

IMPLEMENTING ALPHA AND BETA WHITE NOISE IN A BRAIN-CONTROLLED DRONE SIMULATION



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ABSTRACT

Controlling the drones in the simulation requires a lot of concentration. Therefore, the games featured in the simulation could be used as training to increase the attention retention levels of people with Attention-Deficit Hyperactivity Disorder (ADHD) or with low concentration levels in general. They could even be used in future experiments to study the concentration and relaxation levels of a participant. For the purposes of this work two minigames were developed one to help the player concentrate and another to help the player relax. The first minigame consists of an endless track which auto-generates as the user progresses. The second features instructions and timers for different breathing exercises. Background Beta white noise was implemented in the first game to increase concentration levels and in the second background Alpha white noise was implemented to increase relaxation levels. The beta and alpha white noise minigames were successful in creating tests that scientists will be able to use in their experiments related to beta and alpha brain waves.

Introduction

- Brain-Computer Interface (BCI) technology is a versatile and effective tool for reading brain waves
- Beta waves are present when we are concentrating, or in a state of high alert
- Alpha waves are present when we are in a relaxed state of being
- BCIs take can translate brain signals into usable computer inputs
- BCI assisted video games make them accessible for people with disabilities and would create a level playing field for all players

Methodology (Beta)

Beta white noise (Endless Track)

- Added drone model to the scene
- Prefabricated map pieces
- Programmed player movement
- Created a list and filled it 10 map pieces
- Implemented an algorithm to track the drone's location and, add and delete map pieces as required
- Measured the users distance traveled and the time active

Results (Beta)

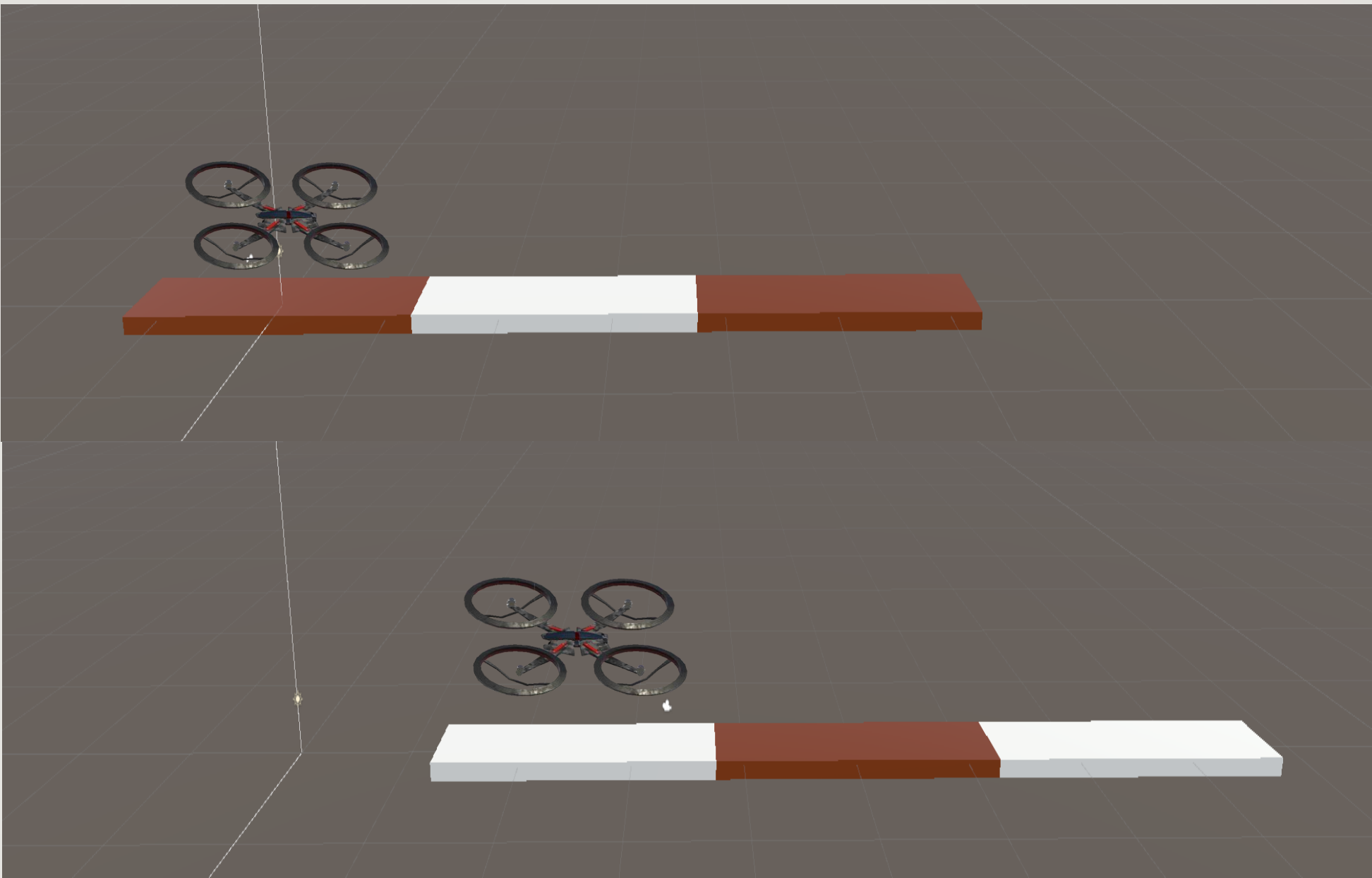


Figure 1. Visual representation of adding and deleting map pieces (drone size exaggerated for emphasis)

Piece List	List 2	List 3	List 4
1. (1 st piece)	1. (1 st piece)	1. (n/a)	1. (2 nd piece)
2. (2 nd piece)	2. (2 nd piece)	2. (2 nd piece)	2. (3 rd piece)
3. (3 rd piece)	3. (3 rd piece)	3. (3 rd piece)	3. (4 th piece)
4. (n/a)	4. (4 th piece)	4. (4 th piece)	4. (n/a)

Table 1. Representation of the List in the algorithm

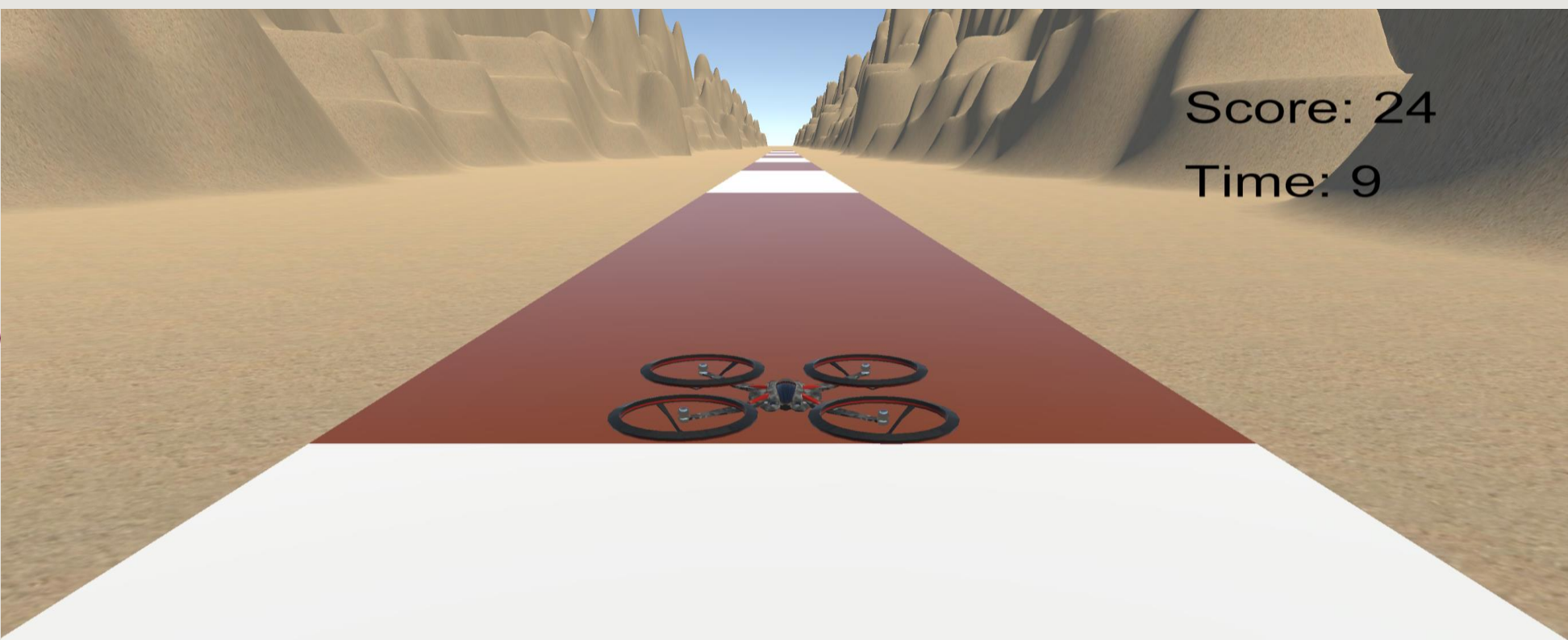


Figure 2. Screenshot of the Beta white noise minigame in-use (with the track score and time displayed)

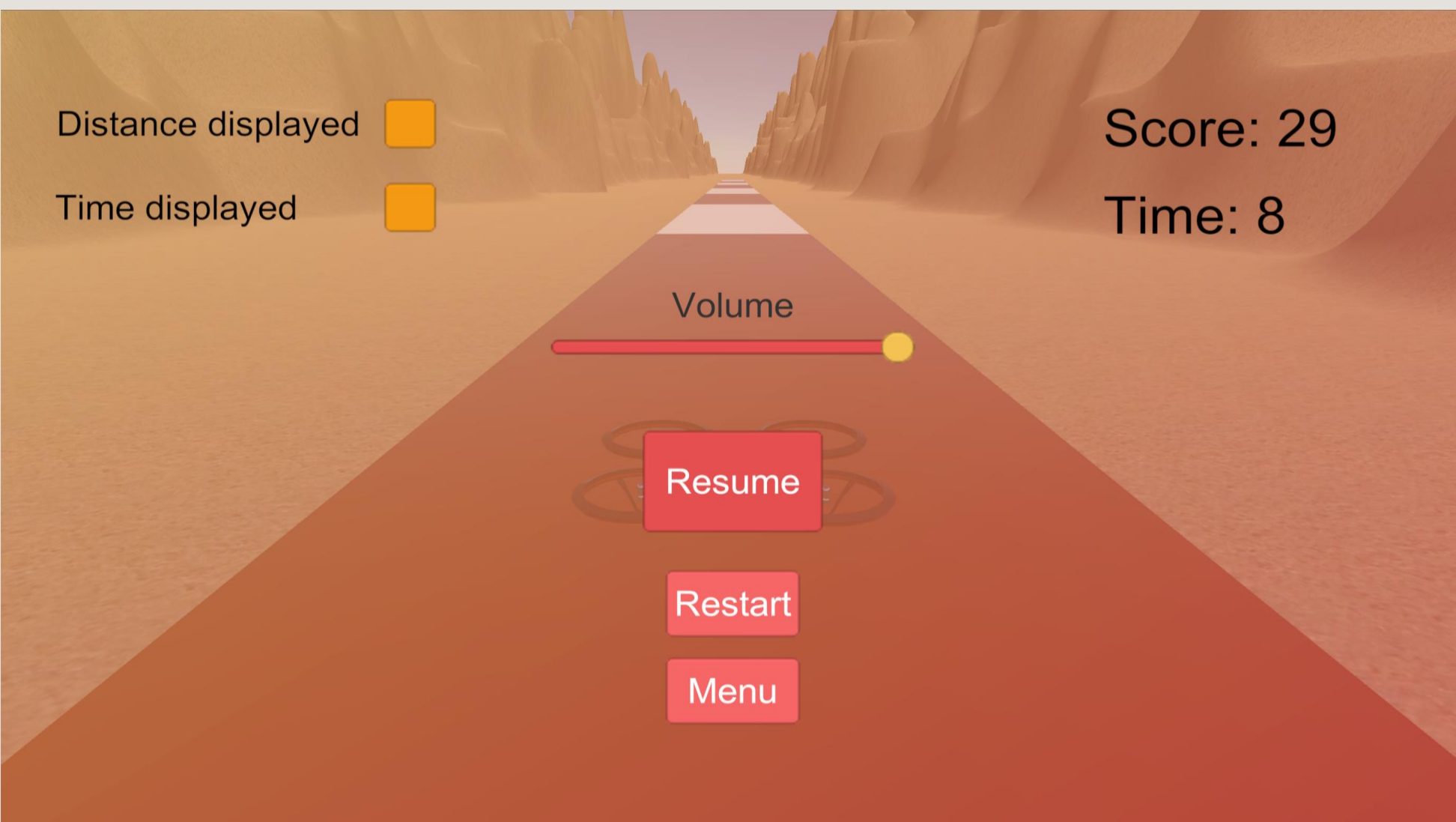


Figure 3. Screenshot of the pause menu with all the option settings available

Methodology (Alpha)

Alpha white noise (Breathing Exercises)

- Implemented the countdown Timer
- Programmed the Different Breathing exercises with their own timers
- Animated a clock which disappears or appears as the timer counts down
- Implemented a slider to raise or lower the volume

Results (Alpha)

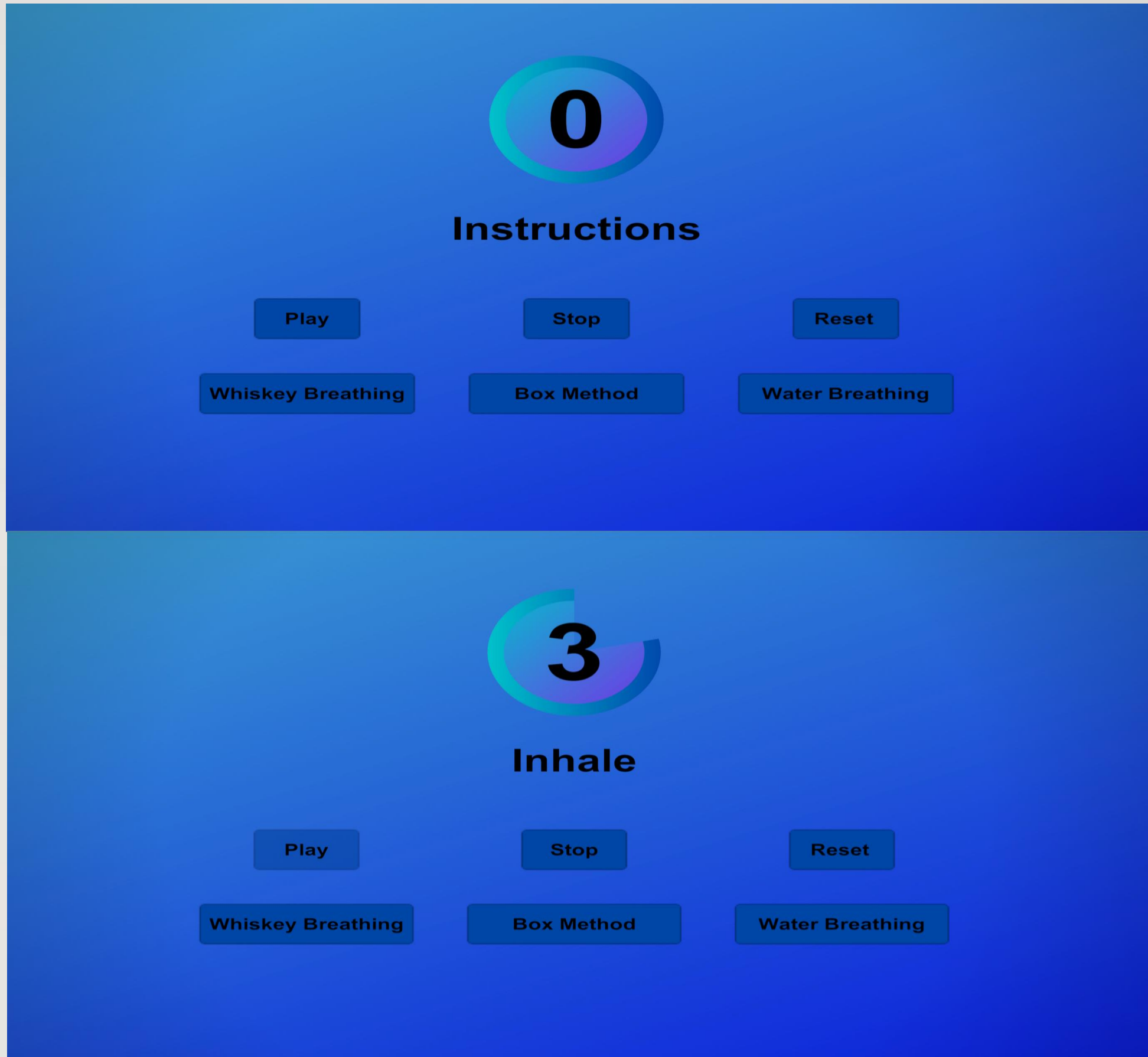


Figure 4. Screenshots of the Alpha white noise minigame

Conclusion

- Used an algorithm to keep track of the map pieces and organize the list to prevent memory overflow
- Created two minigames which can increase the user's concentration or relaxation levels by using beta and alpha waves
- Proved a successful method in creating possible tests that scientists will be able to use to design experiments using BCIs

Future Work

Beta White Noise:

- Add obstacles and instructions
- Implement difficulty settings
- Add a high score function which would display the longest distance traveled, the time active, and a ratio of the two

Alpha White noise:

- Add more breathing exercises
- Add a brief description under each button detailing the purpose of the exercise
- Make the timer settings adjustable

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