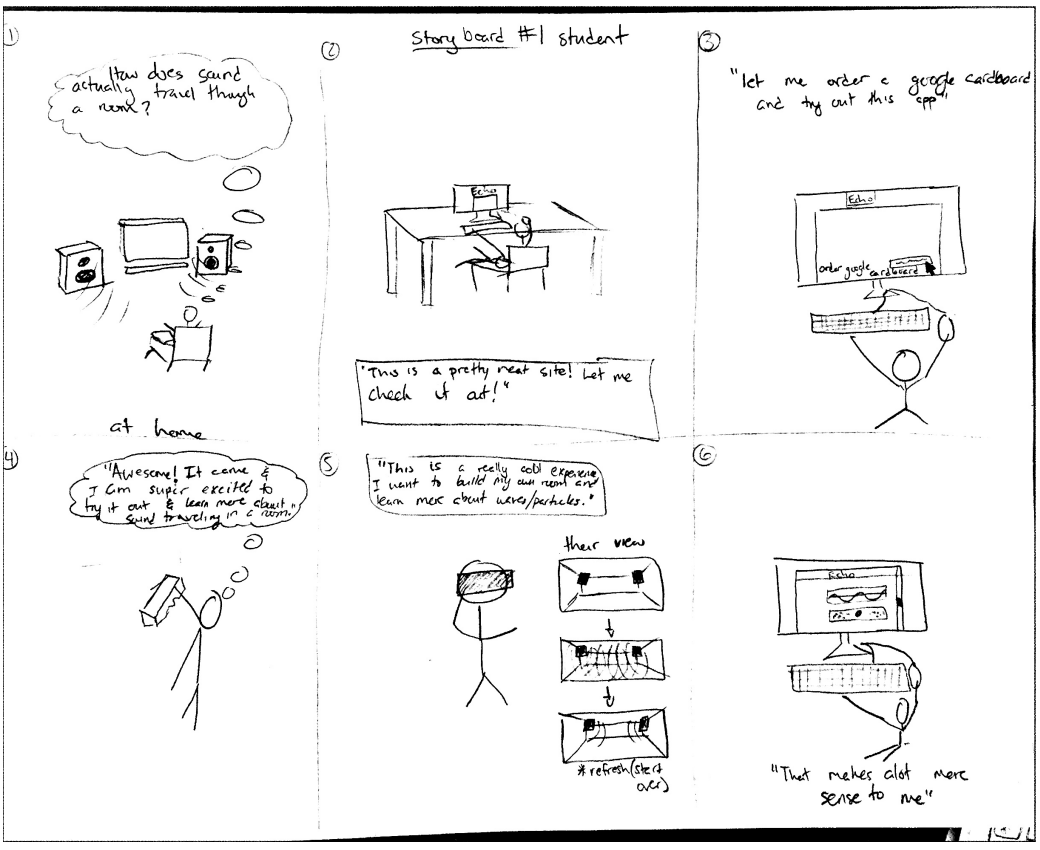




Additional Storyboards



Storyboard - Technical Student

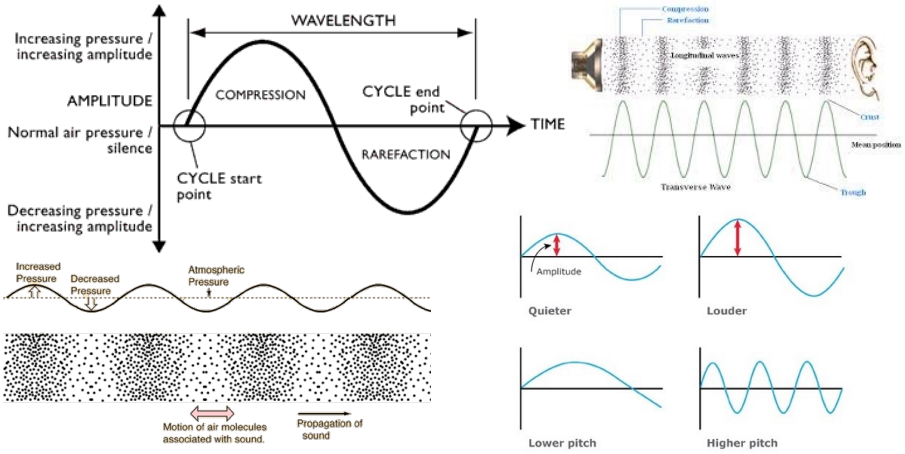


Storyboard - Student

Additional Moodboards

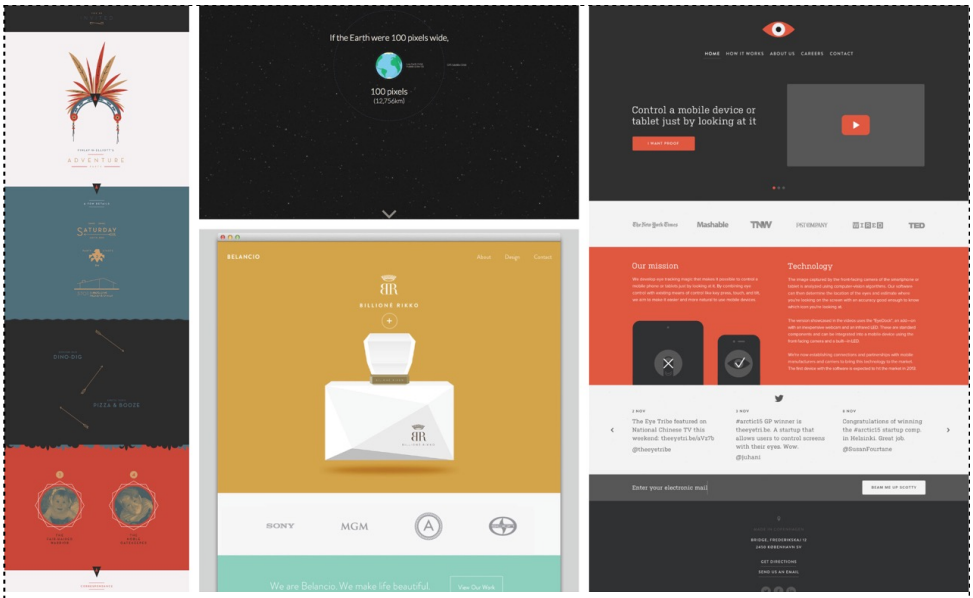
Understanding how user's environments look is important and influential to the ascetic of our project. Where our users learn will help us pull common design elements to incorporate into the design of the web and VR application. We want our application to appear human-centered as well, so including images of humans will help.

Moodboard - Human-Centered Approach



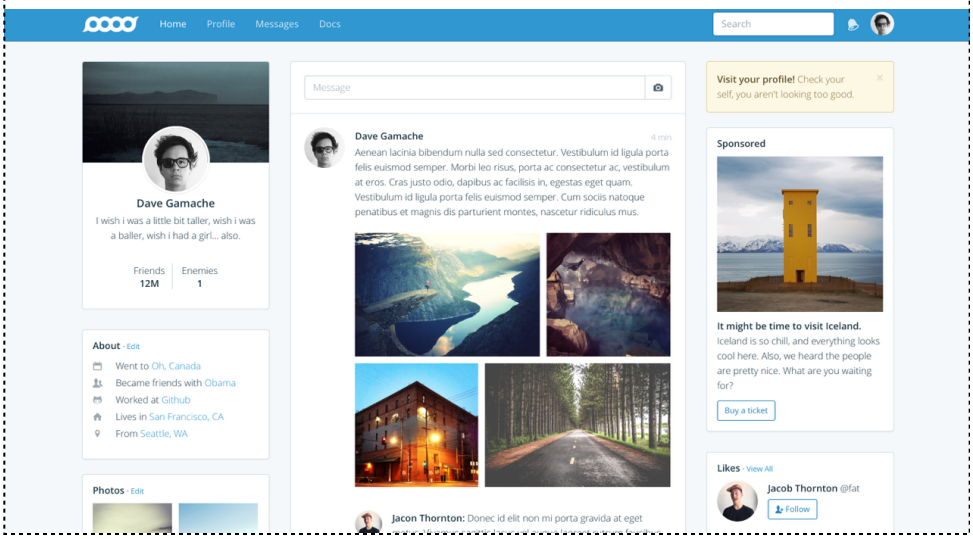
Potential modals to be referenced when explaining the physics of our application. Diagrams like these will be featured on our website and in our VR application.

Moodboard - Acoustic Wave Modeling



The simple block formatting and sharp, uncluttered layout of these applications will serve us greatly. We need our application to be as straightforward as possible. Uploading a new VR environment, logging in to an account, uploading a song to visualize. These key features need to be cleanly designed like these designs.

Web Apps



Moodboard - Web Application