**A Video Game to Help Children with ASD Combat Multiple Stimuli Issues Called: The Great Audio Race**

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**Executive Summary**

Autism Spectrum Disorder (ASD) is a problem affecting not only millions of children but also millions of teens across the world. ASD is hard to treat and sometimes teens are overlooked, especially in creating fun therapeutic methods.

Our task was to make a game that serves as a method of therapy, was completely customizable, gave positive reinforcement, and was to be completed on time.

The purpose of this document is to present our project, The Great Audio Race, and discuss how it is a great game to counteract the symptoms of ASD commonly found in teens and older children, and more specifically issues related to dealing with multiple stimuli.

We chose to offer complete customization by having the player pick any song they prefer. People have very diverse tastes in music, so this is a way to cater to their individual needs. There is a visual connection with what they hear, as the map builds on each song uniquely, and there is a personal gameplay experience.

We are here to present what we feel is a finished product that will help millions of ASD patients across the planet to become more adjusted to dealing with multiple stimuli.

For our design, we wanted to attack the multiple symptoms of ASD. We made total customization in terms of what they see and hear. Players simply choose their own song. When a song is selected, a totally customized map will be playable for the user. We made it easy to understand gameplay. Our game appeals to older ages as well. Our main features and benefits deal with age, complexity of what it does, yet simplicity in what you see. Essentially we took the very loft goal of giving each user of the game a completely unique gameplay and made it possible. We believe this is a very powerful game and has a lot of potential in the sense that we target an older audience with a potential for highly engaging gameplay.

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**1.0 Introduction**

This game was designed to help students with a problem and a background with ASD. We specifically tackled the older age group due to the motivation behind the original game design, as well as the marketability of such a product. The game had certain task and requirements we had to fulfill, in which we did so.

*1.1 Motivation*

A major motivational factor for this game was team member Brandon Scott’s older sister. At the beginning of the project everyone had to sit down and propose a game that they thought would help revolutionize the gaming industry, but that also helped with ASD. With this hitting Brandon with a sense of reality, since he comes from a long line of family members with ASD, he hoped to propose a game that would help people more like his sister.

When drafting up the proposal he knew he couldn’t go based solely off of just his sister, so he set out to have interviews with families like his own. He interviews roughly three families that he knew had older children with Autism. Each family said the same thing, that as their children got older, they had a harder time reacting to multiple things at once. So then Brandon set out to design a game that he thought would help these students with these problems, as we as be fun and enjoyable for them.

*1.2 Tasks*

At the beginning of the project each team was given a set of task that their game must have in-order to be adequately scored during the final release. The tasks included: a prevalent combativeness to ASD, a game with a positive reinforcement, customizability, and having a complete game. All of this was done and done as the highest level of sophistication that the team could provide with the amount of time constraints given.

1. **Objective**

The main objective of this project was to create a game that met all criteria, was completed within all constraints, and was released for final viewing on the drop-dead date.

*2.1 Criteria*

There was a set criterion that each team during this project had to fulfill. Those included: have an obvious therapeutic value, be very customizable, have positive reinforcement, and be completed on time. We completed each of these at a higher that sufficient rate.

*2.2 Constraints*

The team had many constraints on this project, the top one being time. We were given set dates for the alpha release, beta release, and final release. Also, we were given set dates to have our Technical Communication papers due as well.

The other major constraint we had was within the game itself. We took up a majority of our time trying to analyze the data we collected through the Fast Fourier Transform method, and that process took more than two weeks longer than we anticipated, setting back the entire project.

**3.0 Features**

The Great Audio Race has many great features within it; the most notably being the game is completely customizable. The game was built on the foundation of being able to create your own game with the single choice of a song.

*3.1 Customizability*

The greatest aspect of this game is really the customizability. The heart of the entire game is based around this one key concept. When the user clicks play, they are brought to a screen in which they select a song and a map is generated for them to use based on the song they selected. Pure customization is when the entire game is not how we create it, but how the user creates it and that’s exactly what this aspect of the game is doing.

*3.1.1 Difficulty Settings*

The game itself isn’t the only aspect of the game that is completely customizable. Also, the user has the choice of what pace they want to play the game. They can change the pace at which the asteroids come at them, which is the difficulty level of the game. This comes into major effect when the player is starting to have too easy of a time wit the easier difficultly level, or if the therapist wants to see how well they react at faster speeds, since ASD patients have problems reacting to multiple stimuli and have even a harder time making quick reacting decisions.

*3.1.2 Color Scheme*

To some ASD patients all of this could be a little overwhelming, so to combat that we made our game have a selection of multiple colors. The user can change the color of the screen menus, as well as the color of their rocketship. This will give the user a much more “at home” feeling while playing the game and may help to lighten the distractions a little bit, especially for someone just starting out or for someone with a severe case of ASD.

*3.2 Benefits*

The benefits that could stem from playing The Great Audio Race are endless. Starting from the core benefit of reacting to multiple stimuli down to the benefit of simple pleasure of listening to your favorite song.

The major benefit that is incorporated within The Great Audio Race is the reaction of the user with multiple stimuli. While playing this game the user has many things to do. They must listen to music, dodge obstacles that coincide with the music, collect coins, and they can’t lose all their lives. This may seem like a lot for one person to handle, but the average human being can do it without as much as thinking about it. For someone with ASD this could become increasingly harder, especially with the severity of his or her condition.

The other great underlying benefit of this game is simple the gameplay itself. The user gets to enjoy their own music while playing an enjoying game. This is a key concept we like to push forth because not many therapeutic games are enjoyable. They become tedious and less and less unfulfilling. However, with The Great Audio Race, the user never feels that way.

1. **Meeting the Criteria**

The criteria for this project, which was outlined in section 2.1 of this report, seem like basic criteria for any project. However, since this had to be done over the course of only a semester, the work behind it became very strenuous.

*4.1 Obvious Therapeutic Value*

The most important aspect of this game is it has to have an obvious therapeutic value to it. This game has therapeutic value written all over it. As the user moves through the game they are caught with the challenge of dodging and weaving through obstacles, while simultaneously attempting to listen to music and collect coins for points.

This is therapeutic because of the reaction to multiple stimuli that the user has to perform. In interviewing families, Brandon was able to find out that the hardest struggle for the parents was to have their son or daughter respond to multiple things at once. For example being able to listen to directions while also doing a task at hand. This can become quite a problem for families, especially in situations in which time management and multitasking is a key aspect of their daily lives. A game like this allows the children to learn how to be able to respond to such things, thus giving it much therapeutic value.

*4.2 Customizability*

Customizability became one of the main criteria for this project when we found out during a lecture from a guest speaker that each case of ASD is different. Therefore, there must be some sort of customizability within the game that helps them feel more at home while playing the game.

The greatest aspect of The Great Audio Race is the fact that the game is entirely customizable. From the second the player clicks the play button they are customizing the game to their liking. They select the song of choice and the game will be generated based on the selection of the user. No other game can say that the entire goal of their game is based purely on the user input, which is why The Great Audio Race has the upper hand when it comes to customizability.

*4.3 Have Positive Reinforcements*

When listening to the guest speakers we learned that children with ASD have a high need for positive reinforcement. It will allow them to start to progress better as well as show them that they are doing well within the game. The Great Audio Race does have a reinforcement system that is obscure enough to not make the teenage user feel like a child, but prominent enough to allow them to know that they are in fact doing well within the game.

The positive reinforcement system within the game is the score they receive as they play. As the player progresses through the song they will receive points for how far they have gotten into the game and can earn more points by collecting coins. There is no flashy images that reward the user because teenage students don’t like those types of things. When dealing with people who have ASD that are teenagers you have to understand where they come from. In an interview with one student who has mild ASD and is eighteen he stated, “I just want to feel like everyone else, I don’t need to be babied, I just need extra time to understand.” So that’s why this game doesn’t produce flashy images with a victory. This game targets teenagers and teenagers are just trying to fit in.

*4.4 Game Completion*

The obviously most crucial criteria for the game was the game being complete by the drop-dead date of December 11th at 11:55 pm. This was the toughest aspect for our team because we ran into early problems with actually getting the game to function, and our collision detection had troubles. We had troubles with our right side obstacles picture timing match up with their actual collision detection. This set us back roughly three days at the end of the project, which wasn’t anticipated. However, through the painstaking work the team did complete the game on time, which was quintessential within the game itself.

1. **Major Design Decisions**

Meeting the criteria of designing a therapeutic game for people afflicted with ASD was a major drive in making our game. The game design was based solely on the idea of customization. Customization is an important element in treating ASD, because having a variety of options appeals to a wide audience of autistic people with different problems. Not only can the player customize the rocket ship, but the whole map is customizable depending on the song selection.

Another decision made was the placement of the rocket ship. The decision was made of having the player on the bottom of the screen moving left to right, rather than having the idea of the screen coming at you in a 3D way as described in the proposal. It was believed that this would be an easier experience for the player and a more desirable way to view the game.

The decision of having a rewards system was based on having a therapeutic benefit of being successful in the game. When the player collects coins or avoids obstacles, there is a score awarded to the player. The scores are placed in the high scores menu to view the progress and success of the player.

*5.1 Alternative designs*

Using a different point system was a design that was debated. The system was based on the Guitar Hero point system, and this was not used because it did not meet the requirements of having multiple lives.

Having the player on the left hand of the screen, rather than the bottom, was also debated. The player would be positioned on the left, with objects coming from right to left horizontally. The player would move up and down. This was not used because of easier figure placement to have a person use left and right arrow keys, and it also a better visual placement.

1. **Potential Drawbacks**

The Great Audio Race was made in a very limited time, so of course there were some details that could have been further developed with more time. The graphics might not have been as great as we wanted. With more time, the game could have been fully polished to look outstanding. There was also a faulty collision detection. Sometimes the collisions were a little buggy. A majority of our project dealt with figuring out the main algorithm for developing a map based on a song, so much of our time was taken up from this. Once this was developed, there was not as much time as would have been desired to make a game without drawbacks.

**7.0 Testing**

Testing for The Great Audio Race was probably the most difficult aspect of creating the game. The most difficult aspect was having the program understand the change in the amplitude. The team did a top to bottom method with having the overhead code pre-written, then the team split up the duties of making the smaller modules for each part; the most daunting of those being the method that recognized the music. The team would test this by having a block appear each time. The other testing aspect that took up the most time was collision detection on the right side. The game would move much slower than the actually objects would causing the right hand side of the map to crash. The team would test this by slightly editing the code then going through and playing the game. Despite all of this, the game was still successfully finished on time and all aspect of the game work correctly.

**References**

(N. Berlincourt, personal communication, September, 2011)

**Appendix C**

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| --- | --- |
|  | 🞂[User Documentation: The Great Audio Race]  [Created by: That1Group] |
|  |  |
|  | Description: Description: Mac OS X:Users:brandonscott:Downloads:Game Logo.png |
|  |  |

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Engineering 100.650

The Great Audio Race

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## System Requirements

[System Requirements]

To run this game, any computer running a modern version of Windows , Mac OS X, or Linux will work.

* Eclipse must be installed.
* Numpy and Scipy Python libraries must be installed.
* Even on modern computers, the game may take a few seconds to load due to the amount of data being collected and processed.

[Main Menu]

Summary:

This is the screen that will be seen originally at the start up of the game. It has four buttons on it that include: Play, Exit, High Scores, and Settings. Each tab leads to a new screen within the game. If the Play button is clicked, the player is brought directly to the screen in-order to begin playing *The Great Audio Race.* If the High Score button is clicked, the player will be directed to the screen to see all of the top scores of that player on the local machine they are playing on. If the Settings button is clicked, the user will be brought to a screen that allows them to customize the game thoroughly. Finally, if the Exit button is clicked the user will exit from the game.

Detailed Information:

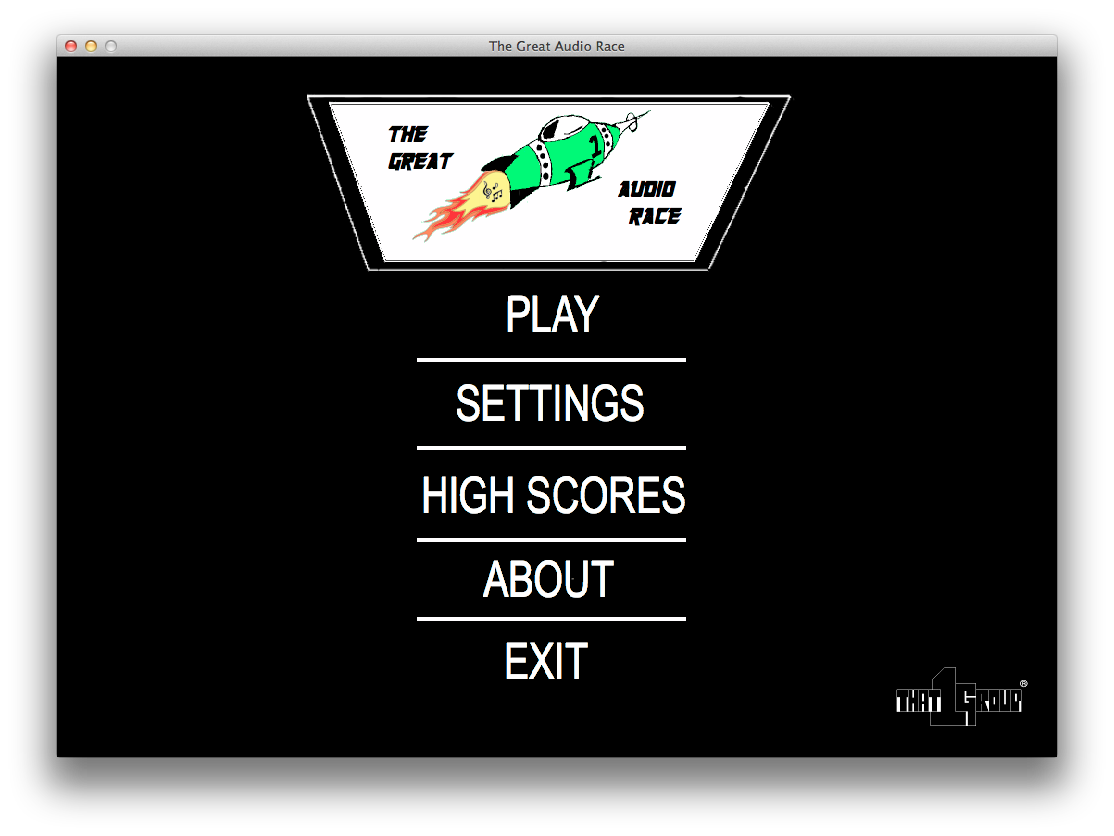
The Main Menu is a file of it’s own that is called upon by the MainGame.py file. When the screen is brought up there are five working and visible options for the user to choose from. They can choose between Settings, Play, High Score, About, and Exit.

As a player clicks the High Scores button they will be brought to a screen with a list of players that have successfully finished the game along with their score within the game. As the user finishes songs and earns points a top ten list will be provided on the screen. This will include the users initials as well as the score that they received in game.

As the player clicks the Play button then would be brought to a screen that will generate a map based on the song they have selected. They will then begin to the play the game until they have successfully finished the song.

As the player clicks the About button they will be brought to a screen that gives the information about the game. They will be taught about the reasons for the games creation as well as its help in the battle against ASD.

As the player clicks the Settings button they will be brought to a screen with a list of customizable options for them to select from. They can select the difficulty of their game, this being the speed of the game, the amount of obstacles, as well as life total. They can also change the menu colors from the original green color that we have provided for them, and they can also change the color of the rocket ship, changed from the color that is provided at the current time. This will allow for full customization to make the user feel much more comfortable while playing *The Great Audio Race*.



[About]

Summary:

This module describes the About Menu, which is accessed by clicking the “About” option on the main menu. It describes the therapeutic values as well as the goals of our game. The therapeutic values are that the user, usually a patient with ASD, will be able to react and develop the skills needed to react to multiple stimuli simultaneously. Patients that play this game will usually have problems reacting to multiple things that are going on at simultaneous events. With *The Great Audio Race* they will be able to adhere to attempting to fix this problem by completing the ultimate goal of our game, which is for the patient to receive maximum score on our hardest difficulty with their favorite song.

Detailed Information:

The therapeutic values of this game are to help the user adhere to multiple stimuli at simultaneous times. The game idea sprung from project founder Brandon Scott’s sister. He sat down with his sister and his parents and asked them what they thought was the hardest thing for Regina, his autistic sister, to deal with. They said that she had difficulty reacting to multiple things at one time, especially while she listened to music. Therefore, Brandon thought that a game that incorporated both reaction and music would be very helpful for patients with ASD.

The idea behind the game is that users wilave to dodge obstacles and follow a path based on the frequency behind their favorite songs. This will allow them to focus on two things at once both music and collision. The user will react simultaneously to obstacles that generate as well as the map that generates that they can’t see. We as the creators are confident this will help people with ASD attain a much better ability to be able to adapt to situations that they would usually not be able to handle the pressure of overwhelming situations.

The goal of the team is that patients with ASD will walk away after using this therapeutic item with a better grasp on adhering to multiple stimuli at one time. With this game the ASD patient should have a better understanding of decision making as well. Since people with ASD have a very difficult time with making their own decisions, this game has an underlying theme of making sure that the user will be able to make quick time decisions. Usually people with ASD have problems with driving cars, living by themselves, and even simple things like choosing what they want to get when they go out to eat. With this game, we hope that the user will be taking one step closer to being able to make their own decisions. We don’t except them to be drastic changes, but steps in the right directions.



[Play]

Summary:

Pressing the play button starts the main game loop. After being pressed, the person playing the game will select an audio file from their computer that will generate the level they are about to play. Once a track is selected, the main player object (a rocketship) will appear at the bottom of the screen. Obstacles, such as asteroids and other space objects, will appear based on the difficulty of the song selected. The person playing the game has the responsibility to avoid the falling and appearing obstacles on the screen. Obstacles will scroll down the screen, and the person playing the game will have the ability to move the spaceship left or right with the arrow keys.

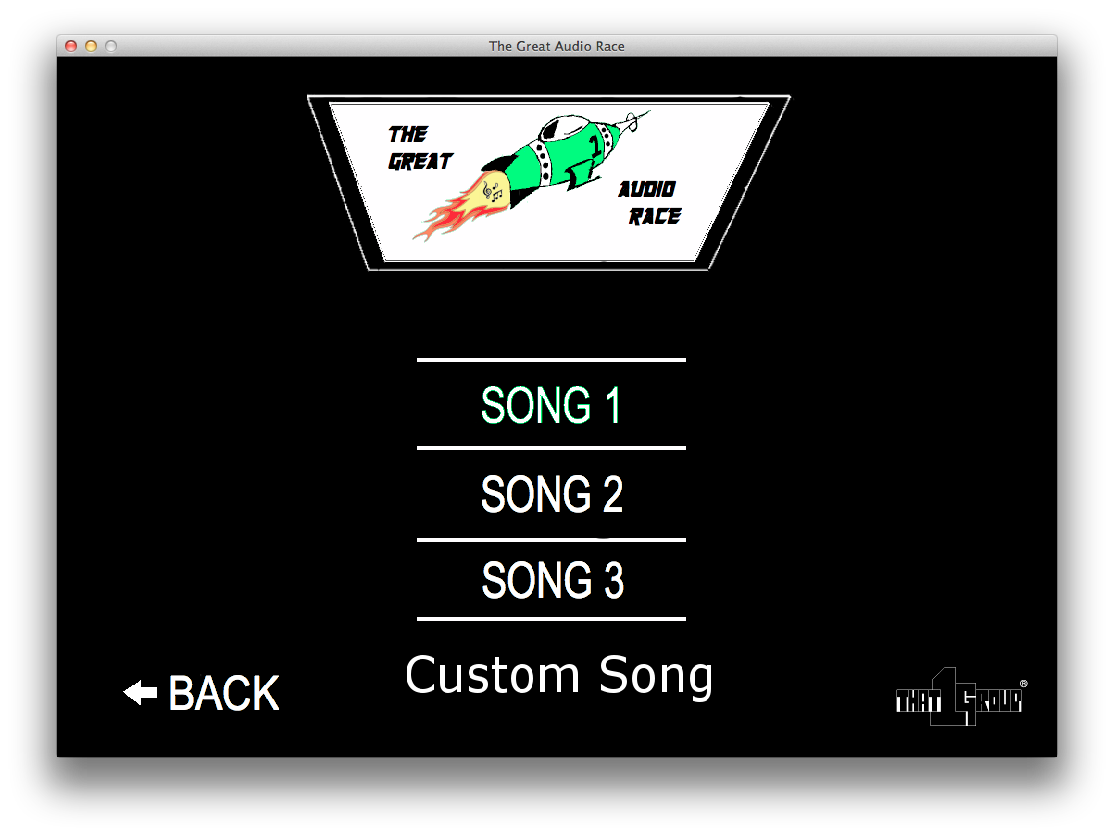
Detailed Information:

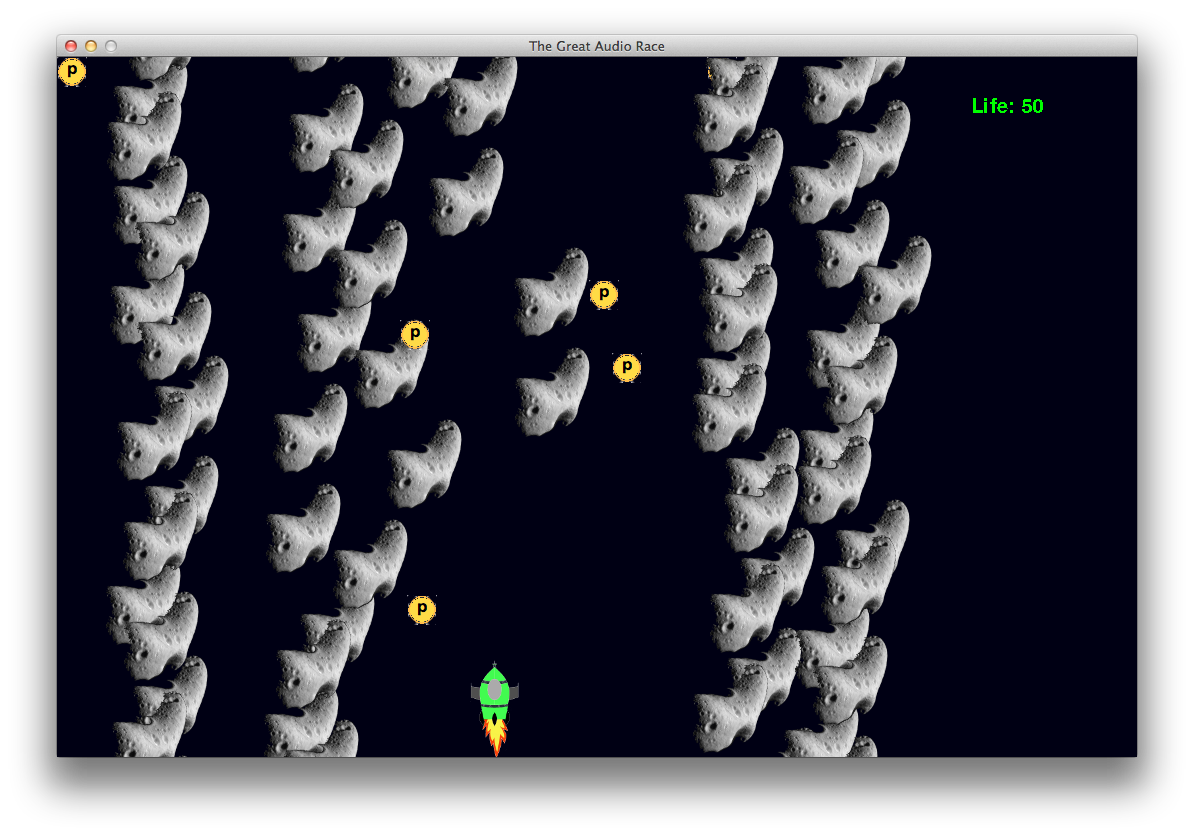
This module describes the Play button and what happens when it is clicked. When the play button is clicked on the main menu, the main game loop method is called from the Main.py file. The previous main menu interface will disappear and will be replaced by a menu that allows the user to select a music file from their music directory folder on their computer. After a song is selected, the menu will disappear and the main game interface will show. The song will be analyzed and a level will be created to correspond to the frequency, tone, and pace of the song.

The main objective of the game is for the player to move the rocket ship left or right to avoid the falling and randomly appearing asteroids and other obstacles on the screen. If the song selected has a faster pace, or higher frequency, more asteroids and obstacles will appear on screen for the player to avoid. The more obstacles the player avoids, the more points they will be rewarded. After so many points have been collected, more health will be added to the player’s health bar.

If the rocket collides with any of the asteroids or other obstacles, the rocketship will be returned to the center of the screen. If gameplay is in “easy” mode, then no health will be subtracted from the player. However, if gameplay is in “medium” or “hard” mode then health will be lost each time a collision occurs.

When the end of a level (song) has been reached successfully, the screen will transition to a congratulations screen where an animation of the rocket ship and the number of points awarded will be shown. After a few seconds, the view will transition to the high score screen. If the player looses all health, they will be prompted to either select a different song or try the same song again, perhaps at an easier level of difficulty.





[Settings]

Summary:

The Settings Menu is the menu that customizes the game. It contains various buttons that can be toggled by the user to have a more customizable and personal experience when playing the *Great Audio Race.* The options that can be edited are Difficulty, Menu Colors, and Rocketship Colors. The user has the ability to toggle what difficulty setting and what game colors that the individual will enjoy.

Detailed Information:

This module describes the Settings Menu, which is one of the five choices that the user can choose from in the Main Menu. When this screen loads there will be three different options to choose from with multiple buttons to toggle. The player has the options of: Difficulty, Menu Colors, and Rocketship Colors. Whether it is the user, a therapist, a doctor, or the user’s parents, the options can be customized to have the best experience possible.

As the player clicks the Settings button they will be brought to a screen with a list of options for them to customize. They can select the difficulty of their game, this being the speed of the game, the amount of obstacles, as well as life total. The buttons that can be toggled for difficulty are Easy, Medium, and Hard. When the level of difficulty is selected, the button will have a white font, while the other difficulty buttons will appear as the preselected menu colors.

The player also has the option to select the Menu Colors. This allows the player to choose a favorite color for the menu layouts out of the six colors that have been provided to be selected from. There are at total of six colors to choose from, and the default color is green. When a color is changed, all of the titles and words will change to the preferred color.

The final option to edit is the rocketship’s color. The player can make the rocketship a color of their choice. These choices are the same color choices that the user can select for their menu colors. This is so the user can have a more uniform game if they so choose.

This menu is vital for *The Great Audio Race.* It gives the game versatility and helps aid the user by not overwhelming them at one time. If gives them the ability to have some customization, but not so much that the game doesn’t do what it is entitled to do. The game is trying to make the user react to multiple stimuli at once, however it is understand that too much at once can be negative, and the Settings Menu allows for a smooth transition.



[High Scores]

Summary:

This module describes the function of the High Scores menu as well as the ability to track a user’s progress based on the difference in scores. The High Scores menu is a basic menu that is used to track the greatest scores achieved by the users while playing the game. These scores can in turn be compared to determine if a specific user is progressing.

Detailed Information:

The High Scores menu will be used to display the highest scores achieved by all users. Each entry will have the user’s initials aligned along the left side of the screen and the corresponding score aligned on the right side of the screen. The scores will be listed in descending order with the highest score at the top of the screen. The ranking of the stored scores will create a competitive nature in the game. The user will always be trying to achieve a greater score and to secure a spot higher in the menu.

The scores that are assigned won’t be specific to each song or difficulty but rather a generalization of both factors. If a song is quick, and the difficulty is set to hard, the user will have more opportunities to gain points. However, if the user selects a harder difficulty, it will be harder to earn the points. This generalization allows for the tracking of progress for a user without the need to repeatedly use the same song or the same difficulty.

The high scores can be used to track the progress of a certain user. By comparing each score that the user receives with the old scores they have obtained, a trend is created on whether the user is adapting to the gaming and progressing. Positive trends suggest that the user is doing well and is able to understand the task at hand while negative trends can signal a lack of understanding. A negative trend doesn’t necessarily mean the user isn’t progressing, a lower difficulty or slower song may be recommended to set a base score.

Each High Scores menu will be localized meaning that the high scores stored in one users’ computer won’t reflect the high scores of another users’ computer. This allows for the tracking of each users progress to be clear and coherent because other scores won’t fill up the spaces on the high scores menu.

