

Rochester Institute of Technology

RIT Digital Institutional Repository

Theses

12-10-2015

Multiplayer Sound-Oriented Game Design: An iOS brain and hearing training game

Liwei Yu
ly7523@rit.edu

Follow this and additional works at: <https://repository.rit.edu/theses>

Recommended Citation

Yu, Liwei, "Multiplayer Sound-Oriented Game Design: An iOS brain and hearing training game" (2015). Thesis. Rochester Institute of Technology. Accessed from

This Thesis is brought to you for free and open access by the RIT Libraries. For more information, please contact repository@rit.edu.

Multiplayer Sound-Oriented Game Design

-- An iOS brain and hearing training game

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Fine Arts in Visual Communication Design

Liwei Yu
Rochester Institute of Technology
College of Imaging Arts and Sciences
School of Design
MFA Visual Communication Design
December 10, 2015

Title: Multiplayer Sound-Oriented Game Design -- An iOS brain and hearing training game

Submitted by: Liwei Yu

Date: December 10, 2015

Thesis Committee Approval:

Chief Thesis Adviser: Daniel Deluna, Visual Communication Design

Associate Thesis Adviser: Chris Jackson, Visual Communication Design

Associate Thesis Adviser: Shaun Foster, Visual Communication Design

School of Design Administrative Chair: Peter Byrne

MFA Thesis Candidate: Liwei Yu

TABLE OF CONTENT

ABSTRACT		1
-----------------	--	----------

INTRODUCTION	PROBLEM STATEMENT	2
	SURVEY OF LITERATURE	3

DESIGN PROCESS	DESIGN PARAMETERS	6
	DESIGN CONSIDERATIONS	6
	DEFINING TARGET AUDIENCE	7
	GOAL AND RULE DESIGN	7
	APP FLOW	8
	SINGLE CHALLENGE FLOW	9
	CHALLENGE DESIGN	11
	BACKSTORY SETUP	12
	INITIAL SKETCH	13
	LO-FI PROTOTYPE	14
	HI-FI USER INTERFACE DESIGN	14
	TROUBLESHOOTING	26

SUMMARY	EVALUATION	27
	SURVEY RESULT	29

CONCLUSION	SIGNIFICANCE OF THE PROJECT	35
	NEW QUESTIONS	35
	NEXT STEP	35

APPENDIX	APPENDIX	36
-----------------	-----------------	-----------

ABSTRACT

Hearing (auditory perception) is one of the most important senses in our human bodies. There are millions of different sounds in our world; humans perceive the sounds from the outside world to get information, and respond to them. It is beneficial to enhance hearing abilities and hand-ear coordination to boost brain fitness, engage in better communication with others, and enhance concentration abilities.

With the fast development of smart mobile devices and mobile internet, it is easy to get people connected no matter where they are. Some people usually play games during short fragments time.

Considering these factors, it is a good approach to take full advantage of these moments, so this project is a real-time multiplayer game in iOS, and it is all based on sound. Players are required to listen to a piece of audio first, then complete the task, and the one who completes it faster or better can win the points.

This game is audio-oriented, social and has various types of challenges. Players are randomly matched to compete in real time, or one can pick someone else to challenge, motivating people to win. There are four main categories: dexterity challenge, memory challenge, discrimination challenge and attention challenge, and each category contains hundreds of relevant challenges.

Keywords: *Game Design*
Brain Training
Hearing Training
Hand-ear Coordination
Multiplayer
Sound Oriented
Socially

INTRODUCTION

PROBLEM STATEMENT

Our brains need exercise to stay fit, otherwise, they will turn lazy and dull. People usually talk about hand-eye coordination and the importance of developing such skills at a young age. Of course it is beneficial to sharpen visual acuity, as well as the hearing ability. Research has shown that musicians who frequently works under the conditions of sounds are better able to pick out speech or other important information from surrounding noise as they age compared to non-musicians. The non-profit organization, the Hear the World Foundation, has done a survey of over 4,000 people in five countries on different topics related to hearing in different areas of life, and it is surprising to find that hearing influences so many aspects of people's daily lives, like the quality of communication for example. It also shows that better hearing enables people to experience life in a more active and healthier way, and helps people reduce the possibility of scatterbrain due to a noisy environment.

Enhancing hearing ability benefits our brains, and it helps people do better jobs in their lives and communicate better.

However, there are fewer exercises online for people to train hearing ability or hand-ear coordination. People have less motivation to train their hearing due to primarily three reasons:

1. Because there lacks a system of data collection, people can not see improvement after exercising, which means it is difficult to let them know that their performance is better compared to before exercising.
2. People usually view training as a boring process because it lacks entertainment and variation.
3. People do not like to spend too much time on training, especially if it means staying still in front of a computer to do the training.

On the other hand, nowadays the number of mobile phone users is increasing every year, and mobile phones are becoming much more entertaining and multifunctional than in the past. Some people deal with their fragmented time by playing games on mobile phones. The auditory hardware in mobile devices and audio accessories like earphones provided by phone makers can perform better and better in terms of sound quality.

By rethinking the approach to this problem, it is possible to design an online interaction game on mobile devices to solve this problem.

Designing Interfaces

Author: Jenifer Tidwell

Publisher: O'Reilly Media (January 9, 2011)

This book provides useful advices as well as solutions for most common user interface design problem. There are lots of examples including web applications, desktop software and mobile devices.

Mobile Interaction Design

Author: Matt Jones, Gary Marsden

Publisher: John Wiley & Sons Ltd (February 10, 2006)

This book is suitable for students self study, there are tons of examples, exercises and case studies, it is open minded which inspires students create new generation of mobile application.

The Dominance Factor: How Knowing Your Dominant Eye, Ear, Brain, Hand & Foot Can Improve Your Learning

Author: Carla Hannaford

Publisher: Great River Books (September 11, 2011)

The book offers some insight of why people varied and how people learn, and it is helpful to get to know that the linkages between the side of the body we favor for seeing, hearing, touching, and moving and the way we think, learn, play, and relate to others.

Advanced Brain Training

Author: Terry Horne, Simon Wootton

Publisher: McGraw-Hill; 1 edition (February 13, 2013)

This book teaches you to out-think and do better job than others at work, at home or on other field, the first chapter is mainly about the theory and the second chapter focuses on practices, including some challenges like Mensa-level puzzles, sudoku grids, crosswords and lateral and logical thinking problems.

Change Your Brain, Change Your Body: Use Your Brain to Get and Keep the Body You Have Always Wanted

Author: Daniel G. Amen

Publisher: Publisher: Random House Audio (February 16, 2010)

The author Dr. Amen pioneered the use of the most advanced brain imaging technology. This book provides some theory and solutions for how to take care your brain. Enhancing your brain could enhance almost every aspect of daily life.

Rules of Play: Game Design Fundamentals

Author: Katie Salen Tekinbas

Publisher: The MIT Press (September 25, 2003)

This book serves as a theoretical guide for interactive designer, the authors teaches game design by seeing a game as systems of emergence and information, as contexts for social play, as a storytelling medium, and as sites of cultural resistance.

The Art of Game Design

Author: Jesse Schell

Publisher: CRC Press; 1 edition (August 4, 2008)

This book allows you to master the fundamentals of game design by teaching you view the game from different perspectives, for examples, view from the perspective of psychology, architecture, music, visual design and film. It inspires you to create a better game than you can expect.

A Theory of Fun for Game Design

Author: Raph Koster

Publisher: Paraglyph Press (November 6, 2004)

This book is fully illustrated, full of narrative storyboard on art and great examples of great game design. Although it is not so practical but the thought-provoking questions about the nature of fun could be a good start for new game developers.

Playful design creating game experiences in everyday interfaces

Publisher: Ferrara

Publisher: Rosenfeld Media, LLC (April 1, 2012)

This book shows the relationship between web design and game design, and it explores the gamification for learning, social change, and its impact.

The Big Book of Brain Games: 1000 PlayThinks of Art, Mathematics and Science

Author: Ivan Moscovich

Publisher: Workman Publishing Company (July 18, 2006)

This book is full with challenges of different levels and they are all well illustrated, those challenges could be served as a database for getting inspiration.

Brain Games Kids

Publisher: Publications International, LTD (November 1, 2008)

The challenges in this book covers from language arts, math, science, social sciences, physical and emotional development, and fine arts.

Hands On Training: Actionscript 3.0 for Adobe Flash

Author: Perkins, Todd

Publisher: Addison-Wesley (October 5, 2007)

The book serves as a technical support for programming in Flash, some features like debugger that could allow users to step through a wide variety of properties in their code at runtime, with greater flexibility and feedback.

**SURVEY OF LITERATURE
(APPS)**

QuizUp

Seller: Plain Vanilla Corp

It is a multiplayer trivia game with tons of intriguing question, players can choose different category and play in real time.

BrainWars

Seller: TRANSLIMIT, INC.

This is a competitive brain training game test your hand-eye coordination and quick response. Players are randomly matched to compete in the game, and the score will be recorded, then players can see the history of their improvement.

**SURVEY OF LITERATURE
(WEBSITES)**

Fit Brains

Seller: Paul Nussbaum

This is a mobile/online platform focused on the area of brain fitness through exercises. It is focused on exercises in the form of brain games, personalized tools that provide feedback and charts to improve brain fitness

Lumosity

This is an online brain training and neuroscience research company. It has a brain training program consisting of games in the areas of memory, attention, flexibility, speed of processing, and problem solving.

BrainFM

Brain.fm works by playing 30-minute clips of brainwave-altering sounds to help users focus on whatever it is needed to do. They believe the sound is vastly underestimated as a tool for therapy and mental performance. With brain.fm we embark on changing the world's perception of sound.

DESIGN PROCESS

DESIGN PARAMETERS

Considering the time allotted and the limitation of the thesis candidate's skills, the project scope was narrowed down to these following deliverables: The rules of the game, eight types of challenges, mixed audios, user interface design, visual design, and a three minutes demo video. In order to better focus on the design aspect, programming/coding is not included in this project. The game has at least twelve different themes and over hundreds of different challenges, which means there are over hundreds of sound effects. So paring down the number of challenges to just five in the final video would make it brief and less redundant. The final five types of challenges are typical and transformable to other themes or other varieties. The logic behind the game is complex, as well as the abundant UI animation, making it difficult and time consuming to develop even a simple prototype, in this case, a short video would be the best way to demonstrate.

The final demo video shows the complete flow from login to matching players to five different types of challenges, which illustrates the basic concept of the game.

DESIGN CONSIDERATIONS

Basically there are four main considerations to be made about the design choices for this thesis.

First of all, the thesis explores gamification design. The project is aimed at making the ear training process to be more interesting and attractive to users. It is important to get users immersed continuously in the gamification training process and never let them feel boring.

The second consideration is the feedback from the training. In order to notify users that they are actually making progress after playing the game, one of the very effective ways to demonstrate the positive feedback is to show users the records and scores, the training goal is broken down into four sections and each section has relevant challenges.

The third one is the balance between the background and the main UI elements. Since it is an audio-oriented game, it is important to avoid visual distraction when users are highly focused on listening to the audio, at the same time, the illustration in the background is also very important because it represents the theme and user status.

Last but not least, audio design is the core factor that affects the experience of this game, sound effects should be various, attractive and high quality, so they need to be created by multiple sound tracks with some effects.

DEFINING TARGET AUDIENCE

The target audience are people from 13 to 40 years old with no severe hearing loss, having a smart mobile phone and a pair of earphone is better. There is no education and occupation limit, any language background are considerable to play the game since the audio in the game does not contain any specific human language or dialog.

GOAL AND RULE DESIGN

The design of most products is about making things as easy as possible. Game (and puzzle) design is unique in that the goal of the design is to actually make the thing harder to do. Once the goal of the game is set out, the next part of the design is to make meeting that goal a challenge.¹ Here is the goal and rule of this game: Players compete in a real time game that contains 5 rounds (they have to play over 5 randomly given challenges). At the beginning of each round, players have to read the challenge within a given time, then the challenge starts, and then the audio of the challenge will be played just once. After the sound is played, players have to complete the challenge as soon as possible.(Fig.2).

There is a time limit of 8 seconds for each round to progress the game forward in the event of certain scenarios, such as if a player disconnects or cannot complete the challenge.

The system calculates the total time that the players have spent at the end of each round, and give them corresponding scores. The faster the rounds are completed, the higher the score. Accumulating scores results in level up, which means the base that represents level will be visually upgraded and more themes are unlocked. Also, as user's level gets higher, the system will match them to compete with higher level players, in more difficult challenges.

In terms of the whole game app flow, see Figure.1.

APP FLOW

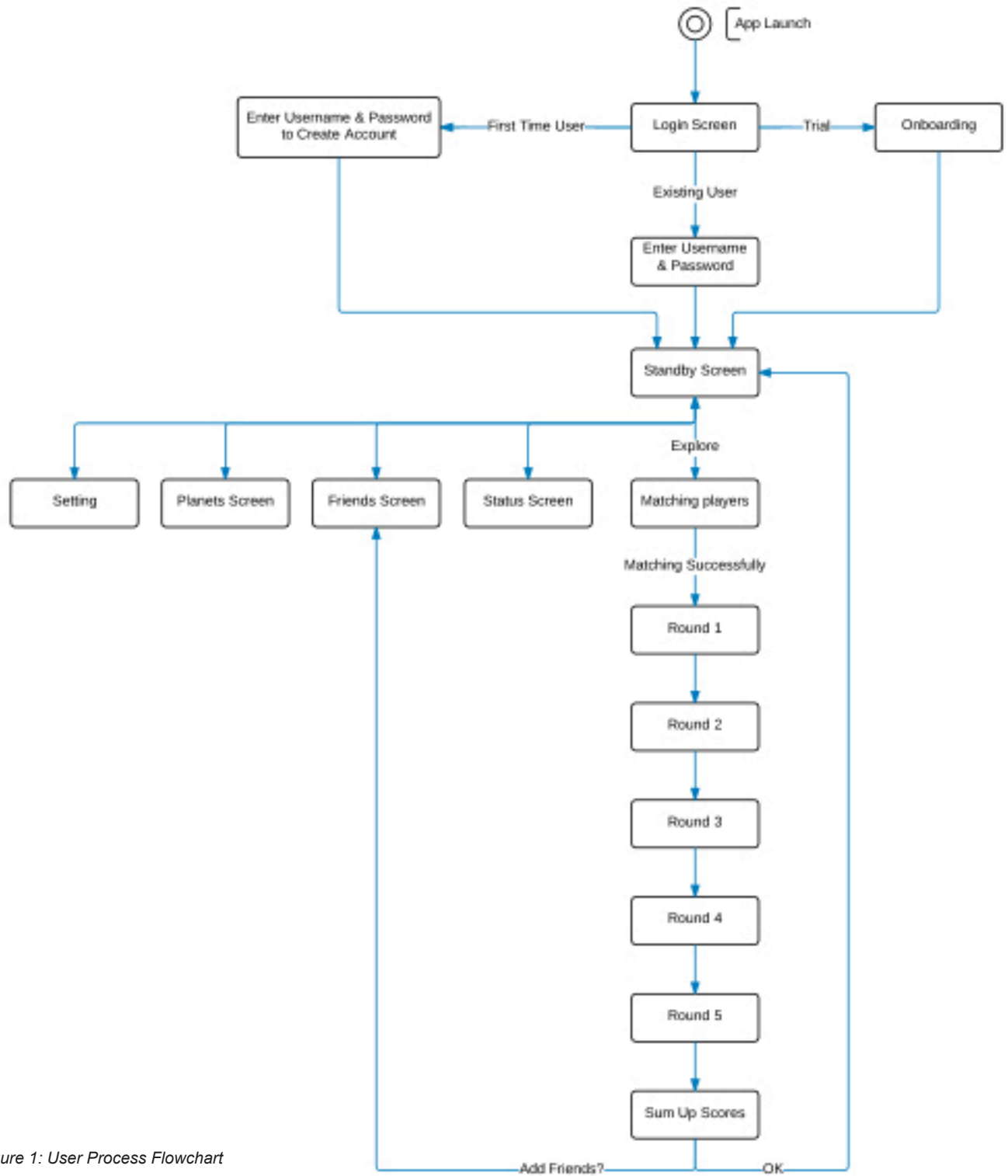


Figure 1: User Process Flowchart

SINGLE CHALLENGE FLOW

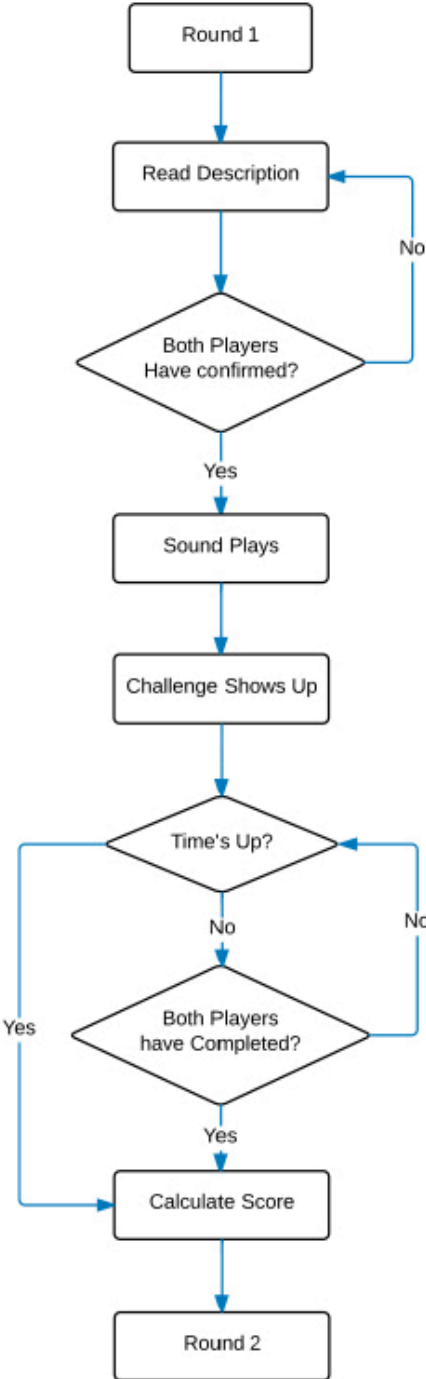


Figure 2: User Process Flowchart In a Single Round

CHALLENGE DESIGN RESEARCH

Although Fit Brains(<http://www.fitbrains.com/>) is not sound-oriented, it is a great online brain training game to get inspiration. This online game has three types of matching challenges, users will go through it from easy to difficult, its challenges are well designed, by just slightly changing the rule to increase the difficulty, making the game more challenging while not adding burden to design work. The summary page shows total reaction time, accuracy and ranking in a very intuitive and simple way. However, the game is just focus on concentration ability, and it lacks sufficient feedback on how to achieve improvement.

Lumosity(<http://www.lumosity.com/>) is not a sound-oriented training game, but it is another great resource to get inspiration. Compared to Fit Brains, it has three types of challenges: Speed, Attention and Memory, each section has only one difficulty, which means users just need to learn how to play only once for each challenge. The coach/tutorial design is very intuitive, using graphic with animation to demonstrate the rule. The overview page contains lots of data and records, it provides sufficient visualized data feedback on how the user is doing and they look authentically. While the “Compared with others” feature is hidden in a secondary page, which is believed to have different product strategy than this project, it is not focusing on social feature.

CHALLENGE DESIGN

After doing research on challenge design and difficulty design, doing brainstorm with people who loves puzzle games. Here comes the challenges for this project.

1. Dexterity challenges

- **Tap on the screen as fast as possible when you hear the target sound.**

e.g. An audio of a balloon is been inflating, the player should tap on the button as soon as possible once the balloon explodes.

- **The sounds coming from either left or right side, the player need to tilt the mobile phone on the opposite side as fast as possible.**

e.g. An audio of automotives rushing is played on either left side or right side, the player should tilt the mobile phone on the opposite side.

- **Perform different gestures according on the sounds.**

e.g. Perform the double tap when the bird tweets and perform the single tap when the dog bark.

2. Memory challenges

- **4*2 block matching pairs game**

e.g. Among the 8 unknown blocks, there are 4 pairs of sound, tapping on the block and sound would be played, what the player need to do is to match the sounds by tapping on the blocks continuously.

- **Count how many times does the target sound appears.**

e.g. Listen to an audio of a basketball bouncing, then choose the times that the ball has bounced.

- **Several sounds are played sequentially, then repeat the sequence.**

e.g. There are four buttons of a dog, a cat, a lion and a horse, the system plays an audio in this sequence: 1. Lion 2. Horse 3. Dog 4. Cat, then tap on the button correspondingly in the same sequence.

3. Discrimination challenges

- **Guess what abject creates that sound.**

e.g. There are two buttons of a male and a female, then listen to an audio of someone yelling, the player should make the right choice on the gender of the yelling person.

4. Attention challenges

- **Figure out how many objects appear in the audio.**

e.g. Identify what sounds are being played by listening to a mixture of sounds made by different objects.

BACKSTORY SETUP

Stories are an essential part of games. Just look closer, it is easy to see that games have a lot going for them. For example, look at chess, chess doesn't seem to have story. But actually it has characters, a world, progression, and a plot. There is a beginning, a middle, and an end. Even little pawns have an adventure and a transformation ahead. It's all-out war, with conflict, death and victory. There are kings, queens, even horses. Another example is Angry Birds. The story of Angry Birds is very short. The birds are on a mission, they hate the guts of these pigs. The Angry Birds story is one of thievery, sacrifice, parenthood, and ultimately revenge. Stories are essential. In games there is conflict, there is an imaginary world. It is necessary to provide players with stories by giving them context as to what they are doing.²

Step 1: Create the world.

Step 2: Create the characters.

Step 3: Create the conflict.

Step 4: Implement the story in the game.

By following the guide, the background story of the this project is set as a group of explorers that lives on an isolated floating island, looking for sound energy, which is used to develop the center tower. The higher the tower level, the stronger the player. The only way to look for sound energy is to land on other planets, and collect the sounds on that planet. But since sound energy is scarce, players must compete with each other to earn sound energy. Sketches(Fig.9 & 10) were made based on this background to explore the user interface and style.

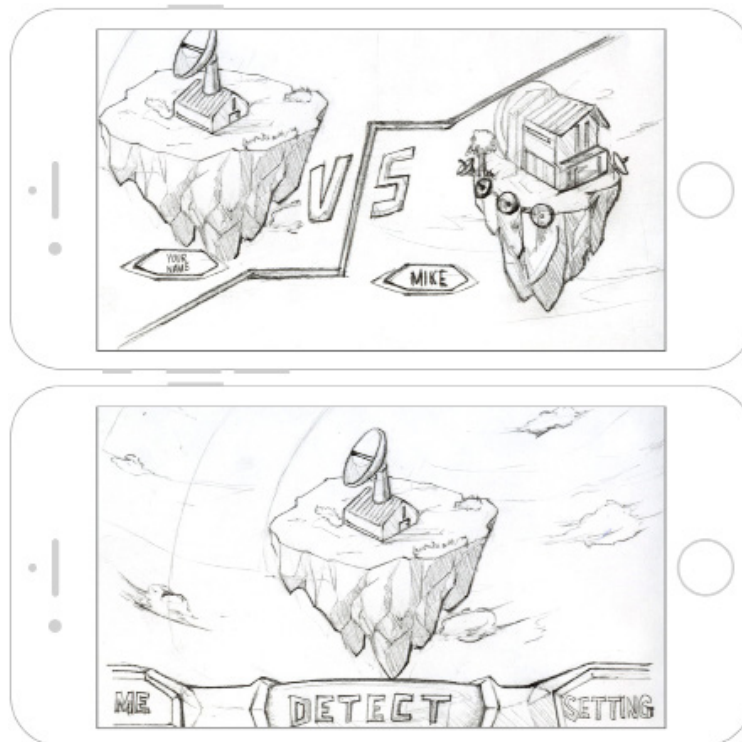


Figure 9: Sketch of the initial idea

INITIAL SKETCH

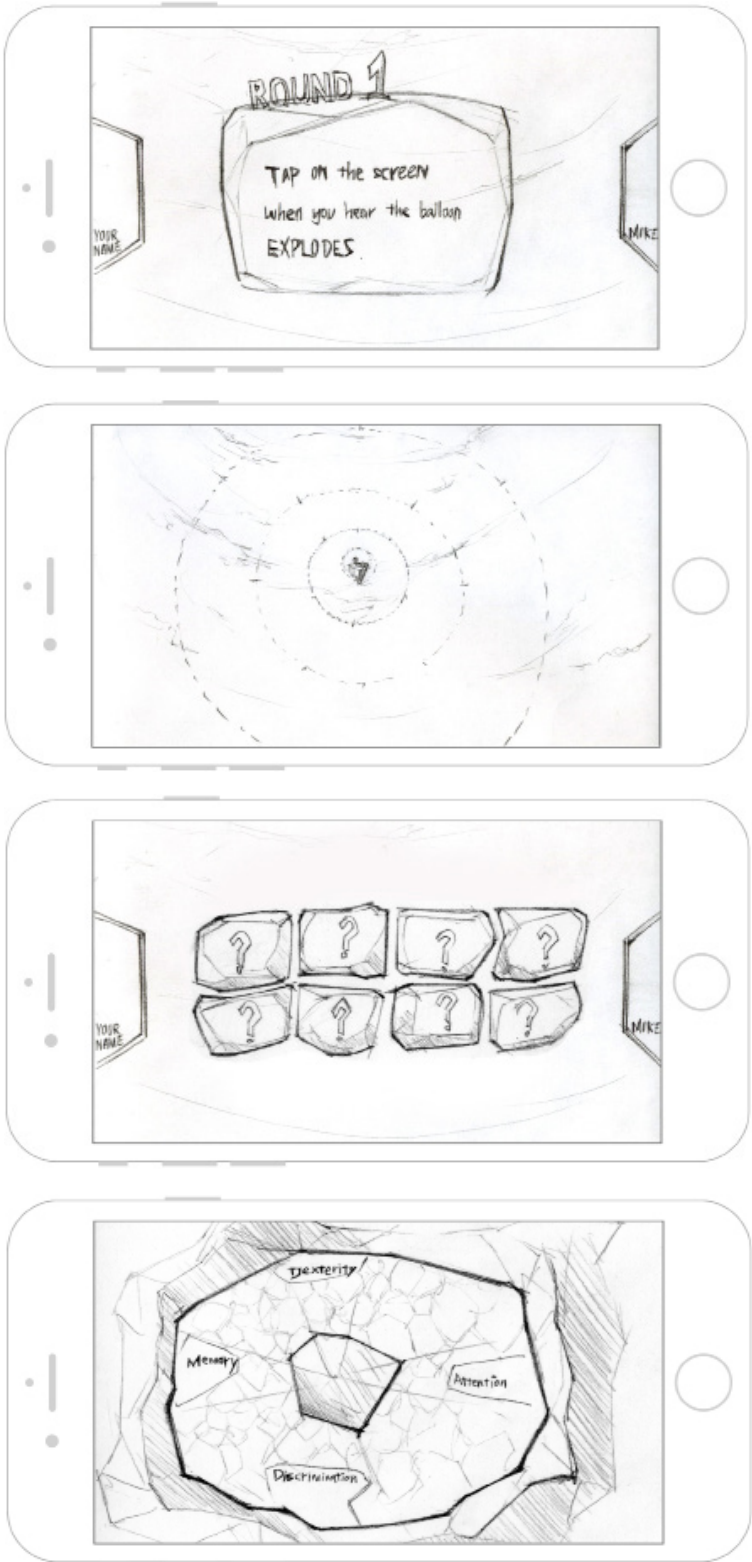


Figure 10: Sketch of the initial idea

LO-FI PROTOTYPE

In order to test the usability, Adobe Flash was used to build a simple prototype(Fig.11) for testing. The prototype was built by using HTML5 canvas feature, making it easy to share through a URL and gather feedback from others. (See appendix: Survey of lo-fi prototype, Fig.53 - 58)

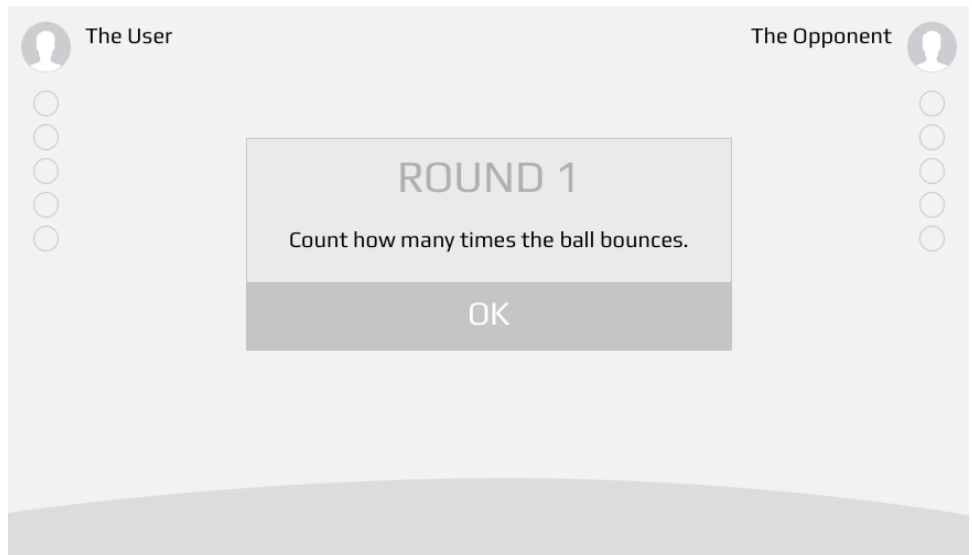


Figure 11: Lo-fi Prototype

HI-FI USER INTERFACE DESIGN

After receiving feedback from the online survey and suggestions from the committee during the weekly meeting, the next step was to design the visual user interface. The style was changed to a more sci-fi/futuristic feeling and the background story was set in space in the following two reasons:

1. There is no sound in space, it perfectly fits the story that sound energy is a rare commodity and people must travel to different planets to search for it.
2. Si-fi gives a mature feeling compared to the kid style in the initial sketch.

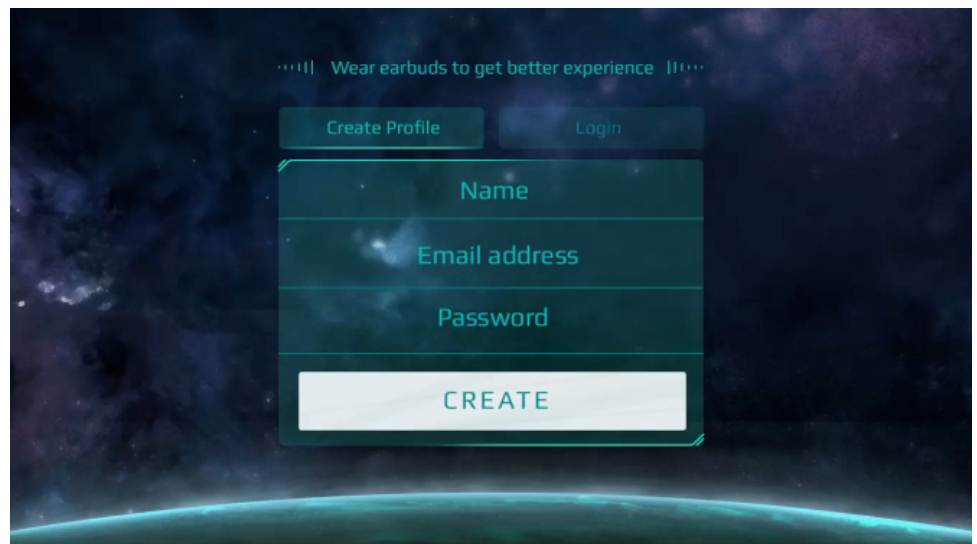


Figure 12: Login/Sign up Screen

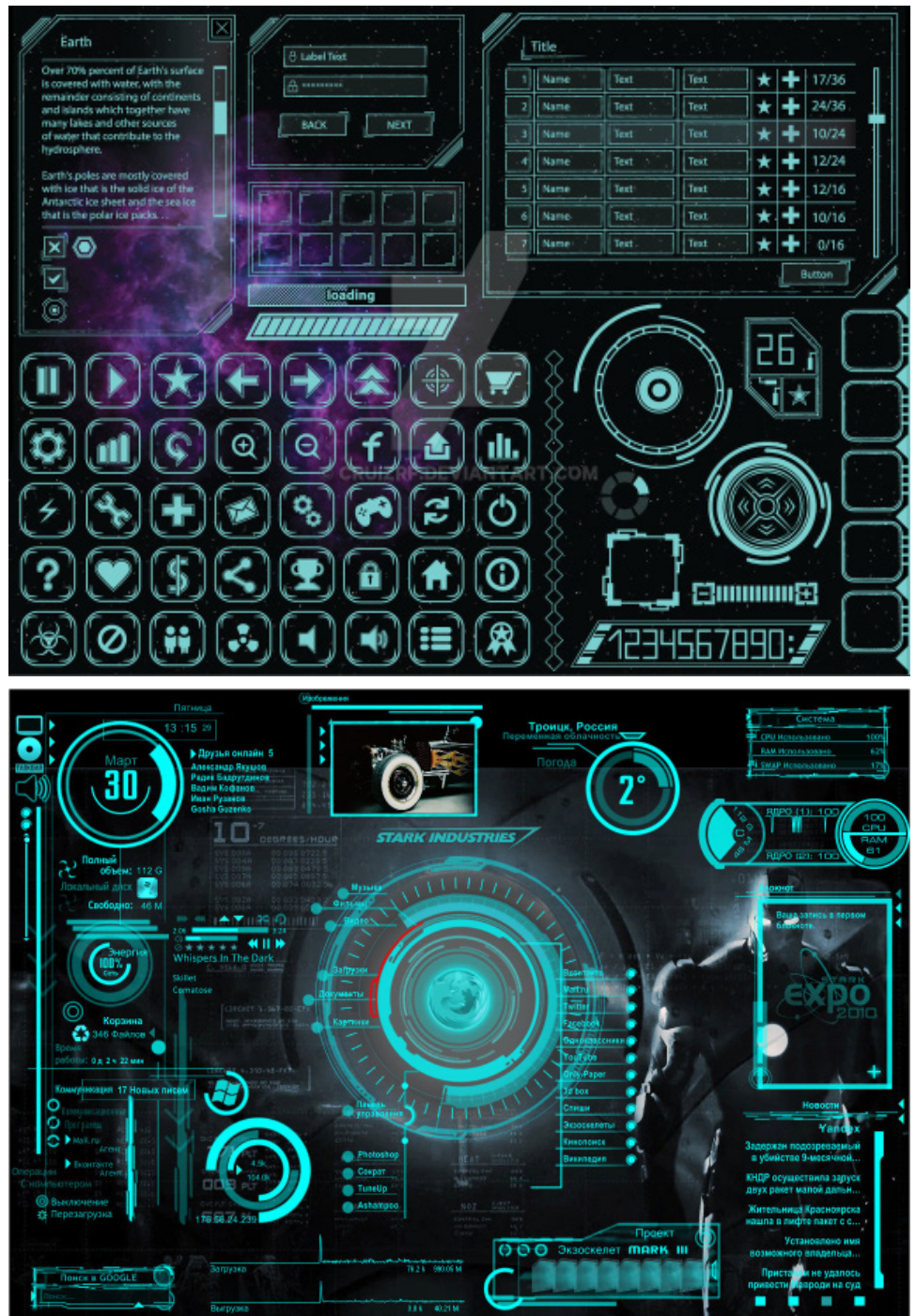


Figure 13: Si-fi Inspiration Moodboards

Gathering some sci-fi style moodboards(Fig.13) for inspiration helped set up the basic UI element in this project, as it is shown in Figure.12, greenish luminescent texts, slim and straight lines and the futuristic style font on the dark background is the basic tone of this project.



Figure 14: First Version of Standby Mode



Figure 15: Thumb reach range

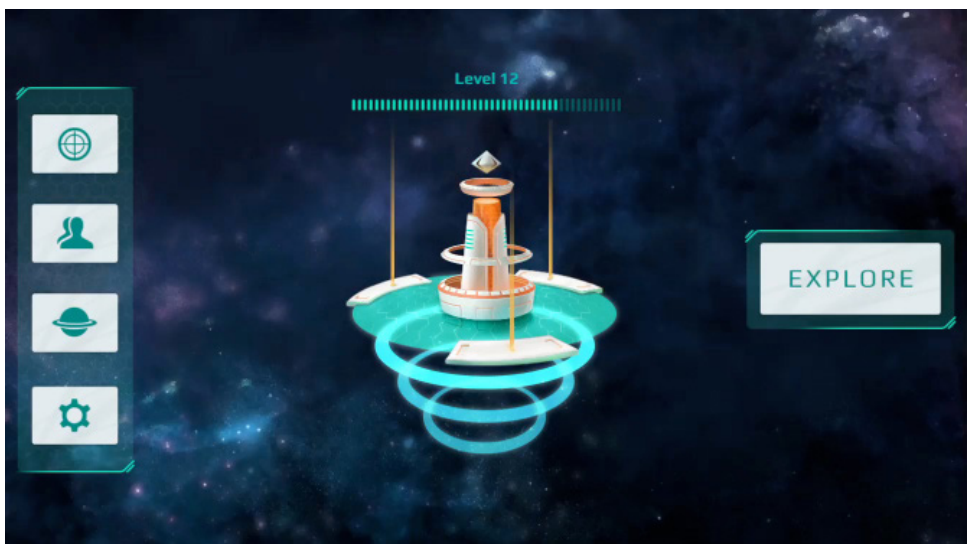


Figure 16: Final Version of Standby Mode

The buttons in the first version of the standby mode(Fig.14) were at the bottom of the screen, it looked well balanced and easy to tap on. But actually when the design was placed in the phone, especially in the large screen phone, it was somewhat beyond the thumb reach range when the user held the phone in landscape mode. (Fig.15)

So after considering this problem, the design was changed to placing buttons on both sides of the screen where thumbs could reach easily(Fig.16). Every coin

has two sides, placing the buttons on both sides of the screen benefits the user's tapping behavior, but it results in the less space is left for the Status information, Friends list and Planets list.

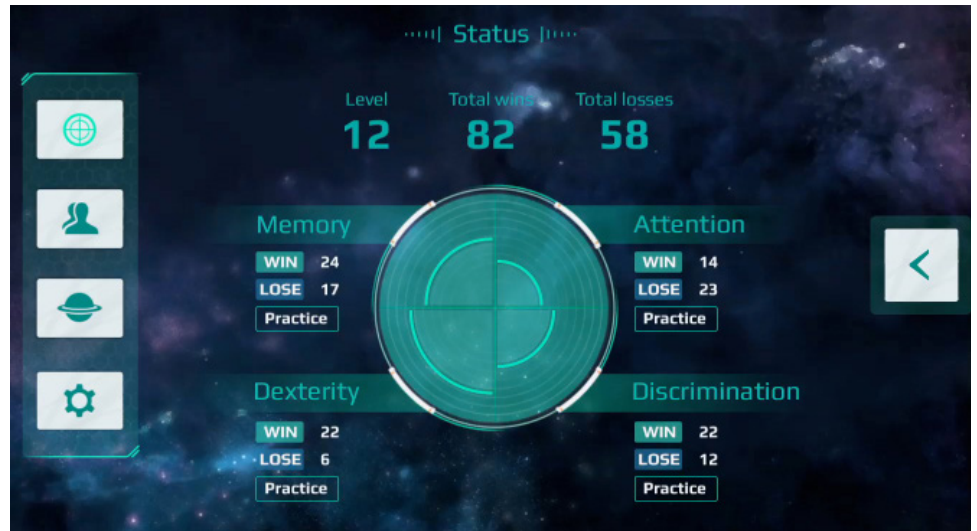


Figure 17: Status Feature Sum Up View



Figure 18: Status Feature Detail View

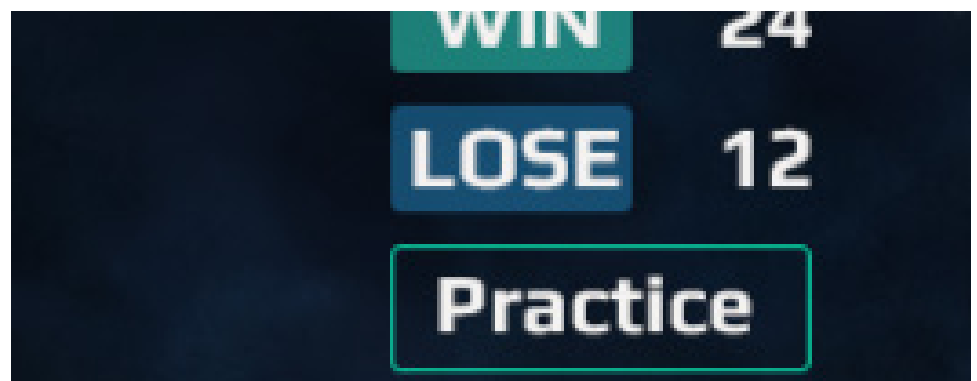


Figure 19: Practice Button

The Status feature (Fig.17 & 18) shows the visualized data collected from every challenge. It contains the wins and losses of each main ability, keeping track and giving constructive feedback of what the user should improve. Brain Wars has done a good job on this data visualization, it is very helpful to take it as

a reference on designing the Status feature. By reconstructing the radar chart, more useful data were added in the design. The user can also choose to focus on one specific challenge by tapping on the “Practice” button(Fig.19), it will bring the user to start a new battle with only the chosen type of challenge.

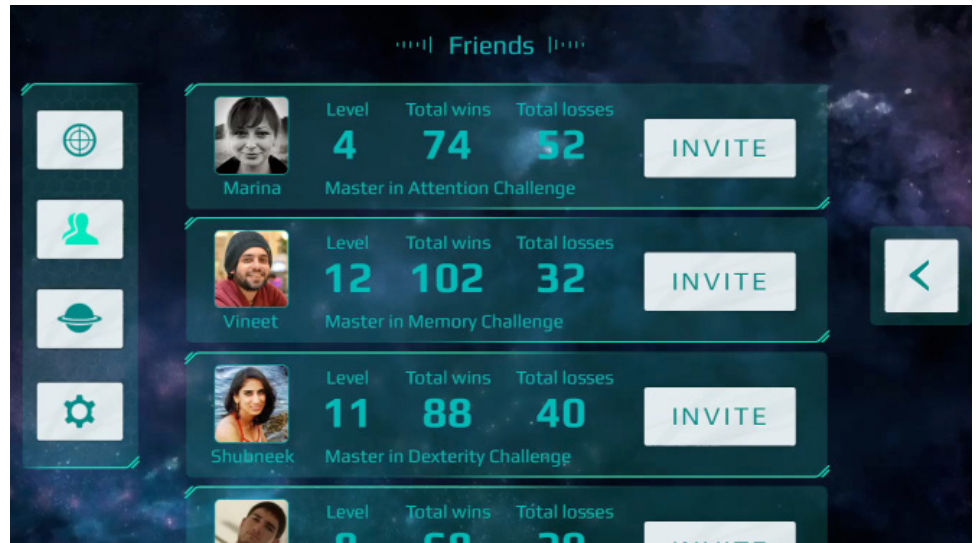


Figure 20: Friends List



Figure 21: Friends List Wireframe Exploration

The Friends list (Fig.20) shows the friends the user has added from the challenge or by the user name, and it contains the wins and losses of each friend and what their specialties are. The invite button allows the user to pick one to invite them to start a new game.

When it comes to use the list view or the grid view in the Friends list design(Fig.21), it is really important to find out the difference between them:

- The list style layout is for the seated because users' actions tend to be very singular in purpose. Users come to the friends list to do one thing: browse and invite. Present the content in this way will make it very easy and simple for the visual flow.
- On the other hand, grid view is for the standing. It's for the restless and curious. User's attention goes from one to the next and never linger in one spot for too long.³

After considering user's actions in this screen, browsing/searching friends is the main action in this scene, so it is reasonable and to apply the list view here.



Figure 22: Planets List

The Planets list (Fig.22) is a map screen, in which each planet represents a theme. Audios are also relevant to the theme, for example, the planet of industry plays the mechanical audios, the planet of woods plays the audios from nature. Tapping on a planet will select that theme, it will ask the user to look for a random opponent or to invite a friend from the friends list.

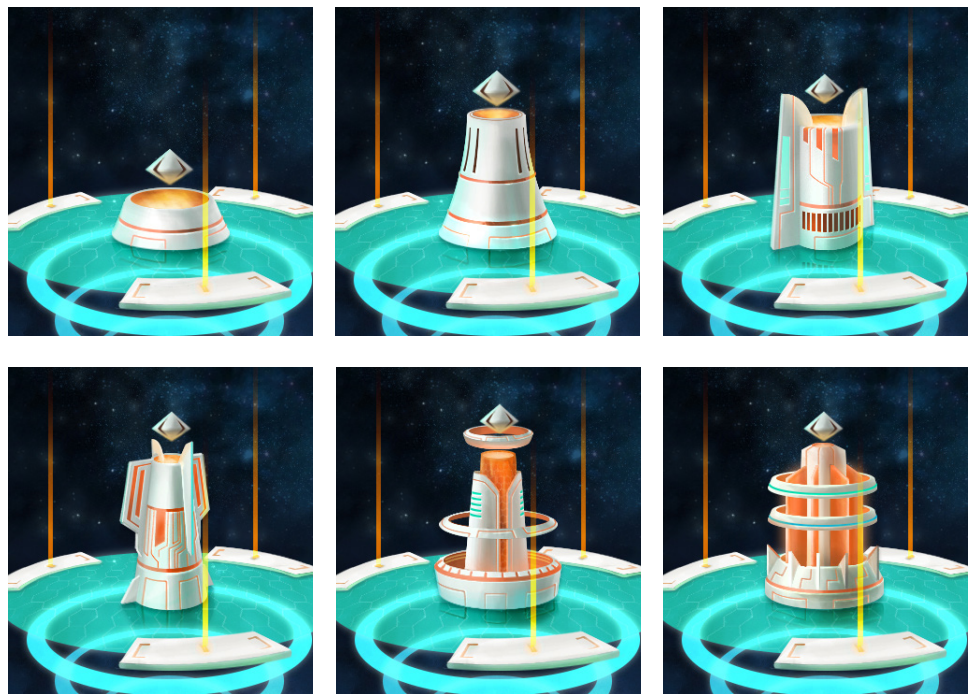


Figure 23: Center Tower Design

The center tower design (Fig.23) improves visually and more deluxe as your level gets higher. Tapping on the tower brings up the entire list. Every time you level up, the tower will upgrade to the next level automatically. Users are allowed to choose a color for the tower theme in the onboarding process, it gives users customization and personalization.



Figure 24: Match Screen

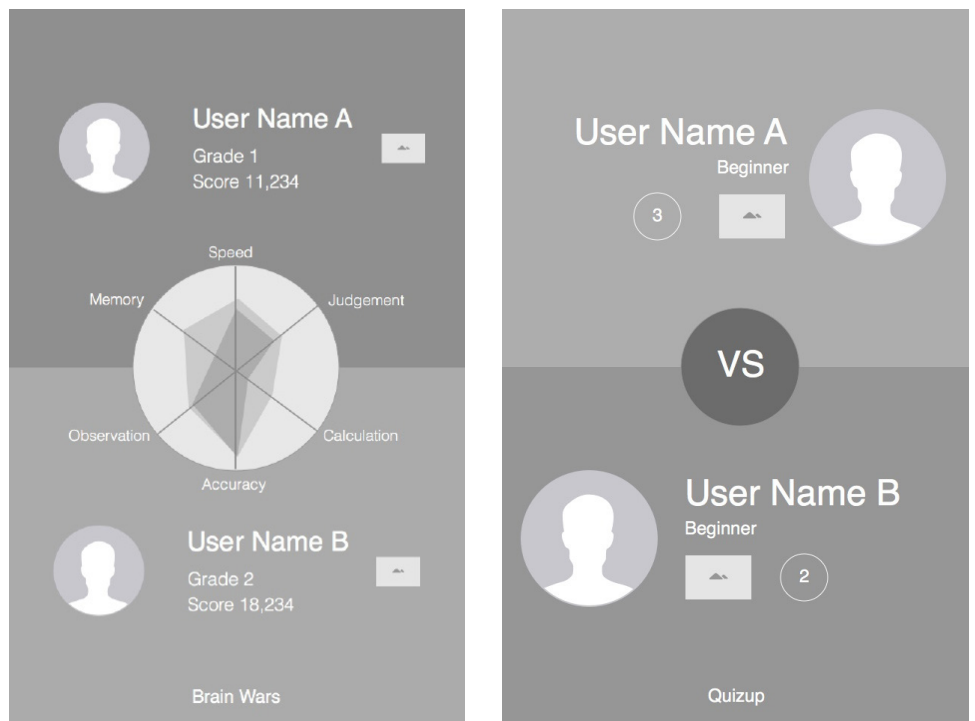


Figure 25: Brain Wars & Quizup Match Screen

This screen shows up as the system has successfully matched an opponent for the user, it is made up of three parts, the left one is the user's information, the right one is the opponent's information and the bottom one is the planet they are going to play on.

The matched screen of Brain Wars shows the overlapped spider charts of both players, it is an intuitive way to display the data/ability difference between two players, but it is hard to tell which data belongs to the user. The matched screen of Quizup only shows level of two players, it is more focused on the nationality.

Since the most outstanding feature of this thesis is various themes, it is necessary to display the planet in this screen, giving users a clue of the theme they are going to play.

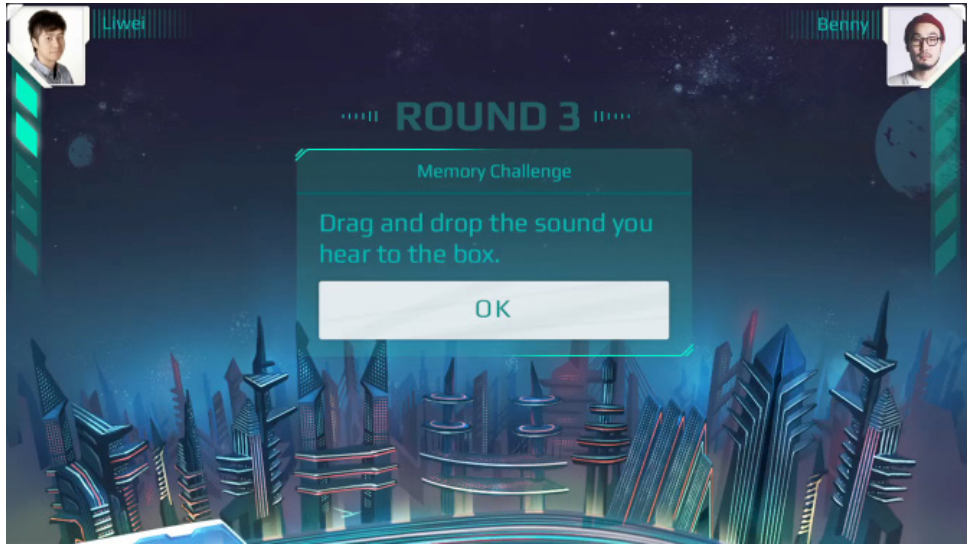


Figure 26: In The Battle

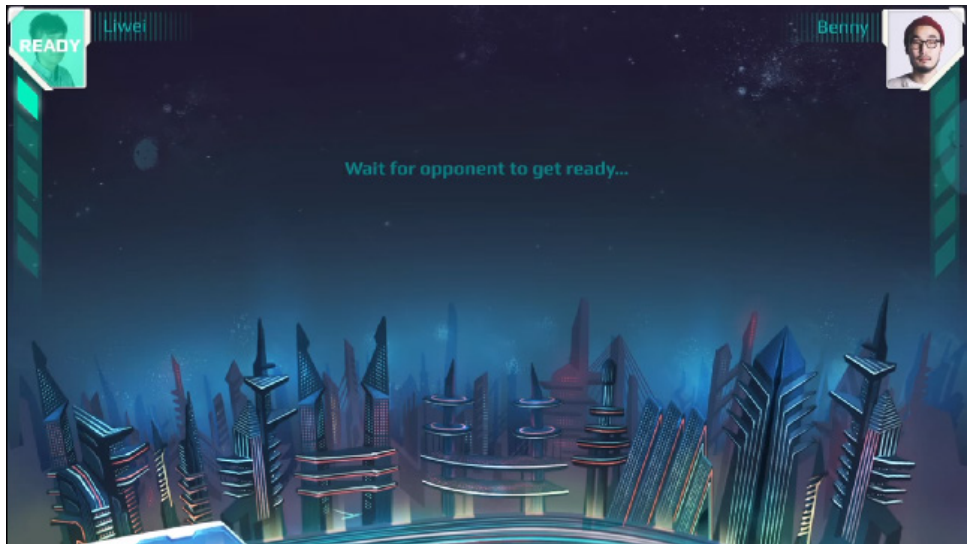


Figure 27: Waiting For Opponent To Get Ready

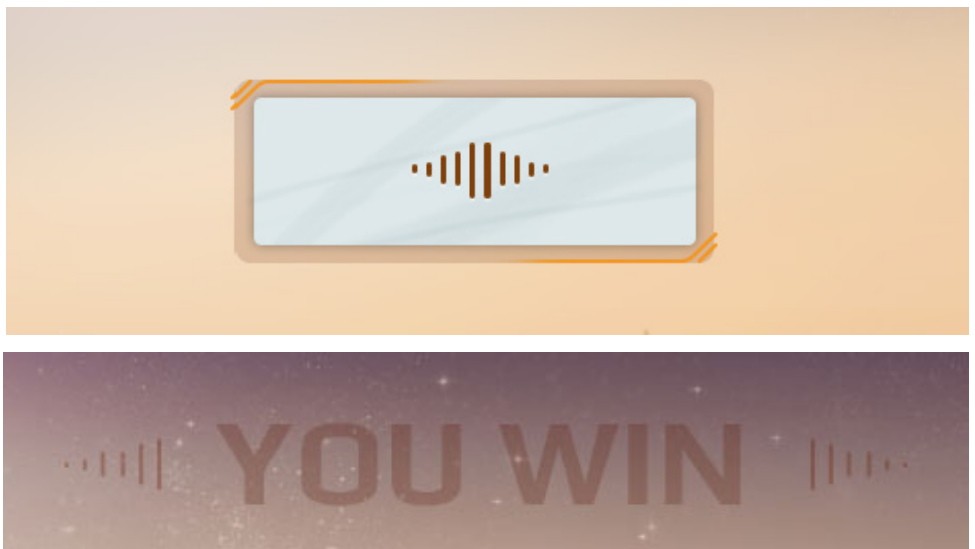


Figure 28: Visual Hint: Sound Wave Design



Figure 29 Visual Hint: Sound Wave Design

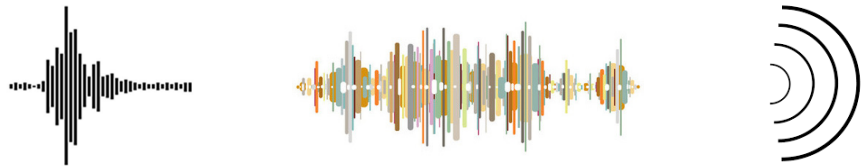
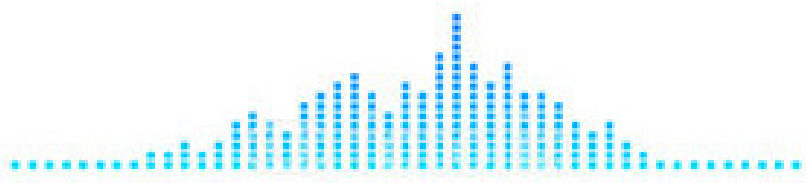


Figure 30: Sound Wave Design Inspiration



Battle screen design(Fig.26) shows the buildings/things that represent the planet in the background and all content like the description and buttons are shown in the center of the interface. The status of players are on each side: the left side shows the user and the right side is the user's opponent. The five parallelogram shape slots represent five rounds and light up when that player has won in that round. The battle will not start until both players tap on the "OK" button, the hint shows up when one player has tapped on OK while the other has not; "Ready" text (Fig.27) shows up on the portrait if the user has got ready. It is a visual clue design to prevent users from being confused that why the challenge does not show up. Since the game is about sounds, it is really important to design details related to it. After searching some examples like BrainFM, there is a moving sound wave at the background, which indicates the sound is being played, the sound wave has pretty high opacity, it works great for BrainFM but it is not wise to apply it to this project because that would be way too distracting. Besides, by seaching some sound visualization graphics(Fig.30) and transforming it into a small element in this project, the final design is a pair of sound waves shown on both sides of the text(Fig.28 & 29, adding a subtle movement to the waves gives a hint to the user that an audio is being played. The color will follow the theme.

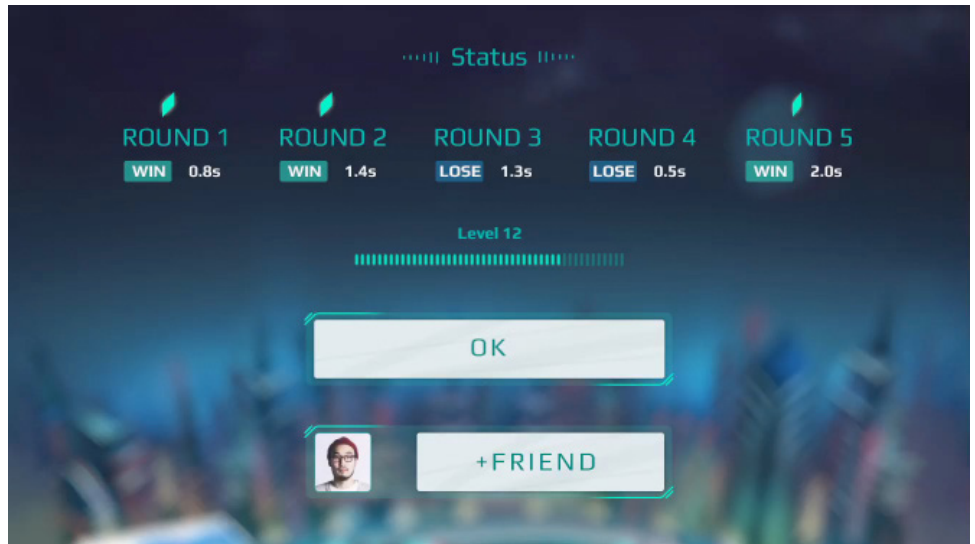


Figure 31: Summary After The Battle

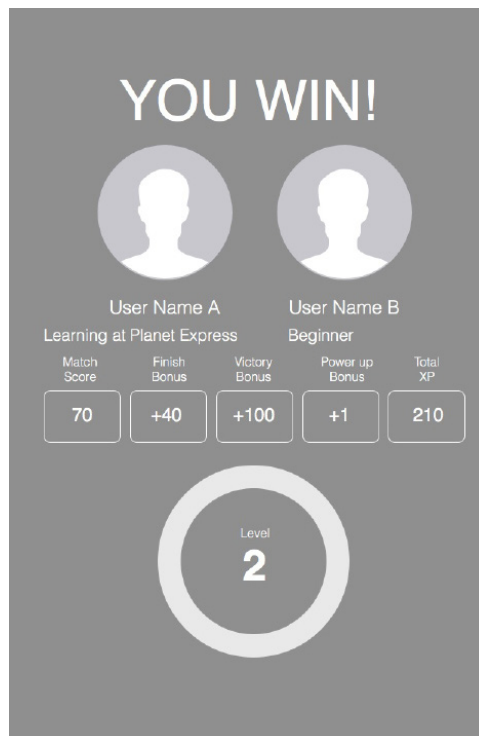


Figure 32: Quizup Summary Page

Summary page design(Fig.31) shows whether the user has won or lost and their time score. The scores will sum up to the total and an “Add” button at the bottom, allowing the user to add the opponent as friends to their friends list. Quziup(Fig.32) has a pretty complex summary page design, there are five types of score. From the app store feedback, users says it is pretty confused how the scores are generated and what they care about is if the experience could make a level up. By taking Quizup as a reference, the only data in the summary page is the time score, and the score sums up to the total experience with a motion.

Figure 33: UI Elements



Figure 34: Initial Text/Button Container



Figure 35: Final Text/Button Container

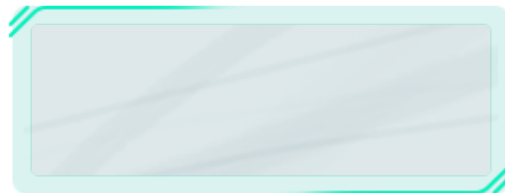
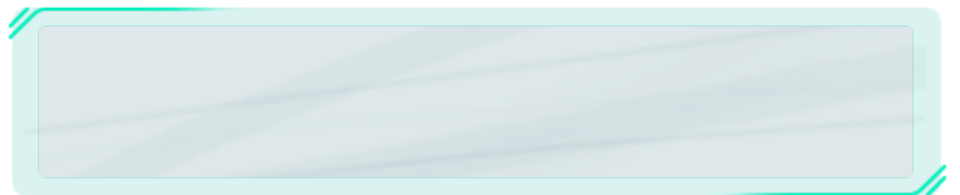


Figure 36: Final Text/Button Container In Larger Size



In order to keep consistent with the whole game user interface, buttons and text containers have a universal style which fits both the overall sci-fi style and the other planets (Fig.33). There are two style colors: a darker theme for light backgrounds and lighter theme for dark backgrounds.

When it comes to the text/button container design, the first design looked pretty heavy and skeuomorphism(Fig.34), with heavy shadow and 3D style on the panel, triangle elements on four corners. The whole screen looked terrible once there were over three containers showing up together.

The final version(Fig.35) looks better by decreasing redundant elements on four corners, making the panel flatter, reducing the shadow and desaturating the color. And what's more, it is scalable(Fig.36), which makes it possible to fit all sizes of button and different length of text. All containers share the same transition/animation, so it could be applied universally, releasing the burden of design and developing works.

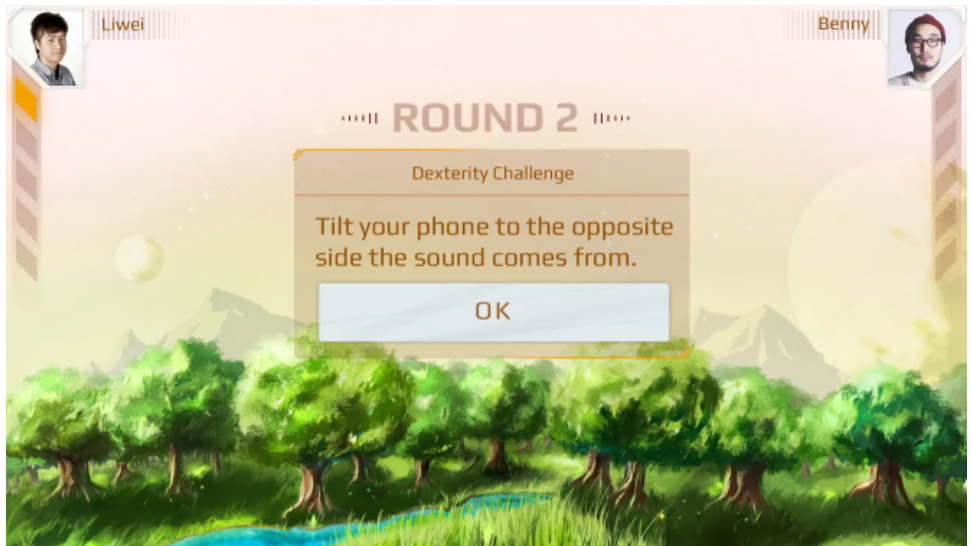


Figure 37: The Planet of Woods

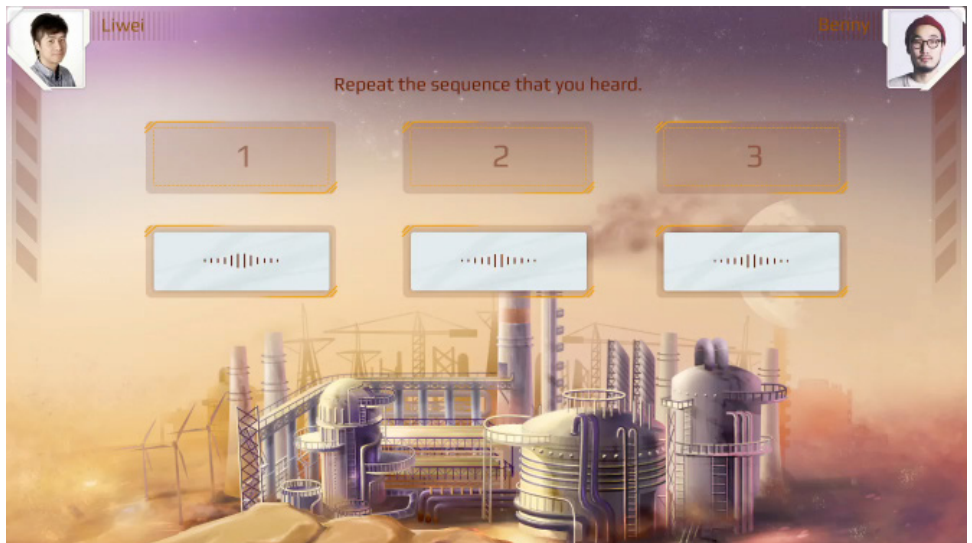


Figure 38: The Planet of Industry

The other planet design.(Fig.37 & 38)



Figure 39: Suggestion For User

Every time the user level up, a tip will show up at the bottom about how the user's progress (Fig.39). Tapping on it expands to view the detail content, containing the summary of the user's status and suggestions of how to improve the weakest ability.

TROUBLESHOOTING

One important problem was the balance between the background illustration and buttons, the initial version(Fig.40) was a disaster because the illustration took up too much space, buttons overlapped and looked messy on the meticulous illustration. It somewhat distracted users when they play the game. In order to fix the problem, the solution was like this: By moving the illustration down a little bit to leave more space for the buttons. The proportion between the illustration and the buttons is shown in Fig.41. The proportion line was set in Photoshop to make sure the illustration didn't cross over in other planet design, there were only pure gradient colors above the line and the objects represented the theme only shown beneath the line. But the second problem followed up, the upper space looked too empty even buttons were applied on it. A bold step was taken to fix this problem: By adding stars and clouds in the upper space, playing around the opacity, lowering the color saturation and blurring the meticulous illustration, the final version was in good balance.

When it comes to the audio resources. One of candidate's seniors happened to own a large pack free of sound effects. By changing pitch and duration, adjusting EQ, adding reverb and echo, mixing multiple sound tracks to fit the theme, the audio worked well with the challenges.



Figure 40: Initial Version Layout

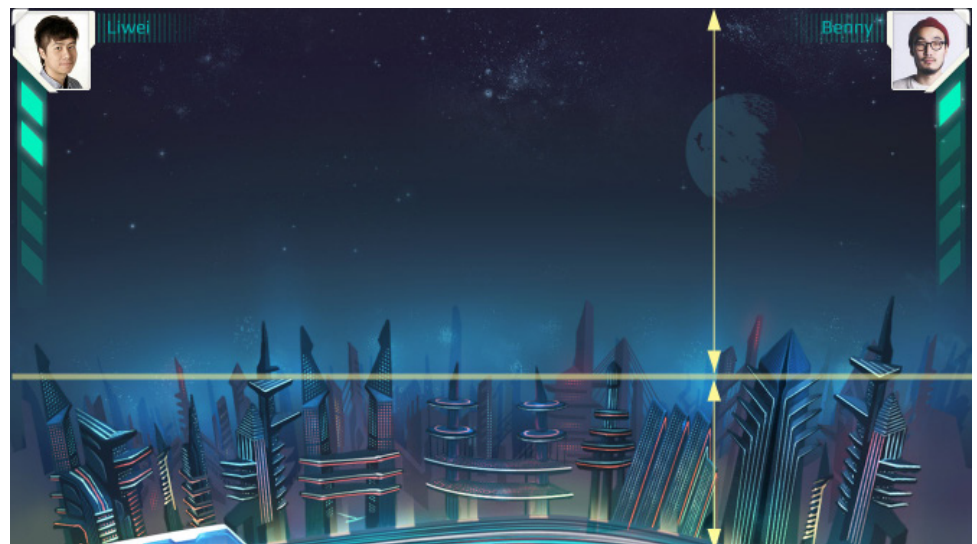


Figure 41: Layout Grid & Rule

SUMMARY

EVALUATION

Proper evaluation of the thesis criteria should employ physical interactions between the app and actual users, but as what is mentioned before, coding is not in scope, so the final deliverables do not contain a real playable app. The demo video is meant to show main features and main app flow, it clearly presents how users access the game, competing in easier and harder challenges, it walks through the status page, friends list and planets list. An online survey was devised to gather clear and essential feedback by focusing on key factors to make sure people can not only understand the concept of the game but also be desired to play the game after watching the demo.

The following section is the survey to test if the game is understandable and disable, it consists of 11 multiple choice questions.

1. Which of the following best describes the game you have seen.(Please select one)

It is a game that you cooperate with other players to earn scores.

It is a game that you compete with other players to earn scores.

2. Which of the following best describes the rule you have seen.(Please select one)

You have to complete the challenge based on the sound you hear.

You have to ignore the sound you hear to complete the challenge.

3. Do you have hard time understanding the challenge?

Yes, I do.

Sort of.

No, I don't.

4. Which of the following best describes the Explore button you have seen in standby mode.(Please select one)

Tap on the button to look for players to start a new game.

Tap on the button to look for players to join an existing game.

5. Which of the following describes the Status.(Select as many as you think is correct)

You can see how much you were faster or slower than your rivals.

You can see the ranking among your friends.

You can see your strongest ability and weakest ability.

You can see your wins and losses.

6. Which of the following describes the Friends.(Select as many as you think is correct)

You can see if your friend is online or not.

You can see the level of each friend.

You can see the wins and losses of each friend.

You can see the strongest ability of each friend.

7. Which of the following best describes the Planets.(Please select one)

It represents planets you can play with and locked ones are for higher level.

It represents planets you are free and the rest are required purchase.

8. Can you see the tip/suggestion after level up?

Yes, I can see it.

No, I can't.

9. Do you know the tip/suggestion is about how to improve your weakest ability?

Yes, I do

No, I don't

10. How many rounds do you prefer to play in each game?

3

4

5(Current is 5 rounds)

6

7

8

11. By watching this video, do you have a desire to download the app in the future?

Not at all.

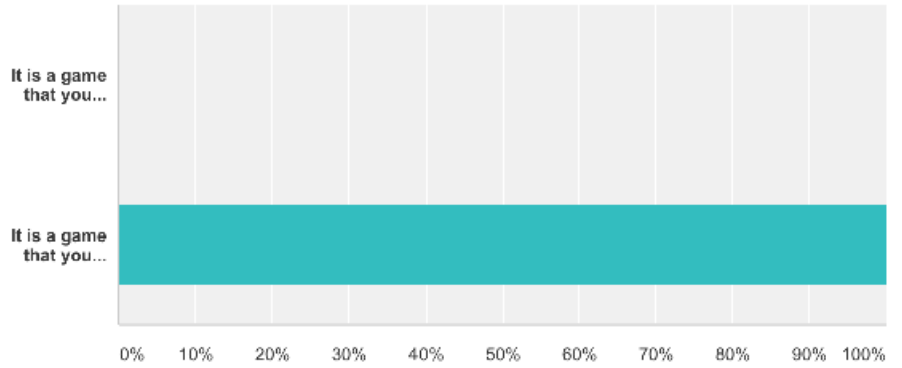
Little bit.

Maybe I'll give it a shot.

I look forward to it.

Which of the following best describes the game you have seen.(please select one)

Answered: 17 Skipped: 0

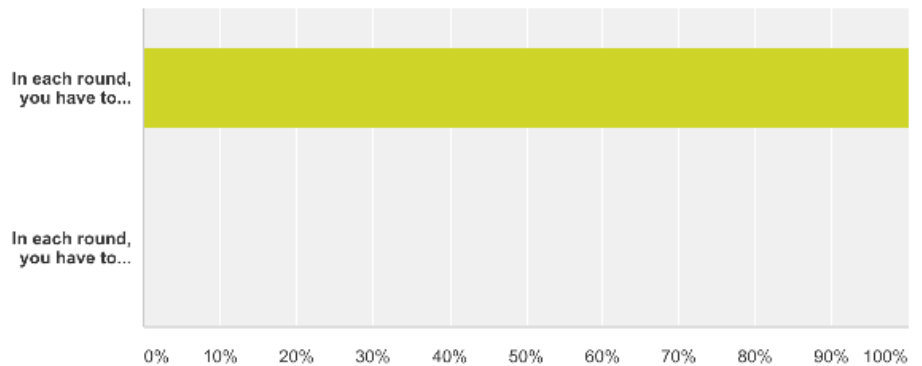


Answer Choices	Responses
It is a game that you cooperate with other players to earn scores.	0.00% 0
It is a game that you compete with other players to earn scores.	100.00% 17
Total	17

Figure 42: Result of Question 1

Which of the following best describes the rule you have seen.(please select one)

Answered: 17 Skipped: 0

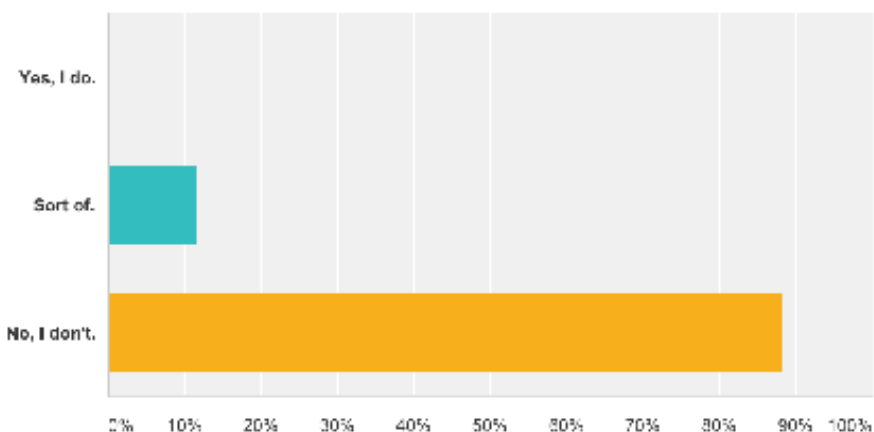


Answer Choices	Responses
In each round, you have to complete the challenge based on the sound you hear.	100.00% 17
In each round, you have to ignore the sound you hear to complete the challenge.	0.00% 0
Total	17

Figure 43: Result of Question 2

Do you have hard time understanding the challenge?

Answered: 17 Skipped: 0

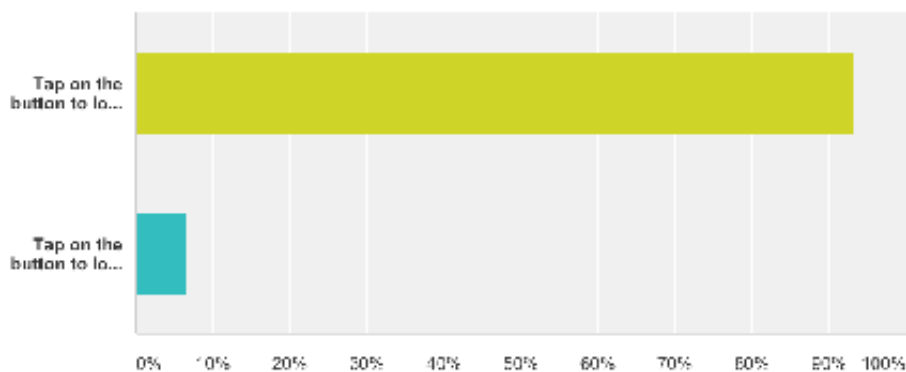


Answer Choices	Responses
Yes, I do.	0.00% 0
Sort of.	11.76% 2
No, I don't.	88.24% 15
Total	17

Figure 44: Result of Question 3

Which of the following best describes the Explore button you have seen in standby mode.(please select one)

Answered: 15 Skipped: 2

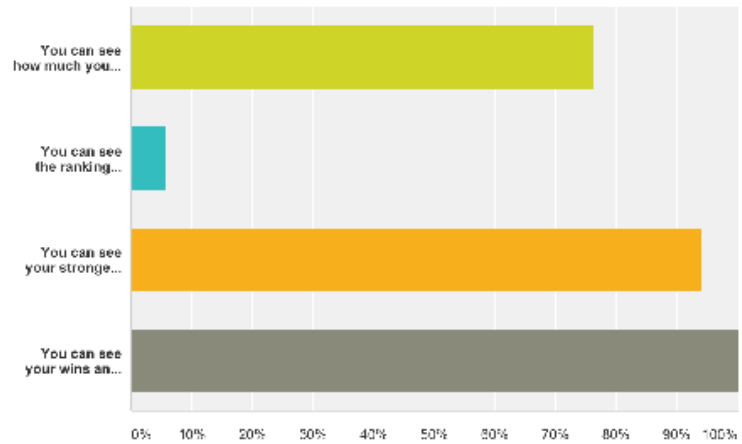


Answer Choices	Responses
Tap on the button to look for players to start a new game.	93.33% 14
Tap on the button to look for players to join an existing game.	6.67% 1
Total	15

Figure 45: Result of Question 4

Which of the following describes the Status.(select as many as you think is correct)

Answered: 17 Skipped: 0

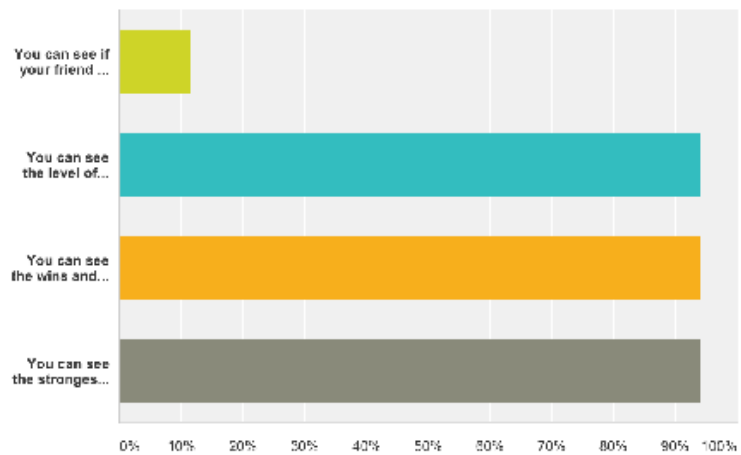


Answer Choices	Responses
You can see how much you were faster or slower than your rivals.	78.47% 13
You can see the ranking among your friends.	5.88% 1
You can see your strongest ability and weakest ability.	94.12% 16
You can see your wins and losses.	100.00% 17
Total Respondents: 17	

Figure 46: Result of Question 5

Which of the following describes the Friends.(select as many as you think is correct)

Answered: 17 Skipped: 0

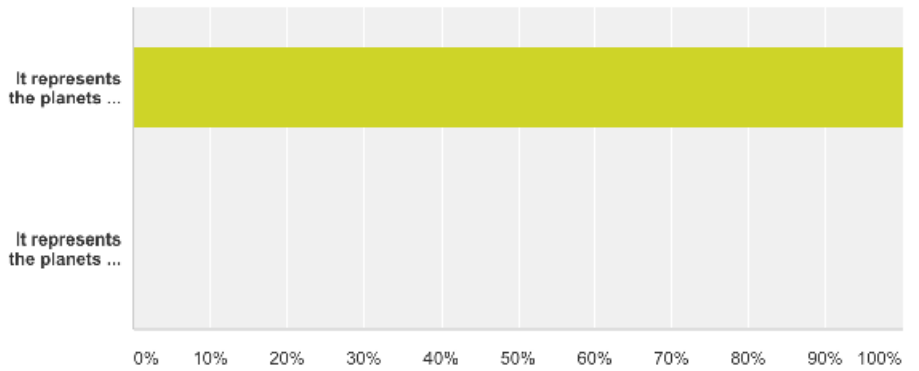


Answer Choices	Responses
You can see if your friend is online or not.	11.76% 2
You can see the level of each friend.	94.12% 16
You can see the wins and losses of each friend.	94.12% 16
You can see the strongest ability of each friend.	94.12% 16
Total Respondents: 17	

Figure 47: Result of Question 6

Which of the following best describes the Planets.(please select one)

Answered: 17 Skipped: 0

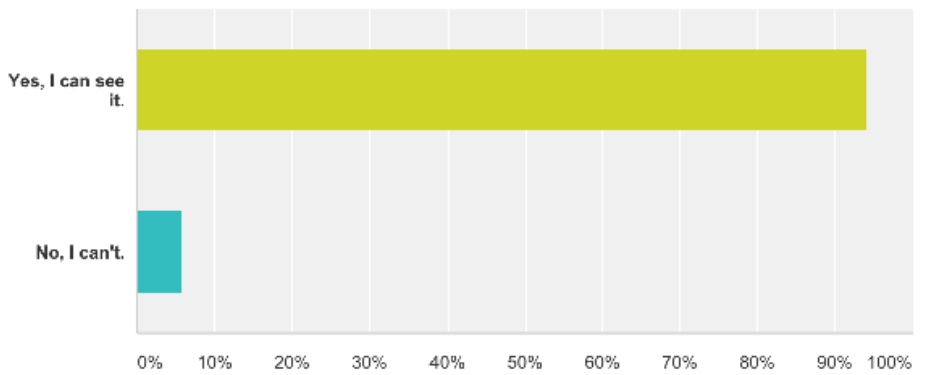


Answer Choices	Responses
It represents the planets you can play with and locked ones are for higher level.	100.00% 17
It represents the planets you are free and the rest are required purchase.	0.00% 0
Total	17

Figure 48: Result of Question 7

Can you see the tip/suggestion after level up?

Answered: 17 Skipped: 0

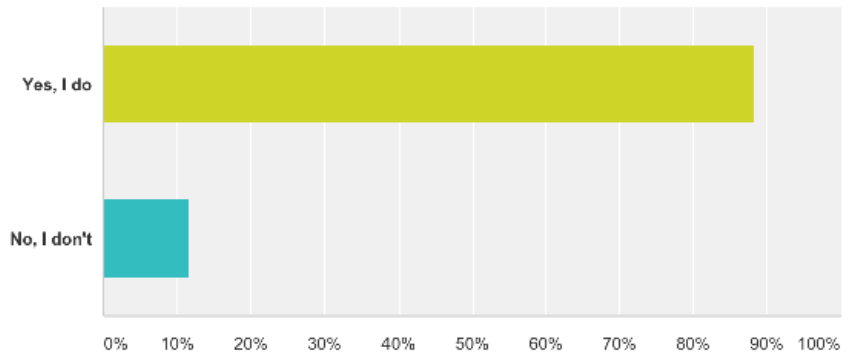


Answer Choices	Responses
Yes, I can see it.	94.12% 16
No, I can't.	5.88% 1
Total	17

Figure 49: Result of Question 8

Do you know the tip/suggestion is about how to improve your weakest ability?

Answered: 17 Skipped: 0

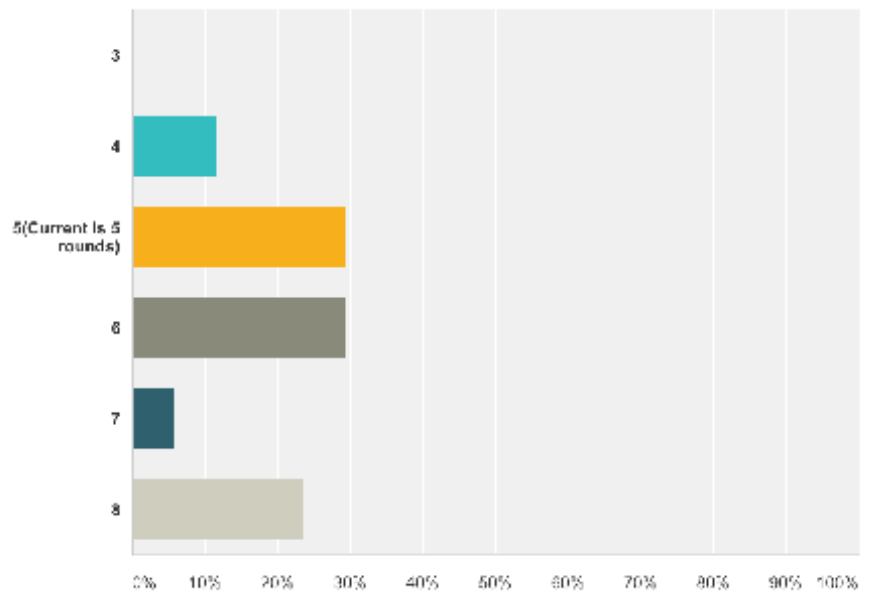


Answer Choices	Responses	Count
Yes, I do	88.24%	15
No, I don't	11.76%	2
Total		17

Figure 50: Result of Question 9

How many rounds do you prefer to play in each game?

Answered: 17 Skipped: 0

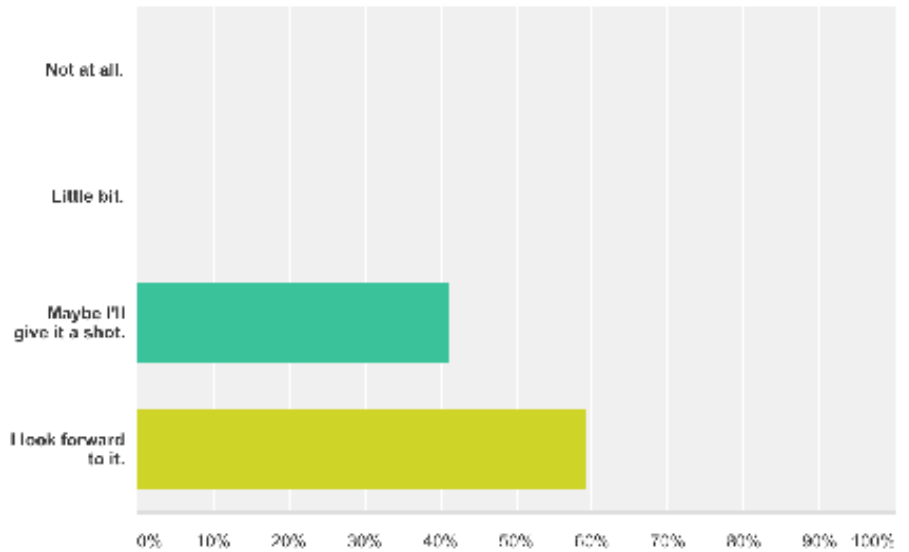


Answer Choices	Responses	Count
3	0.00%	0
4	11.76%	2
5 (Current is 5 rounds)	29.41%	5
6	29.41%	5
7	5.88%	1
8	23.53%	4
Total		17

Figure 51: Result of Question 10

By watching this video, do you have a desire to download the app in the future?

Answered: 17 Skipped: 0



Answer Choices	Responses
Not at all.	0.00% 0
Little bit.	0.00% 0
Maybe I'll give it a shot.	41.1% 7
I look forward to it.	58.9% 10
Total	

Figure 52: Result of Question 11

The online survey results (Fig.42 - 52) and the thesis show survey results (See appendix fig.59 - 65) meet the expectation of what the thesis candidate's want to present in the video, users can clearly understand what the game is and how to play it. And they show high expectation of the game if it comes to life. Take a look at the result of the 3rd question shows users sometimes have hard time understanding the challenge. Actually In order to attract users to this game, it is necessary to have a large number of challenges that can attract them continuously. However, it takes time and effort to learn to play a new type of challenge, so learning is one of the heaviest burdens for new users in this game. To solve this problem in the future, it is very important to have a great copywriter to write a crystal clear description for the challenge, or using a short animation to explain it. In terms of the 10th question, people shows their intentions to have more rounds in a single game, because they are willing to have more immersive experience instead of keeping looking for new rivals. With that being said, compared to design more planets, it is better and effective to design more challenges with different levels of difficulty.

CONCLUSION

SIGNIFICANCE OF THE PROJECT

This project strives to fill in the gap between brain-ear training and gamification, as well as real-time multiplayer quiz games. It is based on a mobile platform because it is more accessible than desktop or other training methods. Making it a mobile app can take advantage of the existing mobile phone technology, like high speed hardware, gyroscope, etc. For those who like playing challenge games and want to train their brains, the game provides a unique solution for them, providing users with various challenges to immerse them. Playing the game with others is actually effectively lowering the uninteresting process of training the ear and brain. When it comes to training experience, the thesis shows that gamification and competing with friends can do more than just regular training. Also, visualizing the training progress data gives clear feedback to users to encourage them to keep doing it. Hearing ability can be broken down into four main abilities--Attention, memory, discrimination and dexterity, and by tracking them individually by the results of corresponding challenges, users can know what they are doing well and what still needs to be improved.

NEW QUESTIONS

This game becomes a tactical problem-oriented training tool that is effective and helpful in making the training process a better experience. Figuring out new challenges with attractive sounds remains a challenge, as it takes much effort to design a large number of challenges that can attract users continuously. The other question would be the contradiction between training hearing and potential damage from wearing earbuds for too long, since the game may require users to wear earbuds for a better experience, but it may cause damage in hearing when users play for too long. However, the goal of the game is to improve brain-ear coordination and hearing ability, so I still have to figure out a balanced way that lets users enjoy the game without wearing earbuds for too long.

NEXT STEP

Next step is to design the case study board to disperse the thesis via the 2016 Adobe Design Achievement Awards, The IXDA Interaction Awards and Core77 Award for social impact design as well as shown at the 2016 RIT VCDE MFA Thesis Show.

Multiplayer Sound Oriented Game Design

-- An iOS brain and hearing training game for the better life

Liwei Yu
Rochester Institute of Technology
College of Imaging Arts and Sciences
School of Design
MFA Visual Communication Design

Thesis Proposal for the Master of Fine Arts Degree

Rochester Institute of Technology
College of Imaging Arts and Sciences
School of Design
MFA Visual Communication Design

Title: Multiplayer Sound Oriented Game Design -- An iOS brain and hearing training game for the better life

Submitted by: Liwei Yu

Date: October 21, 2014

Thesis Committee Approval:

Chief Thesis Adviser: Daniel Deluna, Visual Communication Design

_____	_____
Signature of Chief Thesis Adviser	Date

Associate Thesis Adviser: Chris Jackson, Visual Communication Design

_____	_____
Signature of Associate Thesis Adviser	Date

Associate Thesis Adviser: Shaun Foster, Visual Communication Design

_____	_____
Signature of Associate Thesis Adviser	Date

MFA Thesis Candidate: Liwei Yu

_____	_____
Signature of MFA Thesis Candidate	Date

Thesis Proposal for the Master of Fine Arts Degree

Thesis Title: Multiplayer Sound Oriented Game Design

by Liwei Yu

Abstract

Hearing (auditory perception) is one of the most important senses in our human bodies. There are millions of different sounds in our real world, human perceive the sounds from the outside world to get information, and do response to them. It is benefit to enhance the hearing ability and the hand-ear coordination to boost the brain fitness , better communication with others and enhance the ability of concentration.

With the fast development of smart mobile devices and mobile internet, it is easy to get people connected no matter where they are. Some people usually play games during their fragmented time.

Considering these factors, it is a good approach to take full advantage of them, so this project is a real time multiplayer game in iOS, and the game is based on the sounds. Players are required to complete different tasks of the sounds, and the one who complete faster or better can win the score.

This game is audio oriented, socially and has various types of challenges. The audio oriented game can benefit the hearing ability and gives the user good experience. Players are randomly matched to compete in the game in real time, or one can pick the others to challenge, so it motivate people to win. The different types of challenges (including dexterity challenge, memory challenge, discrimination challenges and attention challenge) makes the game varied as well as challenging.

Keywords: *Game Design*
Brain Training
Hearing Training
Hand-ear Coordination
Multiplayer
Sound Oriented
Socially

Problem Statement

Our human brain needs exercise to keep fitness, if not, it will turn lazy and dull. People usually talk about hand-eye coordination, and the importance of developing such skills at a young age. Of course it is benefit to sharpen the visual acuity, so is the hearing ability. Research have shown that musicians who frequently works under the conditions of sounds are better able to pick out speech or other important information from surrounding noise as they age compared to non-musicians. And the non-profit Hear the World Foundation has done a survey over 4,000 people in five countries, on different topics related to hearing in different areas of life, and it is surprise to find that hearing influences so many aspects of people's daily life, for example the quality of communication. Besides, it shows better hearing enables people experience life in a more active and healthier way. And it helps people reduce the possibility of scatterbrain due to the noisy environment.

So It has been proved that enhancing the hearing ability benefits our brain, it helps peopel do better jobs in their lives and do communication better.

However, there are fewer exercises online for people to train hearing ability or hand-ear coordination. Besides, people have less motivation to train it due to some reasons:

1. People can not see the improvement of after-exercising, which means it is difficult to let them know that their performance is better compared to before-exercising, because of lack of data collection system.
2. People usually view training as a boring process because it lacks entertainment and variation.
3. People do not like to spend too much time on it, especially stay still in front of computer to do the training.

On the other hand, nowadays the number of mobile phone users is increasing every year, the mobile phones are becoming much more entertaining and multifunctional than the past. Some people deal with their fragmented time by playing games in mobile phones. The auditory hardware in the mobile device and the audio accessory like the earphones provided by the phone makers can perform good quality of sounds.

By rethinking the approach to this problem, it is possible to design an online interaction game on mobile devices to solve this problem.

Survey of Literature

Books

Designing Interfaces

Author: Jenifer Tidwell

Publisher: O'Reilly Media (January 9, 2011)

This book provides useful advices as well as solutions for most common user interface design problem. There are lots of examples including web applications, desktop software and mobile devices.

Mobile Interaction Design

Author: Matt Jones, Gary Marsden

Publisher: John Wiley & Sons Ltd (February 10, 2006)

This book is suitable for students self study, there are tons of examples, exercises and case studies, it is open minded which inspires students create new generation of mobile application.

The Dominance Factor: How Knowing Your Dominant Eye, Ear, Brain, Hand & Foot Can Improve Your Learning

Author: Carla Hannaford

Publisher: Great River Books (September 11, 2011)

The book offers some insight of why people varied and how people learn, and it is helpful to get to know that the linkages between the side of the body we favor for seeing, hearing, touching, and moving and the way we think, learn, play, and relate to others.

Advanced Brain Training

Author: Terry Horne, Simon Wootton

Publisher: McGraw-Hill; 1 edition (February 13, 2013)

This book teaches you to out-think and do better job than others at work, at home or on other field, the first chapter is mainly about the theory and the second chapter focuses on practices, including some challenges like Mensa-level puzzles, sudoku grids, crosswords and lateral and logical thinking problems.

Change Your Brain, Change Your Body: Use Your Brain to Get and Keep the Body You Have Always Wanted

Author: Daniel G. Amen

Publisher: Publisher: Random House Audio (February 16, 2010)

The author Dr. Amen pioneered the use of the most advanced brain imaging technology. This book provides some theory and solutions for how to take care your brain. Enhancing your brain could enhance almost every aspect of daily life.

Rules of Play: Game Design Fundamentals

Author: Katie Salen Tekinbas

Publisher: The MIT Press (September 25, 2003)

This book serves as a theoretical guide for interactive designer, the authors teaches game design by seeing a game as systems of emergence and information, as contexts for social play, as a storytelling medium, and as sites of cultural resistance.

The Art of Game Design

Author: Jesse Schell

Publisher: CRC Press; 1 edition (August 4, 2008)

This book allows you to master the fundamentals of game design by teaching you view the game from different perspectives, for examples, view from the perspective of psychology, architecture, music, visual design and film. It inspires you to create a better game than you can expect.

A Theory of Fun for Game Design

Author: Raph Koster

Publisher: Paraglyph Press (November 6, 2004)

This book is fully illustrated, full of narrative storyboard on art and great examples of great game design. Although it is not so practical but the thought-provoking questions about the nature of fun could be a good start for new game developers.

Playful design creating game experiences in everyday interfaces

Publisher: Ferrara

Publisher: Rosenfeld Media, LLC (April 1, 2012)

This book shows the relationship between web design and game design, and it explores the gamification for learning, social change, and its impact.

The Big Book of Brain Games: 1000 PlayThinks of Art, Mathematics and Science

Author: Ivan Moscovich

Publisher: Workman Publishing Company (July 18, 2006)

This book is full with challenges of different levels and they are all well illustrated, those challenges could be served as a database for getting inspiration.

Brain Games Kids

Publisher: Publications International, LTD (November 1, 2008)

The challenges in this book covers from language arts, math, science, social sciences, physical and emotional development, and find arts.

Hands On Training: Actionscript 3.0 for Adobe Flash

Author: Perkins, Todd

Publisher: Addison-Wesley (October 5, 2007)

The book serves as a technical support for programming in Flash, some features like debugger that could allows users to step through a wide variety of properties in their code at runtime, with greater flexibility and feedback.

Games

QuizUp

Seller: Plain Vanilla Corp

It is a multiplayer trivia game with tons of intriguing question, players can choose different category and play in real time.

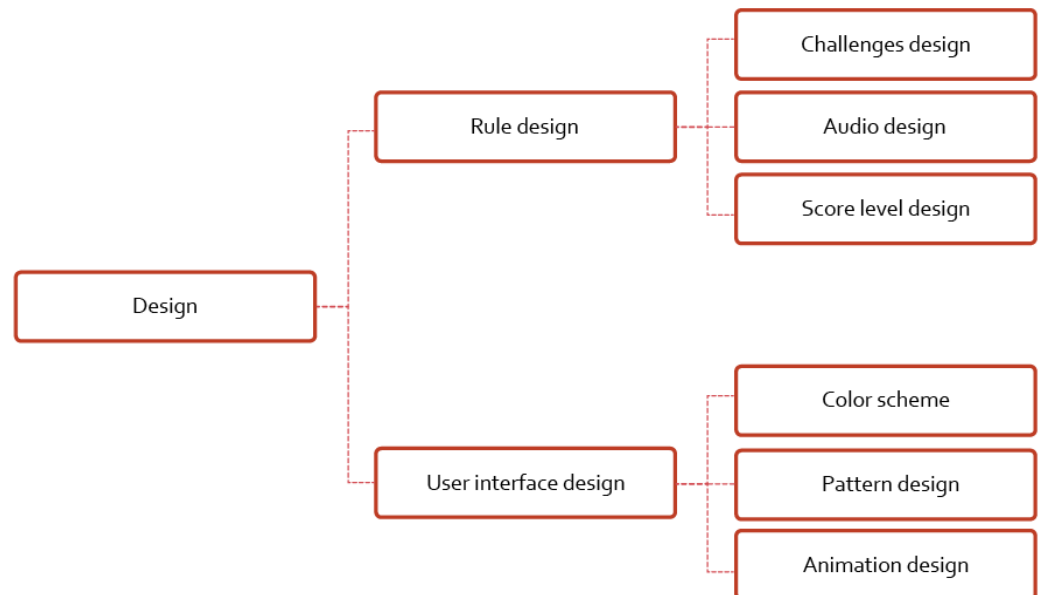
BrainWars

Seller: TRANSLIMIT, INC.

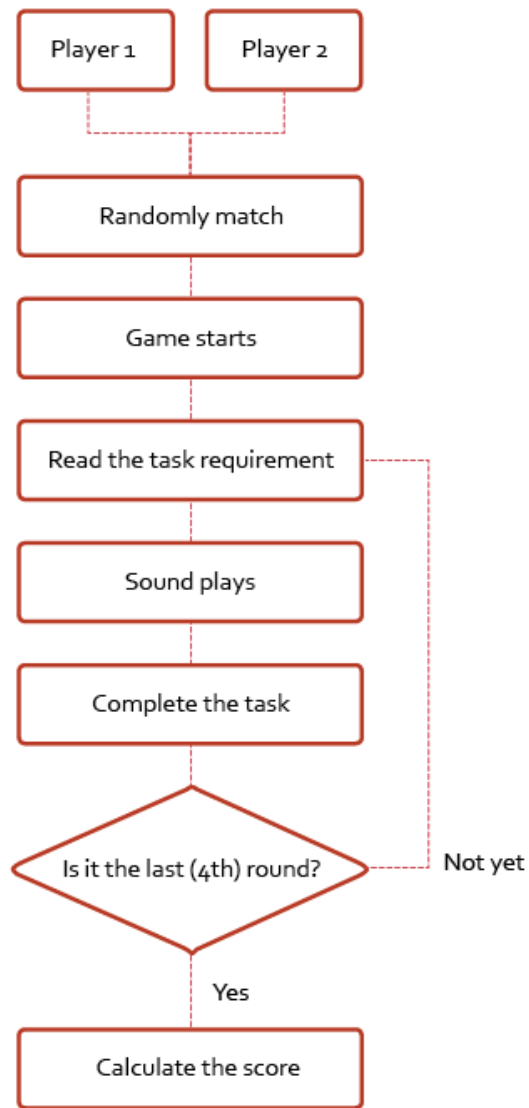
This is a competitive brain training game test your hand-eye coordination and quick response. Players are randomly matched to compete in the game, and the score will be recorded, then players can see the history of their improvement.

Design Ideation

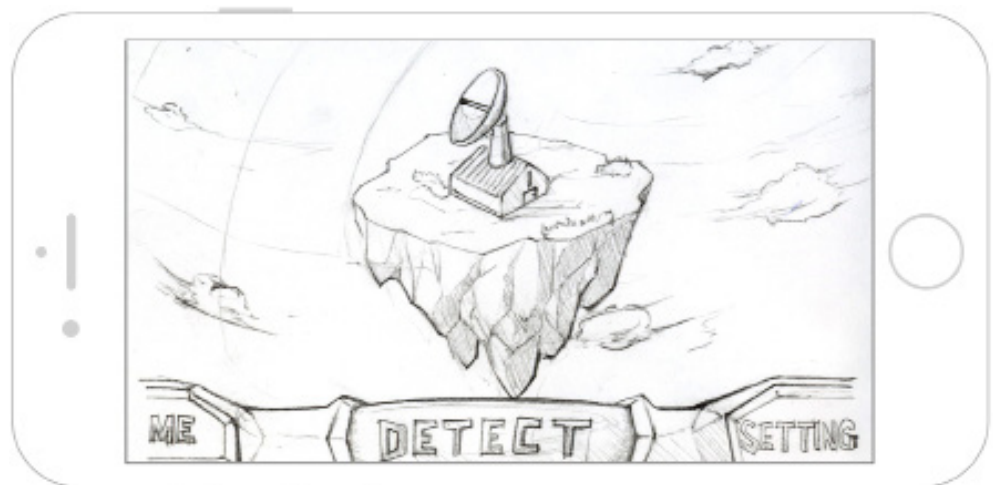
Framework

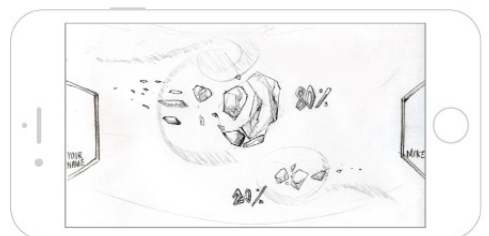
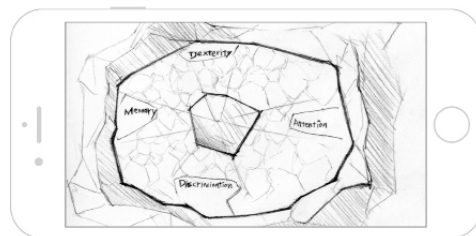
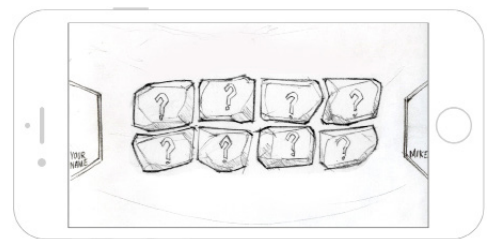
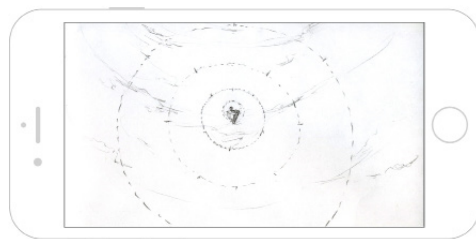
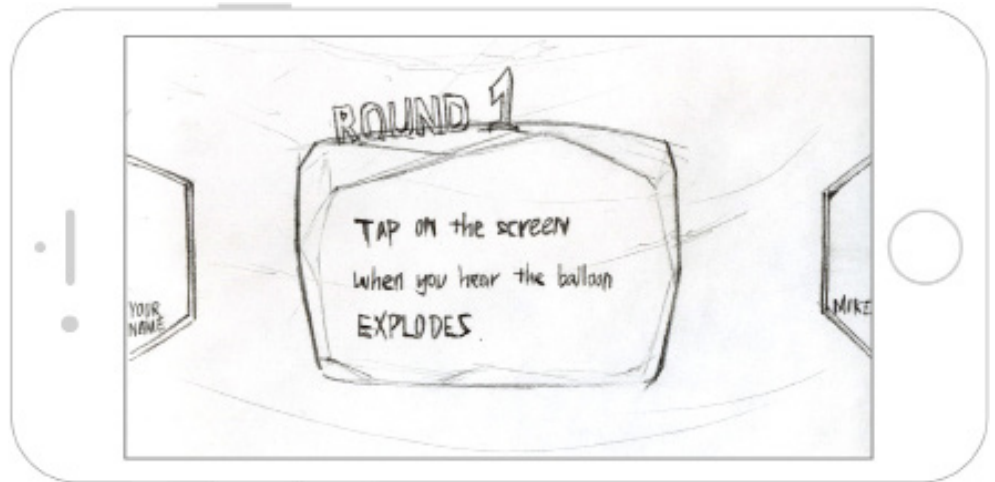
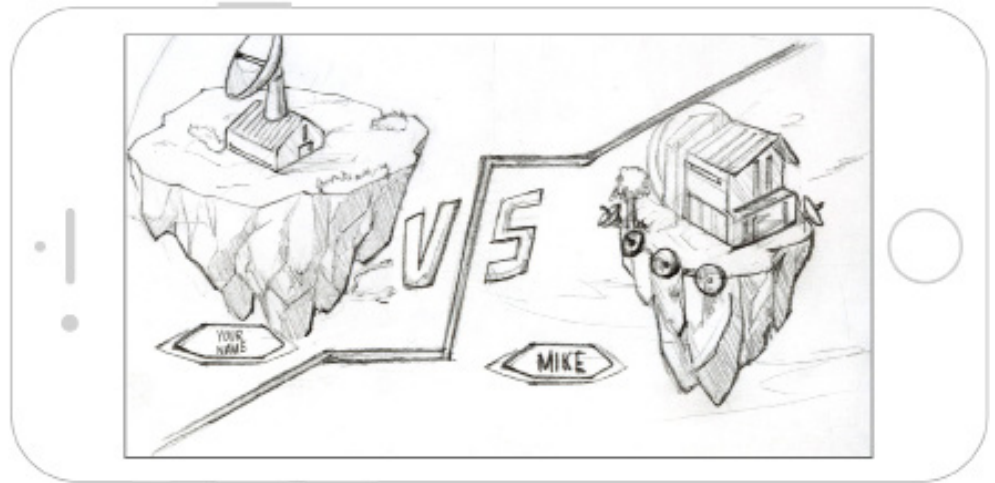


Flowchart



Sketch





Methodological Design

Goal	It is a multiplayer game, who first complete the given challenges can win the game.
Rule	Players compete in a real time game that has 4 rounds (They have to play over 4 randomly given challenges). At the beginning of each round they are allow to read requirement of the challenge within a given time, and then the challenge starts, the audio of the challenges will be played just once. After hear the sound, players can start to work on the challenge and try to complete the challenge as soon as possible. In order not to let the game last forever on some special situations like one of players intend to not complete the challenge, or one of players get stuck due to his/her internet, there is a time limit of 8 seconds for each round, which means everyone is forced to end this round after 8 seconds no matter if they have completed or not. When they play through 4 rounds, system calculates the time they spend, and give them corresponding scores. The faster, the higher.
Interaction	Players can interact with each other.
Types of Challenges	<p>1. Dexterity or hand-ear coordination challenges</p> <ul style="list-style-type: none">- Tap on the screen as fast as possible when you hear the target sound. <i>e.g. An audio of a balloon is been inflating, you should tap on the button as soon as possible once you hear the balloon explodes.</i>- The sounds coming from either left or right side, you need to tilt your phone on the opposite side as fast as possible. <i>e.g. An audio of cars keeping rushing to you on either left side or right side, you should tilt your phone on the opposite side.</i>- Perform different gestures according on the sounds. <i>e.g. The system shows you that you should perform the double tap once you hear the bird tweets.</i> <p>.....more coming</p> <p>2. Memory challenges</p> <ul style="list-style-type: none">- 4*2 block matching game <i>e.g. Among the 8 unknown blocks, there are 4 pairs of sound, you can tap on the block to hear the sound, what you need to do is to match the sounds by tapping on the blocks continuously.</i>- Count how many times does the target sound appears. <i>e.g. There are some choices of number listed out, listen to an audio of a basketball bouncing, then choose the number that you hear.</i>

- Several sounds are played sequentially, then repeat the sequence.
e.g. There are four buttons of a dog, a cat, a lion and a horse, the system plays an audio in this sequence: 1. Lion 2.Horse 3. Dog 4. Cat, then you need to tap on the button correspondingly in the same sequence.
.....more coming

3. Discrimination challenges

- Guess what object creates that sound.
e.g. There are two buttons of a male and a female, then listen to an audio of someone yelling, you should make the right choice on the gender of the yelling person.
.....more coming

4. Attention challenges

- Figure out how many objects appear in the audio.
e.g. There are over 10 buttons of different objects listed out, then system plays an audio of a mixture of a basketball bouncing, an ambulance horn and a beating drum, you should tap on the corresponding buttons that you hear.....more coming

Flow Plan

In the analysis step I will basically divide it into two parts, one is to do the survey on the literatures and the other is to analyze some similar games. Then I will step into the design part, I will do the brainstorming, try to figure out the flow and framework of the game, and make low fidelity paper prototype for testing. On the same time, I will start to work on the detail of challenges, for example mix the audio. After that, I will get to the user interface design step. In this step I will design the color, pattern and animation. Then prototype it in Axure for testing playability, if it works well without any problems, I will start to work on the motion graphic demo to display the complete version of the game.

Target Audience

The target audience would be people from 13 to 38 years old with no severe hearing lost, having a smart mobile phone and a pair of earphone is better. There is no education and occupation limit, any language background are considerable to play the game since the audio in the game does not contain any specific human language or dialog.

Tools

Adobe Photoshop, Adobe Audition, Adobe After Effects will be utilized as design tools in this project. An iMac will be served as the platform for displaying. If possible, iPad could be served as an alternative.

Implementation Strategies

Prototype

Since learning a new programming language for iOS in a limited time is difficult for me, meanwhile it might not work well because of the startup coding level. So the project would be displayed as a motion demo to show the complete version of the game.

Deliverables

Format: A motion graphic demo

Software: Adobe Photoshop, Adobe Audition, Adobe After Effects

Concept development

-Task design

-Standard design

-Audio design

User Interface development

-Flowchart and wireframe design

-Icon, color scheme and animation design

-First usability test and get feedback

Motion demo

-Create a motion to demonstrate a complete version of the game, animation and full functions will be displayed in the demo.

Dissemination

The project will be exhibited in the 2015 MFA thesis show, and the Wallace Library Archives will keep it on file for future research.

The other way to promote the project is to attend design competitions like Adobe Design Achievement Awards, The IXDA Interaction Awards and Core77 Awards.

Submitting for publication to magazines would also be a way, I will take the game into an article form, then submit it to Communication Arts, Pocket Gamer Guide as well as Apps Magazine.

Evaluation Plan

Formative Evaluation

The first test is in the sketch step, I will test the paper prototype so I can modify it quickly. The next test is to test in the Axure prototype, I will observe the way they play the game, meanwhile I will collect the feedback from users by asking them to fill out a simple form, then I can modify it before I go into the user interface design.

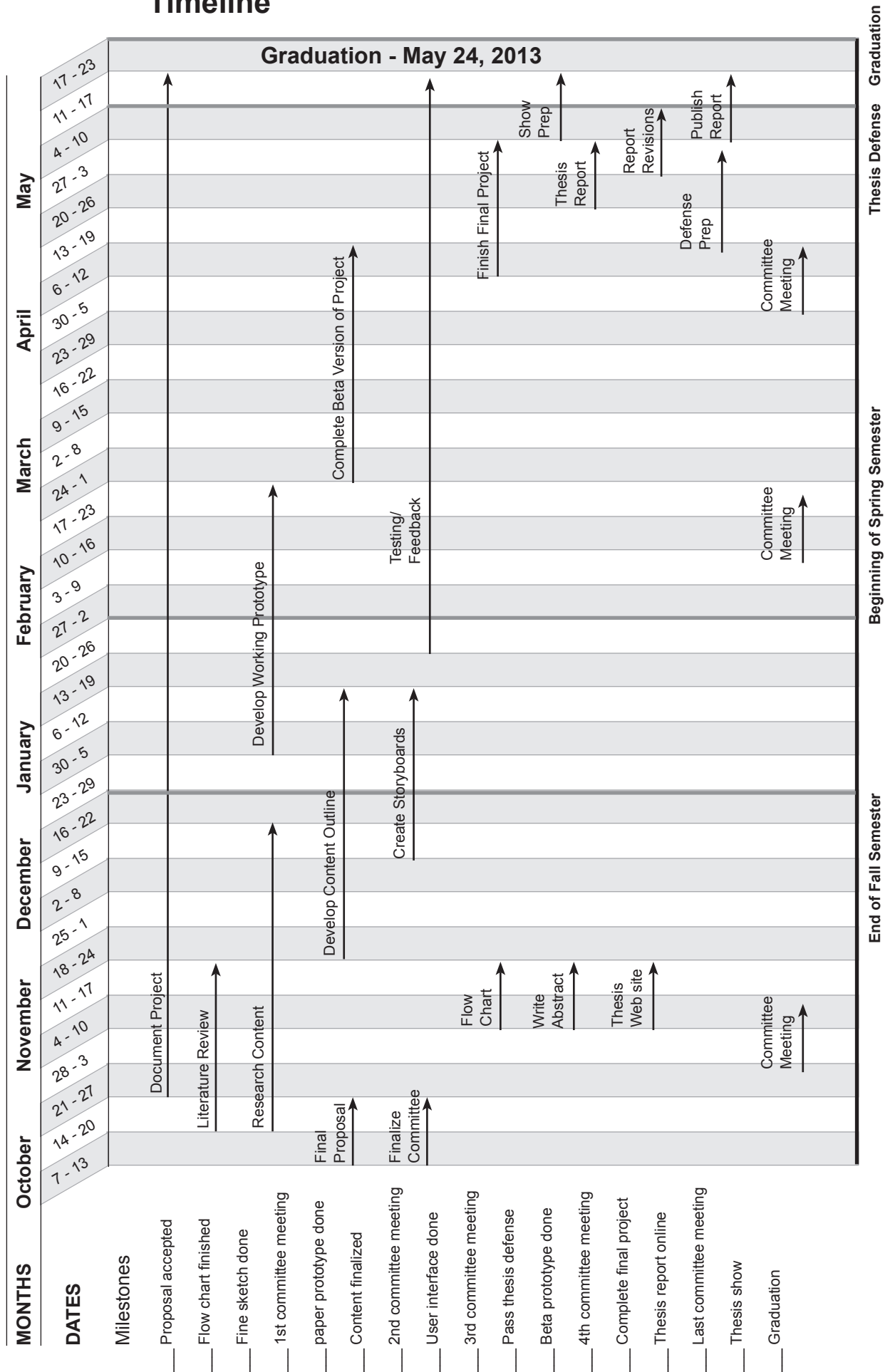
Summative Evaluation

Testers are asked to finish a simple questionnaire to determine whether the game is playable and desirable, but it takes a period of time to see the improvement of training the brain and hearing, so I am not able to track the long term improvement. The questionnaire includes some questions of whether the game makes you concentrate more or not, to evaluate the effectiveness of the product.

Pragmatic Considerations

Budget will not be the hindrance to this project since no physical object is required, all the design and technology are done under the software that are all available in the CGD lab.

Timeline



Bibliography

1. "65 Mobile Gaming Stats to Impress Your Friends." Skillz. <http://skillz.com/blog/2013/03/05/65-mobile-gaming-stats-to-impress-your-friends/> (accessed October 1, 2014).
2. Amen, Daniel G.. Change your brain, change your body: use your brain to get and keep the body you have always wanted : boost your brain to improve your weight, skin, heart, energy, and focus. New York: Harmony Books, 2010.
3. Crooks, Clayton E.. iPhone game development for teens. Boston: Course Technology/Cengage Learning, 2013.
4. Ferrara, John. Playful design creating game experiences in everyday interfaces. Brooklyn, N.Y.: Rosenfeld Media, 2012.
5. Wikimedia Foundation. "Game." Wikipedia. <http://en.wikipedia.org/wiki/Game> (accessed October 1, 2014).
6. Hannaford, Carla. The dominance factor: how knowing your dominant eye, ear, brain, hand & foot can improve your learning. Arlington, Va.: Great Ocean Publishers, 1997.
7. Jones, Matt, and Gary Marsden. Mobile interaction design. Chichester, England: John Wiley & Sons, 2006.
8. Kasongo, Enongo. "Hand-Ear Coordination." Musicology in the Flesh Papa Sangre Explorations. <http://enongo.wordpress.com/2012/03/07/hand-ear-coordination/> (accessed October 1, 2014).
9. Koster, Raph. "The Fundamentals of Game Design." Raphs Website. <http://www.raphkoster.com/2010/10/12/the-fundamentals-of-game-design/> (accessed October 1, 2014).
10. Koster, Raph. A theory of fun for game design. Scottsdale, AZ: Paraglyph Press, 2005.
11. Moscovich, Ivan. Big book of brain games: 1000 playthinks of art, mathematics & science. New York: Workman Pub., 20062001.
12. Salen, Katie, and Eric Zimmerman. Rules of play: game design fundamentals. Cambridge, Mass.: MIT Press, 2003.
13. Schell, Jesse. The art of game design: a book of lenses. Amsterdam: Elsevier/Morgan Kaufmann, 2008.
14. Tidwell, Jenifer. Designing interfaces. O'Reilly, 2006.
15. Wootton, Simon, and Terry Horne. Advanced brain training. London: Hodder Edu-

cation, 2012.

16. "therpgfanatic." 10 Simple Rules for Good Game Design. <http://www.giantbomb.com/profile/therpgfanatic/blog/10-simple-rules-for-good-game-design/61994/> (accessed October 1, 2014).

17. Perkins, Todd. ActionScript 3.0 for Adobe Flash CS3 professional: includes exercise files and demo movies. Berkeley, Calif.: Lynda.com/books :, 2009.

18. Szalavitz, Maia, and Maia Szalavitz. "Can You Hear Me Now? Training the Brain to Hear Better | TIME.com." Time. <http://healthland.time.com/2013/02/12/can-you-hear-me-now-training-the-brain-to-hear-better/> (accessed October 20, 2014).

19. "Improving the Human Condition: Brain Training for Better Hearing | BSOS College Website." Improving the Human Condition: Brain Training for Better Hearing | BSOS College Website. <http://www.bsos.umd.edu/messaging/Improving-Human-Condition-PSYC> (accessed October 20, 2014).

20. "About the study: Hearing is living." Hearing is living. <http://www.hear-the-world.com/en/hearing-and-hearing-loss/special-topics/hearing-is-living-a-study-by-hear-the-world/hearing-is-living-a-study-by-hear-the-world.html> (accessed October 20, 2014).

SURVEY OF LO-FI PROTOTYPE

1. You can understand the game is to complete the challenge based on the sound you hear.

Definitely can't Probably can't Probably can Definitely can

2. You can understand the challenge on each round.

Definitely can't Probably can't Probably can Definitely can

3. You can understand the way to win is to be quicker.

Definitely can't Probably can't Probably can Definitely can

4. You can understand where to tab on.

Definitely can't Probably can't Probably can Definitely can

5. What type of sounds do you prefer to play with? Pick 4 you prefer most.

Musical instrument sounds

Nature sounds

Abstract sounds

Sci-Fi sounds

Daily life sounds

Mechanical sounds

Animals sounds

Ambiance sounds

Figure 53: Survey For The Lo-fi Prototype

You can understand the game is to complete the challenge based on the sound you hear.

Answered: 18 Skipped: 0

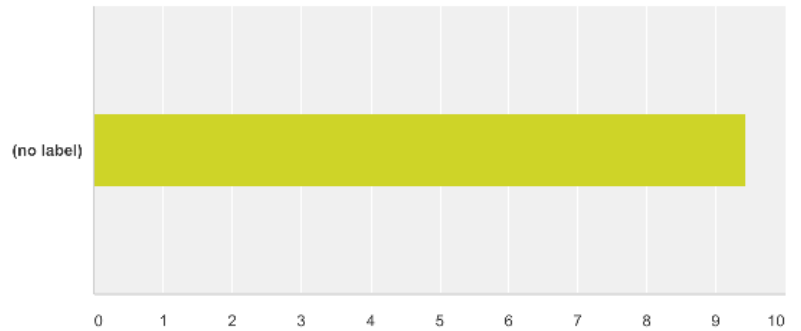
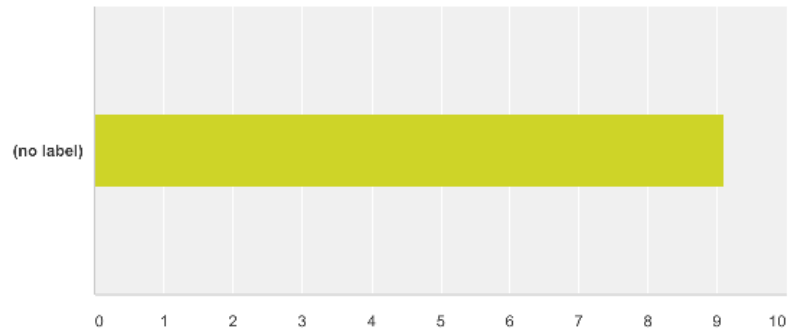


Figure 54: Result of Question 1

You can understand the challenge on each round.

Answered: 18 Skipped: 0

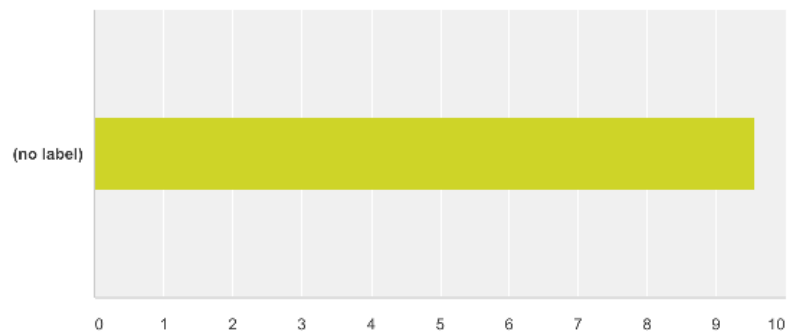


	Definitely can't	Probably can't	Probably can	Definitely can	Total	Weighted Average
(no label)	0.00% 0	0.00% 0	44.44% 8	55.56% 10	18	9.11

Figure 55: Result of Question 2

You can understand the way to win is to be quicker.

Answered: 18 Skipped: 0

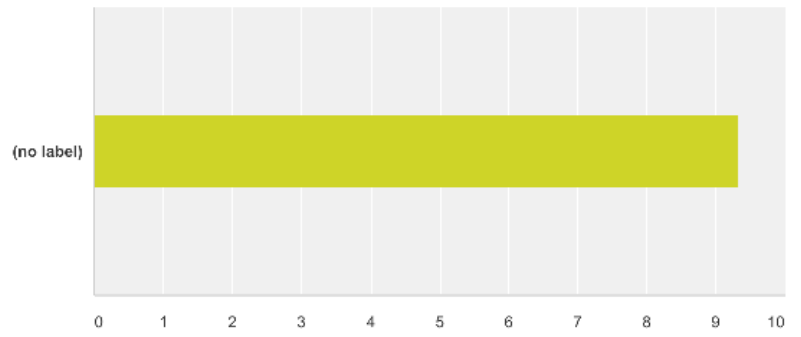


	Definitely can't	Probably can't	Probably can	Definitely can	Total	Weighted Average
(no label)	0.00% 0	0.00% 0	22.22% 4	77.78% 14	18	9.56

Figure 56: Result of Question 3

You can understand where to tab on.

Answered: 18 Skipped: 0

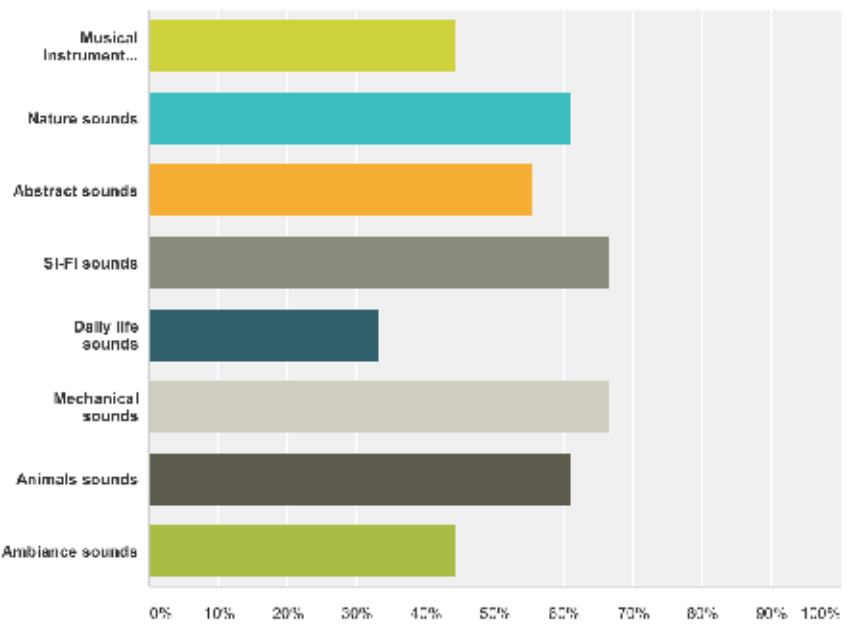


	Definitely can't	Probably can't	Probably can	Definitely can	Total	Weighted Average
(no label)	0.00% 0	0.00% 0	33.33% 6	66.67% 12	18	9.33

Figure 57: Result of Question 4

What type of sounds do you prefer to play with? Pick 4 you prefer most.

Answered: 18 Skipped: 0



Answer Choices	Responses
Musical instrument sounds	44.44% 8
Nature sounds	61.11% 11
Abstract sounds	55.56% 10
Si-Fi sounds	66.67% 12
Daily life sounds	33.33% 6
Mechanical sounds	66.67% 12
Animals sounds	61.11% 11
Ambiance sounds	44.44% 8
Total Respondents: 18	

Figure 58: Result of Question 5

**SURVEY OF
THE FINAL DEMO PROTOTYPE**

Sound Battle App Survey

1. Which of the following best describes the game you have seen? (please select one)

It is a game that you cooperate with other players to earn points.

It is a game that you compete with other players to earn points.

2. Which of the following best describes the rule you have seen? (please select one)

In each round, you have to complete the challenge based on the sound you hear.

In each round, you have to ignore the sound you hear to complete the challenge.

3. Do you have hard time understanding the challenge?

Yes, I do.

Not at all.

No, I don't.

4. Which of the following best describes the Explore button you have seen in standby mode? (please select one)

Tap on the button to look for players to start a new game.

Tap on the button to look for players to join an existing game.

5. Which of the following describes the Skills? (select as many as you think is correct)

You can see how much you were faster or slower than your friends.

You can see the ranking among your friends.

You can see your strongest ability and weakest ability.

You can see your wins and losses.

6. Which of the following describes the Friends? (select as many as you think is correct)

You can see if your friend is online or not.

You can see the level of each friend.

You can see the wins and losses of each friend.

You can see the strongest ability of each friend.

7. Which of the following best describes the Planets? (please select one)

It represents the planets you can play with and locked ones are for higher level.

It represents the planets you can buy and the rest are required purchase.

8. Can you see the tip/suggestion after level up?

Yes, I can see it.

No, I can't.

9. Do you know the tip/suggestion is about how to improve your weakest ability?

Yes, I do.

No, I don't.

10. How many rounds do you prefer to play in each game?

3 rounds

4 rounds

5 rounds

6 rounds

7 rounds

8 rounds

Figure 59: User 1 In Thesis Show

Sound Battle App Survey

1. Which of the following best describes the game you have seen?(please select one)

- It is a game that you cooperate with other players to earn scores.
- It is a game that you compete with other players to earn scores.

2. Which of the following best describes the rule you have seen?(please select one)

- In each round, you have to complete the challenge based on the sound you hear.
- In each round, you have to ignore the sound you hear to complete the challenge.

3. Do you have hard time understanding the challenge?

- Yes, I do.
- Sort of.
- No, I don't.

4. Which of the following best describes the Explore button you have seen in standby mode?(please select one)

- Tap on the button to look for players to start a new game.
- Tap on the button to look for players to join an existing game.

5. Which of the following describes the Status?(select as many as you think is correct)

- You can see how much you were faster or slower than your rivals.
- You can see the ranking among your friends.
- You can see your strongest ability and weakest ability.
- You can see your wins and losses.

6. Which of the following describes the Friends?(select as many as you think is correct)

- You can see if your friend is online or not.
- You can see the level of each friend.
- You can see the wins and losses of each friend.
- You can see the strongest ability of each friend.

7. Which of the following best describes the Planets?(please select one)

- It represents the planets you can play with and locked ones are for higher level.
- It represents the planets you are free and the rest are required purchase.

8. Can you see the tip/suggestion after level up?

- Yes, I can see it.
- No, I can't.

9. Do you know the tip/suggestion is about how to improve your weakest ability?

- Yes, I do.
- No, I don't.

10. How many rounds do you prefer to play in each game?

- 3 rounds
- 4 rounds
- 5 rounds
- 6 rounds
- 7 rounds
- 8 rounds

Figure 60: User 2 In Thesis Show

Sound Battle App Survey

1. Which of the following best describes the game you have seen?(please select one)

- It is a game that you cooperate with other players to earn scores.
- It is a game that you compete with other players to earn scores.

2. Which of the following best describes the rule you have seen?(please select one)

- Each round, you have to complete the challenge based on the sound you hear.
- In each round, you have to ignore the sound you hear to complete the challenge.

3. Do you have hard time understanding the challenge?

- Yes, I do.
- Sort of.
- No, I don't.

4. Which of the following best describes the Explore button you have seen in standby mode?(please select one)

- Tap on the button to look for players to start a new game.
- Tap on the button to look for players to join an existing game.

5. Which of the following describes the Status?(select as many as you think is correct)

- You can see how much you were faster or slower than your rivals.
- You can see the ranking among your friends.
- You can see your strongest ability and weakest ability.
- You can see your wins and losses.

6. Which of the following describes the Friends?(select as many as you think is correct)

- You can see if your friend is online or not.
- You can see the level of each friend.
- You can see the wins and losses of each friend.
- You can see the strongest ability of each friend.

7. Which of the following best describes the Planets?(please select one)

- It represents the planets you can play with and locked ones are for higher level.
- It represents the planets you are free and the rest are required purchase.

8. Can you see the tip/suggestion after level up?

- Yes, I can see it.
- No, I can't.

9. Do you know the tip/suggestion is about how to improve your weakest ability?

- Yes, I do.
- No, I don't.

10. How many rounds do you prefer to play in each game?

- 3 rounds
- 4 rounds
- 5 rounds
- 6 rounds
- 7 rounds
- 8 rounds

Figure 61: User 3 In Thesis Show

Sound Battle App Survey

1. Which of the following best describes the game you have seen?(please select one)

- It is a game that you cooperate with other players to earn scores.
- It is a game that you compete with other players to earn scores.

2. Which of the following best describes the rule you have seen?(please select one)

- In each round, you have to complete the challenge based on the sound you hear.
- In each round, you have to ignore the sound you hear to complete the challenge.

3. Do you have hard time understanding the challenge?

- Yes, I do.
- Sort of
- No, I can't

4. Which of the following best describes the Explore button you have seen in standby mode?(please select one)

- Tap on the button to look for players to start a new game.
- Tap on the button to look for players to join an existing game.

5. Which of the following describes the Status?(select as many as you think is correct)

- You can see how much you were faster or slower than your rivals.
- You can see the ranking among your friends.
- You can see your strongest ability and weakest ability.
- You can see your wins and losses.

6. Which of the following describes the Friends?(select as many as you think is correct)

- You can see if your friend is online or not.
- You can see the level of each friend.
- You can see the wins and losses of each friend.
- You can see the strongest ability of each friend.

7. Which of the following best describes the Planets?(please select one)

- It represents the planets you can play with and locked ones are for higher level.
- It represents the planets you are free and the rest are required purchase.

8. Can you see the tip/suggestion after level up?

- Yes, I can see it. *But missed it at first.*
- No, I can't.

9. Do you know the tip/suggestion is about how to improve your weakest ability?

- Yes, I do.
- No, I don't.

10. How many rounds do you prefer to play in each game?

- 3 rounds
- 4 rounds
- 5 rounds
- 6 rounds
- 7 rounds
- 8 rounds

Figure 62: User 4 In Thesis Show

Sound Battle App Survey

1. Which of the following best describes the game you have seen?(please select one)
 - It is a game that you cooperate with other players to earn scores.
 - It is a game that you compete with other players to earn scores.
2. Which of the following best describes the rule you have seen?(please select one)
 - In each round, you have to complete the challenge based on the sound you hear.
 - In each round, you have to ignore the sound you hear to complete the challenge.
3. Do you have hard time understanding the challenge?
 - Yes, I do.
 - Sort of.
 - No, I don't.
4. Which of the following best describes the Explore button you have seen in standby mode?(please select one)
 - Tap on the button to look for players to start a new game.
 - Tap on the button to look for players to join an existing game.
5. Which of the following describes the Status?(select as many as you think is correct)
 - You can see how much you were faster or slower than your rivals.
 - You can see the ranking among your friends.
 - You can see your strongest ability and weakest ability.
 - You can see your wins and losses.
6. Which of the following describes the Friends?(select as many as you think is correct)
 - You can see if your friend is online or not.
 - You can see the level of each friend.
 - You can see the wins and losses of each friend.
 - You can see the strongest ability of each friend.
7. Which of the following best describes the Planets?(please select one)
 - It represents the planets you can play with and locked ones are for higher level.
 - It represents the planets you are free and the rest are required purchase.
8. Can you see the tip/suggestion after level up?
 - Yes, I can see it.
 - No, I can't.
9. Do you know the tip/suggestion is about how to improve your weakest ability?
 - Yes, I do.
 - No, I don't.
10. How many rounds do you prefer to play in each game?
 - 3 rounds
 - 4 rounds
 - 5 rounds
 - 6 rounds
 - 7 rounds
 - 8 rounds

Figure 63: User 5 In Thesis Show

Sound Battle App Survey

1. Which of the following best describes the game you have seen?(please select one)

- It is a game that you cooperate with other players to earn scores.
- It is a game that you compete with other players to earn scores.

2. Which of the following best describes the rule you have seen?(please select one)

- In each round, you have to complete the challenge based on the sound you hear.
- In each round, you have to ignore the sound you hear to complete the challenge.

3. Do you have hard time understanding the challenge?

- Yes, I do.
- Sort of.
- No, I don't.

4. Which of the following best describes the Explore button you have seen in standby mode?(please select one)

- Tap on the button to look for players to start a new game.
- Tap on the button to look for players to join an existing game.

5. Which of the following describes the Status?(select as many as you think is correct)

- You can see how much you were faster or slower than your rivals.
- You can see the ranking among your friends.
- You can see your strongest ability and weakest ability.
- You can see your wins and losses.

6. Which of the following describes the Friends?(select as many as you think is correct)

- You can see if your friend is online or not.
- You can see the level of each friend.
- You can see the wins and losses of each friend.
- You can see the strongest ability of each friend.

7. Which of the following best describes the Planets?(please select one)

- It represents the planets you can play with and locked ones are for higher level.
- It represents the planets you are free and the rest are required purchase.

8. Can you see the tip/suggestion after level up?

- Yes, I can see it.
- No, I can't.

9. Do you know the tip/suggestion is about how to improve your weakest ability?

- Yes, I do.
- No, I don't.

10. How many rounds do you prefer to play in each game?

- 3 rounds
- 4 rounds
- 5 rounds
- 6 rounds
- 7 rounds
- 8 rounds

Figure 64: User 6 In Thesis Show

Sound Battle App Survey

1. Which of the following best describes the game you have seen?(please select one)

- It is a game that you cooperate with other players to earn scores.
- It is a game that you compete with other players to earn scores.

2. Which of the following best describes the rule you have seen?(please select one)

- In each round, you have to complete the challenge based on the sound you hear.
- In each round, you have to ignore the sound you hear to complete the challenge.

3. Do you have hard time understanding the challenge?

- Yes, I do.
- Sort of.
- No, I don't

4. Which of the following best describes the Explore button you have seen in standby mode?(please select one)

- Tap on the button to look for players to start a new game.
- Tap on the button to look for players to join an existing game.

5. Which of the following describes the Status?(select as many as you think is correct)

- You can see how much you were faster or slower than your rivals.
- You can see the ranking among your friends.
- You can see your strongest ability and weakest ability.
- You can see your wins and losses.

6. Which of the following describes the Friends?(select as many as you think is correct)

- You can see if your friend is online or not.
- You can see the level of each friend.
- You can see the wins and losses of each friend.
- You can see the strongest ability of each friend.

7. Which of the following best describes the Planets?(please select one)

- It represents the planets you can play with and locked ones are for higher level.
- It represents the planets you are free and the rest are required purchase.

8. Can you see the tip/suggestion after level up?

- Yes, I can see it.
- No, I can't.

9. Do you know the tip/suggestion is about how to improve your weakest ability?

- Yes, I do.
- No, I don't.

10. How many rounds do you prefer to play in each game?

- 3 rounds
- 4 rounds
- 5 rounds
- 6 rounds
- 7 rounds
- 8 rounds

Figure 65: User 7 In Thesis Show

BIBLIOGRAPHY

1. "65 Mobile Gaming Stats to Impress Your Friends." Skillz. <http://skillz.com/blog/2013/03/05/65-mobile-gaming-stats-to-impress-your-friends/> (accessed October 1, 2014).
2. Amen, Daniel G.. Change your brain, change your body: use your brain to get and keep the body you have always wanted : boost your brain to improve your weight, skin, heart, energy, and focus. New York: Harmony Books, 2010.
3. Crooks, Clayton E.. iPhone game development for teens. Boston: Course Technology/Cengage Learning, 2013.
4. Ferrara, John. Playful design creating game experiences in everyday interfaces. Brooklyn, N.Y.: Rosenfeld Media, 2012.
5. Wikimedia Foundation. "Game." Wikipedia. <http://en.wikipedia.org/wiki/Game> (accessed October 1, 2014).
6. Hannaford, Carla. The dominance factor: how knowing your dominant eye, ear, brain, hand & foot can improve your learning. Arlington, Va.: Great Ocean Publishers, 1997.
7. Jones, Matt, and Gary Marsden. Mobile interaction design. Chichester, England: John Wiley & Sons, 2006.
8. Kasongo, Enongo. "Hand-Ear Coordination." Musicology in the Flesh Papa Sangre Explorations. <http://enongo.wordpress.com/2012/03/07/hand-ear-coordination/> (accessed October 1, 2014).
9. Koster, Raph. "The Fundamentals of Game Design." Raphs Website. <http://www.raphkoster.com/2010/10/12/the-fundamentals-of-game-design/> (accessed October 1, 2014).
10. Koster, Raph. A theory of fun for game design. Scottsdale, AZ: Paraglyph Press, 2005.
11. Moscovich, Ivan. Big book of brain games: 1000 playthinks of art, mathematics & science. New York: Workman Pub., 20062001.
12. Salen, Katie, and Eric Zimmerman. Rules of play: game design fundamentals. Cambridge, Mass.: MIT Press, 2003.
13. Schell, Jesse. The art of game design: a book of lenses. Amsterdam: Elsevier/Morgan Kaufmann, 2008.
14. Tidwell, Jenifer. Designing interfaces. O'Reilly, 2006.
15. Wootton, Simon, and Terry Horne. Advanced brain training. London: Hodder Education, 2012.

16. "therpgfanatic." 10 Simple Rules for Good Game Design. <http://www.giantbomb.com/profile/therpgfanatic/blog/10-simple-rules-for-good-game-design/61994/> (accessed October 1, 2014).
17. Perkins, Todd. ActionScript 3.0 for Adobe Flash CS3 professional: includes exercise files and demo movies. Berkeley, Calif.: Lynda.com/books :, 2009.
18. Szalavitz, Maia, and Maia Szalavitz. "Can You Hear Me Now? Training the Brain to Hear Better | TIME.com." Time. <http://healthland.time.com/2013/02/12/can-you-hear-me-now-training-the-brain-to-hear-better/> (accessed October 20, 2014).
19. "Improving the Human Condition: Brain Training for Better Hearing | BSOS College Website." Improving the Human Condition: Brain Training for Better Hearing | BSOS College Website. <http://www.bsos.umd.edu/messaging/Improving-Human-Condition-PSYC> (accessed October 20, 2014).
20. "About the study: Hearing is living." Hearing is living. <http://www.hear-the-world.com/en/hearing-and-hearing-loss/special-topics/hearing-is-living-a-study-by-hear-the-world/hearing-is-living-a-study-by-hear-the-world.html> (accessed October 20, 2014).