

AUDIOGAME

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Introduction

In this document, we will introduce the design of a game that is intended for visually impaired children. This means that the whole game will consist solely of sound and will not contain graphics. The main goal of the game is to teach these children orientation skills.

Using only sound in a game introduces some interesting problems. For example, guiding the player through the 3D environment is harder than in a normal game, as it is impossible to use visual aids for this purpose. We will try to address these problems using several design elements.

The document starts with discussing the exact assignment and target audience, followed by the success criteria. We will then discuss the techniques that will be used, the level design and the story. Both the level design and the story will be justified with respect to the goals of the game.

Assignment

The assignment is to create a serious game for blind children, that teaches them skills that are essential to blind people when they want to navigate through new environments.

Target Audience

Our main target audience is blind kids, as we want to train them to navigate better in the world. This allows them to get further in life. However, a secondary target is non-blind people, as they would experience how it is to be blind, which is great for awareness.

Goal

The main goal of our game is to train blind kids to orient better in an environment, just by the use of sounds, and while having fun. Hopefully, this will improve their lives as orientation is essential.

Success criteria

There are multiple criteria that have to be satisfied in order to make this game a success:

1. The game must be entertaining to (blind) children.
2. The game must increase the confidence of blind people in navigating new environments.
3. The game must train people in judging the origin of a sound.
4. The game should train people in focusing on sounds important to a certain situation.
5. It would be nice if the game introduces users to navigation by means of echolocation.
6. It would be nice if the game trains people in echolocation.
7. It would be nice if the game trains a user's spatial memory.

Furthermore:

8. It would be nice if the game decreases people's reaction time.
9. It would be nice if the game trains people in stress management.
10. It would be nice if the game encourages people to challenge their friends.
11. It would be nice if the game trains a user's overall memory capabilities.

Technical Details

Game Engine

We have decided to use the game engine Unity, which is available for free. It is a lightweight engine that functions as a great easy-to-use and easy-to-learn sandbox and packs a lot of useful features. It allows for quick prototyping games, and can export to all major platforms, including mobile.

Target Platform

Firstly, we are aiming for the PC, as sound simulation possibly requires quite some computation power. Furthermore, some Unity plugins might not export to other platforms very well. Our next target platform is mobile, as we would love for every user in the world to be able to play our game anywhere, easily.

Controls

The player will walk around in a 3D scene, like a normal FPS game. So the usual WASD keys or arrow buttons on the keyboard will function as the movement of the player, whereas the mouse movement will control the direction that the current player is looking at. Here the movement will always be relative to the direction that the player is looking at. Thus, pressing forward will make the player move forward into the direction the player is looking. Furthermore, pressing the buttons to move right or left, will respectively make the player strafe to the right or left, relative to the player's current orientation.

In order to make orientation with the head a bit more intuitive, we would like to add the possibility to use the accelerometer and gyroscope sensors of the phone for this purpose. Here the phone would be held in the hand of the player, while the player physically rotates.

Finally, we could possibly use the oculus rift purely for its head tracking capabilities. Obviously, the screens would not be used, and could be turned off. This allows a very immersive experience, as the head rotation of the player would be mapped 1:1 into the game. This is assumed to be very useful, as head tilting or rotating can be used to more accurately pinpoint the origin of a sound.

Sound

In real life, every sound is affected by the direction and velocity at which the originating object moves. Furthermore, all objects around you reflect and absorb sounds, which creates reverb and occlusion effects. Also, the shape and material of your body, head and ears change sounds before they reach your ear drums.

For this game to meet all its success criteria, we need a sophisticated simulation of these effects. We found two promising sound engines: GSound and AstoundSound.

GSound focuses on modelling the reflections, occlusions and reverberations of sound in the environment you are in. This is useful when you are determining what kind of environment you are in, for instance a big cathedral or a small hallway. It also helps deciding whether the sound is created in the room you are in or is originated in a nearby room. However, GSound does not make use of sophisticated surround sound techniques, such as a Head Related Transfer Function (HRTF), thereby making it harder to locate the origin of a sound.

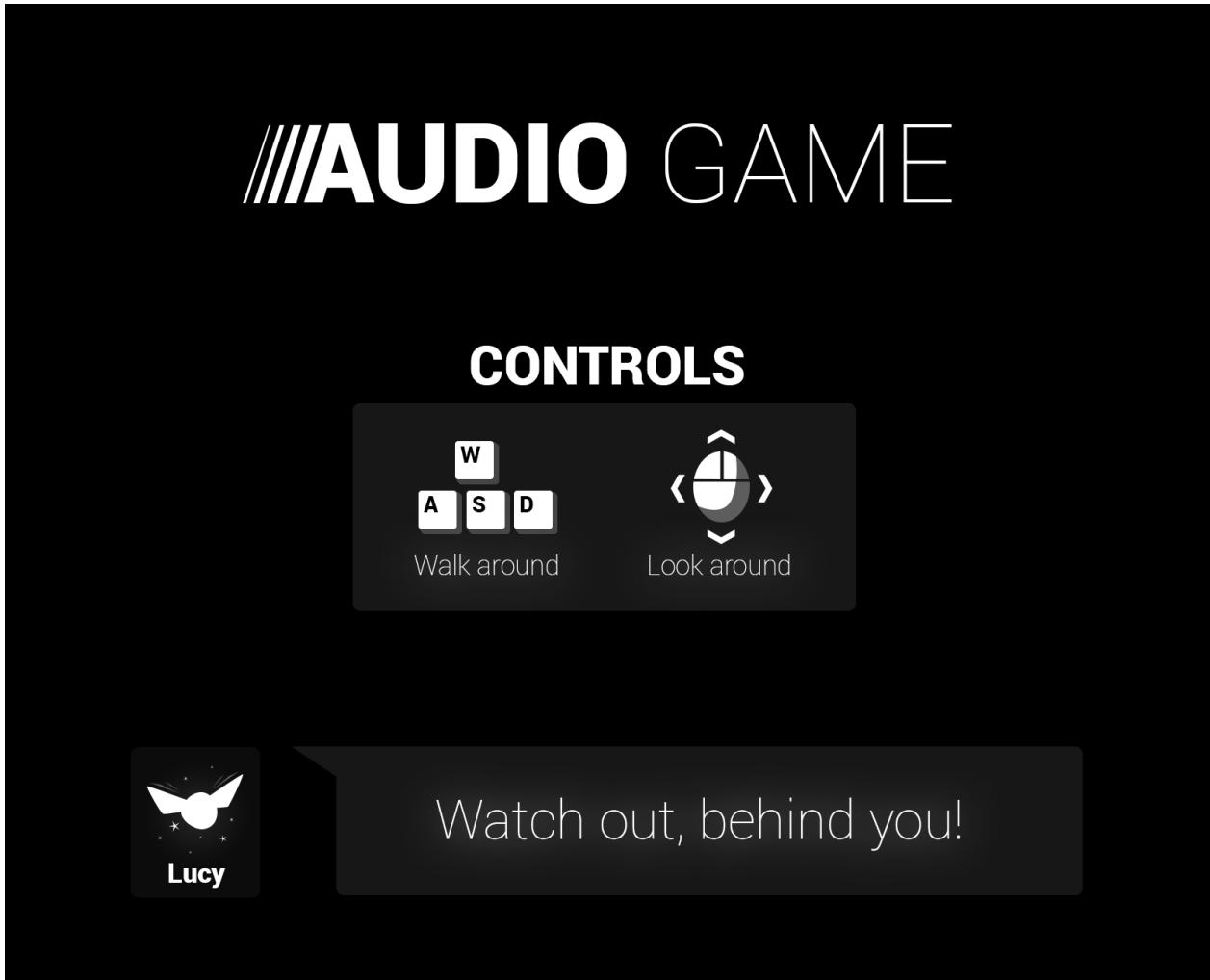
AstoundSound tries to simulate the way your body transforms sounds before they reach your ear drums. It also makes use of years of research in how the brain perceives sound. This makes it possible to accurately locate the origin of a sound in virtual 3D space when played through simple stereo headphones.

Ideally we would like to use a system that does both really well, in real-time, as this allows us to train users navigation by means of echolocation and it allows them to accurately determine the origin of sounds. However, this is not currently directly available within Unity. We favor using AstoundSound as we assume that determining the origin of sound is most essential to blind kids. To be sure, we will try both systems too see if our assumptions are correct.

Art

The game will not contain too much art, as it is created for blind kids. However, those who aren't blind could help and guide the visually impaired players, in case something is unclear. For this purpose, we will show some text and images that people who are able to see can use for guiding those who are blind.

The art style used will be very simple and slick, to the point, and quick on the eyes. The color scheme will also be simple: black and grayscale. Black will be the background, in order to reflect the main theme of the game: blindness. Gray foreground colors will be used to show text and images. Some tiny highlights will be presented with a single bright red color.



Level Design

The game will be built around the goal that the player should be taught how to navigate through the world, blindly. It gradually increases the difficulty, and different kinds of puzzles are presented, in which different kind of navigational skills will be required to solve the puzzles. With each puzzle, a new skill is required, such that the game stays challenging. However, the story will make the game appealing to the player.

Puzzles

Level 1

The first puzzle of the first level acts as a **tutorial**. The fairy Lucy will make a sound at some location within the first room (Alex the bear's bedroom), and the player needs to walk towards Lucy. This will repeat itself at different locations several times in order to introduce the player to the **movement controls** and the directional sound. The last location Lucy will guide the player towards is the door of the first room.

Once the player opens this door, Alex' family will see the bear and start making scared noises. This will introduce the player to the concept of noise: sounds that are not interesting for the player and do not hurt him/her if he comes close to the origin of the sound. The player still needs to follow Lucy. In the real world, there is always a lot of noise. Putting these noise objects in our game will teach the player **how to navigate a noisy situations** better. When the player exits the room with the family members, he/she enters the city.

In the city a third kind of sound is introduced, one which should be avoided. In this case, it is the noise of cars. The cars are obviously a danger to the player. Lucy will go to the other side of the road, and wait for the player to arrive there. The player needs to reach it without getting hit by a car. The cars will always take the same path. Memorizing and picturing this path in space can therefore help the player to evade the cars. The level starts with a single car, but later introduces multiple, thereby increasing the difficulty, preparing the player for the later levels. This puzzle will teach the player to **watch out for certain noises, and train his/her spatial memory** by remembering the paths the cars take. Once the player has managed to evade the cars and cross the necessary roads, he/she will be taken to the next level.

Level 2

The puzzles in the second, and final, level will test the skills the player learned in the first level, by requiring him/her to remember locations and limiting the time he/she has to grab certain objects.

The level will start with a memory puzzle. Lucy will sing a melody in the middle of the room. The player needs to remember this melody and then go to the correct room, a room from which the same melody emerges. This will teach the player the usefulness of **remembering sounds** to make sure that he/she is in the correct location. Because the melody is a bit different if sung by the wizard or Lucy (male and female voice), it might also be a useful in teaching the player to **relate similar sounds**.

The second puzzle in this level will contain non-moving objects that need to be avoided. These objects are fairly close together and don't make a constant noise. However, the frequency of the noise will increase as the player gets closer. This should again train the player to better **locate the origin of sounds** and use his/her **spatial memory** not to make the same mistakes again.

After this puzzle, the player will reach the final boss, which acts as a **final test for the reactivity and sound localization skills** that the player has trained so far. The final boss will use two different projectiles. One of them is a fireball and should be avoided, while the other can be used to counter-attack and eventually defeat the final boss. However, these projectiles move and, when the wall is hit, will disappear. This means that the player needs to be able to trace the origin of the sound fast enough.

When the player is hit by a fireball, he/she needs to go to a pool of water on the left and right side of the room. This pool of water is recognizable by the sound of flowing water, but the player can get there quicker if he/she remembers its location. This means that better **spatial memory** will result in a better score, and so will better localization of sounds.

Situation & Theme

In order for the story to appeal to kids, we decided to use a fantasy world as the theme. It allows for many kinds of gameplay and a fantasy world allows for funny or appealing explanations for events in the game.

Story

The player starts in a regular kids room in a regular house, where at some point the player is introduced to the first abnormality. A fairy talks to you, and guides you through the controls of the game. After which the player has to navigate through the world, in which more and more abnormalities get introduced. Having players learn new things about the world keeps the story interesting.

Characters

Alex	Alex is a regular kid (can be any gender) in primary school. Alex is not mute but doesn't talk during the dialogues in order for the player to feel more connected to the character. (<i>inspiration: Link</i>)
Lucy	Lucy is a fairy from Opacam. She is friendly, makes jokes, and is sometimes clumsy. She helps Alex through the entire adventure by providing him indications. She is small and weak but always tries her best. (<i>inspiration: Disney characters like the Genie, Snowman from Frozen, Navi from Zelda etc</i>)
Malum	Malum is an evil wizard that threw a spell at Alex that turned him/her into a bear, in order to steal Alex's vital force, making Malum powerful enough to rule Opacam. He is cunning and powerful, and is ready to do anything to get power. (<i>inspiration: Ganondorf, Jafar</i>)
Ruby	Ruby is a magician. She is a long time rival of Malum. She got captured by Malum because she was able to take down some magical protections of his fortress. (<i>Inspiration: Triss Merigold from The Witcher</i>)

Overview

The evil wizard Malum casts a spell upon Alex the child, after which he is transformed. Alex does not realise this yet. When Alex wakes up in his room, the fairy Lucy tells Alex to follow her. After Alex leaves his room, his family starts to scream, because Alex now looks like a bear. Lucy helps Alex regain his human form but not before he finds and confronts Malum and gets him to transform him back to human.

Emotional value

The goal of the story is to show the kids that it is OK to be blind, and that they will still be able to accomplish a lot of things in life. They just have to practice to orient better!

We decided that the player starts as a bear because of its fluffiness and the emotional value that is already attached to it by a kid. This is assuming that kids already have a teddy bear to play with. In the end the kid might even get one as a reward, both in-game and in real life.

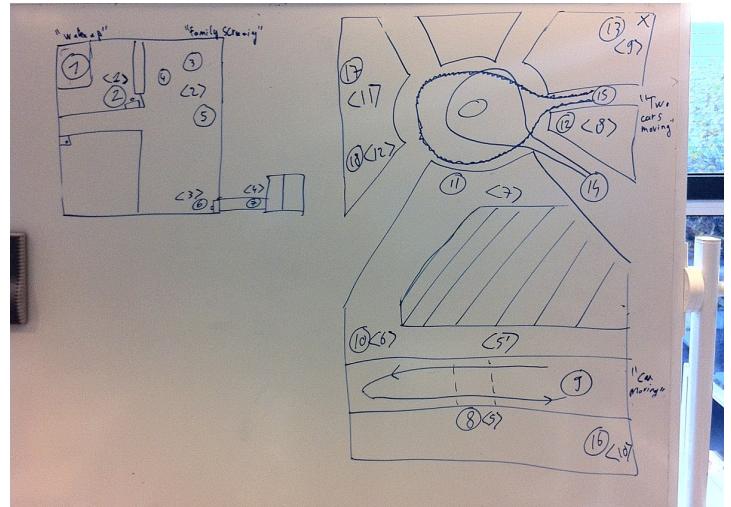
Full Story Script

Notations:

- <1> Description of script
 (1) important object 1

Level 1: The real world

Quick description of the level: Alex is woken up by the fairy Lucy, flying around with her bell around you, that explains him that she has to follow her, and that she would explain what's happening later. You follow her through the corridor, you hear your family screaming "OMG a bear". You get out, get in the elevator, then street, and quickly go in the forest nearby. She teleports you into Opacam.



- <1> Lucy's bell ringing.
 (1) Player (2) Lucy.

Lucy: "Wake up Alex! Wake up! Oh at last you're waking up. Listen, it will be a surprise, but I am a fairy, my name is Lucy, and you need to follow me immediately. Follow the sound of my bell. I will explain you what's happening later, but you have to follow me now."

When player's close enough, door opening noise

- <2> Family screaming.
 (3) Thomas the father (4) Martha the mother (5) Jack the uncle

Thomas: "Is that a bear ?!"

Martha: " Oh my god did he eat our son ?!"

Jack: "How did it arrive here ?!"

- <3> (6) Lucy

Lucy: "Oh yeah by the way you are a bear now. I will explain but follow me now, your family are scared enough like that!"

When player's close enough, door opening noise

- <4> (7) Lucy

When player's close enough, door opening noise

- <5> Small sound of wind continuous for the entire level
 (8) Lucy, (9) Car moving in the drawn circle. If the player gets too close, the car stops with a brake noise.

Lucy: "Watch out! quickly join me".

Lucy: "Ok listen I am going to teleport you through a portal, but we need to go to the magic epicentre for me to do so. Don't worry it's nearby. Keep on following me, but watch out for cars!"

Lucy moves to <5'>

- <10> (16) Man in the street: "Oh my god what's a bear doing in the middle of the town ?!"

Man runs out of the game screaming

- <6> (10) Lucy

- <7> (11) Lucy

Once player is close enough, Lucy moves to <8>

- <12> (18) Woman screaming: "Watch out! There is a bear! Stay away"

Woman runs out of the game screaming

- <11> (17) Bird singing

- <8> (11) Lucy

14) Car following a loop

15) Car following a loop

Once player is close enough, Lucy moves to <8>

- <9> (13) Lucy

Lucy "Ok time for you to enter my world. It's called Opacam. Get ready I will teleport you!"

Magical sound, end of the level

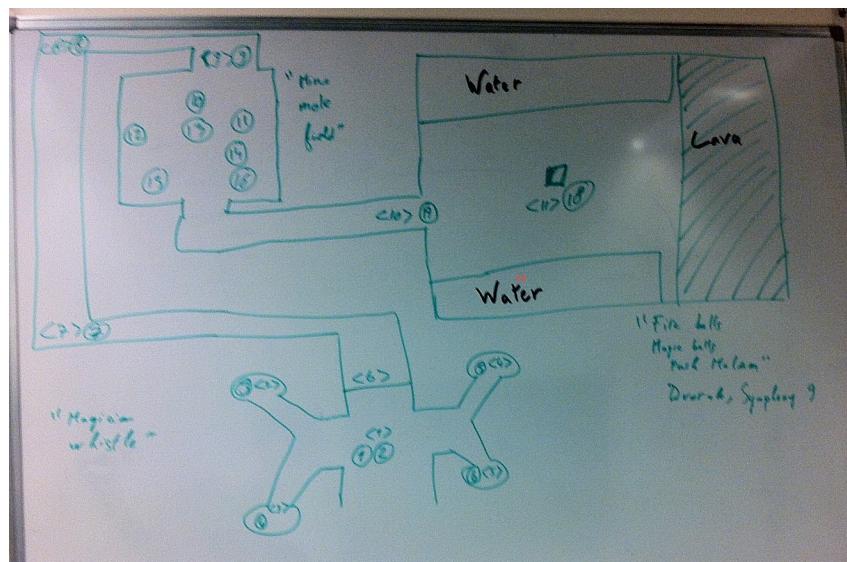
Level 2: Malum's Fortress

Quick description of the level: You go through the fortress, rescue the magician Ruby, then walk through a "mine field" made of moles, and finally facing Malum. He continuously throws fireballs at you, but one out of three is made of good magic. Alex gets it, grabs the good magic ball, and roars at Malum. After doing so twice, Malum falls into a pit of lava

- <1> Portal sound

(1) Alex (2) Lucy

Lucy: " Alex, listen to me, we are in Malum's fortress. It is time for us to stop him! But he locked the main



entry and put traps in his castle. First, we need to find the magician Ruby. She's my friend and she sent me to pick you. She knows how to break the spell for the door blocking us the path. We have a code in case of us gets trapped, we whistle this melody" *Whistles mozart's symphony number 9.* " But she is probably very weak now, so she can't whistle very loudly! There are some cells around us, listen carefully and don't open the cell of anyone, some prisoners are dangerous!"

<2,3,4> A troll whistling a different song.

If Alex comes too close, Lucy yells "Watch out, it's a troll, run!" and rings for the player to come back to her

<5> (6) Ruby

Ruby (tired): "Lucy, is that you ?"

Lucy: "Yes Ruby, I brought the human as you told me to. Are you ok ?"

Ruby: "I am exhausted but fine. Alex, listen to me, you will have to fight Malum. He is very powerful, so be careful, but his spell over you isn't finished yet, so you can defeat him. To fight, Malum can throw fireballs. But as long as the spell he put on you isn't finished, some of his attacks will be useful for you! Now go and regain your human aspect. I just unlocked the door. I can't move properly yet, so I will have to wait for you. I am sure you will succeed"

<6> *Lucy rings*

Lucy: "Follow me Alex, it is time to kick Malum's butt for all he put through!"

<7> *Lucy rings*

(7) Lucy

<8> *Lucy rings*

(8) Lucy

<9> (9) Lucy

Lucy: "Watch out! This room is trapped. Some evil moles are waiting in the ground to grab you! If they do, they will send you back to where you stand now! Luckily if they start dig close to your position, you will hear them squeak! I am going to fly at the end of the room, try to follow me while avoiding the moles."

(10)(11)(12)(13)(14)(15)(16) Moles. They make some animals noise if the player comes closer. If the player comes too close, he is brought back to position <9>. Once a mole captures the player, she disappears.

<10> (17) Lucy

Lucy: "Ok Alex Malum is right behind me. He is waiting for you. I heard that he could throw fireballs at his enemies! But you are fast, so you can avoid them! And according to Ruby, some of his spells will sound different because he will fail to do them properly. Get ready to grab the ones that do not sound like fireballs, it will give you power to do a roar that hurts Malum. If you get burned, I will ring to indicate you where to get in the water."

(18) Malum

(19) Lucy

Malum: "Here you are Alex! I did not think you could make it that far and reach me! I guess congratulations are in order! But it is time for you to die! Once you are dead, my powers will be big enough for me to rule the world, and all shall be my slaves!"

Lucy: "Because you think we will let you do that ? I am going to kick you so badly you will cry for your mommy! ... I mean Alex will. Oh Malum is looking at me in a really mean way... Now you really have to win Alex!"

Fight begins. Start playing Dvorak, symphony 9. Malum throws fireballs headed at Alex. Once every three fireballs, a positive magic spell is thrown (really different sound). If the player gets it, he roars and Malum is pushed backwards. If the player gets hit, he has to get in the water where Lucy is ringing. After roaring two times, Lucy tells you: "Yes! One more time and Malum will fall in the lava behind him!"

Malum falls in the lava the third time the player roars. Malum yells: "Noooooooooooo" with sound of melting behind.

Lucy: "Oh how incredible, Alex, you did it! Ruby was right to send me to get you! You just saved us all!"

Magic sound: Alex turns back human.

Lucy: " Oh you're human again, great! You look better without such a huge amount of hair! My entire world is grateful for what you did today Alex. Since everything went well, let me help you this time. I am going to use my powers and I will make everyone in your world forget about you being a bear and all the fuzz in the city."

Magic sound.

Lucy: "Here, it is done. Well Alex, it is time for goodbye. I am going to miss you, you hairy beast! Just kidding, just kidding!"

Portal sound.

Lucy: "Hey Alex... What you did today was incredible. Remember no matter what, you will always be my friend."

Portal closing sound

Lucy: "Goodbye my friend".