
ACRONYMS

RIR	Room Impulse Response	3
first:	Click here	
Second:	Click here	

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USER TESTING

Once the implementation of the system to allow the user to move themselves around a virtual space had been completed, the plausibility of the methods used were tested. The following sections present the aims of the user tests in full and the procedure required to fulfil the set objectives.

2.1 - USER TESTING AIMS

There were a total of 3 user tests, with the third being split into two parts with an identical procedure. The aims of each test were as follows:

Test #1: Investigate the effect of using the synthetic Room Impulse Response (**RIR**)'s as opposed to the previously used real **RIR**'s used.

Test #2: Investigate how far the user has to be moved before they notice that have been moved using synthetic **RIR**'s

Test #3.1: Investigate which **RIR** grid provides the user with the best sense of mobility

Test #3.2: Investigate whether the users opinion changes when using a position feedback system

2.2 - TESTING PROCEDURE

Before the tests were conducted, each participant was presented with a 'Test Participant Form', informing them of the aims of the tests and the procedures that were to follow. As they were going to be stood inside the speaker array, the answers provided by each participant were taken down on their behalf. At the end of the experiment the answers were checked and signed by the participant assuring that their answers had been taken down accurately. The form provided to the participants can be found in [Appendix D](#).

2.2.1) Test #1

To test the effect of using sysnthetic **RIR**'s as opposed to real **RIR**'s the use was asked to perform the same takst twice. the taks

To investigate the difference in the perception of distance moved when using either synthetic or real **RIR**'s, the following procedure was carried out:

Figure 1 shows an illustration of the virtual space indicating where the four RIR locations used for the test are. The black numbers indicate the coordinates of the RIR's relative to the top left corner of the room (note that the x and y axis are opposite to convention due to the way the building was modelled in Google SketchUp), and the red numbers are used to indicate which location the user was moved to during each test, shown in table 1.

The user was placed in the centre of the virtual space and asked to say the word 'Bob'. They were then moved

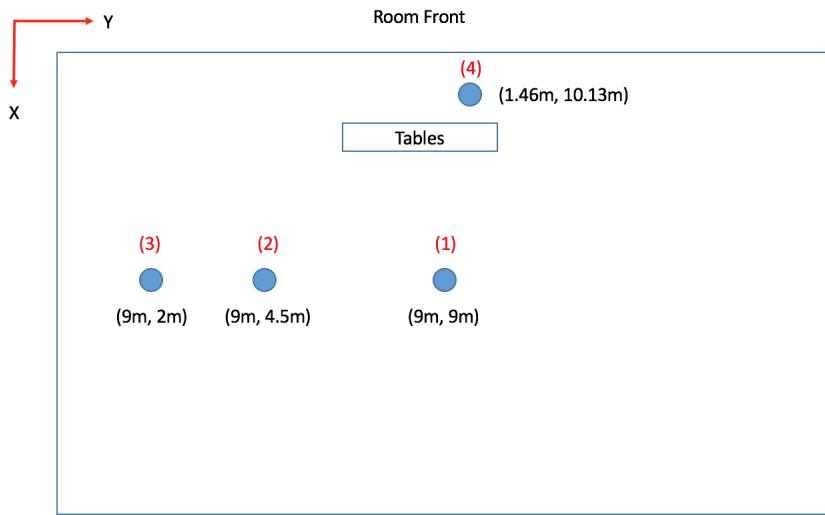


Figure 1: Illustration of RIR locations used for user test #1.

Trail	Real RIR		Odeon RIR	
	Start	End	Start	End
1	(1)	(2)	(1)	(2)
2	(1)	(3)	(1)	(3)
3	(1)	(4)	(1)	(4)
4	(1)	(3)	(1)	(4)
5	(4)	(1)	(1)	(3)

Table 1: Showing

2.2.2) Test #2

2.2.3) Test #3

2.3 - RESULTS

2.3.1) Test #1 Results

2.3.2) Test #1 Discussion

2.3.3) Test #2 Results

2.3.4) Test #2 Discussion

2.3.5) Test #3 Results

2.3.6) Test #3 Discussion

2.4 - DISCUSSION

Appendices

APPENDIX A

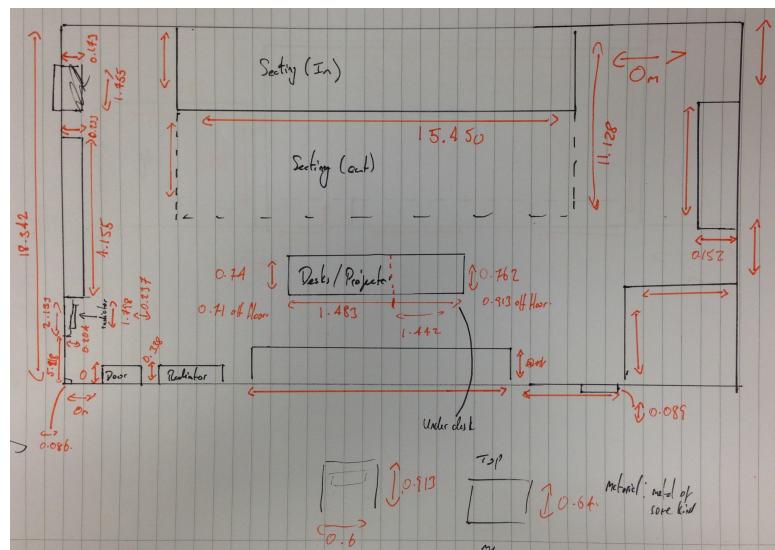


Figure 2: Annotated blueprint of Hendrix Hall from a birds-eye view

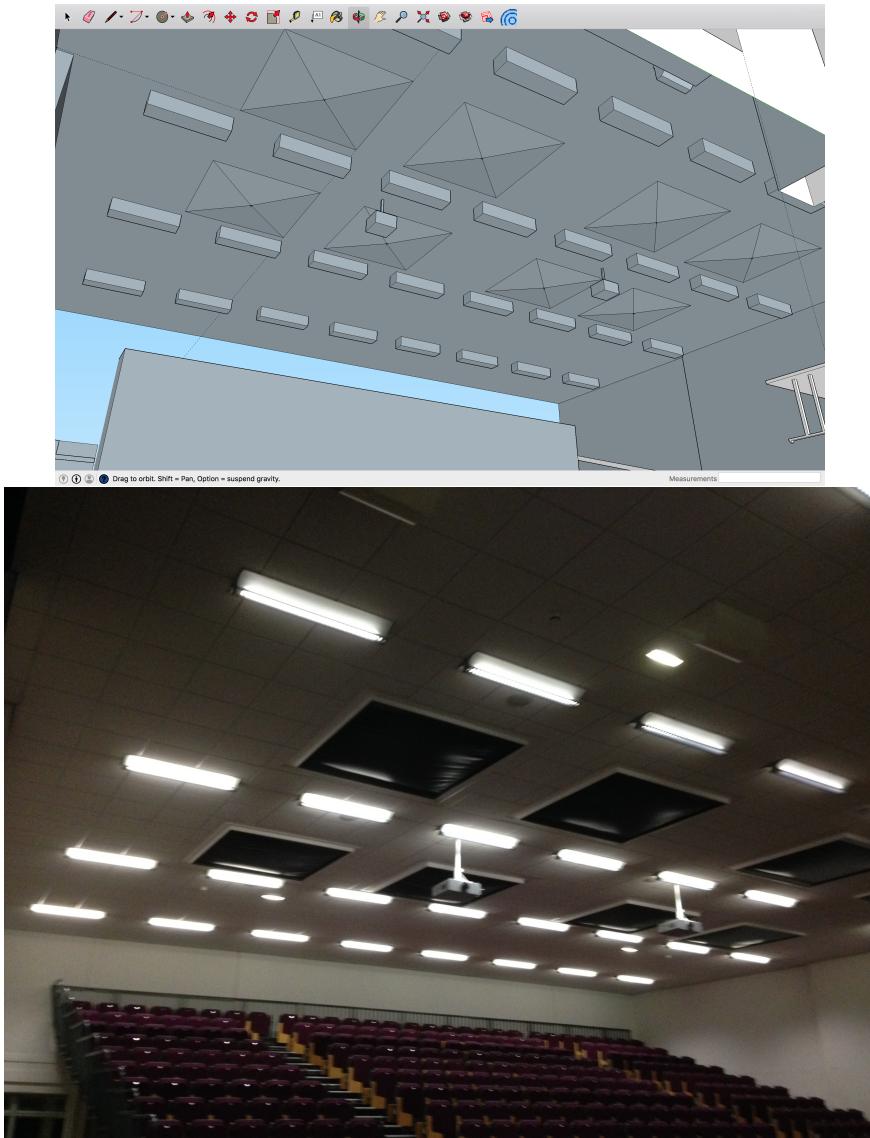


Figure 3: Real Vs SKU Roof

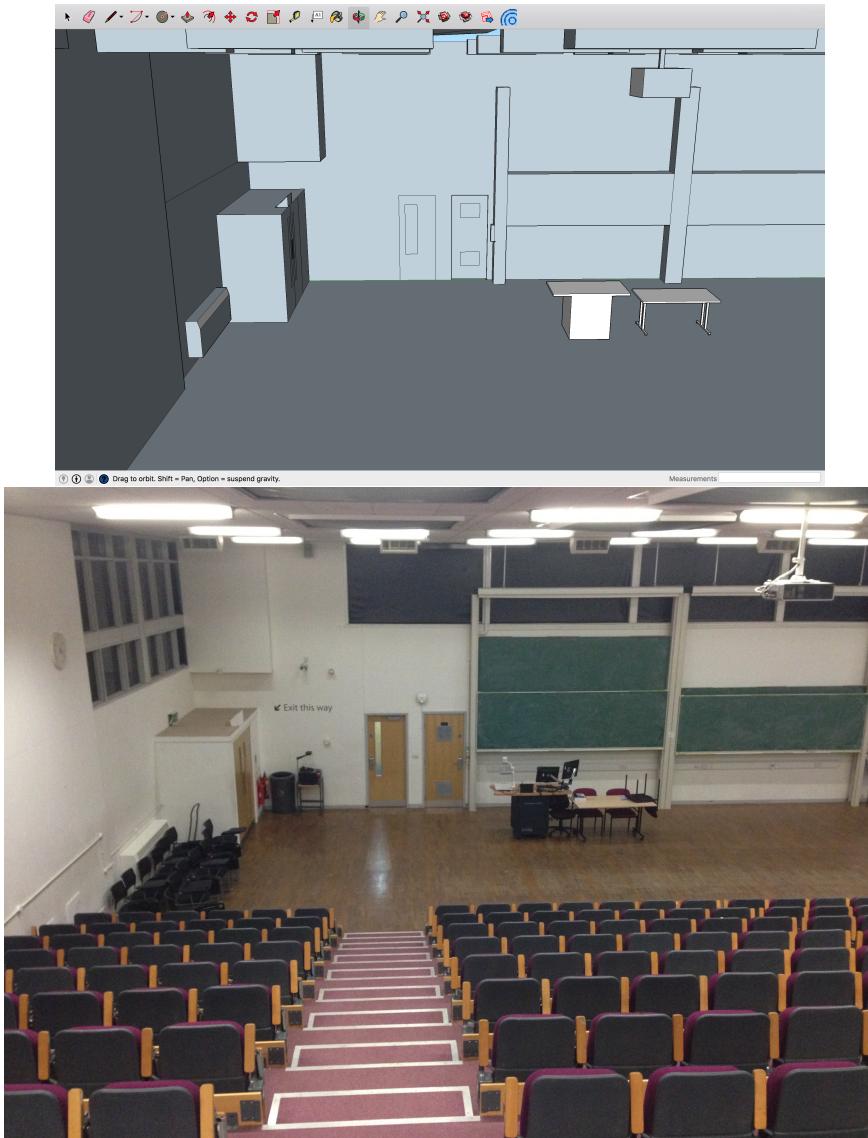


Figure 4: Real Vs SKU Roof

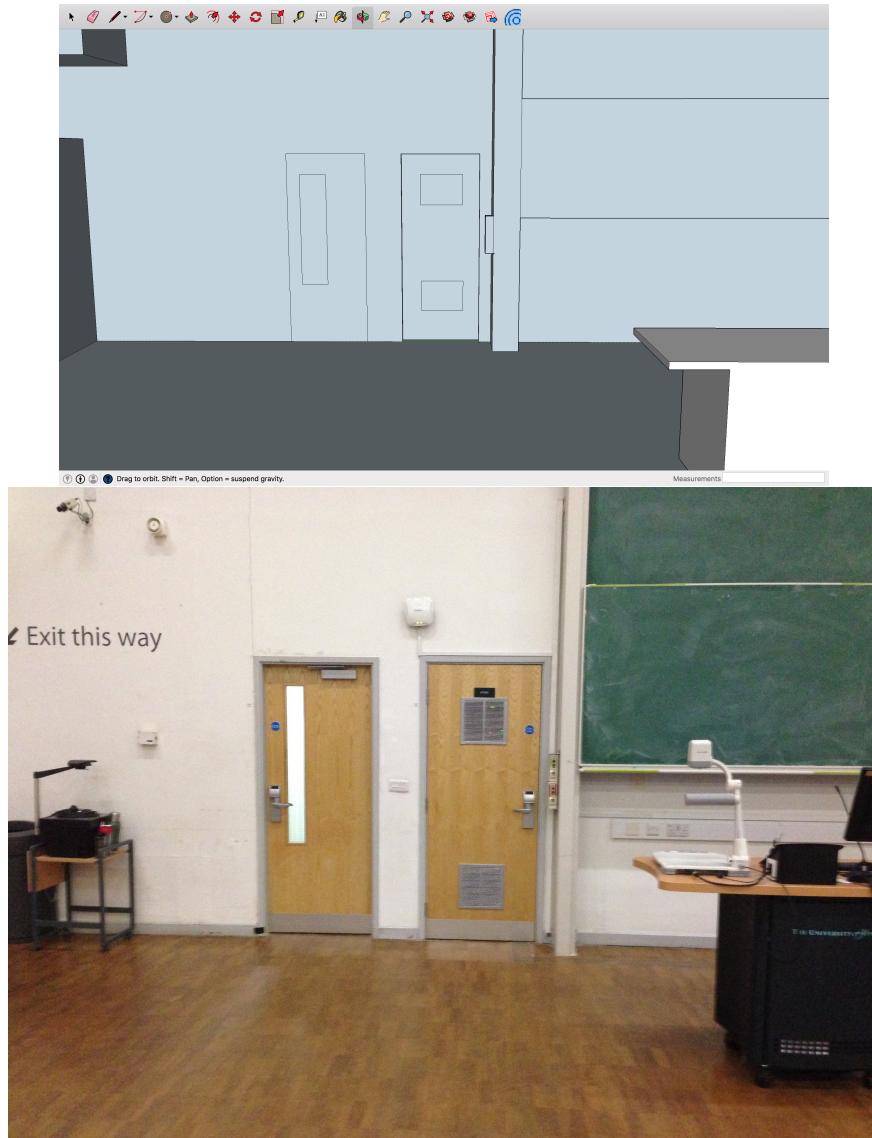


Figure 5: Real Vs SKU Roof

APPENDIX B

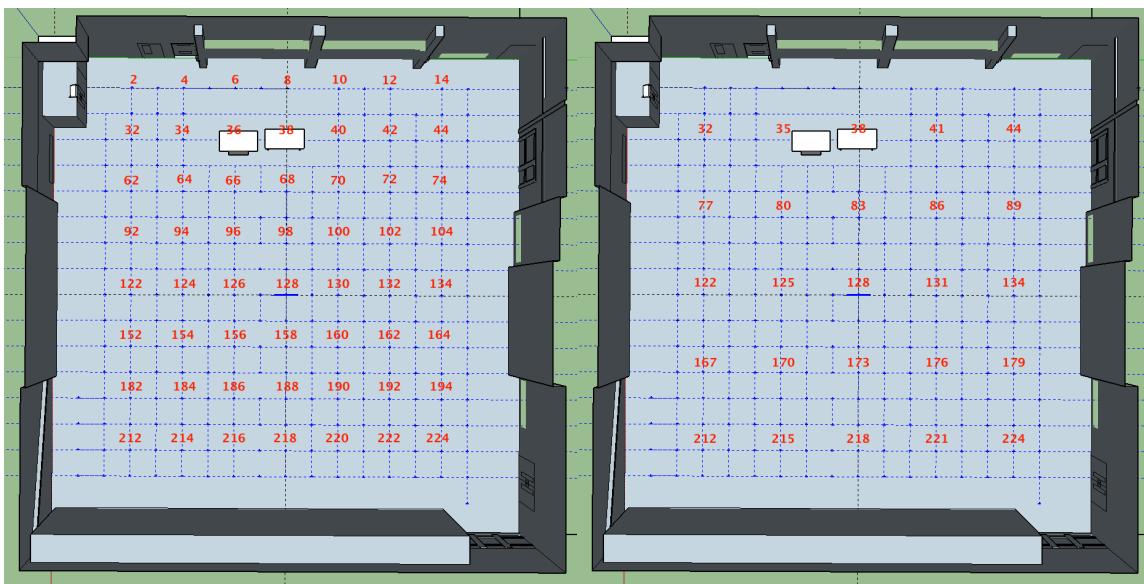


Figure 6: RIR grid with 2m separation

Figure 7: RIR grid with 3m separation

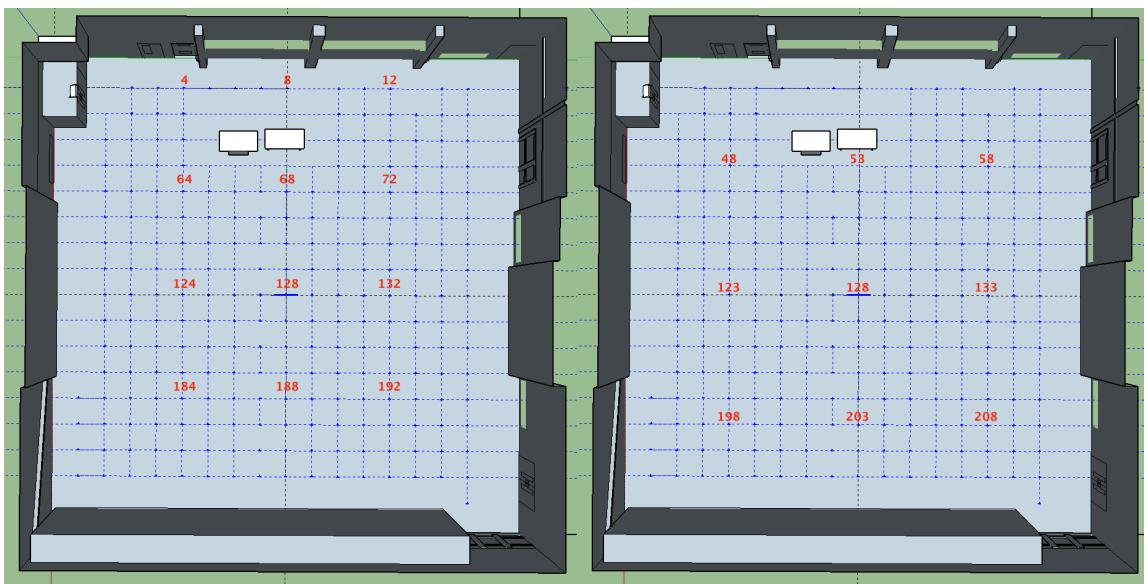


Figure 8: RIR grid with 4m separation

Figure 9: RIR grid with 5m separation

APPENDIX C

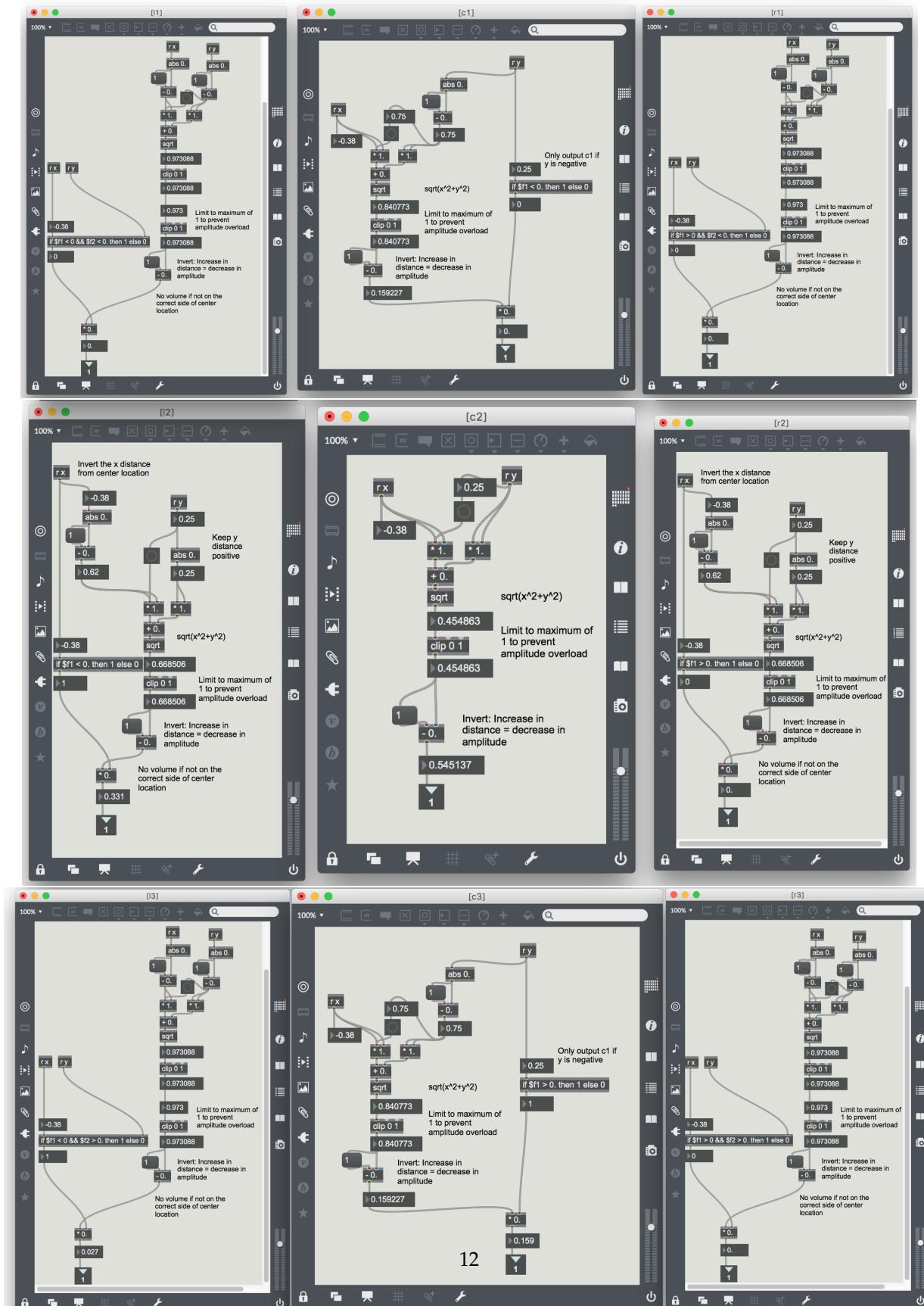


Figure 10: Overview of the individual panning algorithms used in iteration 1.

```

1inlets = 5;
2outlets = 5;
3
4//Create arrays to store previous positions
5var xArray = new Array(2);
6var yArray = new Array(2);
7
8var windowSize = new Array(2);
9
10//Variables to use for file searching
11var fileX, fileY, search;
12
13//Defines how to split up the grid
14var numberOfMeters;
15
16//Loads appropriate files given users finger coordinates
17function msg_int(input){
18 if(inlet == 0){
19   xPos = input;
20 } else if (inlet == 1){
21   yPos = input;//Add off set to start at (0,1)
22 } else if (inlet == 2){
23   windowSize [0] = input;
24 } else if (inlet == 3){
25   windowSize [1] = input;
26 } else if(inlet==4){
27   numberOfMeters = input;
28 }
29
30 //Split into sections
31 if(numberOfMeters == 3 || numberOfMeters == 5){
32   //Even grid for 3m and 5m
33   xPosition = (xPos/windowSize[0])*(numberOfMeters);
34   yPosition = (yPos/windowSize[1])*(numberOfMeters);
35 } else if (numberOfMeters == 4 || numberOfMeters == 8){
36   //4m separation requires different x,y coordinate scaling
37   xPosition = (xPos/windowSize[0])*(numberOfMeters-1);
38   yPosition = (yPos/windowSize[1])*(numberOfMeters);
39 } else{
40   //Extra row for others
41   xPosition = (xPos/windowSize[0])*(numberOfMeters);
42   yPosition = (yPos/windowSize[1])*(numberOfMeters+1);
43 }
44
45 //Round to nearest value
46 xSection = Math.round(xPosition);
47 ySection = Math.round(yPosition);
48
49 //Start the lcd grid sections from column 1 row 1 instead of column 0 row 0
50 if(xSection == 0){
51   xSection = 1;
52 }

```

```

53 if(ySection == 0) {
54   ySection = 1;
55 }
56
57 //Distance in % away from center of section
58 xBetween = 2*(xPosition - xSection); //x2 to get 100%
59 yBetween = 2*(yPosition - ySection);
60
61 //Which RIR to load in centre location
62 outlet(0,xSection);
63 outlet(1,ySection);
64
65 //Output panning values
66 outlet(2,xBetween);
67 outlet(3,yBetween);
68
69 //Store current location
70 xArray[0] = xSection;
71 yArray[0] = ySection;
72
73 //If either coordinate is changed search for new files
74 if(xArray[0] != xArray[1] || yArray[0] != yArray[1]){
75
76   if(xArray[0] != xArray[1]){
77     //Store previous value
78     xArray[1] = xArray[0];
79     X = xArray[0];
80   }
81
82   if(yArray[0] != yArray[1]){
83     yArray[1] = yArray[0];
84     Y = yArray[0];
85   }
86
87 //Output user location within grid
88 if(numberOfMeters == 4 || numberOfMeters == 8){
89   fileNumber = X + ((numberOfMeters-1)*(Y-1)); //Requires different algorithm for 4m
   due to different grid shape
90 } else {
91   fileNumber = X + ((numberOfMeters)*(Y-1));
92 }
93 outlet(4,fileNumber);
94 }
95}

```

Sections/Appendix/AppendixA/Code/loadFilesLogic.js

APPENDIX D

Test Participant Form

You have volunteered to partake in two user tests that should take no longer than 30 minutes to complete.

Test Descriptions

The VSS (virtual singing studio) is a system that is used to simulate the acoustics of another room. The system can be used by standing in the centre of the speaker array and singing into a head mounted microphone. By wearing the provided head-tracking device, you can turn in the virtual space by turning your head/body.

Test #1

This test aims to investigate the perception of movement within the virtual acoustic environment when using two different methods: Method **A** and Method **B**. You will be asked to step inside the VSS and say the word “Bob”. Your location within the virtual space will then be changed and you will be asked to produce another sound. This process will then be repeated a second time but this time using method **B**. You will then be asked to state whether method **B** felt like you had:

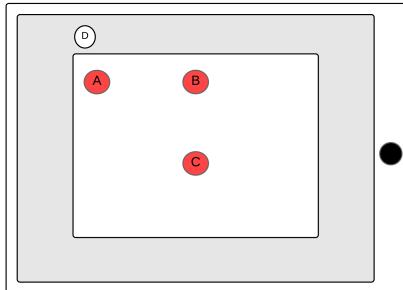
- Moved a **shorter** distance than I had in **A**
- Moved the **same** distance as I had in **A**
- Moved a **further** than I had in **A**
- I don't know

This process will be repeated 5 times in total.

Test #2

Part 1: You will be asked to step inside the VSS and to sing or produce a noise. After a short amount of time you will be asked to do the same again. You will then be asked whether you feel you have changed location or not with a simple Yes/No answer. This will be repeated 8 times.

Part 2: In this part of the test, you will be asked to change your location within the virtual space yourself by tapping on a location or dragging your finger around the iPad provided for you. You will be asked to rate on a scale of **1 - 10** how free you feel you can move about the room with **1** being a *jumpy movement* and **10** being *complete freedom to move without limitations*. You will also be given the opportunity to add comments to further explain you score if you wish.



To the left is a diagram of an iPad. **A**, **B**, and **C** indicate where parts of the room can be located. When situated in the VSS, you will start in the center of the room (**C**) facing towards the front of the room (**B**).

- | | |
|-----|----------------------------------|
| A = | Top left corner of the room |
| B = | Front of the room |
| C = | Centre of room |
| D = | Button to calibrate head tracker |

Answering Question

Note that when you're within the VSS it will be difficult to write down your answers to the questions asked. Therefore you will be asked to answer verbally and your answers will be taken down for you. You will be asked at the end of the test to check that your answers have been taken down truthfully.

Information and Consent

Experimenter: _____

Please read the following statements and tick the boxes on the right hand side to indicate that you understand and agree.

- I understand that at any point I may choose to withdraw from the experiment
- I understand that I may omit answers to any questions
- I agree that I am here voluntarily
- I understand and agree that the experimenter conductor will be observing the experiment
- I agree that the system being used has been explained to me
- I agree that the point of this experiment has been explained to me

Participant Signature: _____

Answer Sheet

Participant Number: _____

Date: _____

Test #1**Question 1:** Please state whether you feel you have:

- Moved a **shorter** distance than I had in A
Moved the **same** distance I had in A
Moved a **further** distance than I had in A
I don't know

Trial	Score			
	Shorter	Same	Further	Don't Know
1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I agree that the answers that have been taken down on my behalf are correct

Participant Signature: _____

Participant Number: _____

Date: _____

Test #2 - Part 1**Question 2:** Do you feel you have changed location within the room?

Trial	Answer
1	YES/NO
2	YES/NO
3	YES/NO
4	YES/NO
5	YES/NO
6	YES/NO
7	YES/NO

Test #2 - Part 2**Question 3:** Please rate on a scale of **1 - 10** the mobility within the virtual space where **1** = Extremely "jumpy" movement and **10** = Completely smooth movement or please select "N/A" if you can not tell you are moving.

Trial	Score										N/A
	1	2	3	4	5	6	7	8	9	10	
1	○	○	○	○	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○	○	○	○	○
4	○	○	○	○	○	○	○	○	○	○	○
5	○	○	○	○	○	○	○	○	○	○	○

Comments:I agree that the answers that have been taken down on my behalf are correct

Participant Signature: _____

Question 4: Please rate on a scale of **1 - 10** the mobility within the virtual space where **1** = Extremely staggered movement and **10** = Completely smooth movement or please select "N/A" if you can not tell you are moving.

Trial	Score										N/A
	1	2	3	4	5	6	7	8	9	10	
1	○	○	○	○	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○	○	○	○	○
4	○	○	○	○	○	○	○	○	○	○	○
5	○	○	○	○	○	○	○	○	○	○	○

Comments:

I agree that the answers that have been taken down on my behalf are correct

Participant Signature: _____