de0974 & de0972
Personal Project 2 & Final Project
Design Document

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Final Video Link:
https://www.youtube.com/watch?v=2T5f1wurLpc

Contents

The Brief

For this project I have been given an open brief, so in the following pages I have provided an outline of my aims and objectives the the purpose of answering the brief. I have chosen to continue my ideas from personal project 01 and wish to develop these further. For the outcome of this project I hope to have created a fully functioning prototype in order to demonstrate my skills and ideas appropriately for the targets I have set myself.

Brief

I have set myself the brief of creating a more immersive and interactive environment for a seemingly dull public space, such as an unused room in a museum or gallery. My inspiration stemmed from an observation of a particular gallery where I noticed the room was merely a passage for users to get to the other side, which made me wonder how I could encourage users to remain in that space, and discover something they may have previously bypassed.

I aim to have a fully functioning prototype in order to demonstrate the effects of my interactive space in a replica room.

Objectives:

1. Apply comprehensive analytical research to complex design issues and topics leading to holistic design-related outputs or solutions.

2. Demonstrate the ability to research all relevant considerations for interactive media design, and make effective use of this research throughout a design process.

3. Produce, present & communicate design solutions to a professional, highly creative standard to specialist and non specialist audiences.

4. Reflect on, evaluate and respond to feedback in relation to own performance and identify personal strengths and needs and accept personal responsibility.

5. Devise a working prototype that demonstrates an innovative solution to a design problem.

Aim

The aim of my project is to develop a creative solution to the issues I have raised concerning the interactivity of dull public spaces, possibly in the direction of a gallery space. I wish to create a solution that will make a seemingly boring space more exciting and attractive to users, making a more memorable experience.

The space will be interactive as well as immersive, which will encourage users to explore and remain in the space, in turn encouraging them to explore something, such as art or objects, that they may have previously ignored.
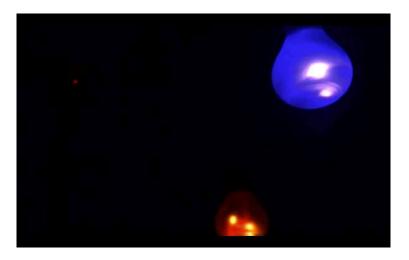
Continuing from my Last Project

Last year I wanted to explore creating an interactive space using Arduino prototyping. I created Absorb, which allowed the user to move around within the space to control the lights and the sound.

The aim of Absorb was to allow the user to explore and stimulate the senses, and to explore the difference between the digital and the natural which were portrayed though the different lights and sound effects.

I used the project as a way of developing my prototyping abilities, because previously I had only used Arduino to create a small interaction, where as I wanted to expand this and create interaction on a room sized level. I consider my last project to an explorative learning curve for me, as I was unsure of how to create a large scale interaction. I learnt a lot from this first prototype and has given me further ideas of how I can better the interaction within a space.

A video of Absorb can be found at this link:
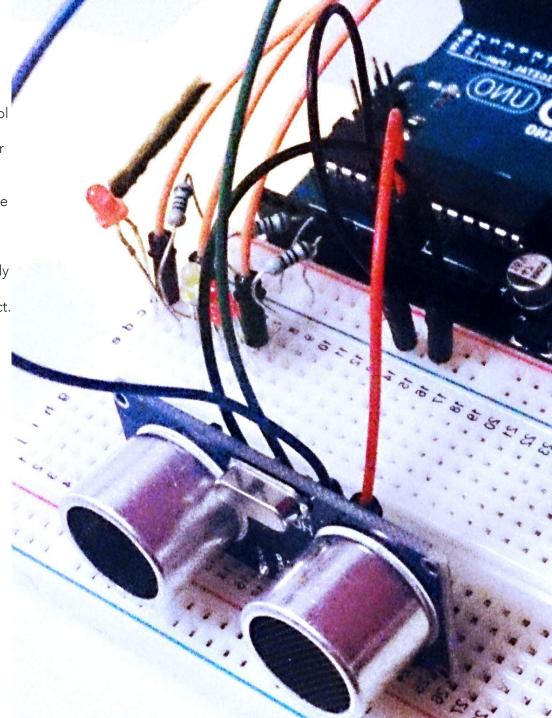https://www.youtube.com/watch?v=dszO9IJ47Bs

However the project was limited in several ways. For motion to control the effects I used an ultrasonic range finder, which is an extremely sensitive sensor, but could only work in straight lines, limiting the user to one path. This meant that the idea of exploring a space was affected and limited the users experience. For my new project I am going to look into different ways a user interacts with a space, and use this as a way of creating the interaction instead.

For Absorb I also wanted to create a mood lighting effect with the lamps, but again was limited by my resources and the lights were fairly small. Having only used LEDs before my natural path of thought was to continue using LEDs rather than to source an alternative light effect. The LEDs were still effective, but I am going to look to use a larger source of light for my final project.

Ultimately I hope that I can create a more exciting project with more refined interaction.

Inspiration

Initially I decided to gather a variety of different examples of exhibitions and installations that I have been inspired by. A lot of my inspiration has stemmed from exhibitions that I have seen in the past, which caused me to learn more about the artist and how they create the work, and I have discovered other artists along the way.

Infinity Rooms

'Infinity Mirrored Room – Filled with the Brilliance of Life' by Yayoi Kusama

Yayoi Kusama, also know as *The Princess of Polka Dots,* had one of her latest displays in the TATE Modern in London. In particular I have looked at her Infinity Mirrored room and how it has been created and the reasons behind the installation. The walls and ceiling of the room (roughly the size of a small bedroom) are mirrored, and the floor features a shallow pool of water. Visitors walk through the room on a walkway made of mirrored tiles. Hanging from the ceiling are hundreds of small, round LED lights that flash on and off in different colour configurations. The pinpricks of light in the otherwise darkened room appear to reflect endlessly in the mirrors, giving the viewer the experience of being in an apparently endless space, broken only by points of light in the darkness.

Kusama's work has been marked with obsessiveness and a desire to escape from psychological trauma. In an attempt to share her experiences, she creates installations that immerse the viewer in her obsessive vision of endless dots and nets or infinitely mirrored space. The Infinity Mirror Rooms can be seen as the expression of Kusama's interest in infinite, endless vision, something that can also be seen in the 'all-over' quality of her earlier work in painting, sculpture and installation.

I really like Kusama's work with the Infinity Rooms as they are almost a cumulative perspective of all of her earlier work. She has used the digital lights to create an immersive experience and for viewers to understand her obsessive visions. It is interesting to see how fine artists have created visions and installations through the use of digital technology, and in doing so, create immersive experiences for the viewers.

http://www.independent.co.uk/arts-entertainment/art/news/yayoi-kusama-is-named-the-most-popular-artist-in-the-world-10153249.html

http://www.itsnicethat.com/articles/yayoi-kusama

http://www.tate.org.uk/context-comment/blogs/kusama-and-infinity

The UVA

'Momentum' by the UVA

Momentum was displayed in the Barbican Curve Gallery, London 2014. The UVA presented this piece as an immersive installation that combines light, sound and movement. Drawing on physics and digital technology, UVA turned the Curve into a spatial instrument, installing a sequence of pendulum-like elements throughout the 90 metre long gallery to create an evolving composition of light and sound.

The pendulums – sometimes moving in unexpected ways – project shadows and planes of light across the 6 metre-high walls and curved floor of the space. Visitors are invited to explore the room at their own pace, and their movement through the gallery shapes their individual experience. Momentum creates an environment that has its foundations in detailed research, sophisticated computer technology and mechanical expertise. Yet, the effect is to create a space that feels wondrously transformed, one which you are invited to experience and explore. The installation has been described to create feelings that range from strange, to meditative, as the room is quite hypnotic.

I think the work done by the UVA is really interesting, as they have put a lot of thought and research into something that is very technically demanding, but appears simplistic and innovative on the surface. I like the way users are encouraged to take their time with this piece, and to create their own story or journey through it. It seems that the UVA don't want to dictate people's thoughts and emotions too much and want the users to decide for themselves how they feel.

As a piece of inspiration for my own work, again I like the use of lights, and this installation has also incorporated the use of sound to create a fully immersive room for the senses. Personally it is hard to see how the sound worked as I have not seen it for myself, but it is worth experimenting with for my own project.

https://uva.co.uk/work/momentum

Figure 2

The UVA

'Triptych' by the UVA

Triptych was designed for the Nuit Blanche art event in Paris, 2007, and has also appeared in the TodaysArts festival in Holland. It is an audio/visual installation for public display, which is made up of three equal sized LED blocks hooked up to motion detector cameras. Triptych emits light and sound, but relies on the viewers around it. When people approach, the soothing colours and calming sounds turn louder and harsher, suggesting Triptych has a temperamental and powerful presence within.

Triptych is a creative and simple installation, I feel that its main purpose is to provoke entertaining interacting from its viewers. Only through exploring the different states by moving around does the user start to understand how to control and manipulate the lights and sound through the interaction. It might be interesting to note that Triptych might not be as responsive unless there is a large group of people to explore and work together.

I enjoy this piece of installation because it provokes curiosity. Its also the first piece that I have looked at that requires audience participation in order to create the piece. Without the interaction, the lights and sounds wouldn't be changed, and the 'temperamental presence within' would remain silent.

This is one of the few pieces I chose out of the work produced by the UVA to discuss. I like the work done because it creates a branch between artwork installation and modern technology.

http://uva.co.uk/work/triptych

Figure 3

Impulse

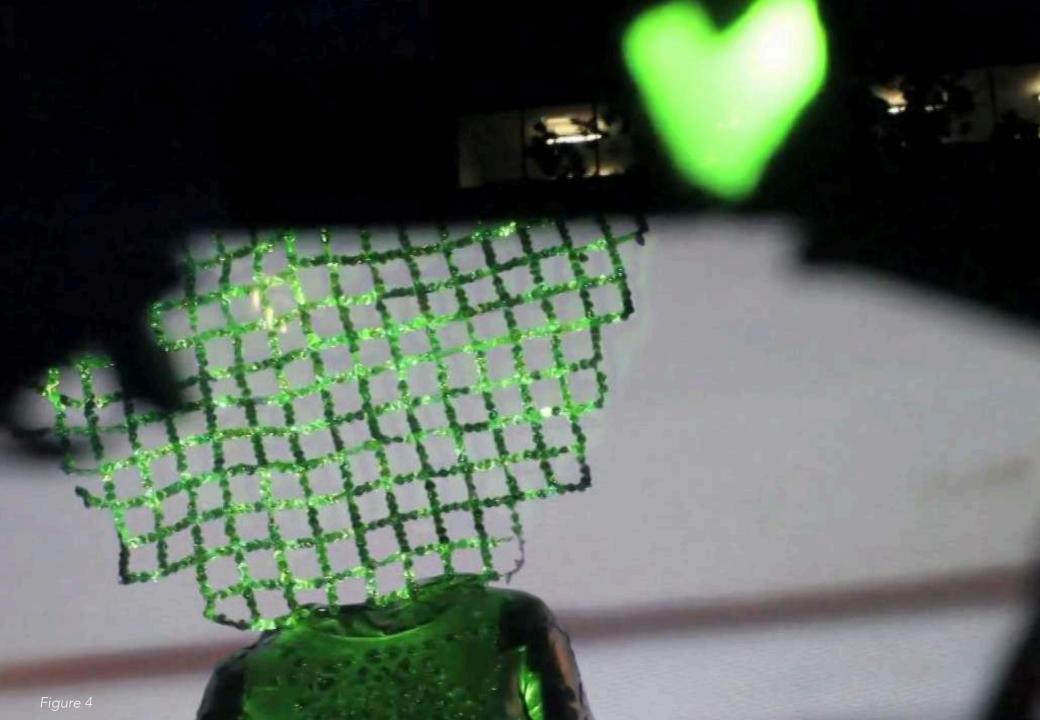<u>*'Impulse'* by the Danielle Gotell</u>

Impulse was displayed at the G++ Interactive Media Gallery in 2012 as part of an exhibition, contributed by Gotell. Impulse uses a system of heart rate sensors to blend four heart beats into a multi-media video installation. Up to four participants interact with one another within the intimate space, the inner space is kept private for the active participants to experience through individual viewports.

The idea of the installation is to draw upon the vital actions of our bodies and amplifies the information that would usually be broadcasted unconsciously. Also the combination of the different heart beats create a unique experience for each different user, as the display changes and adapts depending on the participants involved.

I think that this piece is quite individual, and it is interesting to understand what the artist wanted to achieve by incorporating

strangers into the installation. I think the most interesting thing about Impulse is that it creates a show for the participants, and not the rest of the public, which entices people to engage and explore the piece further, rather than simple observational interaction.

https://vimeo.com/49036402

http://www.huffingtonpost.com/2012/07/13/artist-danielle-gotells-i_n_1668272.html

Figure 4

John Martin

'The Destruction of Sodom and Gomorrah' by John Martin, on display in the Laing Art Gallery, Newcastle.

This classic painting by artist John Martin is currently on display in the Laing Art Gallery, Newcastle Upon Tyne, as part of the *Northern Spirit* collection which celebrates art produced from artists that have come from Northumberland.

John Martin's pieces are well know for being large and dramatic, often portraying scenes from the bible or apocalyptic landscapes, creating large scale scenes of fire and destruction.

In particular this piece is displayed in an unique way in the Laing, to create an immersive experience for the painting. It is held in a large structure in which the user is invited to go inside. There is a bench and a couple of buttons, which can be pressed to start a series of different light and sound effects. These effects are used to recreate the atmosphere that Martin is trying to capture within the painting, such as fire crackling and lighting sounds. It was interesting to see a painting displayed like this in a gallery that is fairly traditional in it's approaches. In doing this it highlighted the painting and made it a more memorable experience for me, which is why I have chosen to discuss this in my inspiration.

It is interesting to see how different galleries are using technology and different techniques to bring the artwork to life, and it has given me different ideas for what else can be achieved in the spaces. I feel that there are plenty of pros and cons when using these techniques however, as I feel that the personal viewing and reflection of the painting was compensated in return for a short light show. Also because of the container the painting was set behind some thick glass, which made it more difficult to view the painting in detail. However the lights and sounds, coupled with the painting made it the highlight of the exhibition, regardless to the faults.

http://www.twmuseums.org.uk/laing/northernspirit/john-martin/

Figure 5

Pulse Room

<u>'*Pulse Room*' by Rafael Lozano-Hemmer</u>

Rafael Lozano-Hemmer held his touring solo exhibition, *Recorders,* which came to the Manchester Art Gallery in 2010, presenting eight to thirteen interactive large scale pieces, that underline the performance of the public as an interactive part of the artwork. In Recorders, the artworks see, hear and feel the public, and they exhibit awareness and record and play memories obtained entirely from the show. The pieces specifically depend on participation to exist, or gather information from the public in order to display. In doing so the exhibition blurs the lines of participation and observation. In all cases the artwork compiles a database of behaviours that then becomes the artwork itself.

Pulse Room is an interactive installation featuring one to three hundred clear incandescent light bulbs, 300 W each and hung from a cable at a height of three metres. The bulbs are uniformly distributed over the exhibition room, filling it completely. An interface placed on a side of the room has a sensor that detects the heart rate of participants. When someone holds the interface, a computer detects his or her pulse and immediately sets off the closest bulb to flash at the exact rhythm of his or her heart. The moment the interface is released all the lights turn off briefly and the flashing sequence advances by one position down the queue, to the next bulb in the grid. Each time someone touches the interface a heart pattern is recorded and this is sent to the first bulb in the grid, pushing ahead all the existing recordings. At any given time the installation shows the recordings from the most recent participants.

Lozano-Hemmer's work has been really inspiring to look at, having not seen it myself the video documentation of his work has given me a really useful insight into how these pieces work. His other work can be found in the links that follow, but it is all very interesting and inspiring work, which adapt and tailor themselves to each location.

My favourite is definitely this Pulse Room, because of the excessive use of lights to fill the space, there is no holding back or expenses made for this installation. Not only can the audience participate with the piece in order for it to exist, but they can experience it in other ways and be fully absorbed in the light patterns in the room.

http://www.lozano-hemmer.com/pulse_room.php

http://www.mca.com.au/collection/exhibition/581-rafael-lozano-hemmer-recorders/

Figure 6

Tape Recorders

'Tape Recorders' by Rafael Lozano-Hemmer

In Rafael Lozano-Hemmer's exhibition *Recorders,* which came to the Manchester Art Gallery in 2010, were several different interactive installations, including Pulse Room, which I have previously discussed, and Tape Recorders.

Tape Recorders involves rows of motorised measuring tapes which record the amount of time that visitors stay in the installation. As a computerised tracking system detects the presence of a person, the closest measuring tape starts to project upwards. When the tape reaches around 3 meters high it crashes and recoils back. Each hour, the system prints the total number of minutes spent by the sum of all visitors.

I chose to look at the Tape Recorders in more detail because it intrigued me, because of the fact that the time spent by the visitors is the most contributing factor. Overall I think the installation is fairly simple, compared to some of the other pieces that Lozano-Hemmer

has created. But the purpose of this piece is very different and I like the way he is using the work to almost control how much time will be spent in the gallery. I think it is important to consider that Lozano-Hemmer's interactive artwork lends itself to being more inclusive than traditional paintings, meaning that audience participation is captivating and will cause them to remain longer in the space than usual.

I think that this has been the most interesting development in my inspirational research, and has given me some thoughts on how and why audiences spend their time within certain spaces. It will be interesting to see what ideas can be stemmed from creating different kinds of interaction in order to persuade audiences to spend more time.

http://www.lozano-hemmer.com/tape_recorders.php

http://www.lozano-hemmer.com/rafael_lozano-hemmer_recorders.php

Figure 7

How Should Museums Look in the Future?

I came across an interesting article that discussed the future developments of our museums and galleries, and how they should be developing for the fast passed technological world.

This led me to further read into interesting insights on how museums and galleries should be evolving to incorporate new things to make them more sustainable and appealing to the future generations. It is agreed that places for cultural heritage cannot be lost in the modern day, but the foundations and understandings of traditional galleries are fast becoming out dated. It is important for these spaces to be revolutionised in order to make them more exciting and usable spaces for everyone.
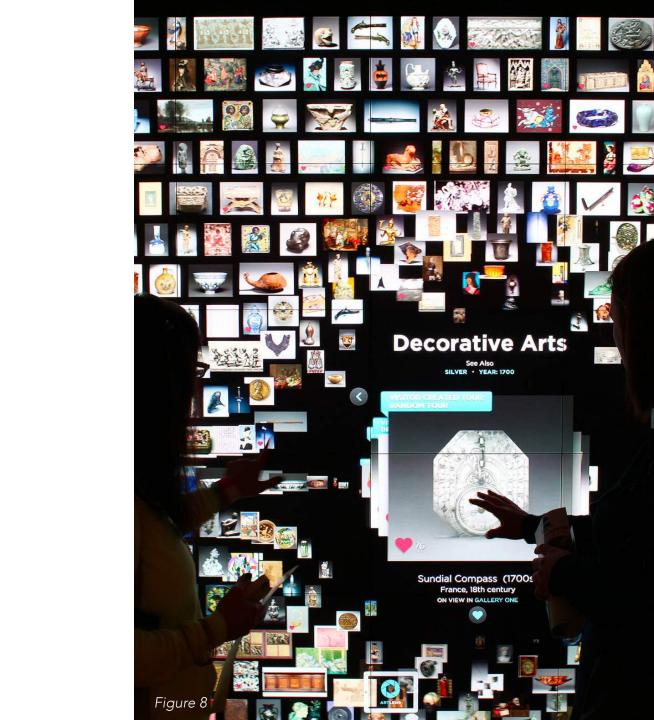
One interesting point that I read was that museum and gallery spaces should be more than just observational rooms, but spaces where users can interact and learn. These spaces could become centres or hubs for cultural bonding and understanding, and places for research and exploration of ideas.

With this in mind I think that it is important to explore the different ways in which museums and galleries can be made more exciting and interactive spaces. There seems to be a stigma around galleries being 'boring places' to the younger generation and I want to challenge this belief.

http://www.theguardian.com/culture-professionals-network/2015/mar/16/museums-in-2020-industry-experts-views
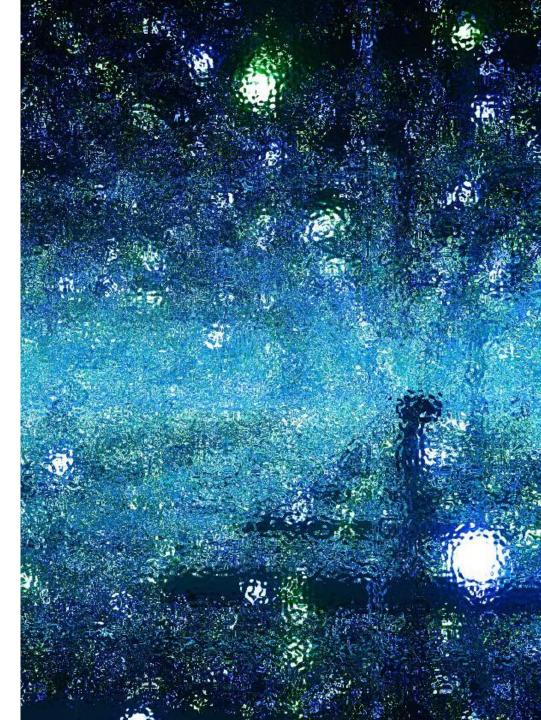
http://www.cntraveler.com/galleries/2011-11-30/six-awesome-interactive-art-exhibits

http://www.nytimes.com/2013/03/21/arts/artsspecial/at-cleveland-museum-of-art-the-ipad-enhances.html

Figure 8

Research

From my inspirational reading around new and exciting gallery installations and interactive spaces, I have chosen to conduct some research in order to aid my project development. I have decided to get a better understanding of the type of people who use museums and galleries through user research. I have also looked into certain areas of interaction design, as well as competitor research in order to analyse the different types of galleries and how they are already creating new and exciting audience participation developments.

Research Targets

Moving on from my inspiration research around different interactive spaces and installations, I have chosen to conduct some research in order to further my project development.

User Research
In order to better understand how people move or interact in public spaces I plan to carry out some observational research. I also plan to understand the type of people I will be designing for to ultimately create a better experience.

Interaction Research
I plan to better understand the different types of interaction involved in public spaces by users, and how this will shape my installation.

Competitor Research
It is important to know and understand what has been created before, I have already looked a lot into different types of artistic installations but I feel that I also need to research different types of public places that encourage interaction.

User Insights

As part of my user research and understanding of how people use and move within a public space, I chose to carry out some observational research.
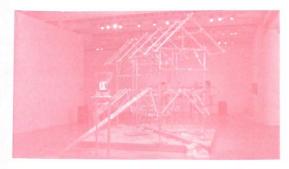
This involved me going to the BALTIC gallery in Newcastle and for an hour record the different people in the main gallery space. I chose to conduct my research at the BALTIC because it has a large space for the public to move around in, it also attracts a variety of different people which is good for my research. Also I could observe people from a vantage point using the balcony viewing platform on the 5th floor, looking down onto the main gallery floor space on the 4th floor.

I went to the gallery on Wednesday 22nd April, and observed from 1.30 – 2.20 pm. The exhibition that was on show was by Jason Rhodes, and involved a variety of large sculptures made out of found materials, such as TV sets, scaffolding and wooden objects.

I decided to record the number of people who entered the space, as well as their gender and rough estimate of their age group. I recorded the time they spent in the space, and also drew a suggestive map showing their walking trajectories. This was the most interesting part as the map quickly built up to show where people walked around the room, and where they spent the most time looking at the sculptures.

BALTIC TODAY #17

A guide to everything BALTIC including exhibitions, facilities and the building. balticmill.com
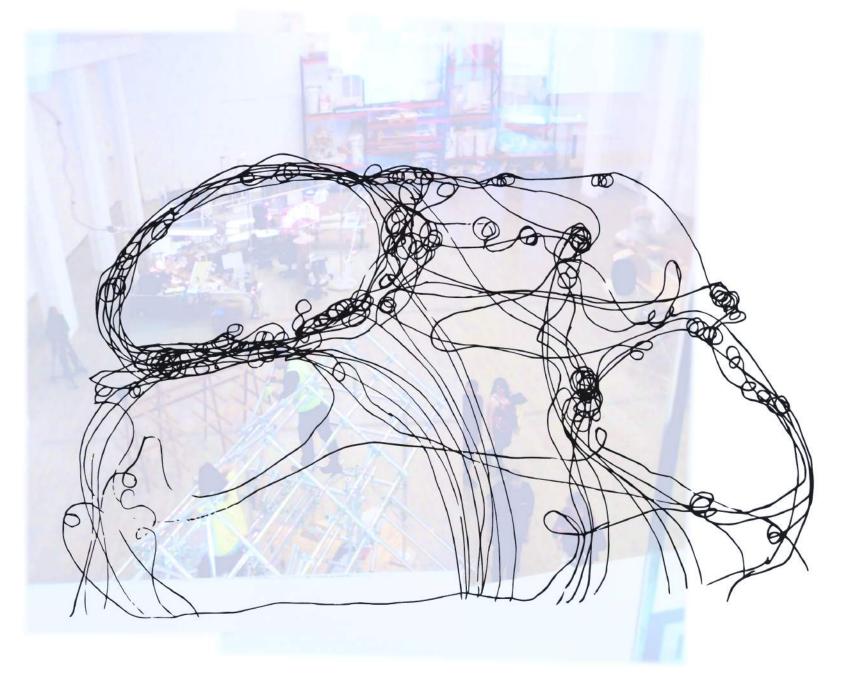
JASON RHOADES
Jason Rhoades, Four Roads
6 MARCH – 31 MAY 2015
LEVEL 4 & NORTHUMBRIA UNIVERSITY
GALLERY, LEVEL 3

TONY SWAIN
Undetailed Progress
7 MARCH – 12 JULY 2015
LEVEL 2

Digital overlay of the paths in clearer detail over an image of the gallery space taken from my viewpoint.

User Insights

Information gathered from my observations at the BALTIC, includes details on the number of people, rough age estimate and how much time was spent in the gallery space for both floors.

Wednesday 22nd April 1.30 – 2.30pm

BALTIC, Newcastle upon Tyne
Overlooking Jason Rhodes exhibition, large gallery space, level 4

2 young females (20+) – 1min 30secs
1 young female (20+) – 5mins
1 young male (20+) – 1min 30secs
1 young male (20+) – 4mins
2 young males (20+) – 1min 30secs
2 older males (40+) – 3mins
1 young female (20+) – 8mins
1 older male (40+) – 4mins
2 young adults (couple) – 4mins 30secs
2 small groups of school children – 5mins
2 older females (40+) – 4mins 30secs
2 young adults (couple) – 8mins
2 young adults (couple) – 8mins
2 young adults (couple) – 3mins
2 young adults (couple) – 3mins
2 young adults (couple) – 3mins

Extension to the Jason Rhodes exhibition, small viewing platform, level 5

1 small group of school children – 2mins
1 young adult (20+) – 2mins
1 young adult (20+) – 2mins
1 young adult (20+) – 2mins
1 young adult (20+) – 2mins
5 teenagers (15+) – 3mins
1 young male (20+) – 1min
2 young males (20+) – 1min
1 small group of school children – 1min
1 young male (20+) – 1min
2 young adults (couple) – 2mins
2 older females (40+) – 2mins

Evaluation

From my study I was able to gain some really useful insights into how people use and move around a space. The gallery gave me a particular advantage as I was able to have a 'birds-eye' view of the floor, and was able to map out the way the space is used.

Looking at the map, it is clear to see the areas most used within the hour, the circled areas show where people tended to linger, and spend more time looking at the sculptures. The sculpture in the back left of the image proved most popular, as people tended to walk all the way round, and spent the most time studying it. It is important to note that this was the most engaging piece, as it had neon lights and TVs to catch the user's attention. There were no other sources of light in the other sculptures and I feel that this is the most contributing factor as to why people were more attracted to this piece. The straighter lines show where people walked with purpose, as it can be seen in the middle of the image, it is where people were moving to leave the gallery. This also shows where there seemed to be a lack of interest in the pieces.

Looking at the information I gathered, it was good to see a wide range of different age groups attending the gallery, as well as a mix of gender. The biggest group is dominated by the young adults attending, and I presume this is because of the time of day, and young people who may be students wont be at work during these hours.

The most interesting data I feel is the amount of time spent in the gallery, with the average only being around 2 or 3 minutes. These groups of people tended to walk once around the gallery, as if to assess the value of their time to study the pieces any further. They then often left quickly, as their interest was not peaked. On the other hand there were several people who stayed for a lengthy time, taking a more leisurely pace and stopping to study the pieces regularly.

This study has offered me a useful insight into the behaviours of people in public spaces, and it is apparent to me that there are 2 kinds of users. 1 of the groups were there because they had devoted time to spend at the gallery, and were far more interested in the pieces. On the other hand the other group were people who might have come by an off chance, to see if there was anything of interest to them. These are the people who weren't as interested in spending any more time than they had to in the gallery.
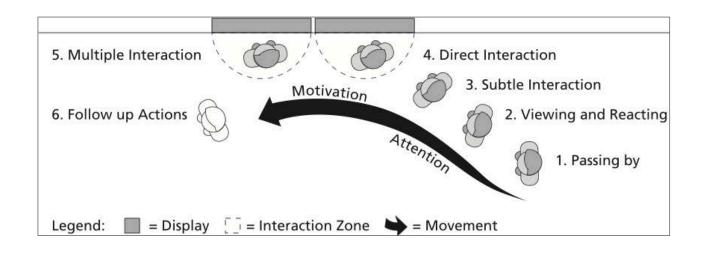
For the purpose of my project and research, the second group that I have identified are the target audience for my installation. I want to be able to create a more immersive environment that will capture the attention of people, causing them to spend more time in a public space that they may consider as dull.

Interaction in Public Spaces

During my research into interaction and how users interact in public spaces, I came across this study on advertising and interaction for public spaces. The workshop involved looking into and studying how technology is pervasive in public spaces, and I thought that the diagrams included were extremely useful. They have been created particularly for these digital mirrors as part of the project, but I like the simplistic analysis of how to engage the public.

"In this paper we discuss the fundamentals for creating exciting public displays and multimedia experiences enabling new forms of engagement with digital content. Interaction in public space and with public displays can be categorized in phases, each having specific requirements. Attracting, engaging and motivating the user are central design issues that are addressed in this paper. We provide a comprehensive analysis of the design space explaining mental models and interaction modalities and we conclude a taxonomy for interactive public display from this analysis. Our analysis and the taxonomy are grounded in a large number of research projects, art installations and experience. With our contribution we aim at providing a comprehensive guide for designers and developers of interactive multimedia on public displays."
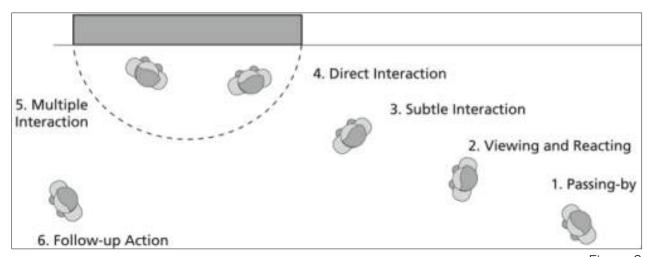
http://www.magicalmirrors.de/

Figure 9

The two different diagrams depicting how users engage in with an interactive exhibit. It is quite different to how I want to create my interaction, as this is very linear, and the area for interaction is fairly small. However I think the most useful points are the different stages of how someone might approach the area, and how their attention might be attracted.
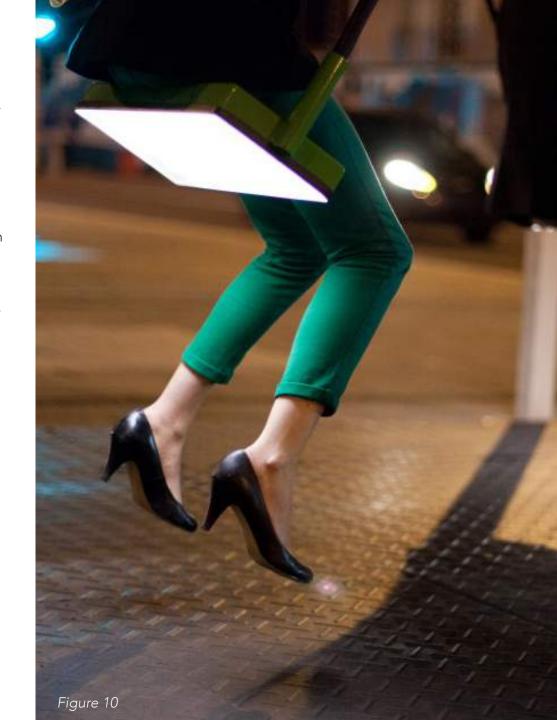
Competitor Research

As part of my research I felt the need to further my understanding of the competitors of this field from what I had already learnt from my inspirational development. I chose to look into different types of public installations that have been made specifically for public display and use.

I came across a group of designers known as *Daily Tous Les Jours* who are based in Montreal, and are an interaction design studio with a focus on public spaces. They create new ways to interact and create stories through collective experiences.

The installation that caught my eye is this 21 Balançoires (21 Swings), a giant collective instrument. When in motion each swing triggers different notes, and when used all together the swings create a musical composition in which only certain melodies emerge through cooperation.

This installation has been made with the public in mind, and it is fun and creative at the same time. The idea is to bring people together and to create stories through the interaction.

http://www.dailytouslesjours.com/project/21-balancoires/

Figure 10

Competitor Research

I chose to look into different types of public installations that have been made specifically for public display and use. I came across this exciting installation by J. Meejin Yoon of MY Studio, who specialise in multidisciplinary practice, operating in the space between architecture, art and landscape.

In particular I like this installation Light Drift as it was such a statement piece. Light Drift was a temporary interactive lighting installation along the edge of the Schuylkill River Banks that drew thousands of viewers into a playful engagement with the artwork, the river's edge, and each other. The project created a field of lighting elements arrayed along the waterfront, with elements on land and in the water.

https://www.youtube.com/watch?v=jLdgJ7556Fs

http://www.mystudio.us/projects/70

Figure 11

Concept

From the projects that have inspired my ideas and the insights that I have gained from my research I feel that I have create some solid foundations to begin outlining the concept and plans for my project and installation. I plan to create a fully immersive and interactive installation that will answer my brief to enhance dull public spaces.

"fine artists have created visions and installations through the use of digital technology, and in doing so, create immersive experiences for the viewers"

"only through exploring the different states by moving around does the user start to understand how to control and manipulate the lights and sound through the interaction"

"a lot of thought and research into something that is very technically demanding, but appears simplistic and innovative on the surface"

"the pieces specifically depend on participation to exist, or gather information from the public in order to display. In doing so the exhibition blurs the lines of participation and observation"

"the idea of the installation is to draw upon the vital actions of our bodies and amplifies the information that would usually be broadcasted unconsciously"
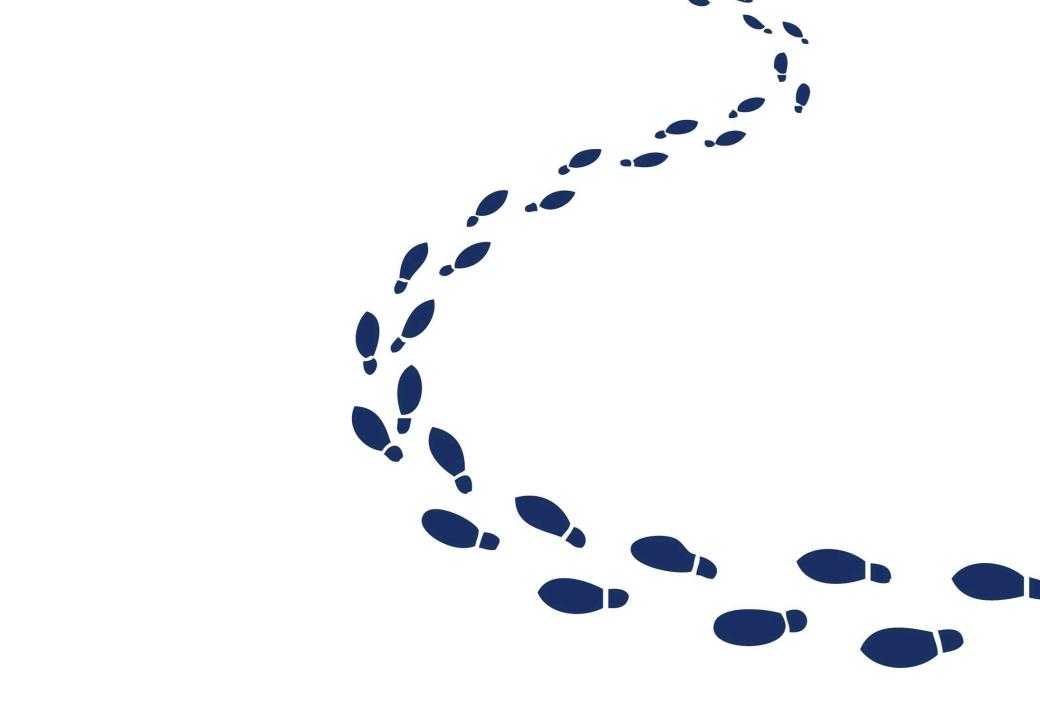
Research Insights

I have complied what I have learnt from my research and what inspiration I have gained from my insights in order to establish how I will answer my brief.

The statements on the left show the key points that I have gathered from the inspiration I took from the artist installations. In particular I want to create an installation that can only exist with user participation, using lights and sounds to fully immerse the user.

From my user and interaction research I have understood:

1) To capture the users attention through lights and sound.

2) In public spaces it is important to engage users who may have other agendas.

3) There are 2 types of users to design for. My main focus group is to attract users who consider the space as dull.

4) Ultimately I want to create a space that will be attractive and imaginative to users, and to create a more memorable experience.

Footsteps

How can I create different effects from subtle interaction within the space?

From my observations I felt that I needed to create some form of interaction that did not require any extra effort from the user other than their standard bodily functions. Some previous work that I looked at used heart beats, something that is normally used unconsciously. From being in a public space, such as within the gallery I noticed that my footsteps were louder, and echoed around the room, giving me inspiration.

Footsteps? Could this be used to create a new experience?

Quite spaces often result in echoey footfall. I have chosen to interpret this into a visual element using a variety of coloured lights.

The user will be able to walk around the room and there will be a light and sound display which corresponds to the footsteps of the user.

The more footsteps, the more intense the lights and sound will be.

Technology Research

Arduino Sensors
For my previous project I created an immersive space in which the user could influence the change in light and sound by moving about the space. I gained a lot of knowledge on motion sensors, both PIR and Ultrasonic, during this, and learnt a lot with how the user could interact in different ways. The ultrasonic sensor was very good at calculating very accurate results as to how far away the user was in the space, but is limited to straight lines. It could work if I used more than one sensor, but still would not be very effective at picking up footfall. The PIR sensor is better at detecting movement, rather than distance, but again would not help me to determine footsteps.

The main problem I wanted to address is how the user will be able to have full control over the lights and sounds without knowledge of the sensor being present, and I will have to broaden my research into further Arduino prototyping and sensors.

Museum Technology
I have been in contact with staff who work in the Discovery Museum, Newcastle, out of curiosity wanted to know what technology they used in the public spaces. I was informed that they use motion detectors and sound systems that can be bought from the sites below, or else they construct similar models from their own prototyping for a cheaper alternative. It is useful to know what is used within the industry as to compare for what I wish to achieve with my prototype. However these are used to create very directional sounds in a limited space, and ultimately wont help me to achieve my vision with using footsteps.

Ultrasonic range finder

PIR motion detector

http://www.museumtools.com/products/

http://www.ultrasonic-audio.com/products/acouspade.html

Light Ambitions

Previously I have discussed that in my last project that using simple LEDs were not bright enough to create the immersive effect that I wished to create. Luckily one of my tutors has suggested to me that I could use his Kam LED Parbar REM1 instead, which will be much more effective for my project.

The parbar consists of 4 panels of LEDs, each can display a mixture of red, blue and green lights, and is mounted on a tall stand. The parbar can be controlled through pre-sets and using the foot pedals or there is a DMX plugin, which means it can be controlled through a computer. Using the DMX input the parbar can be controlled using MIDI data that can be sent via Ableton Live 9 software, which fortunately I have used before.

If everything works together I plan to use the LED parbar for my project, as it will be highly effective within a darkened space.

https://www.youtube.com/watch?v=nix0170gZyI

http://www.kam.co.uk/index.php?action=product&product_id=385

Detecting Footsteps

I have conducted some research into a variety of different sensors that can be used with Arduino prototyping that will be effective at detecting footfall, and a lot of my peers have suggested trying out the piezo disc sensors.

These sensors are used for picking up vibrations, and converting the information into a variety of usable data. Most commonly they are used for instruments, as the data can be converted into musical notes, or MIDI. I have also been told that they can pick up the vibrations from a wide range if the right surface is used. I decided to investigate further…

"PZ1 can be kept in the cantilever mode or cemented or clipped to a wall, curtain, step, car, etc. The circuit can be made much more sensitive by cementing to its upper surface a stiff metal rod with a small weight mounted on its free end. Footsteps can be detected when a piezo disc with an attached rod is mounted on or under a flat surface such as a wood floor or step."

Perfect! I found some instructables that claimed that the piezo's can detect footsteps, if I use a hard surface that will allow the vibrations to travel. Also because the piezo's can send out MIDI notes, it will work perfectly with the DMX input for the parbar, and will directly be able to control the lights through the Arduino sensor input.

http://www.instructables.com/id/Arduino-Sensors-and-MIDI/step10/Arduino-and-Piezo-Sensor/

http://makezine.com/projects/make-40/vibration-sensors/

https://www.sparkfun.com/products/10293

Vision

In order for me to successfully create an effective prototype I am going to base the foundations of what I want to create around the equipment I can use. I have done projects in the past where my vision has been more difficult than what I have been able to create, and I feel that this has often compensated some of my designs. I don't want this to be the case with this project, so I plan on using the parbar for the lights, as they are good quality and will provide good and ambient lighting. Therefore I am going to base my vision for what I can achieve around the basis that I will be using these lights.

In a small room or space, I plan to have a temporary floor laid down that the user will be able to walk across. I also would like to detach the lights from the bar in order to mount them separately, the reason for doing this is because I want to create an all-round immersive effect. Because I have been informed that the piezo sensors can send MIDI data, this will be able to send information to the parbar, and I think they will ultimately be the best decision for me to use these. I plan to have multiple sensors attached to the floor that will detect the footsteps on and around the individual sensors. At the moment I am going to focus on the lights and visual elements of my prototype, but I may consider adding extra features to it, such as sound and imagery.

With this project I plan to work with the prototype to see what effects can be created at the end. I feel that this will be an experimental piece as I am unsure of what the outcome will be, but I have faith it will produce an exciting immersive atmosphere.

Limitations

Naturally there will be limitations as to what I can achieve in the time scale of this project and the space and cost of my prototype. Ideally I would like the create a large scale room that would demonstrate my idea, possibly as an ambient piece in the final show. However the cost involved to place an entire new floor seems a bit steep at this moment in time. A smaller scale room will be easier for me to control the interaction and effects.

Also concerning time, I have planned to create an initial prototype before progressing onto a more final one, and then will be able to conduct some user testing. If I follow to these plans I will be able to achieve what I set out to do. Because I have so many ideas for this project, I would like to be able to continue this further if I had more time, and to test out the interaction and refine the effects.

Development

Now that I have outlined the purpose and the concept for my project, I am moving onto the development for creating my solution to the brief. For this project I am going to create a fully functioning prototype that will include the parbar for my installation. The next steps involve me starting to understand how to use the equipment and how to harness this for my installation.

Essential Software

To create my installation I will be using Arduino prototyping to detect the footsteps. I am confident with Arduino and hopefully this wont cause too many problems for me.

I will also be using Ableton Live 9 to control the parbar and to create the sounds. I know that I will be able to control light pre-sets by using MIDI notes assigned to each pre-set.

To send MIDI data from Arduino to Ableton Live I will need a bridge, and I can download a free software called The Hairless Midi to Serial Bridge. This will allow me to send the Midi data coming in through Arduino, to Ableton Live where the lights will be controlled.
And finally I will be using the plug in for Ableton Live, called DMXIS, which will allow me to control the pre-sets on the parbar.

DMX Control

The parbar can be simply used on its own with the presents and the foot pedals, or it can be controlled by using this DMXIS box, that plugs into the back of the parbar. This box plugs into the computer and has software that can be used to control the parbar through MIDI data.

In this instance, I have installed the DMXIS software to be used as a plugin for Ableton Live. This allows me to control the lights through the computer, so I can change the colours of each panel, alter the brightness, and create different effects such as strobes or chasers. The DMXIS plug in also allows me to save pre-set light combinations, which can be assigned to individual Midi notes.

http://www.dmxis.com/dmxis/

http://www.enttec.com/index.php?main_menu=Products&pn=70570

Getting to Grips with the Parbar

Naturally when starting to use a new piece of software or technology it takes time to familiarise with it, and this was the same with the parbar. The first hurdle was to get the bar to connect with the computer through the DMX box. After reading the manual I soon realised that I needed to change the channel on the back of the bar in order for it to recognise the DMX input, which can be seen in the chart on this page.

I also could use the DMXIS as a separate piece of software on my computer, so I had a go with that first before using Ableton Live. I had to overcome a small hurdle with installing the software, as I has to disable the FTDI driver on my Mac first. Once I has everything set up I was able to do simple controls, such as turning on and off the different coloured lights.

http://www.kam.co.uk/media/file/product/manual/Kam%20LED%20Parbar%20REM1%20manual%20V1%2031-07-12.pdf

Function Setting
Sound-to-Light – controlled by sound and send data to the slave.
Auto – do not accept external control but send data to the slave.
Manual – do not accept external control but send data to the slave.
DMX – accept data from DMX512 controller, Obey3 controller and the host.

Function setting via button + digital tube. The operation panel is as shown in the picture below:

MENU   DOWN   UP

The display is as shown in the picture below:

Function setting and display
This product has memory function and enters DMX mode directly at initial power up and shows"A001". Besides, it has an extra function of Obey3 controlling.
Press button"Menu"to enter different modes, the details are as shown in the table below.

Menu Control mode	Display	Down	Up	Menu
DMX512	A***	A512-A001 (DMX address selection)	A001 – A512 (DMX address selection)	Return
Auto	AP**	AP12-AP01 (selection of 12 patterns)	Enter the interface of speed selection	Return
		F-00 – F-08 (selection of 8 patterns)	Save the data and run	Return
Manual	Colo	No function	Enter the interface of red selection	Return
		r-00 – r-08 (selection of 8 luminance values of red)	Enter the interface of green selection	Return
		g-00 – g-08 (selection of 8 luminance values of green)	Enter the interface of blue selection	Return
		b-00 – b-08 (selection of 8 luminance values of blue)	Enter the interface of speed selection	Return
		F-00 – F-08 (selection of 8 strobe speeds)	Save the data and run	Return
Sound	Soun	No function	Enter the interface of sound control pattern selection	Return
		SP00 – SP03 (selection of 4 sound control patterns)	Save the data and run	Return
Obey 3 Channel	Ob-3	No function	No function	Return

Ableton Live 9

After I felt that I was comfortable with the parbar, and I could control the basics through the DMXIS software, I moved onto Ableton Live. I have previously used Ableton Live to create a soundtrack, so it was not unfamiliar to me but I still find it fairly complex! I started off by creating a simple Midi track for the notes.

Getting the DMX plug in to work however was slightly more complicated. Luckily I had some help from my tutor Trev, who has used this software before, and remembered some important factors when installing the plug in.

Firstly the plug in had to be placed on the *'B Delay'* track, where you can open up the configuration settings and the DMXIS software, which is where I can create the pre-sets for the parbar. Then it was important to note that the Midi track has to send to the *Delay DMX,* and must be on *Channel 16* to work.

Trev also helped refresh my memory on how to write Midi notes, and most importantly the DMX only reads notes from the very bottom end of the scale, so the keyboard has to be set to *Octave C-2 to D-1*.

Finally I was able to work out how to create a pre-set using the DMXIS plug in. After going to the *delay* track and opening up the window (which can be seen opposite), I learnt how to turn on and off the colours which I wanted, and could create chase and strobe effects. Then in the 'preset manager' I could easily save my combinations under different names.

I was really grateful for all the help I received from Trev, which meant I could quickly put together what I needed for the lights. The best thing was the the pre-set light combinations automatically assigned the the lowest notes, starting at C-2 and going up, meaning that the Midi notes I had created in the track previously, now activate the parbar when played.

Piezo's for Beginners

After I felt that I was confident with the parbar and had mastered Ableton Live, I chose to move onto the second half of my prototype, the Arduino.
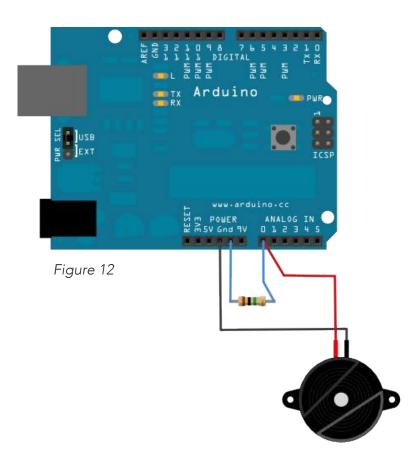
The piezo disc sensors come in a variety of different sizes, but I went on the principle that I wanted to pick up the vibrations from a large area, so I would need the largest size piezo. I found a couple of instructables online that helped my to understand the basics of the piezo, on how to connect it properly and other useful bits of information.

http://www.arduino.cc/en/Tutorial/Knock

http://www.instructables.com/id/Arduino-Sensors-and-MIDI/step10/Arduino-and-Piezo-Sensor/
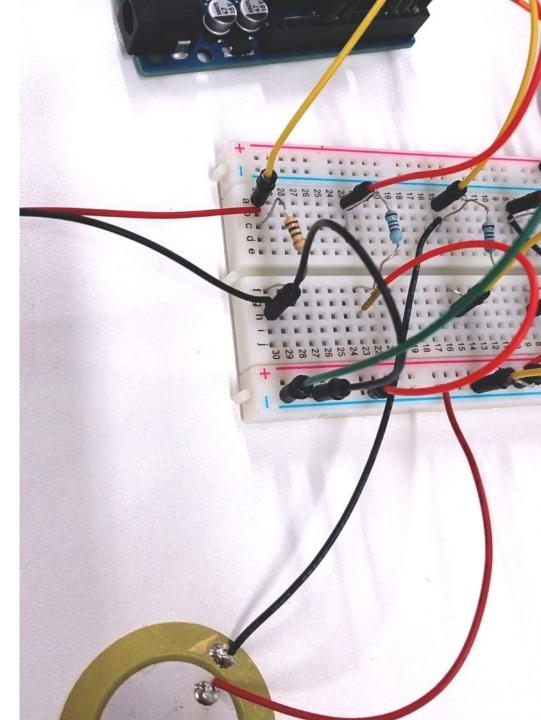
http://www.piezo.com/tech3faq.html#hp2

I first began with one piezo, but quickly learnt that I needed to use a larger resistor in order to get the most out of the sensor. I sourced a couple of 1K ohm resistors so I could continue working, and quickly hooked up 5 different piezo's to the Arduino.

Figure 12

I used a simple code *piezo val* to determine the input value of the sensors, and to check that each one was working correctly. I noted that the constant input of the piezo was around 0 when stable, but when the piezo's were tapped or felt some form of vibration, the value jumped up to around 600, which means that there is a clear distinction between the two different states.

For the piezo's to be able to send data to Ableton Live, they must first be able to send out individual Midi notes, tailored to each sensor. Fortunately a classmate of mine had created a similar project last year, in which he used piezo sensors to send Midi notes to Ableton to create drum sounds, and gave me his basic code for sending the notes from the piezo's. I used this basic code as a basis for mine, and developed it further to send the right kind of notes to Ableton.

Coding


```
piezo_val | Arduino 1.6.0

piezo_val

int piezo = A0;

void setup() {
  Serial.begin(115200);
}

void loop() {
  int piezoVal = analogRead(piezo);
  Serial.print("Sensor1 = ");
  Serial.print(piezoVal);
}
```

```
send_midi_note | Arduino 1.6.0

send_midi_note

int noteOn = 144;
int piezo0 = A0;
int threshold = 60;

unsigned long note0off = 0;

void setup() {
  Serial.begin(115200);
}

void loop() {
  int piezo0Val = analogRead(piezo0);

  if ((note0off==0) && (piezo0Val>threshold)){
    MIDImessage(noteOn, 0, 127);
    note0off = millis()+100;
  }

  if ((note0off!=0) && (note0off<millis())){
    MIDImessage(noteOn, 0, 0);
    note0off = 0;
  }
}

void MIDImessage(byte command, byte data1, byte data2) {
  Serial.write(command);
  Serial.write(data1);
  Serial.write(data2);
}
```

Arduino sketches for the value of the piezo's, and the basic send Midi note.
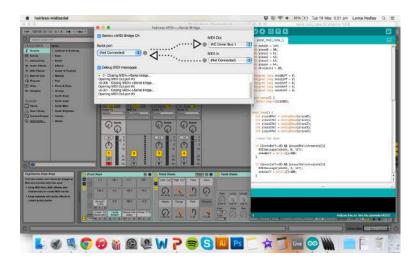
Circuit Diagram

This is my final circuit diagram for my Arduino set up, containing 5 different piezo disc sensors, 5 1k ohm resistors, breadboard and an Arduino Uno.

Sending MIDI Notes

One of the main things that I had to address and change with the code was the type of notes being send by the data. Because the parbar only works at the bottom end of the scale, I needed to use the bottom five notes, *C-2, C#-2, D-2, D#-2, E-2.* The code uses numbers that correspond to the correct notes, so I found out what numbers I needed on the chart opposite, and conveniently the numbers I need start at 0, to 4.

Once I had all this set up I began to use the Midi to serial bridge to communicate to Ableton Live. I had a couple of issues with the Hairless on my first attempt as it didn't seem to be connecting properly. I soon trouble shooted these issues, adjusted the baud rate and restarted the programme and everything was working fine. I had a simple drum rack set up in Ableton to test out the connection first, and as I was tapping the 5 different sensors, it was playing the 5 different sounds in Ableton.

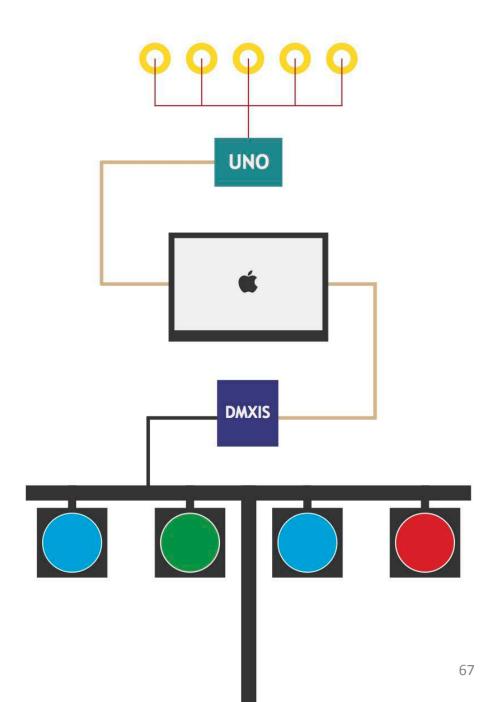http://projectgus.github.io/hairless-midiserial/#downloads

Note = MIDI #	Note = MIDI #	Note = MIDI #
C-2=0	C0=24	C#=49
C-2#=1	C#=25	D=50
D=2	D=26	D#=51
D#=3	D#=27	E=52
E=4	E=28	F=53
F=5	F=29	F#=54
F#=6	F#30	G=55
G=7	G=31	G#=56
G#=8	G#=32	A=57
A=9	A=33	A#=58
A#=10	A#=34	B=59
B=11	B=35	C3=60
C-1=12	C1=36	C#=61
C#=13	C#=37	D=62
D=14	D=38	D#=63
D#=15	D#=39	E=64
E=16	E=40	F=65
F=17	F=41	F#=66
F#=18	F#=42	G=67
G=19	G=43	G#=68
G#=20	G#=44	A=69
A=21	A=45	A#=70
A#=22	A#=46	B=71
B=23	B=47	C4=72
	C2=48	

Workflow Diagram

A visual representation of the set up of all the elements in my prototype and how they will work together. Starting with the piezo sensors which will be attached to a temporary floor, these will talk to the Arduino.

This will send data through to my MacBook Pro in the form of Midi notes, through Ableton Live. This data will then get sent through the DMXIS box to the KAM LED parbar, where the Midi notes will control different light pre-sets and sounds.
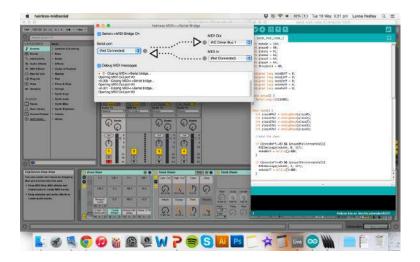
First Connection Attempt

I had both elements of the prototype ready, the parbar pre-sets were connected to notes in Ableton Live, and the piezo sensors were sending out notes to Ableton too, so in theory everything should work together.

However this is very rarely the case, as when I connected both the parbar and the arduino to my laptop everything seemed to break! The Hairless appeared to be sending endless amounts of data through to Ableton which couldn't process the information at all. I decided to leave my prototype for a bit, and come back to it with a fresh head to see if I could work out the issue.

I noticed that I was having problems with my USB ports, and things weren't connecting properly, so I went about fixing these first, hoping this might be the solution to my problems. I found and ran a SMC + PRAM reset, which fixed the connection issues.

I came back to my prototype and hooked everything up, luckily everything worked this time, and when I tapped the piezos, the parbar was displaying the different light pre-sets.

https://www.pntbrother.com/macbook-pro-usb-ports-not-working-reading-solution/

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Initial Prototype

Moving on from my development I was very pleased that all the elements of my prototype have come together, and the basic elements are working well as a unit. I planned to create an initial prototype for my project so that I could test out how the piezos would work on a floor and how well footsteps could be detected, before moving onto planning and creating my final prototype.
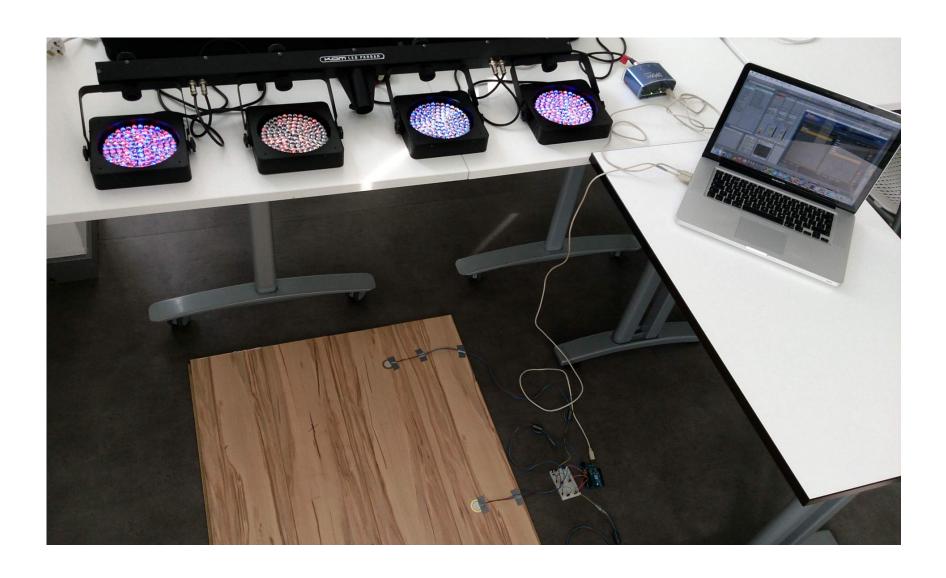
Initial Prototype

The main concern I had with using the piezo sensors was that they would be too directional to pick up vibrations from the area around the sensor, which is the effect I really would like to achieve with the footsteps. So the main purpose of the initial prototype is to see how they would react when used on a temporary floor.
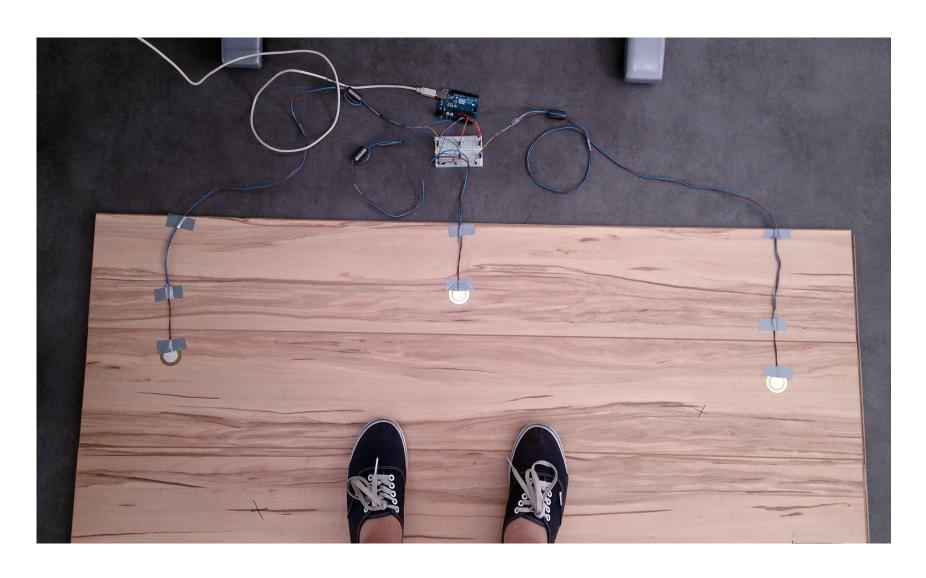
Luckily the flooring in my house has recently been replaced, so I had s couple of spare floorboards lying around. Because the piezo's need a hard surface to pick up the vibrations, this seemed perfect to use.

Surprisingly an unexpected issue raised concerning the interference with the piezos. After some trouble shooting with an arduino expert, Alistair, we discovered that because the current from the piezos is so small, the electrical interference from other objects such as the parbar was interfering with the input data, which was causing problems with the Midi input. He came up with the idea to place *ferrite rings* around my wires, which should help to suppress electrical noise and interference, which can be seen in the following pictures.

With the help of the ferrite rings, I was able to adjust the threshold in the code accordingly, so that the piezos could detect vibrations from around them as well as touching them directly. I also didn't want them to be too sensitive so getting the right balance is key.

The set up, showing the floorboards and piezos attached to the Arduino, and the parbar connected to the laptop.

Birdseye view of the temporary flooring, showing the 3 piezo sensors wired and attached in different places to detect the vibrations. Note, the ferrite rings wrapped around the wires.

Further Development

I am pleased with how my initial prototype has gone and it has given me confidence to move on towards creating my final prototype for this project. The further development for the prototype revolves around refining the elements of the lights and sounds, and preparing for the installation.

What's Next?

Now that I have been able to establish that the fundamentals of my prototype work effectively, I can continue to further develop and refine the interaction and the look and feel of the final prototype.

I have used floorboards for my initial prototype, but I will need to choose a more effective material for my temporary floor, as I will probably need larger sheets and floor boarding the area will be too expensive.

I also need to establish how I want to lights to be displayed, and how best they will work in my room of choice. I also need to decide on what colour and lights combinations I will use, and whether I would like sound to be involved as well.
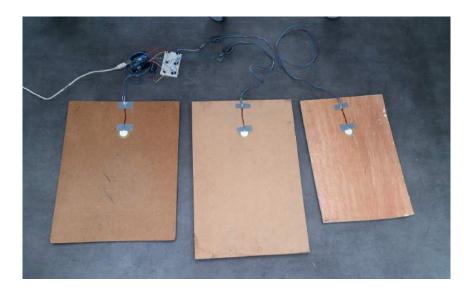
Ultimately I will be finalising my plans for my prototype. Essentially this is only a final prototype to mark the end of this project, but ideally I hope to carry on progressing with these ideas for future use. I think it is also important to recognise and understand how the prototype might alter and shape the interaction, and how much this effects my brief.

Testing Materials

For my initial prototype I had used standard floorboards which offered a great response from the sensors. However for my final prototype I want to cover a much larger area, and I don't think that floorboards would be suitable enough and possibly too expensive. I think that it would be easier to use a simple piece of sheet material you can get from DIY stores. I did some research into the different types of material that these sheets come in, which are MDF, plywood and hardboard sheets.

To test out how effective these material would be I obtained some samples to evaluate the effectiveness of each. As you can see in the pictures I got a peer to help me out by testing each board while I watch the values in the code.

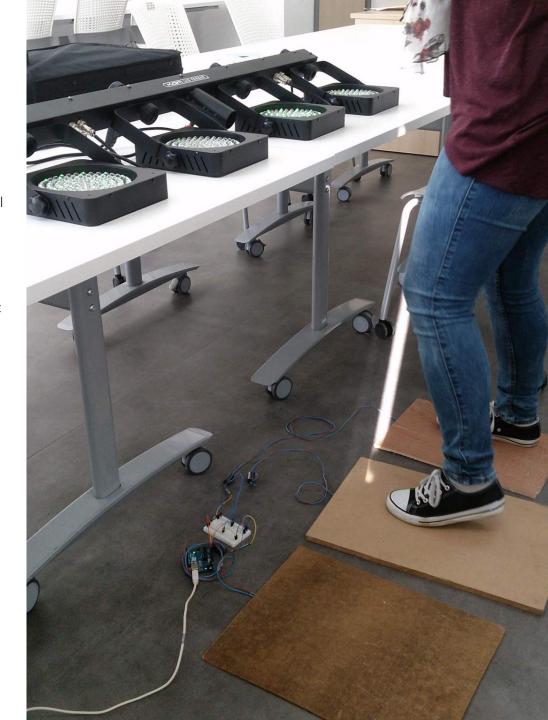While the piezo's were on top the thinner hardboard sheet was the most effective.

Whilst we were experimenting with the different values in the code and how much pressure was needed for the sensors to be most effective, we decided to flip the boards to see how the piezos would react.

The results were surprising as the piezo's worked a lot better this way. I understand that the piezos detect vibrations when pressure is applied both on and off, so I think this must be the case. Vibrations were picked up much more easily on all the materials and we could use a variety of different pressures to achieve different results.

From this experiment I have decided that the thinner hardboard sheet will still be my preferable choice, as it is more flexible than the hardboard or the plywood, which will allow for greater use of footstep control.

Light and Sound Combinations

For my final installation I want the light and sound effects to be ambient and almost trance like, to create the effect that I have outlined in my vision. The parbar only comes in RGB however, which means that I am fairly limited. I used an online source that said how to create different colours using percentages with RGB:

http://www.ehow.com/how_5141040_express-rgb-colors-percentage.html

Previously I have experimented with these, and really like the aqua and purple effects that can be created. Because I want to create an ambient effect I don't want the colours to contrast too much, so I have decided to leave out the red, and go with *blue, aqua, purple and green.*

In terms of sound, I am still unsure of how it will work within the space, and whether it will not work with the lights. This is something that I will have to decide during installation. In the meantime, however I have browsed through the Ableton Live library which has a variety of sounds that could be appropriate, which I have written down on the right.

✓ = Chimes & Bows   (sounds/ambient + evolving)

= Soaring Moving   (instruments / collision / Ambient)

= Earth Pad   (instr / collision / effects)

= Bells 3 Bright   (instr / Mallets / collision)

' Bells 4 Glass

~ Vibes Mellow

= A Snow Pad   (instr / instrument rack / Pad)

= particles Pad

- celestial Pad
  4 snow Pad

C-2
C#-2
D-2
D#-2
E-2

Parbar Display

One of the main issues for my final prototype is how I plan on using the parbar in order to best create my immersive environment. The parbar usually is mounted on a tall pole, supported by a triangle base, which means that the lights will be in a row, stuck in the corner of the room. I have a problem with this because I don't want the parbar to be a focal point in the space, and draw the attention away from the experience.

One option I have is to separate the panels from the pole, and mount them in the 4 corners of the space like I suggested in my vision. This way the lights will be all around the floor space creating a fully immersive environment. However I have research into how I could do this, and I would have to buy these 4 pin connectors in order to extend the wires, as the panels still need to be connected to the main body of the bar. I would also have to buy a lot of cable in order to mount these separately, and discretely reconnect back to the pole.

If I have the time and the money during installation, I will consider extending the lights, but for the purpose of my prototype I feel that it is not necessary in order to convey my idea, but is something to consider for future development.

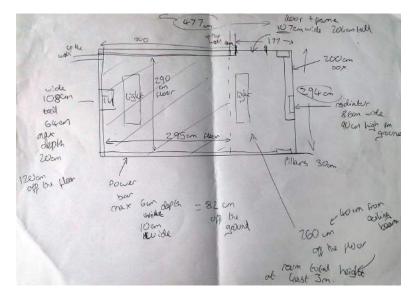https://www.esr.co.uk/electronics/connectors-multi.htm

The Room in Question

In order to install my prototype in University where I can properly document it and keep it up for showing, I need it to be in a small room which is not in the way. The room I have in mind is the small tutorial room in one of the studios, which will be perfect for my installation as it is easy to darken as it has no windows.
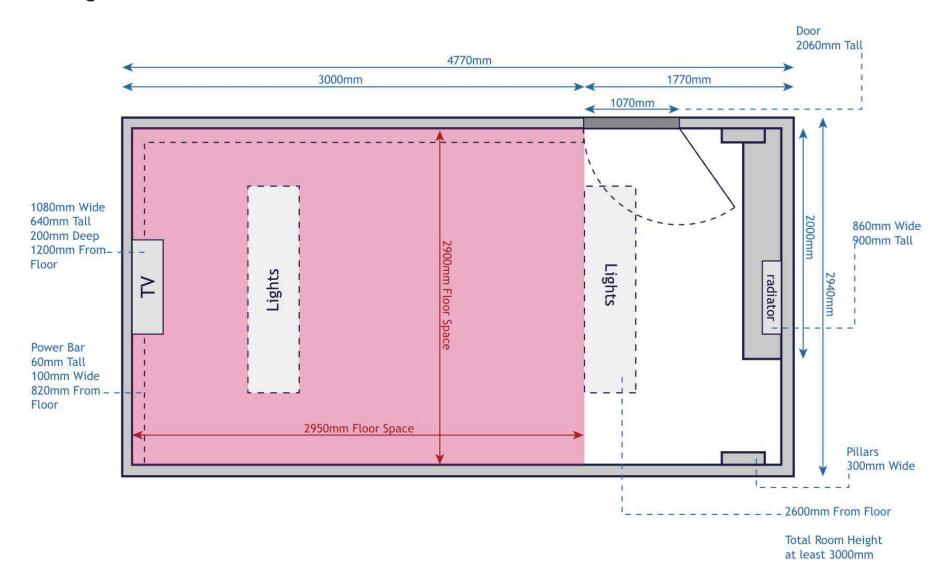
After obtaining permissions from my tutors, I set about planning and designing how my installation could be fitted into the space. I have taken a panorama shot of the room, opposite, which shows the style and shape of the room. A good feature of the space is that it has a power bar running around the length of the room with many plug sockets, which means I am not limited to where I place the parbar (as the power cable is only short).

I took a tape measure to the space and jotted down the dimensions. I was able to asses where the best place was to put down my flooring, which will be at the TV end of the room. Hopefully I will be able to remove the TV for my installation. I have also taken into consideration the height of the room, if I am to carry out my plans to mount the parbar panels separately.

Floor Diagram

4770mm

3000mm

1770mm

1070mm

Door
2060mm Tall

1080mm Wide
640mm Tall
200mm Deep
1200mm From
Floor

2900mm Floor Space

2000mm

2940mm

860mm Wide
900mm Tall

TV

Lights

Lights

radiator

Power Bar
60mm Tall
100mm Wide
820mm From
Floor

2950mm Floor Space

Pillars
300mm Wide

2600mm From Floor

Total Room Height
at least 3000mm

Obtaining the Floor

So once I had decided on the materials I needed, and the size of the floor in which I needed to fill, I had a look at some DIY stores to see what I could get.

I found that *Wickes* offered the best deal on size and price, so I asked a friend for the use of her car to help me bring them into university. However while at the store we faced a problem, and the type of material I wished to buy would not be able to fit in the car. The chipboard I had selected was big enough so that I only would need 2 sheets to cover the floor space, and would have been the most cost effective way. However I ended up going with the hardboard sheets as previously planned, and even found some that are white coated which would offer a nice finish to my prototype. I bought 8 separate panels, and have planned to attach them together with strong duct tape, which should hold them sufficiently.

The materials can be viewed on the links below, however the white hardboard I purchased came in a different size.

http://www.wickes.co.uk/Wickes-General-Purpose-White-Faced-Hardboard-3x606x1220mm/p/110403

http://www.wickes.co.uk/Wickes-General-Purpose-Chipboard-12x606x1220mm/p/110280
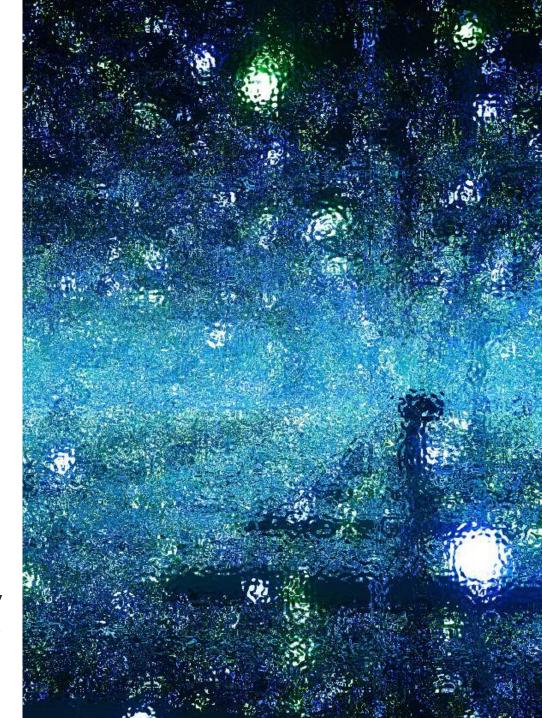
A Moment for Reflection

As I have outlined in my vision I was prepared that my project would change and adapt with how my prototype evolves, so I am taking a moment to see how much things have changed since when I first outlined my brief.

The prototype is ready to be installed and the different elements all work well, so I can establish how the final installation will look. I think the most important factor is that I cant change the orientation of the parbar, so my original plan to create an ambient space may be harder than I thought to achieve. Also other contributing factors such as the size and type of the room, and how much floor space I can use, have shaped my installation into what it is about to become. Generally I think the prototype will be more considered as a stand alone, artistic installation and an experimental piece to see how people react to the space.

I am still excited to see how it will turn out and I am pleased with my progress so far, but there will be a lot of thought as to how this project could develop for the future.

Assembly

All the elements of my prototype are ready for the assembly of my final installation, this section shows the steps I took to achieving this. I also filmed myself for the entire assembly to be created into a time-lapse video. This can be seen at the beginning of my video documentation.
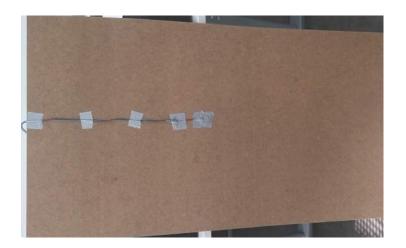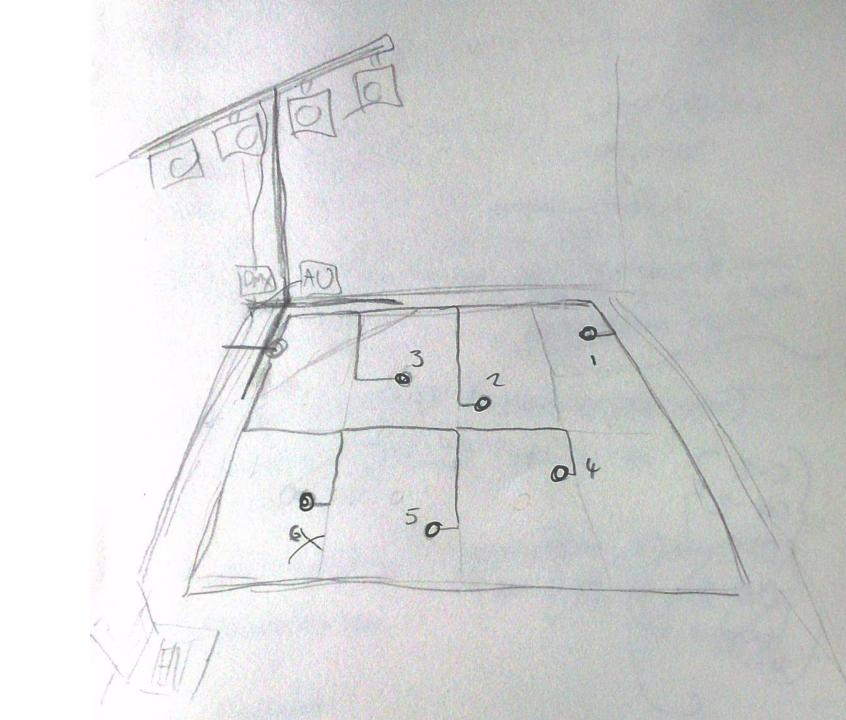
Floor Plan

Firstly I tested out the new panels I had bought for my installation. In this pictures you can see the size of the boards, and roughly how I plan to attach the piezos to the underside of the boards. As experimented, the piezos work fine with the new materials.

I was unsure on how best to go about installing the floor, as I had to place the piezo sensors and wire them correctly. I had to consider the logistics of where to place the Arduino and where the parbar would fit best.

I drew up this quick sketch showing my thoughts. The 8 panels will be joined together in the top corner of the room. I have chosen to run the wires following the creases of the boards, because I don't want the cables to warp the boards too much, as this creates too much vibration and movement for the sensors. I placed the piezo's evenly, around the centre of the boards where they would work best, and wired to the left hand back corner of the floor. This is where the Arduino will be housed underneath the parbar. Then all I need to do is run the 2 USB cables along the side to my laptop, which will be out of the way of the main installation.
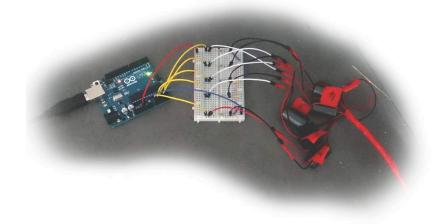
Building and Wiring

I decided that the best way to go about the assembly was to wire the whole floor upside-down, and then flipping it over once it was done. The top picture shows the floor after the wiring was complete. I added a lot more tape to the structure before deciding to flip.

Luckily I had a lot of help as it was difficult to manoeuvre, and I was particularly worried that the boards would not hold together during the process. However, all was well and the floor survived, and I was able to finish off the wiring before attaching to the Arduino, which can be seen below.
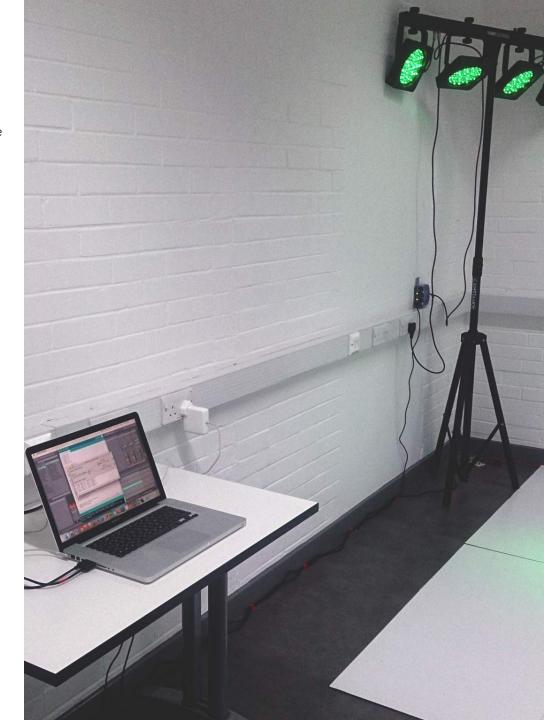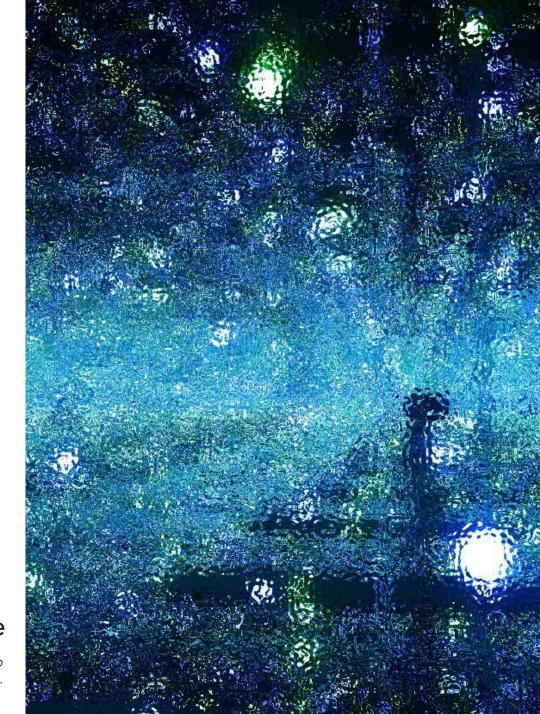
Parbar

When the floor had been built and adjusted to my satisfaction, I assembled the parbar in the top left hand corner. As you can see in the picture the DMX box had to be mounted on the wall, as it was not long enough to reach the floor.

The Arduino and wires have been housed in a small black box to make them discreet, and I purchased 2 longer USB cables to reach my laptop, one for the arduino and the other for the DMXIS.

The main alteration to the prototype during the installation was that I noticed that the interference was no longer an issue. Before I had to place my laptop on the floor for it to work properly, but I think that the tape really insulated the wires and prevents any interference, which is great as I can have my laptop on the table out of the way.

Final Prototype

Images and Documentation of my final installation. During this I also filmed for my video documentation and conducted some user testing.

User Testing

Once the installation was complete I was able to fully appreciate the way my prototype works. I was pleasantly surprised at how responsive the sensors are, and how quickly the lights change in comparison to the footsteps. I decided to conduct some user testing, which I filmed to put in my video documentation, and took some screenshots from the video as well.

It was most interesting to see a group of people on it at once, to see how they reacted to the lights and sounds and how they worked together. I noticed that if someone was new to the installation, they would be quite tentative at first, exploring where the possible pressure areas could be.

When the group begins to run around in circles they have turned the installation into a game, to see how quickly the lights and sounds change the quicker they run. It was interesting to note that they wanted to test the limits of the piece, which might not have been able to do if only one person was on the floor.

This contrasts with the second half of the video when one person is on the floor, but is being instructed by another, gesturing them to move to try and find the pressure points. I think this is the most contributing factor to how the installation has been shaped by user interaction. Because the points are not marked, users have to explore and find the points themselves. My intentions were not to have people wanting to find them, but rather a more ambient experience where it doesn't matter where the pressure points are. I think this might be due to the size of the space, and because it is more of a stand alone installation.

I discovered that it can be quite a different story when only one user is on the interactive floor. With no one to say what to do, or shaping the interaction in any other way, the user is free to explore the piece at their own pace.

One thing that I thought would happen is that the parbar drew a lot of the attention. Users would look up at the parbar to see if they were changing the lights, which originally was not my intention and was something I feared would happen. However I noticed that when a group of people were using it this was not as common, and sound was more important.

Individually people were more involved in changing the lights, but as a group they were focusing more on the sounds, which is incredibly interesting. I think this might be due to the fact that in a group, the other users can be changing the sounds whilst you are on it, and will cause curiosity, distracting the other users and the sound is more responsive.

Reflection

As my project is coming to a close it is necessary to evaluate and reflect on the good points and bad points of my project. I will also be looking into future developments for my installation.

Evaluation

I feel that this has been a very rewarding project for me as I think that I have achieved a lot of my aims and goals that I set out to do. It has also helped me to further develop my personal interests concerning what I want to do after I finish university. Generally this has been a very positive experience for me as I have not had many problems, which has sometimes been the case with past projects, where I have struggled with creating a prototype that effectively communicates my vision. I feel that this project has shown me that I can create effective and working prototypes, and has given me the confidence to do something similar again.

There are many things that I would like to change, that I have mentioned throughout the document. Such as my issue with the parbar being more of a focal point in my installation, when I would have preferred an ambient settings where the lights and sounds are more discreet. My original intension for this project was to enhance a public space, in order to make them a more memorable experience for passers-by. It has been interesting for me to look into public interaction and how this shapes the environment, which has sparked off a more personal interest for me. I have enjoyed looking into public installations and how this bring people together, which I think has ultimately shaped the way my project has evolved. My prototype definitely alters the outcome. If I look back to my original brief, I talk about how I want to enhance public spaces, like museums and galleries to make them seem less dull, however I feel that my installation has almost become an art piece of its own. I still think it is a useful tool, however, for observing how people react to a certain environment, and how they react differently in groups. I look forward to the final show as it will give me more of a chance to observe how strangers will react to my installation.

There are not many things I would like to change concerning the concept of the piece, but I have already mentioned how I would like to alter the aesthetics of the installation. I think the sounds could have used some more thought into them, possibly creating a more ambient atmosphere. I was unsure about using sound in my piece for a long time, only at the end did I decide that it would enhance the piece because it had evolved more into an installation of its own accord. More thought process into what sounds, and what they mean, and how I want people to react to them would have been more beneficial to my project.

I have also had many ideas for what I wanted to add to the piece. I wanted to create almost a fake gallery experience by placing art around the room. The reason I dropped this idea is because they wouldn't have seemed necessary with the lights and the sound which are quite overtaking in the small room. I would have like to have enhanced the interaction further as well, and possibly incorporated the TV into the experience. This could have projected imagery onto the screen which could have been controlled by movement, and this could have enhanced the idea of a more immersive and interactive gallery experience.

Overall I am extremely pleased with the way my project has gone, and what I have been able to achieve. I think my favourite aspect about this project is that it has so many future possibilities that I would love to continue and develop. I think that my prototype has creatively and effectively offered a solution to the issues I raised in my research, on how to enhance a space, and has even offered insights into how people react and use a space with other people. It has been a challenging yet rewarding learning curve and I am pleased with my end result.

Future Development

I have had several ideas on how this project could be taken further, and I think that my prototype has opened up several doors to new and exciting developments.
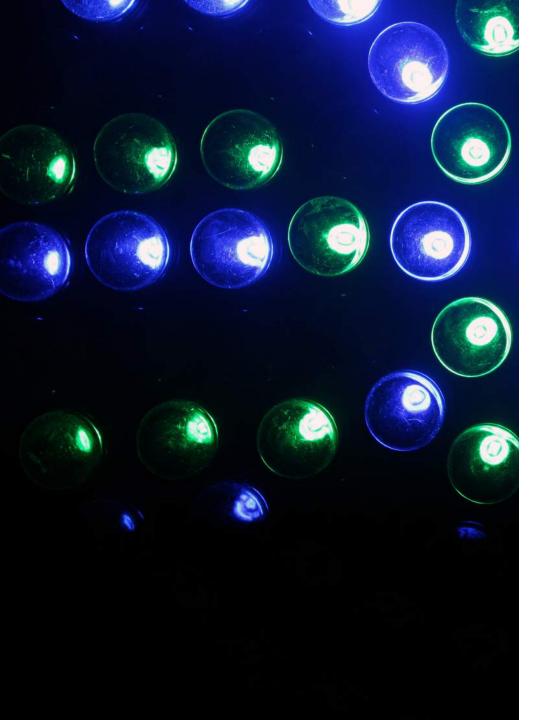
I think that the piezo disc sensors have proved themselves worthy of a future project, as they have been reliable and effective for this demonstration. In terms of enhancing a public space it will be interesting to know what technology is used in pressure sensors, and how this could be used to create a light and sound display.

Ideally I would like to create this installation on a much larger scale, and it could be used in a variety of places, such as in galleries, libraries and shopping malls. It would need somewhere where traffic is not too intense, and could allow someone to stumble upon it unexpectedly.

Also the sounds could relate to something more meaningful, and could enhance a public space in a different way, such as bringing the countryside back to the city. The lights and sounds could correspond to a more natural setting, which would cause users to explore the space and to create a memorable experience.

However on a more personal level, my interest lies within museums and galleries, and I would like to develop my ideas in order to bring unused space into the limelight. The future of museums and galleries lies in new technology, and bringing people together, so I would like to develop my installation into something that would enhance these spaces for that purpose. I could for instance create a fully immersive and digital gallery environment. The user could interact with the space accordingly and explore the artwork, which may be projected digitally. There are definitely a lot of prospects to explore.

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http://www.lozano-hemmer.com/tape_recorders.php

Figure 8
http://www.nytimes.com/2013/03/21/arts/artsspecial/at-cleveland-
museum-of-art-the-ipad-enhances.html

Figure 9
http://www.magicalmirrors.de/

Figure 10
http://www.dailytouslesjours.com/project/21-balancoires/

Figure 11
http://www.mystudio.us/projects/70

Figure 12
http://www.arduino.cc/en/Tutorial/Knock