



XD6003: IxD FINAL PROJECT

BEN ABBOTT | DESIGN DOCUMENT



CONTENTS

5 Brief

Project Overview
Key Aims
Semester One
Abstract

10 Research

AR (Smartphones)
Projection Mapping
AR (Headset)

19 Concept

Idea Generation
Concept 1
Concept 2
Concept 3
Concept 4

30 Competitive Research

Valo Climb
teamLab En Tea House
Theoriz - Mixed Reality
B-Reel PM Multiplayer Game

40 Market Research

USP
Xite Labs
M&P Store
Quince Imaging
Observatory Creative

48 Technology Research

Positional Tracking ("Lighthouses")
Game Controller
Web Server
Mad Mapper
After Effects
Final Cut Pro X
Projectors

57 Contextual Research

Illusion Behind Projection Mapping
AV Enhances Exercise
Mind-Map
Mood-Board

63 User Research

Management Interview
User Personas & Scenarios
Research Summery

70 Branding

Logo Mood-Board
Logo Design

77 The Build

Animation
Model Construction
Final Cut Pro - Video

97 The Future

Critical Review
Future Functionality

100 Bibliography



BRIEF

The aim of this module brief is to create two deliverables, a prototype and a design document. You are required to create (or finalise) your prototype approach and methodology taken. You must communicate and present your prototype in a professional manner - i.e. in a video prototype for example. Students may continue their project from Personal Project or start a new project. In either case, the aim of this module brief is to enable students to continue to resolve their design solutions from Semester 1, or begin to engage with a new design problem. The exact subject material for the project is self-determined but the module content will embrace; visual and verbal preparation of design proposals, research and investigation; assessment of goals, audience, content and design requirements; prototype development and evaluation.

You will be assessed on the submission of the following portfolio elements:

1. A professionally produced design document encapsulating key research findings and iterative design developments leading to the creation of your final design artefact/prototype. This document should also include evidence of assessment, testing and personal reflection where appropriate.
2. The presentation and communication of design artefact/working prototype realised using appropriate design and development skills and use of technology.

PROJECT OVERVIEW

I'm starting a completely new project for my final project. I'm going to try and take the knowledge in regards to my previous modules primarily my experience with VR and Projection Mapping and try to create an new climbing experience.

KEY AIMS

1) Incorporate the use of mixed reality in an interactive way to augment or enhance the way someone climbs. It can be used to make it more fun, provide challenges for more hardcore climbers, and teach new skills.

2) Create a physical prototype showing how this could be implemented into a real-world scenario. Make this prototype to a high standard using modern technologies and tools.

3) Finally, create a video displaying how this prototype is presented in its primary use case possibly even show it being used in that way.

SEMESTER ONE RECAP

With my last project, I explored the way VR could be used to enhance the way people interact with interfaces in VR. With my new project, I wanted to keep my project basis on the cutting edge of modern technology but scale it back a bit so that a proper prototype could be feasible with today's current technology. Last year my concept was also purely "design fiction" whereas I want to fully realise a conceptual prototype for this one.

Another issue hindering the expansion of my previous concept VR Assistant was of how technical it would be to make something working in an actual VR operating system and how new the technology was and modern.

Features that I wanted to use in my prototype weren't even fully built into the dev build I was using in Unity.



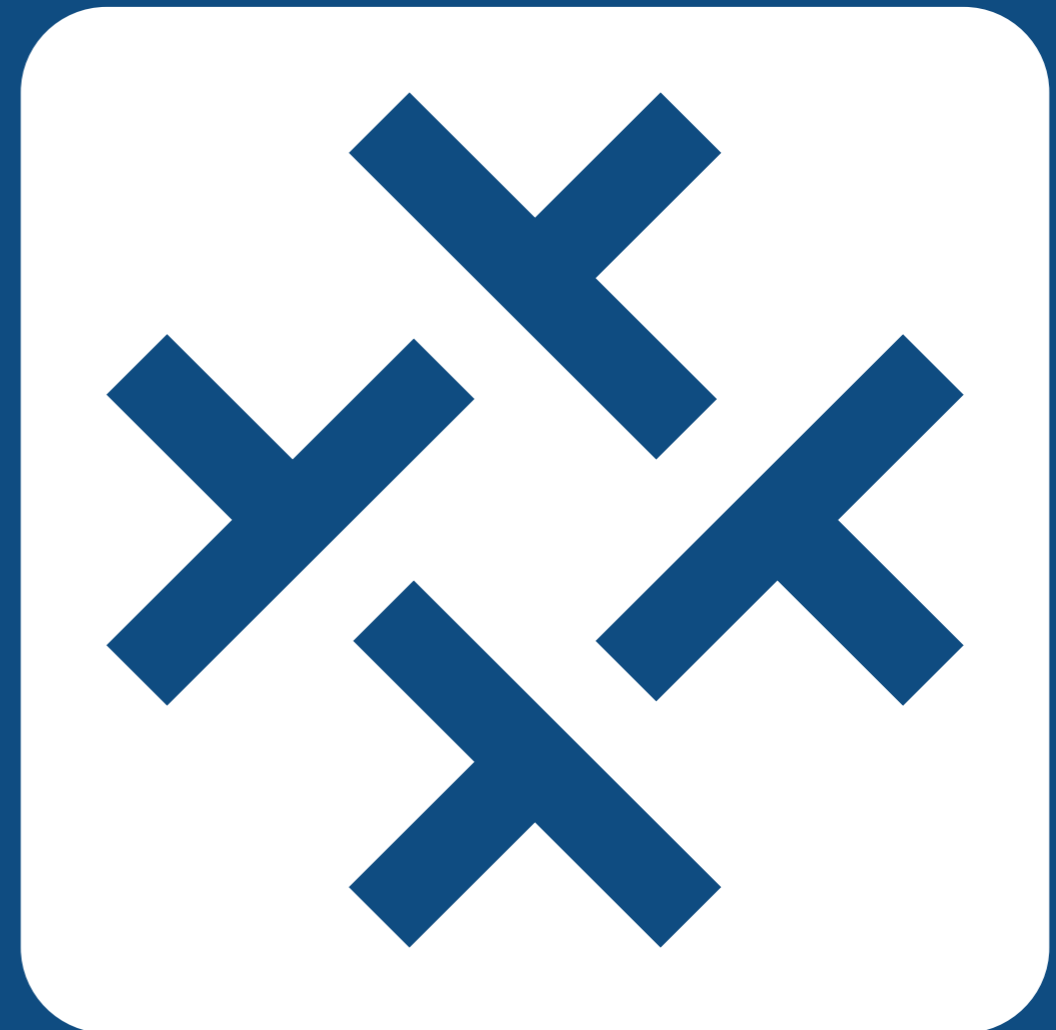
NEXT STEPS

During semester one while I was exploring the use of VR and creating my work for that brief I came across mixed reality set-ups and the benefits they can provide. After exploring the use of such a set-up during another module I wanted to take my knowledge from semester ones realisation project and combine climbing with that module to create an interactive mixed reality concept for a sport I'm more interested in.

ABSTRACT

Crossing technology with an active sport has always been a challenging field of creation. You want that technology to enhance the sport or activity you are doing without interrupting the process or to distract you from it. This makes it difficult to produce something innovative but also appealing to a broad range of climbers.

With my concept, I'd like to inform users on how to improve as climbers but also make something new and fun for them to do without it distracting from what makes climbing fun and interesting sport.





<https://www.outsideonline.com/2405702/new-york-times-wrong-about-climbing>

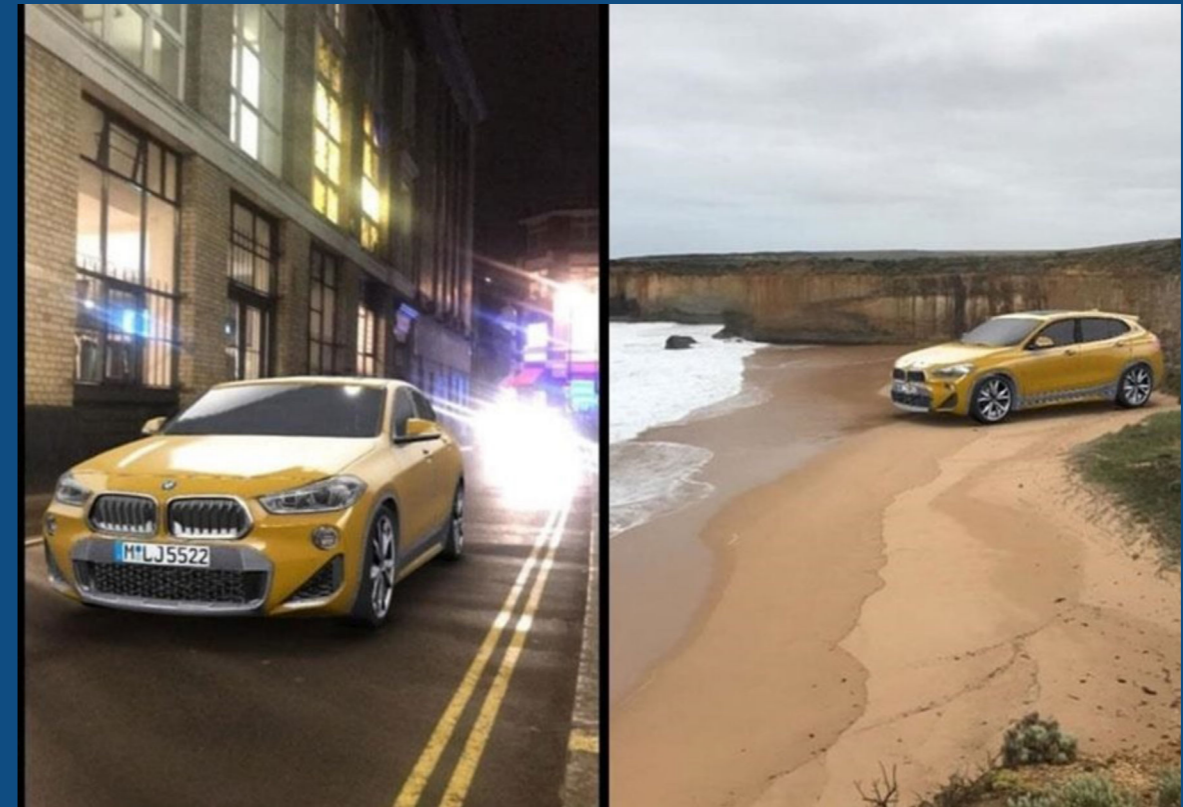
RESEARCH

With this research, I want to focus on how mixed reality has improved other activities and sports. How modern technology has been used to enhance them and how it could keep enthusiasts engaged more into that sport. I wanted to create one concept for each distinctive field of AR. The first part I wanted to explore was AR (Smartphone), Projection Mapping, and other mixed reality concepts and finally dedicated AR headsets such as Microsoft's HoloLens.

AUGMENTED REALITY (SMARTPHONES)

I explored this briefly back in semester one when choosing what field of technology to go down for my initial concept and my summery back then was that more people have access to it (Smartphones) and that in most cases the barrier for entry is a lot lower because of that and because VR requires a physical headset that most people don't have however it wasn't as immersive.

One of the primary developments in the AR space is its integration with modern smartphones using Apple's AR Kit for iPhones and Google ARCore for Android both allowing developers to easily create experiences just by using your smartphone camera. Apple has also recently equipped its latest iPad Pro with a LiDAR sensor allowing augmented reality to become even more accurate.



AUGMENTED REALITY (SMARTPHONES)

Augmented reality is most used most popularly in applications such as Pokemon Go and Snapchat. Pokemon GO, which has been downloaded one billion times, composes Pokemon over a real-life window of the world through your smartphone. Snapchat uses it to enhance interactions between users by composing effects over individual's faces. Both have been used to great effect by each respective company and both have become standout features of their respective application.

Augmented reality has also been used to great effect in the retail sector most notably car buying. Many dealerships allow customers to spec out an augmented version of their future vehicle to see what it could look in the real world before purchase this brings a level of immersion to the experience especially if a car is a limited run model and the customer has to put their name down months or years in advance.



A hand holding a smartphone displaying a game interface, likely Pokémon GO, against a blurred background of a park. The phone screen shows a map with various icons, including a Poké Ball and a character. The background is a bright, outdoor setting with trees and a path.

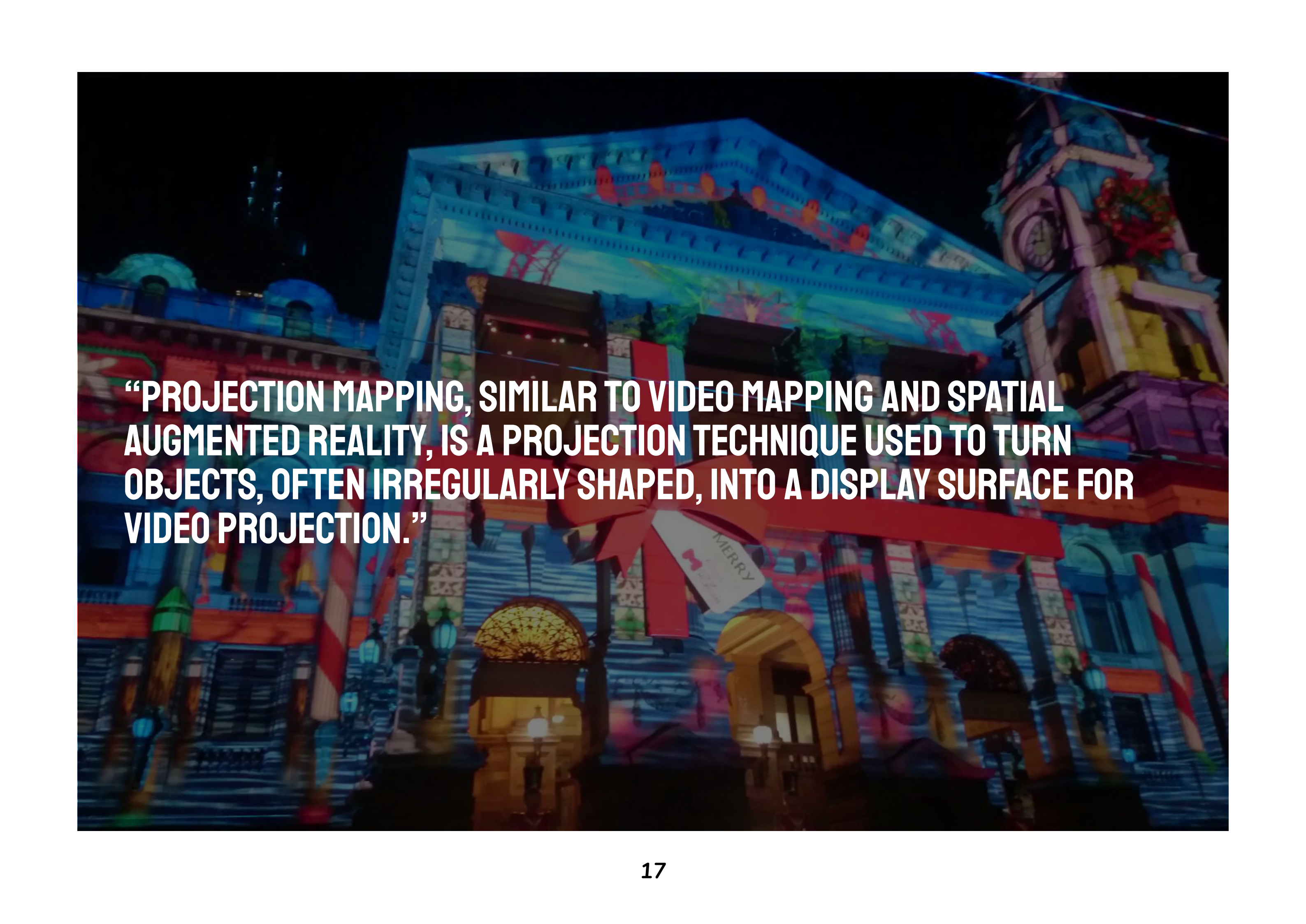
“A TECHNOLOGY THAT SUPERIMPOSES A COMPUTER-GENERATED IMAGE ON A USER'S VIEW OF THE REAL WORLD, THUS PROVIDING A COMPOSITE VIEW.”

PROJECTION MAPPING

Projection Mapping is a very popular technology in large events. It's used to map a picture or video onto an object or large scale building. It can be done using any projector and projection mapping software and can be used to make surfaces more interactive.

It's usually used to put on a large display event for a big crowd or in a commercial environment as it requires large projectors and expensive software however the effect that that can be achieved can be quite good to the eye depending on the imagery shown and can be used for a lot of different creative applications.





“PROJECTION MAPPING, SIMILAR TO VIDEO MAPPING AND SPATIAL AUGMENTED REALITY, IS A PROJECTION TECHNIQUE USED TO TURN OBJECTS, OFTEN IRREGULARLY SHAPED, INTO A DISPLAY SURFACE FOR VIDEO PROJECTION.”

AR HEADSET/GLASSES

The third and final area of AR I researched before coming up with a concept was dedicated to AR devices such as Microsoft HoloLens, Magic Leap One, and Epson Moverio. This is the area with the least development because these devices are incredibly limited to enterprise or workplace applications and have a fairly limited consumer reach.

The devices that do cater to the consumer in some way still cost a lot of money meaning creating a fully realised prototype would be difficult/impossible. I still wanted to look into how these devices can augment reality to see what people could potentially do if any of these hardware became available to the consumer sector.





I THINK EVERYONE WOULD BASICALLY AGREE THAT WE DO NOT HAVE THE SCIENCE OR TECHNOLOGY TODAY TO BUILD THE AR GLASSES THAT WE WANT. WE MAY IN FIVE YEARS, OR SEVEN YEARS, OR SOMETHING LIKE THAT. BUT WE'RE NOT LIKELY TO BE ABLE TO DELIVER THE EXPERIENCE THAT WE WANT RIGHT NOW. — MARK ZUCKERBERG

AUDIO VISUAL EXPERIENCES

After putting some researching into projection mapping and the various technologies used to put on a projection mapped experience I found that a lot of companies that do projection mapping also focus on audio visuals for huge events and big shows. While audio visuals aren't mixed reality they are normally used in conjunction with various MR technologies to produce a more immersive experience.

Audio Visuals are electronic media that specialise in both a sound a visual component. Audiovisuals aren't just used to enhance the entertainment factor of live performance events and can be used in areas such as education, live broadcasting and streaming making a huge portion of our media consumption.

The main part I want to focus on for my research is how it can be used to enhance mixed reality set-ups and the increased immersion it brings to areas like exercise and sport.



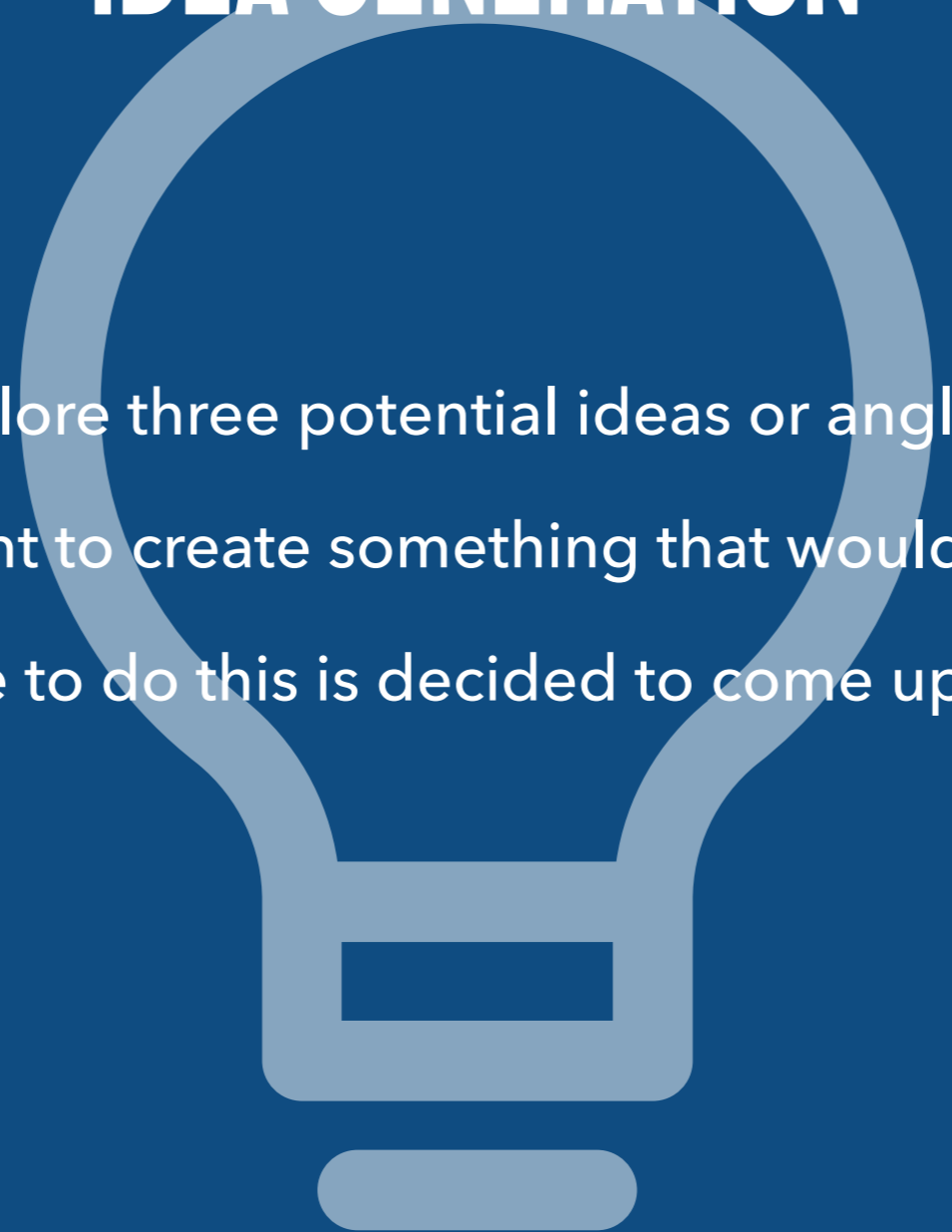
A photograph of a person in an orange shirt climbing a dark, craggy rock face. The climber is positioned on the right side of the frame, reaching up. Below the rock face is a body of water, and in the background, there are dark, silty hills under a cloudy sky. The word "CONCEPT" is overlaid in large, white, bold, sans-serif capital letters across the center of the image.

CONCEPT

Photo by [Steve Bruce](#) on [Unsplash](#)

IDEA GENERATION

To start with I want to explore three potential ideas or angles I could accomplish this with the brief in mind. I want to create something that would augment and improve the user's experience to do this is decided to come up with 4 concepts.



CONCEPT I

I first started exploring a way in which you could use a smartphone to enhance your climbing experience around a bouldering wall. Routes are colour coded then if a person needs more information about that route they go to a sheet on a pinboard beside changing/lockers this is less engaging as a user may have to walk back to the gym area to see what routes are new and available.

I conceptualised a way to display this information in AR by scanning stickers that could be placed around the climbing wall and next to routes with hard problems to overcome giving advice or showing customers the techniques involved with a climb.

This allows the customer to seek help if they require but it keeps the climbing focus while applying an interactive spin on the learning process involved with climbing.

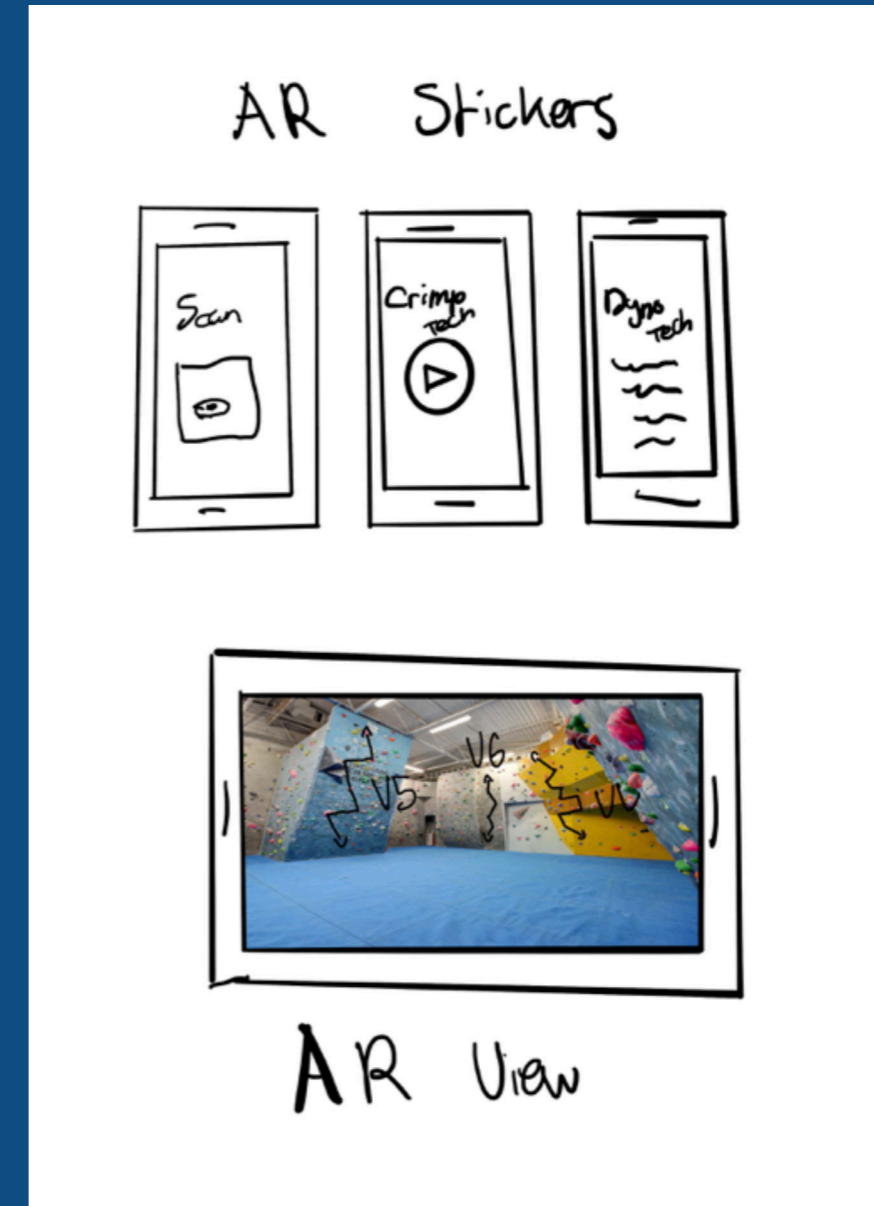
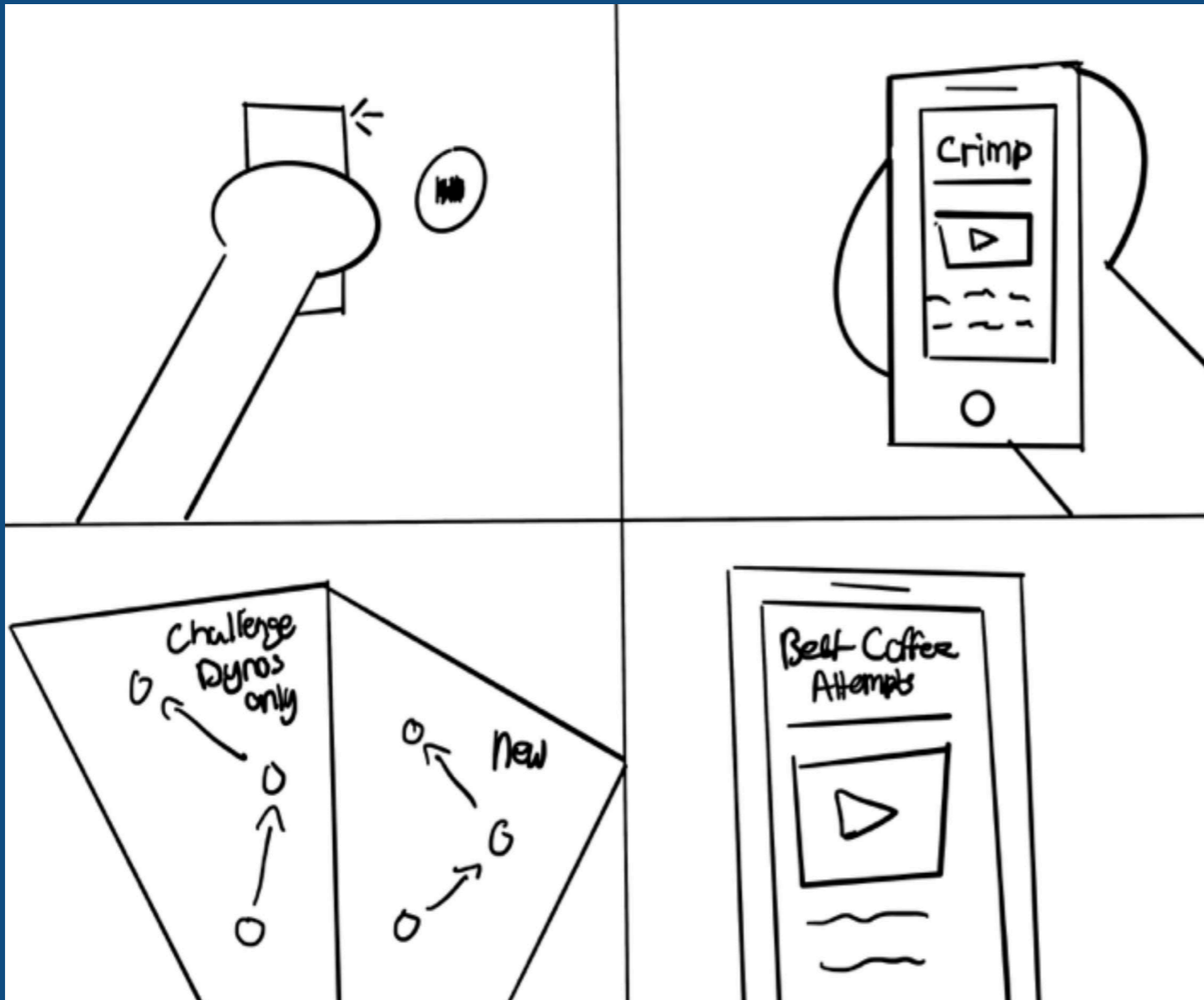
However, the main issue I ran into while talking with a small user group was the safety involved with the process of scanning elements next to a potentially live climber. The climbing wall already has safety guidelines in regards to climbing above other people and people walking under potential people who may fall.

Someone viewing an AR interactive experience might pose a large safety risk especially when the climbing wall is during its peak customer hours.

Functionality

Scanning stickers in AR with a smartphone on climbing routes to get information on that route or to interact with it in some way.

MOCK-UP I



Companion app with built in scanner to bring up information on parts of the climbing wall.

CONCEPT 2

My second idea started with wanting to bring a projection mapped experience to Durham Climbing Centre as part of an event. This would entail shutting a section of the wall off for a few hours to display a projection mapped experience.

Users would then interact with the projection mapped wall as part of a game or visual experience in some way. As long as they don't look away from the wall into the projector this wouldn't pose much of a safety risk especially if it was displayed on the children's wall which is much safer.

The primary problem with this concept would be the lighting levels required to get a visually appealing projection map would have to be reduced potentially hindering the visibility in the climbing wall itself which could be an issue.

Functionality

Projection map visuals onto a climbing surface and allow climbers to interact with those visuals in some way using various technologies.

MOCK-UP 2



Projection mapped experience to increase immersion e.g. rock climbing surface or audiovisual experience.

CONCEPT 3

My third idea is how AR Glasses could be used to enhance climbing inside indoor bouldering walls. This would mean that once a user puts on the headset it could project a real-life rock face onto the indoor climbing wall to make it feel like the user is actually climbing a real rock face.

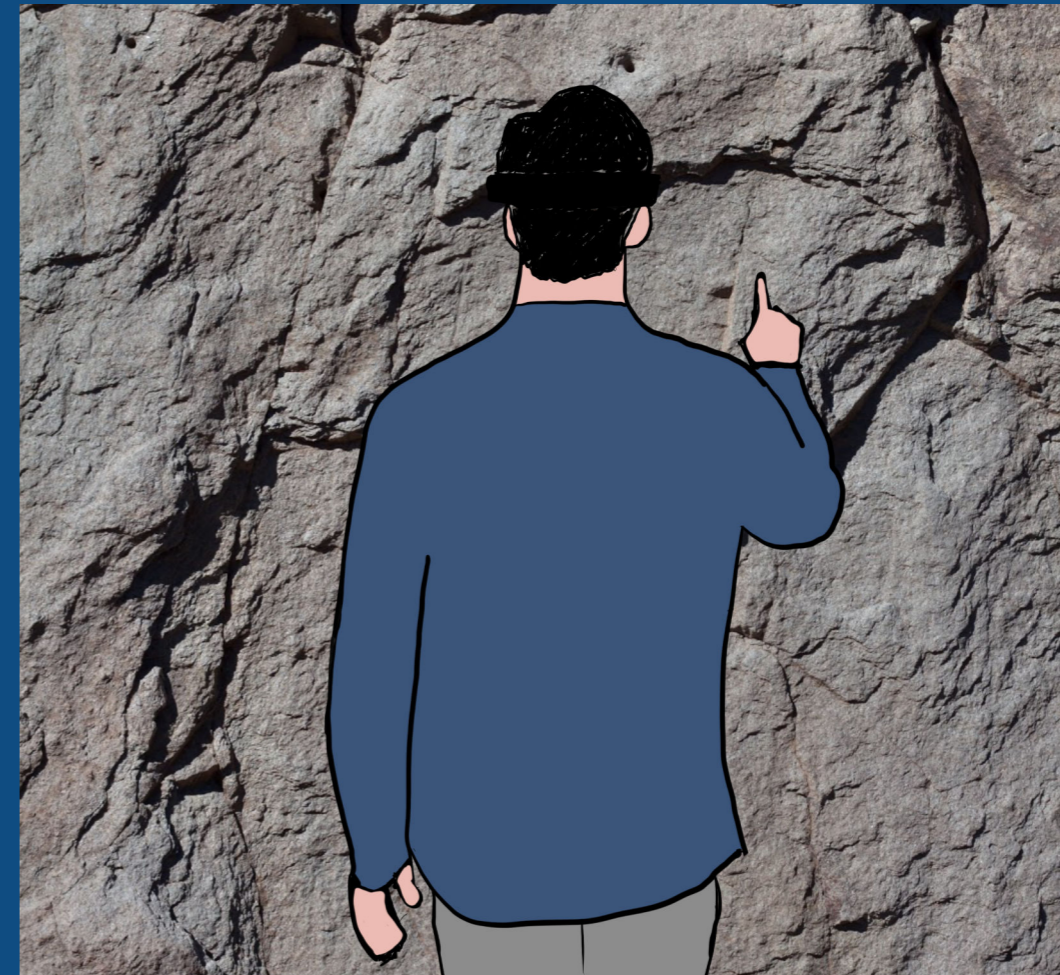
The primary issue with this concept would be fact users have to wear a headset or some glasses while climbing which could be uncomfortable for some climbers and it's the reliance on future technologies.

Overall this is my weakest feasible idea.

Functionality

Use a more dedicated set-up to make the climbing experience more visually engaging with the issue being it's interruption to the main climbing experience.

MOCK-UP 3



AR Headset climbing experience e.g. make the wall look like a real climbing wall or highlight your own route to climb.

CONCEPT 4

My final idea is an audiovisual climbing night that could be put on during the night sessions at Durham Climbing Centre this would be a more action-focused session that would use projection mapping and visual effects to enhance the climbing experience of the users. This would use projection mapping as well as audio (the wall already has a sound system) to create an audiovisual experience for all of the people at the centre.

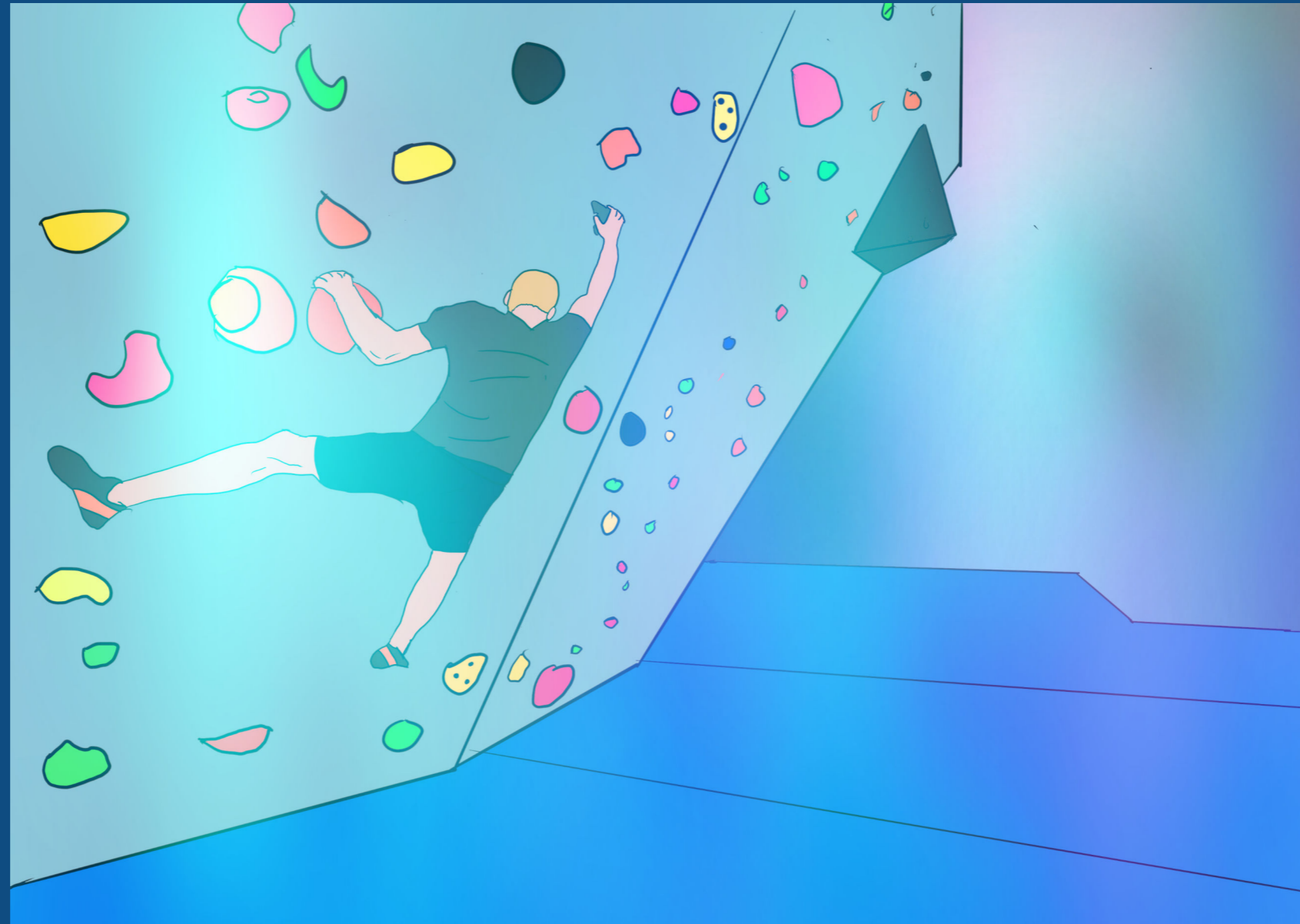
The visuals would interact with the audio effects and the session could be planned around these to make it more engaging and enhance the traditional climbing session.

The primary critique with this concept is the fact that it's an audiovisual experience in a climbing wall and could be deemed too distracting for other climbers. This could be an issue if they are just there to climb however the Durham climbing wall has put on a live DJ set for some of their events to enhance the atmosphere from time to time especially on the big tournament finals. During these sets, they increase the volume of the music giving the centre a more party atmosphere.

Functionality

Reactive light show to create a "pump" workout experience involving climbing walls and its various advantages.

MOCK-UP 4



Audio Visual music and lighting to make a more "pumped" workout experience.

CHOSEN CONCEPT

With ideas 1 and 3 having too many issues in their conceptual phase I decided to explore the safest option and the most user engaging idea out of my initial phase and come up with a projection-mapped climbing experience.

I've already had experience with projection mapping in a previous module meaning I can carry that experience forward and make something more technical as I now know how it works. Projection mapping is also quite rare as it is really expensive to set up as it's mainly used on a large scale because of the costs involved for independent setups (Projector, Software, Person with PM experience and video or image production)

Creating a climbing centred experience around projection mapping will also allow lots of areas for future development such as sound design and what I mentioned in my original concept with potential ways to expand it for a game experience or visual spectacle.

A photograph of two rock climbers on a grey wall with red holds. The climber in the foreground is a man in a blue singlet and white shorts, reaching for a hold. Another climber is visible in the background. Large white text is overlaid on the image.

COMPETITIVE RESEARCH

COMPETITIVE RESEARCH

Now that I have chosen a projection mapping experience as my main concept for this project I wanted to have a look at various current technologies out there from museums, independent creative studios and art displays. I also want to explore large scale projection mapping and how it can be used to enhance various events available to massive crowds.

VALOCLIMB

ValoClimb or Augmented Climbing Wall is an interactive climbing wall that uses projection mapping to display the actual content on the climbing wall. Then using body tracking sensors it can tell if you are touching the wall and for that to interact with the content on screen. It has a touch screen interface that allows users to pick from a range of games and activities that connects to a built-in projector. It's an all in one solution for this specific scenario which makes it easy to set up and easy to use.

The primary issue with this all-in-one solution is that the primary focus of the system is the games included and not the climbing. The wall has to be built specifically for the games not the other way around and that the cost of the device means that it's usually rented and can't be implemented fully.

After doing some research the ValoClimb unit costs approximately \$30,000 which is far out of the reach for most independent climbing wall gyms. Its primary user base seems to be large corporatists putting on one-off events at their events or advertising.



PROS:

All-In-Solution

Intuitive Touch Screen Controls

Innovative body tracking Technology

CONS:

Price

Limited to just gaming experiences

Only works on certain walls

TEAMLAB DAM

teamLabs have set up an en tea house inside the Mori Building in Odaiba, Tokyo, Japan. Using projection mapping they can map a picture of a flower onto your cup of tea you buy at the tea house. Then once you lift the cup up to take a sip the flowers disperse off. It's a good effect thanks to the technology involved with projection mapping. teamLabs also use traditional projection mapping to light up other parts of the building.



PROS:

Easy to set up

Interacts with a physical object (cup of tea)

CONS:

Entire art display so it's not mobile

Content is made specifically for the design

THEORIZ - MIXED REALITY

Theoriz Mixed Reality uses a mix of VR technology specifically the sensor rigs and projection mapping imagery to produce visual effects based on the person's location. The demo shown shows how the floor can follow the individual as they walk around.

This produces what is known as real-time projection mapping as no pre or post-production is required to display the effect. This would be ideal for a climbing scenario as the wall could interact with the player as they climb it. It also seems like a cost-effective method of projection mapping as it uses the HTC Vive Sensors which are easily available and a simple room-filling projection mapping set up.



PROS:

Uses widely available components
Requires no pre/post production work
Can be implemented into a multitude of environments

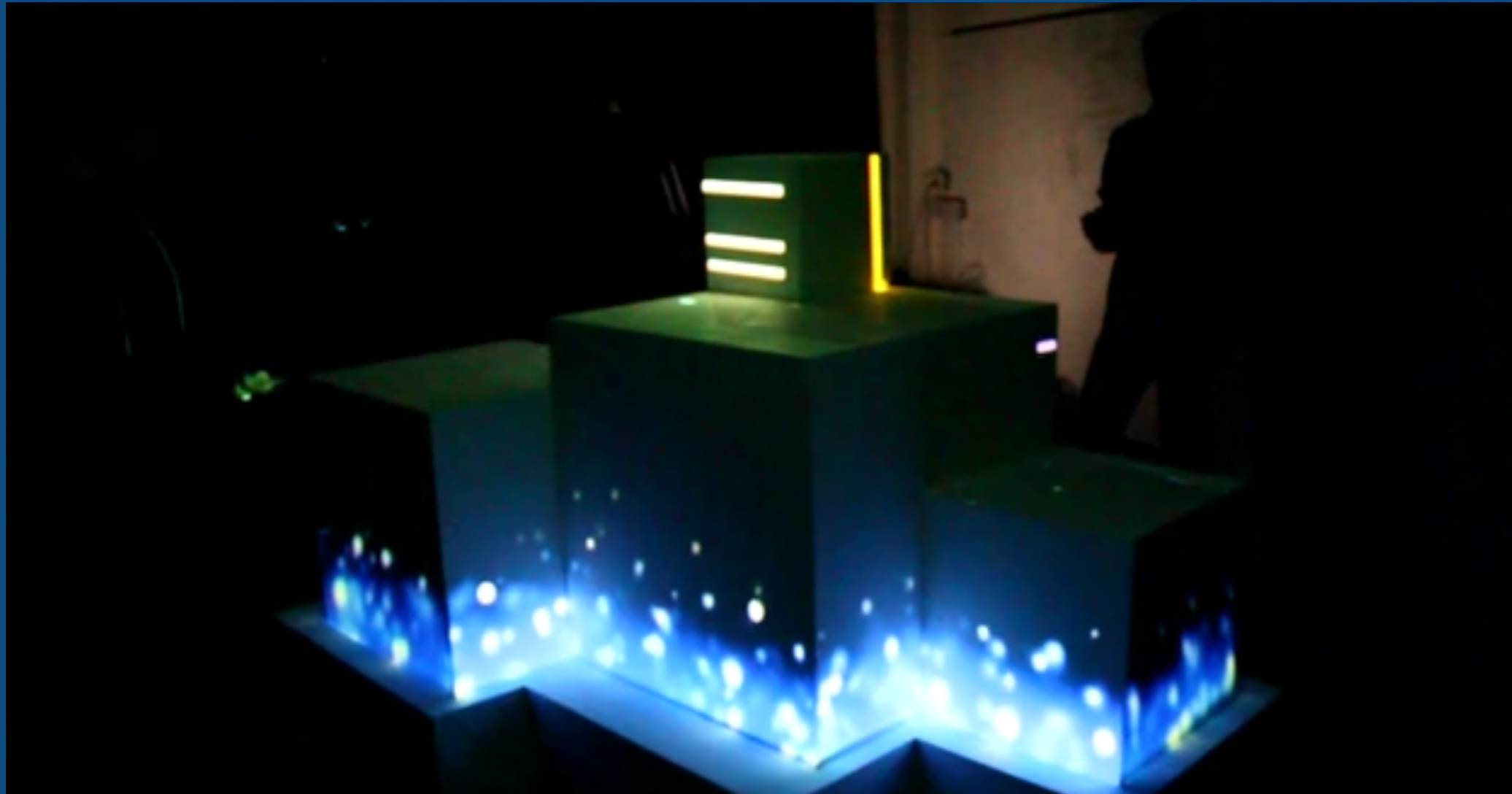
CONS:

Requires more than just projection mapping knowledge to work
VR Sensors require a lot of set up and configuration

PM MULTIPLAYER GAME

A fully interactive 3D projected mapped multiplayer game was made by B-Reel London. This used projection mapping and a web server linked to updating the display output on the projection mapping software using your mobile phone as a controller.

This makes this concept one of the more accessible as it can be played from any modern smartphone. The game requires the user to move around the 3D cube to control their "snake" this has shown how projection mapping could be used to create a more interactive and immersive game experience.



PROS:

Can be adapted and changed to fit a number of locations

Easy to pick up and use with web server based controls

CONS:

Requires a lot of technical knowledge to produce the web server



USP

The unique selling point of this concept is that only a handful of examples of interactive projection mapping exist in the independent creative space. Out of those few only one or two are aimed at climbing. These examples also are pre-defined experiences and have to have the climbing area set up to work with the projection mapping so it's limited in the experience they can provide.

My concept can be adapted to multiple areas as it is a primarily visual focused concept. This can allow it to be placed around the climbing wall as long as the surface isn't out of reach of the projection surface itself. However, every time the projector has moved the visuals will require them to be edited in the projection-mapped software so that they can fit and "wrap" around the new surface.

The immersive experience it will apply to the climb will make it more fun and it can be changed and adapted to meet the user's

needs depending on the visuals used in the prototype. For my project, I will use 2-3 visuals to show off a different type of experience the projection mapping could be used for.

For the project itself, I will fabricate a model climbing wall to project my visuals on alongside a soundtrack. This will just show the practical applications of my project without actually going to a real climbing wall because of the coronavirus implications.

MARKET RESEARCH

After looking at specific examples that relate to interactive projection mapping I wanted to look at systems already implemented into large events and how projection mapping has changed their daily lives or enhanced many events. This will explore a broader scope of projects rather than direct competition to my idea.

XITE LABS

Xite Labs are one of the bigger audio visual companies offering their services to huge clients such as Microsoft, Disney and Blizzard's game tournaments. Depending on the event they can create spectacle using projection mapping with concerts but they can also use projection to share tournament scores like with Blizzards Starcraft tournament. They can use projection and fit to a wide number of audiences on a massive scale which shows how varied projection mapping displays can be.



MAMAS & PAPAS STORE

Mamas and Papas flagship store in Westfield London was opened in 2016. It uses projection mapping for some of the display elements in the baby clothes section. Projection mapped elements move across the wall in one of sections that change from clouds into animals. This is a very creative way to enhance a retail space showing that it can also be used to enhance the ambience of a shopping experience or to wow customers.



QUINCE IMAGING

Quince Imaging is the company behind the projection mapped courts and stadiums for events like the NBA they use projection mapping 3D visual effects to put on a spectacle using the court as the “display” this lights up the court in the colours and designs themed after the teams playing.

It used a lot of hardware placed in the lighting rigs above the court and up to 2 months of preplanning before the event.



OBSERVATORY CREATIVE

Observatory Creative specialises in several services from AR/VR to Motion Graphics they also specialise in Projection Mapping they do everything in-house and have done projects from the mapping onto objects, events, and even buildings. They also provide consultancy and aggregation on viewer interaction.



OBSERVATORY
• VISUAL INNOVATION •



TECHNOLOGY RESEARCH

TECHNOLOGY RESEARCH

Interactive Projection Mapping can vary depending on set up and the effect you are trying to achieve. The primary element of projection mapping is a high-end projector that could project your visuals onto a surface.

Once the projection is projecting onto the surface it's now time to map it to that surface which involves using mapping software such as mad mapper to "warp" or "wrap" the image to the object or surface.

This gives off the illusion that it exists within a 3D space if the object is 3D for example. Multiple projectors from different angles can be used to achieve this effect and make it more immersive.

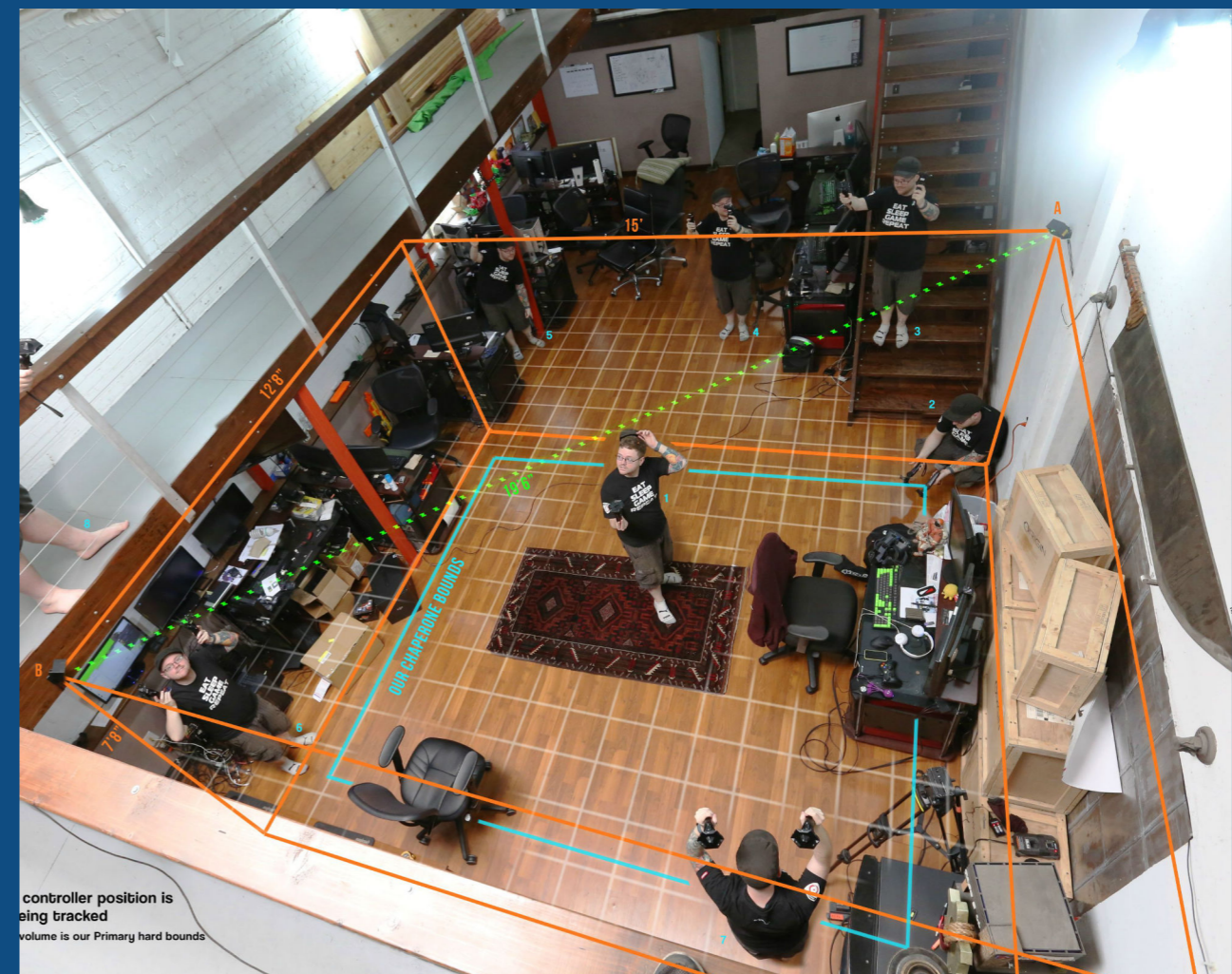
The final part of interactive projection mapping is the interactive element and this is dependent on the effect the individual wants to achieve. If you want the projection map to interact with the person using a body-tracking device such as the sensors that come with VR headsets would be the main part of that setup.

From my research here a few methods of interaction used in projection mapping setups:

POSITIONAL TRACKING (“LIGHTHOUSES”)

HTC Vive allows room-scale positioning using wide-angle IR laser beams across the whole room to track a chip. This chip can measure the time between the IR flash and be hit by a laser sweep on each axis. With this information, it can determine its position in the room which in turn enables body tracking.

This means that the projection map could interact with this positional data and make a more immersive and impactful experience.



GAME CONTROLLERS

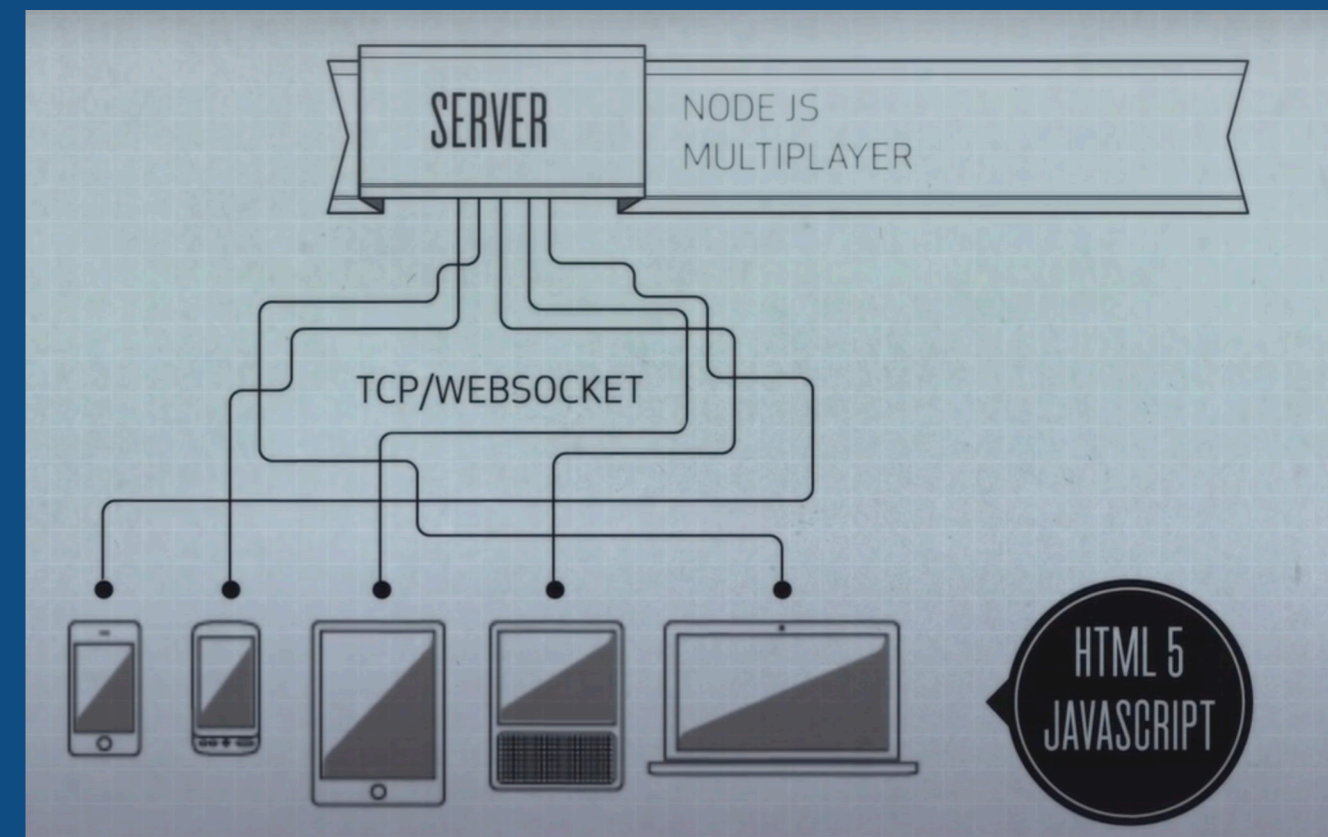
Traditional input methods can be mapped to interact with the projection mapped visuals whether it be some as complex as a game or just used to interact with the visuals on screen.



WEB SERVER

One of the concepts I looked at in my competitive research uses a webserver to allow any user to control their project as long as the game has simple controls and that there was a smartphone with a web browser.

This means that there is no dedicated device to interact with the object. If you have a smartphone you can just connect with a browser link and start playing straight away.



SOFTWARE - MAD MAPPER

Software is a large part of this project as I will be using loads of different software set-ups to achieve the various parts of functionality in regards to my project.

Mad Mapper is a projection mapping software used for video and light mapping. Its primary focus is projection mapping however it can be "linked" through other software so that it can be used for more interactive projects if needed. This will be the primary software I will use to create the projection mapped effect for my project.

Pros:

- Easy to use
- Free Version (with watermark)
- Versatile

Cons:

- Expensive
- Only used for projection mapping

The logo consists of the letters 'm', 'm', 'a', and 'p' in a bold, rounded, lowercase sans-serif font. The letters are white and set against a dark blue background. The 'm's are connected at the top, and the 'a' and 'p' are also connected to the second 'm'.

AFTER EFFECTS

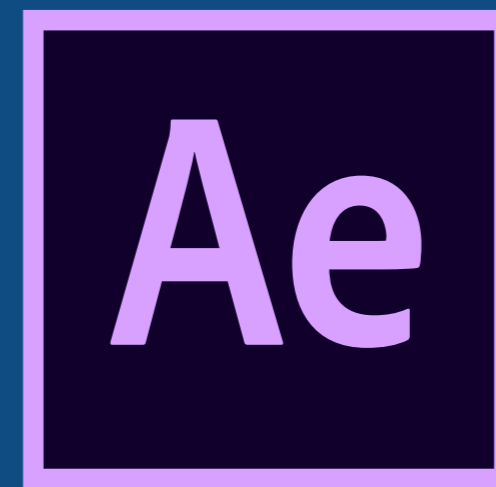
After Effects is a visual effects and animation software which can be made to animate and make visual effects. This can be used in conjunction with mad mapper to make visually engaging projection mapped spectacles. To create a visually appealing experience I will be using after effects to animate all of the visuals I projection map.

Pros:

- Used to create visual effects
- Intuitive animation controls

Cons:

- Expensive
- Subscription Based



FINAL CUT PRO

Every video mapping project needs a video editing software that can be used to stitch all of the different elements together. For this project I will be using final cut pro as my video editor as this will allow me to easily create clean transitions between the animated visuals and edit the timing to put on a more cohesive visual experience.



Pros:

- Fast render times so I'm able to make quicker edits of the final visuals.
- Built in transitions and effects.

Cons:

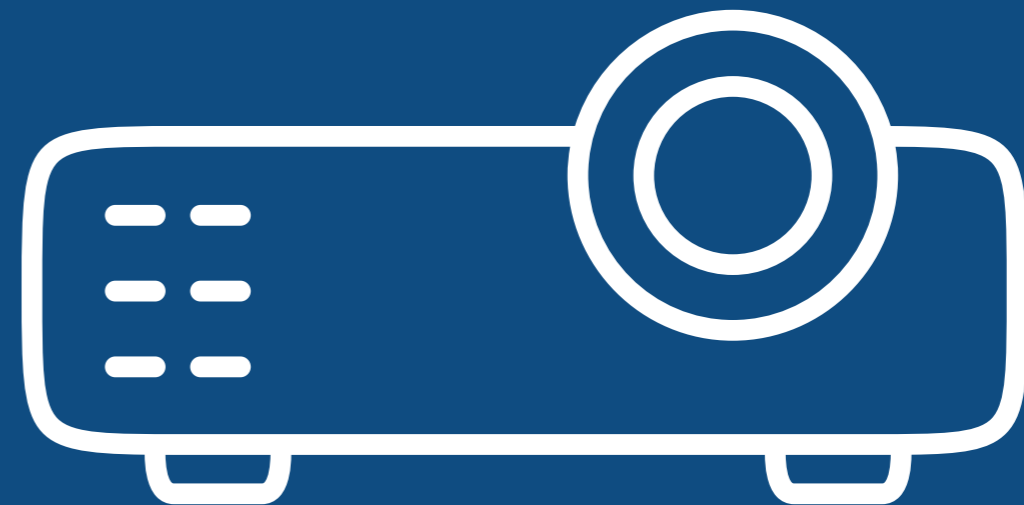
- Expensive
- Fills up storage fast because of background rendering

PROJECTOR

For projection mapping I needed to decide on what projector to use for my project. With my prototype, size didn't matter as I was only producing visuals for the model so I decided to go with a projector which a decent enough lumen count and a good resolution so that the visual effects I display would be clear.

Projection mapping requires a projector so this is one device that I can't iterate one and is required for the prototype.

If the project was to be implemented onto a real climbing wall. It would need to have a large projector and usually because of the indoor restraints it would have to be a big short throw projector to get the best experience.



A photograph of a rock climber on a dark, textured rock face. The climber is positioned in the upper left quadrant, wearing a striped shirt and dark pants, and is secured by ropes. The rock surface is highly detailed with various cracks and textures. The overall scene is dimly lit, emphasizing the ruggedness of the rock.

CONTEXTUAL RESEARCH

PSYCHOLOGY BEHIND PROJECTION MAPPING

When creating this concept I wanted to look at what people feel about the illusion of projecting visuals as they wrap around a 3D object.

After doing some research I found that people are more satisfied and enjoy an experience more if visuals are used to enhance it through the use of projection mapping. The benefits of projection mapping can be used to create more immersive experiences for the people taking part in the activity.

AV ENHANCE EXERCISE

After doing a lot of research into the defining technology of projection mapping I wanted to look into how it could enhance climbing from an exercise perspective. Music has vital audio and psychological applications when it comes to increasing or boosting your mood and ability while exercising.

Gyms have already started implementing audiovisual enhanced gym sessions that have rooms without mirrors and just focus on a “club” gym session with enhanced visual effects and louder music.

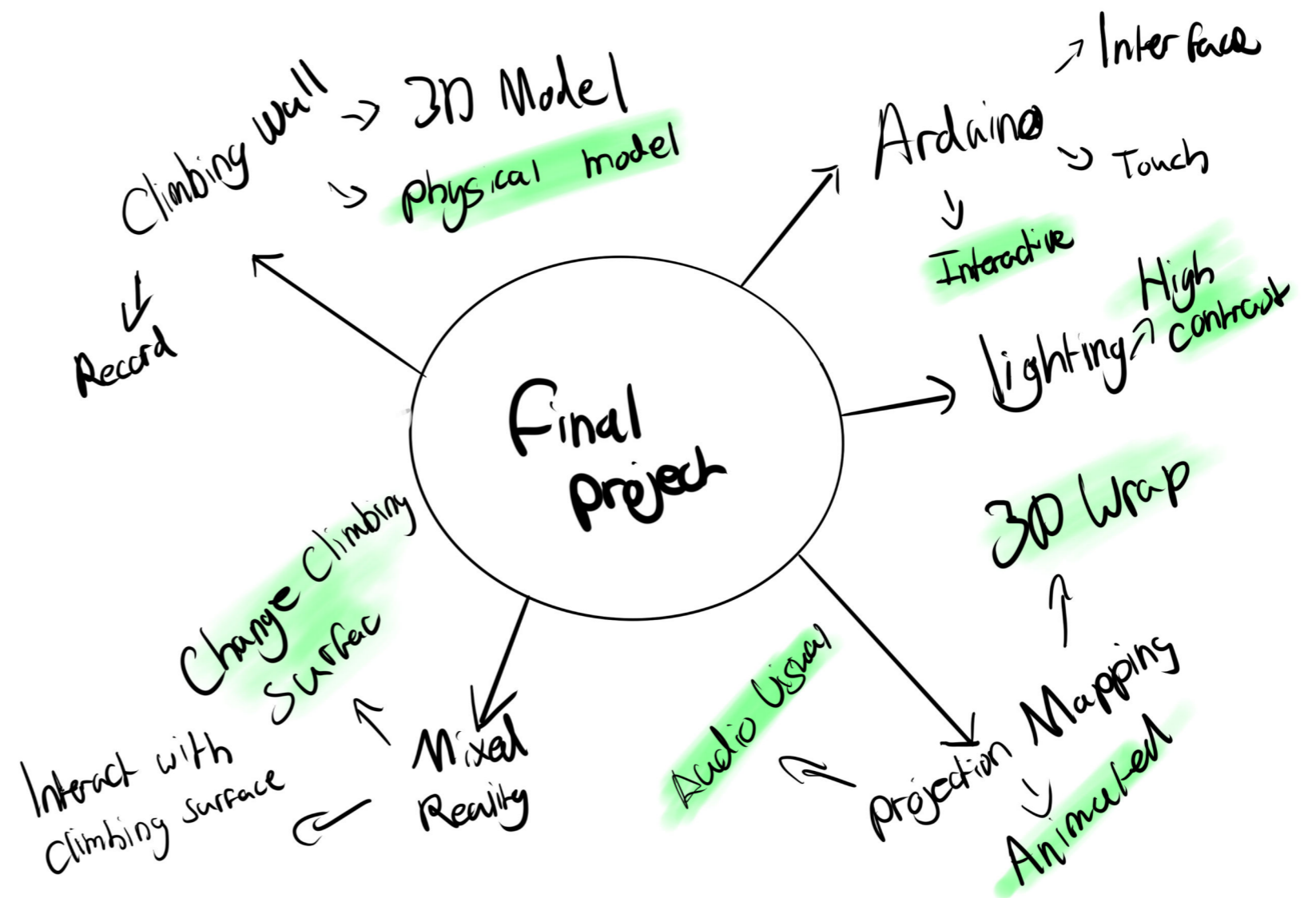
Another point of interest is that climbing is an incredibly versatile activity and a lot of different movements can be done depending on the layout of the wall and the type of holds used which means it can be adapted for a more exercise focused activity.

Since gyms have been using audiovisual effects and equipment to improve their sessions and it’s been proven that these can enhance the experience of the people doing these types of classes. Projection mapping visual climbing sessions could also have the same effect if people want to integrate that into their workout sessions.

MIND-MAP

The mind map is a good way to visualise my thought process early on. After I had made a mind map I then highlighted the thoughts I would like develop further and add as features into my project.

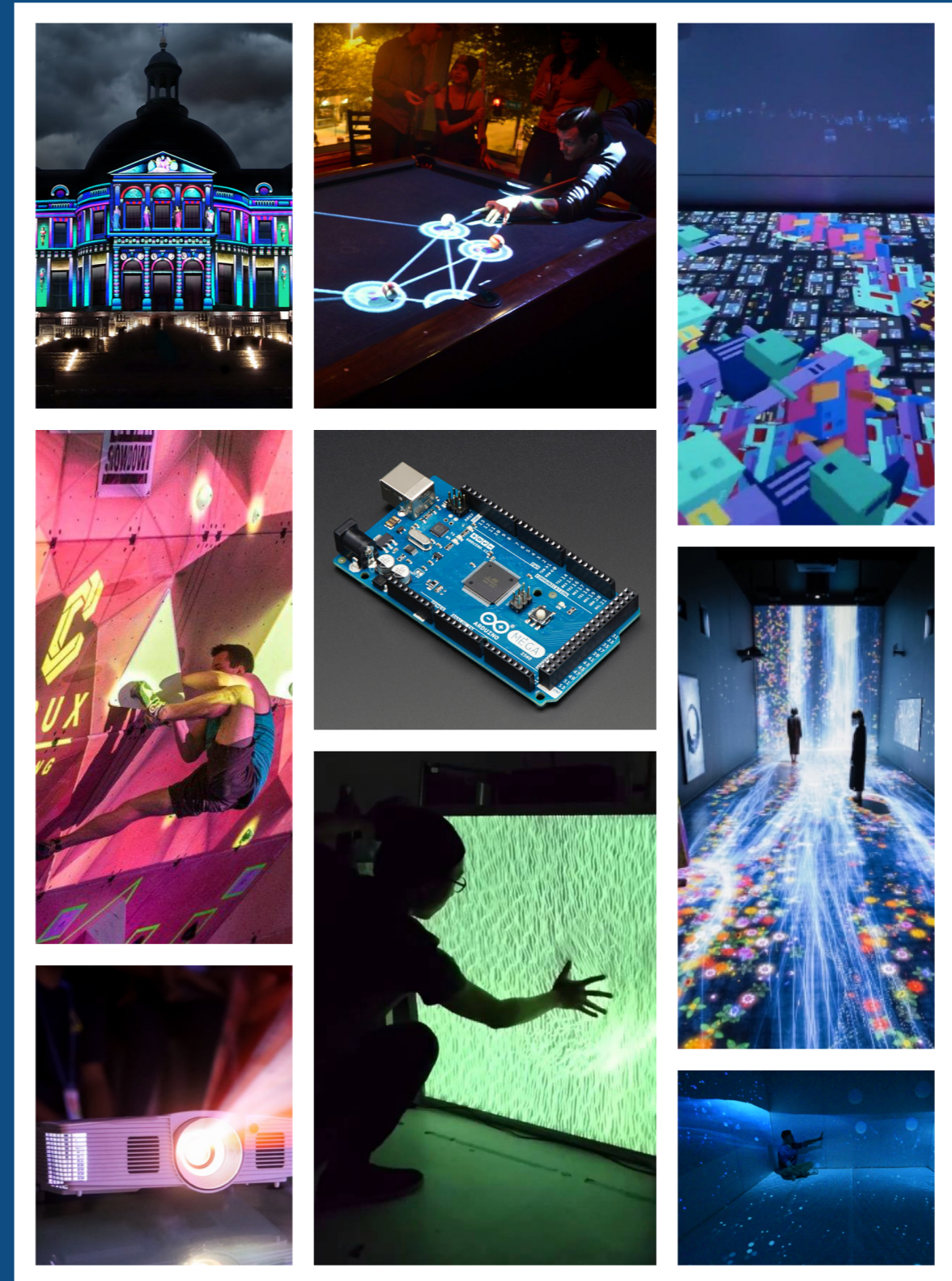
All of the thoughts I want to explore are highlighted in green.



MOOD-BOARD

I wanted to acquire some inspiration for various interactive projection-mapped projects. I examined multiple forms of interaction with projection-mapped objects. I wanted to have a look at projection-mapped projects by also the way people interact with them and try to get some sort of idea for the projects already out there to see if there is a niche my project could fit in.

After focusing on the climbing part of the project I felt it would be best to start focusing on the technical side of the project on how I can make the climbing wall more interactive.



A photograph of a person rock climbing on a light-colored, textured rock face. The climber is wearing a teal long-sleeved shirt, black pants, and climbing shoes. They are secured by a green rope and several metal carabiners. The climber's right hand is reaching up to grip a rock ledge. The text "USER RESEARCH" is overlaid in large, bold, white, sans-serif capital letters across the center of the image.

USER RESEARCH

MANAGEMENT INTERVIEW

During my user research, I had a chance to interview the manager of Durham Climbing Centre. I asked a few questions in regards to the target audience if this concept could help certain aspects of the wall and what issues they could face with its implementation.


During our discussion, I wanted to ask a few key areas in regards to physically implementing technology into the climbing wall and the issues it could face. The first topic we discussed would be the safety of the implemented concept into the wall. I first started by discussing my main project and she laid out a few issues regarding aiming bright light sources at the wall which could potentially distract climbers.

The interactive elements could help climbers but she doesn't want it so that they are fully distracted by it. She also mentioned that a fully implemented concept would be quite expensive especially if they wanted to change any of the projections as it would need to run off a computer and projector set-up.

Another issue she brought up is how much set up the projection mapping set-up would require before it was displayed in the climbing wall. If it would be something the climbing wall would always have up and just require one button to turn on every time they want to use it or would it be something they bring out every few weeks or so that requires manual set-up every time.

USER PERSONAS & SCENARIOS

USER PERSONA



Frank Johnson
21, Student

MOTIVATION PASSIONATE COURAGEOUS WITTY

ABOUT

Frank is a student currently studying at Durham University every week his local bouldering wall Durham Climbing Centre has a student night.

He enjoys climbing but wish it could be a little bit more exciting as the routes are only changed on a monthly basis so introducing something new to the students climbing experience would be an amazing way to get them back involved with it.

GOALS

- Has been going to the climbing wall every week for a few years wants something new added.
- Durham Climbing Centre mix the events up with climbing tournaments and competitive activities perhaps something similar could be added.

FRUSTRATIONS


- Starting to get bored of climbing on a weekly basis unless it's a route change week.
- Needs more interactivity rather than just climbing.

Frank finishes his final seminar of the day and wants to go climbing for the Monday student offer Durham Climbing Centre has one every week. He goes and does his climb but something is different. The climbing wall has a new projection-mapped experience on one part of the wall.

He sees some climbers doing some routes on the projection-mapped portions of the wall. The wall has been turned into a real rock race and while the effect is mostly faked by the projection-mapped area it looks great. Frank is intrigued by this new area and wonders what more it can do.

USER PERSONAS & SCENARIOS

USER PERSONA



Johnathan Miles
35, Architect

COMPETENT ORDERLY SOCIABLE FAIR

“*I want an experience that could help me improve as a climber***”**

ABOUT

Johnathan is a skilled bouldering climber and uses the centre the train in between real-rock sessions. He comes on a weekly basis to improve his techniques and is a really committed climber.

Climbing to him isn't a fun exercise it's a way for to learn complex techniques before testing them out in the real world and the satisfaction that comes with overcoming certain challenges.

GOALS

- Looking for an experience that can enhance his climbing ability and make him a better climber.
- Educate him on techniques he may be weaker at.

FRUSTRATIONS

- His frustrations are more in the line with overcoming climbing challenges but he does wish the sport could be more interactive.
- He wishes that indoor climbing could become more immersive.


Johnathan has just finished work and is about to head to the climbing wall with some new colleagues. He goes on a different week than Frank and the projection-mapped wall has a new experience on. The wall is set up for “experienced climbers only” he sees some other climber competing in “speed” climbing races.

The projection map is set up with a time at the top and a visual indicator on the speed setting. The projection map animates up the wall giving visual guidance to the climber competing in the speed climbing competition at the wall.

This visual feedback is a lot better than manually timing his speed climbing times. It also opens up the wall to a new as they can change the timings on this visual effect to make it go faster so they have something new to try and beat.

USER PERSONAS & SCENARIOS

USER PERSONA



Francesca Delgado
40, Retail Manager

ADVENTUROUS CHARMING TRUSTING PRECISE

“ Making climbing more fun for my children would be wonderful. **”**

ABOUT

Francesca is a retail manager at a large grocery store in Durham she is a parent and doesn't go to the climbing wall for herself just to observe her children when they go for one of the many classes the wall has on.

During the climbing classes the instructors use a lot of props to make the climbing wall more interactive. She enjoys taking his children to these classes because it makes them think out of the box.

GOALS

- Enjoys the interactive parts of these classes and wants them to be even more enhanced.

FRUSTRATIONS

- Feels like the children get bored when they a being taught safety or technical climbing techniques to practice perhaps this portion of the lesson can be made even more interactive and fun.

Francesca Delgado has just finished work and is going to take her children to one of the various kids club activities on after school at Durham Climbing Centre. They have usually used props to make the children's time on the wall more interesting however with projection mapping a lot of these props can be replaced.

The projection mapping is set up so it visually sets up a new game for the children to play. The projection map highlights certain holds for the kids to climbing and research and using the sensors built-in it can detect if that hold has been touched.

This shows a lot better feedback for the children to learn and develop as climbers and the parents are happier with this new experience that makes it more fun and interesting for their children.

DURHAM CLIMBING CENTRE

While this prototype could be adapted to fit other climbing walls I wanted to primarily focus on one I was well acquainted with.

This would like to develop a prototype for the needs of customers and give me direct access to the type of events the wall usually puts on allowing me to gauge if it would be something the wall would make a reality.

It will also inspire me to develop a model from using a climbing face I'm familiar with which will support my projection mapping creation.



SUMMARISED RESEARCH

After doing research into the primary applications of projection mapping and how they can be adapted to fit almost any scenario with the only issue being how modern the technology is with not many companies wanting to use for their concepts preferring to go with more tested technology and even physical displays if possible.

Mixed reality which projection mapping fits into also requires a lot of development to make it look visually appealing such as warping the projection-mapped visuals to the object, making those visuals using an application such as After Effects and finally making all the parts work together.

However, while projection does require a lot of effort to set up compared to traditional media the effect it produces can be so much more visualising and immersive it can be used to interact with surfaces which is something traditional technology can't achieve.

It's also true that projectors and the software involved with setting up a projection map can be really expensive which is why it's currently limited to massive events or small creative studios and hasn't made its way into the hands of much independent business or small companies as putting on a projection-mapped display would just be too expensive for them despite the advantages.



Figure 1

BRANDING

My prototype needed some branding and I wanted to make it as if it an all in one solution or if a company existed that specialised in interactive prototypes what would their brand look like and how would they create a brand around projection-mapped visuals. A lot of companies either specialise in the hardware of projection mapping or visuals. Companies would get a VFX company to make the visuals for projection mapping however I centred the brand around if both of these were offered.

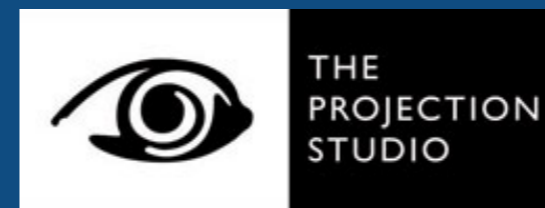
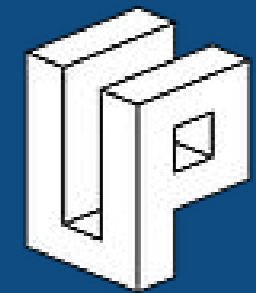
When designing a logo for my brand I wanted to have a look at other brands that came close to achieving a similar idea as mine. I created a logo mood-board which helped me visualise a design for my final logo.

LOGO DESIGN - INSPIRATION

To get some inspiration for my logo design I looked at what other companies were doing with their projection mapping brands. Most of these have organised for huge events and have a lot of experience doing video mapping for different organisations.

The main thing I wanted to look at was the type of fonts and logo design they were using. A lot of the logos used isometric shapes. One of the main similarities was the use of eyes or "vision" based design elements.

A lot of projection mapping companies don't just specialise in projection mapping they also specialise in audiovisual performances and their logos represent this in a number of ways.



LOGO DESIGN - INSPIRATION

For my logo design I started by drawing a load of shapes I would associate with projection mapping. I first started with basic 2D shapes but then found that axonometric shapes or axonometric projection which is a way of simulating a 2D object in a 3D space. Projection mapping is the way of representing 2D video or visuals and wrapping them to a 3D object so if felt using an axonometric icon would be a good way to represent the brand of my prototype.

Colour Choice

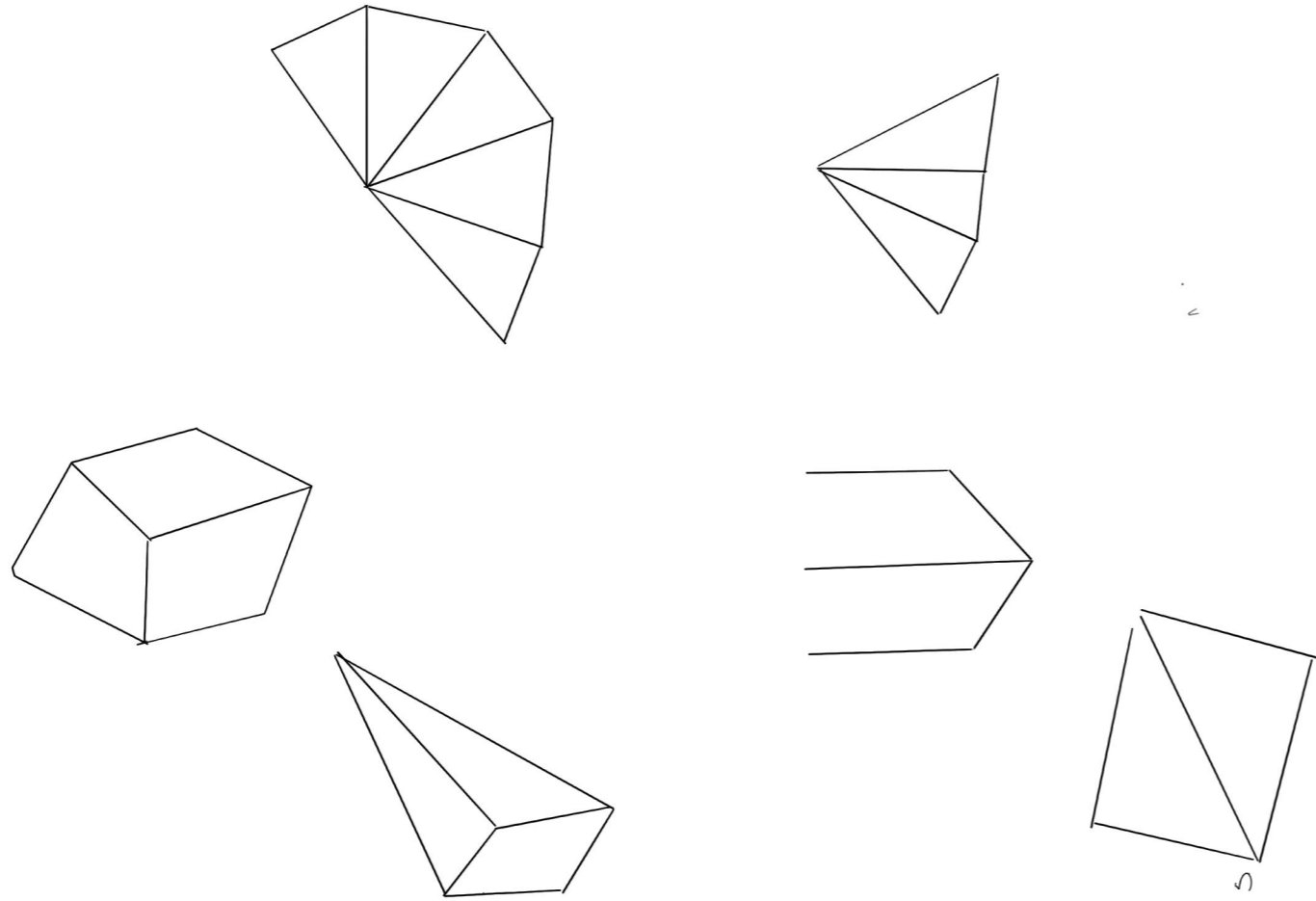
With the colour of my logo, I wanted to go with something new a modern and something that could represent an emerging technology. So I decided to take a look at what Pantones colour of the year was. The colour of the year was classic blue

so I decided to use that as part of my final logo design. The colour means what the future will bring which is a good meaning behind the technology I'm choosing with projection mapping.


Font Choice

For the font, I wanted to pick something futuristic that could display the meaning around projection mapping. I decided Anurati as the font because of the shapes and right angles in the text edges. It also had gaps that show that the font has 3 dimensionalities and would look good projection-mapped onto a surface.

LOGO DESIGN - IDEATION



CLMB  MAP

CLMB  MAP

CLMB MAP



LOGO DESIGN - FINAL LOGO

CLMB

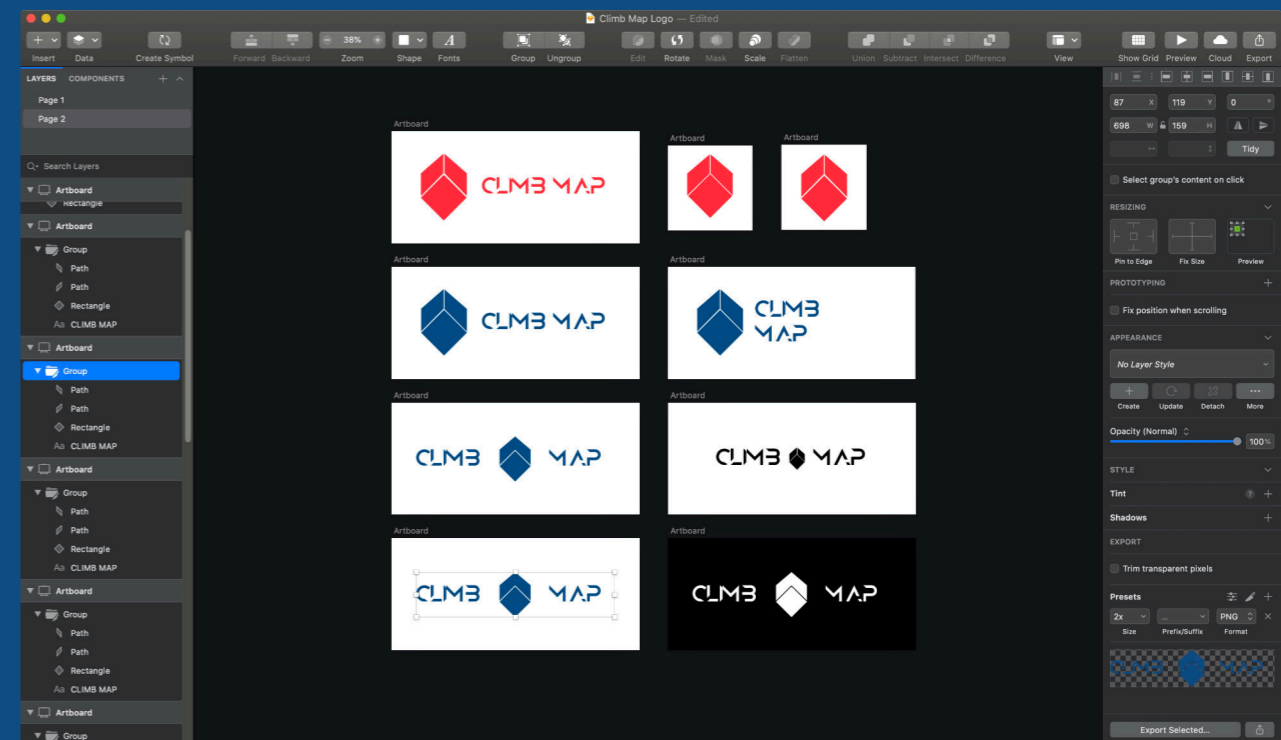


MAP

LOGO DESIGN

To create my logo I used Sketch which is an incredibly powerful vector graphics editor for the Mac. To create the logo shape I used the path tool to draw the unique shapes I was after and then grouped them together with a font.

I originally wanted to use red as the primary colour for my branding elements however I decided against it and went with the classic blue as I felt it was more appropriate for a projection mapping project.



Sketch



ANIMATION

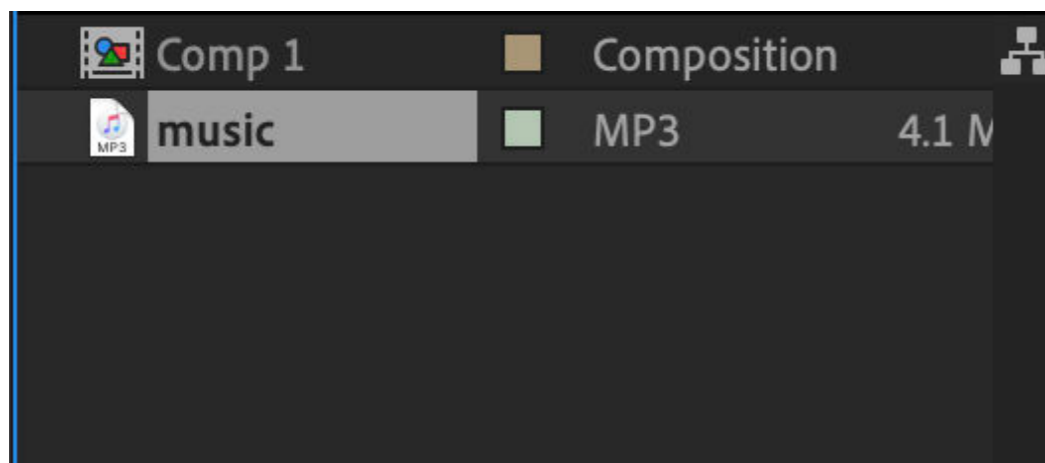
The main visuals for the projection mapping will be animations. To create these animations I will be designing and making them in Adobe After Effects. For my final prototype, I'm going with more of an audiovisual experience as I feel that will create more of a showpiece effect for my final project.

I'm also going to demonstrate one more immersive experience alongside the audiovisuals to show the real-life application of the project.

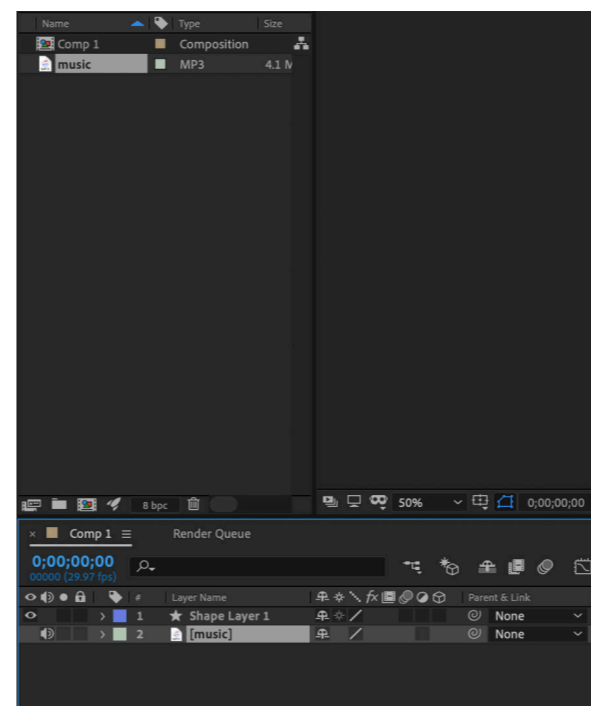
I started out by creating an audio visualiser for my project. This will be projection-mapped onto the climbing wall and provide a more audiovisual experience for the climbers.



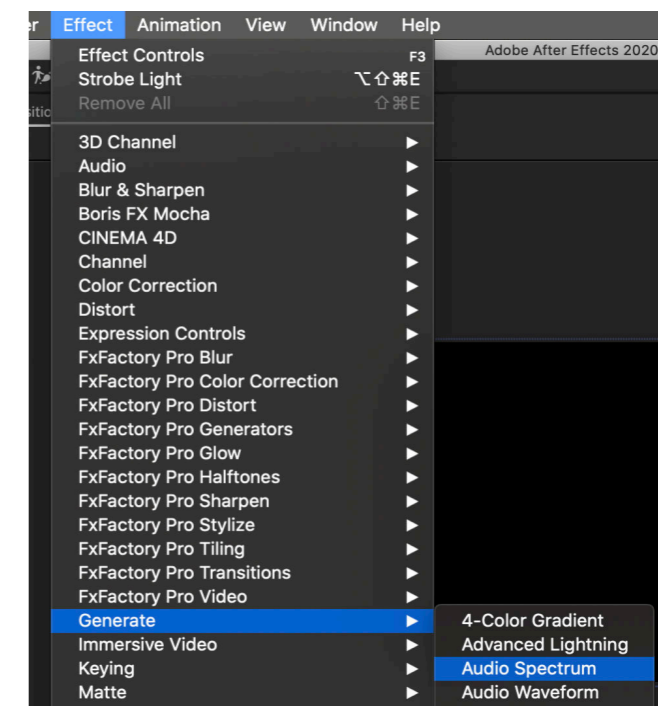
ANIMATION - IMPORTING



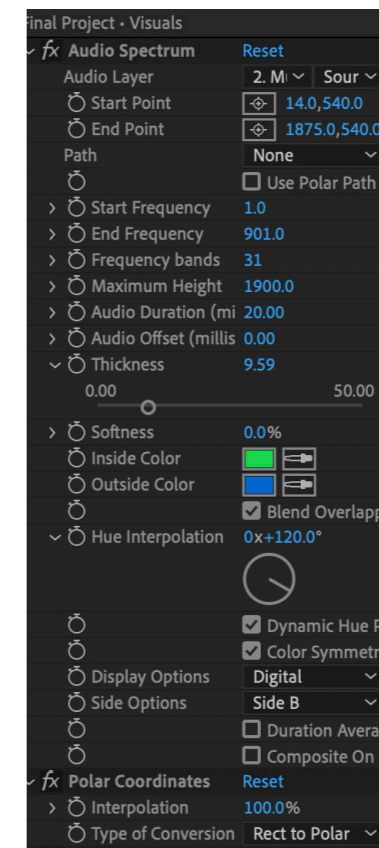
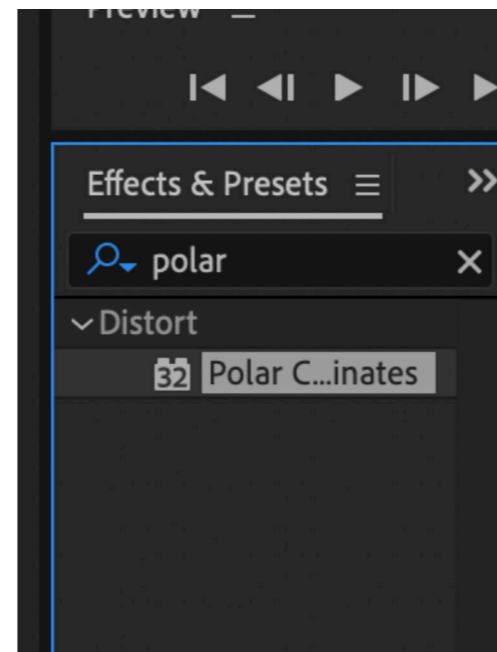
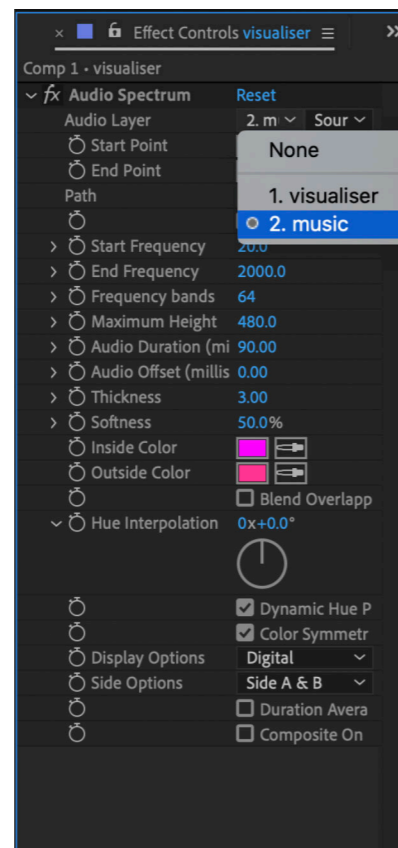
After creating my composition and making it a few minutes long to fit the music. I imported some upbeat music into After Effects.



After importing the music I dragged into my timeline and generated an audio spectrum from a shape layer.



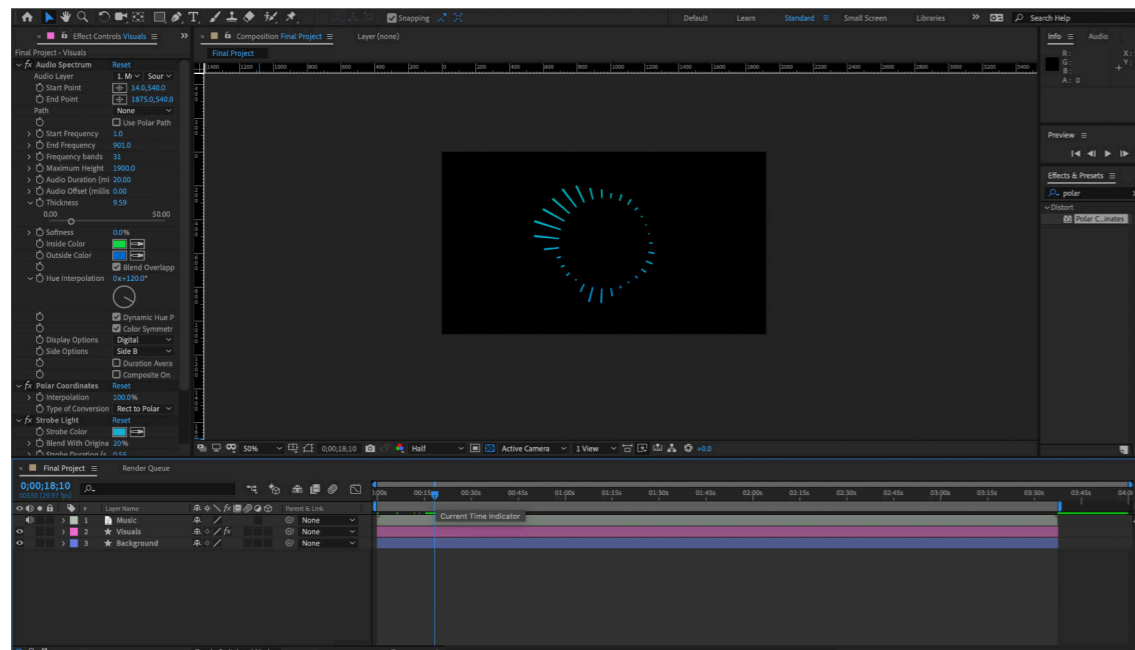
ANIMATION - AUDIO VISUALISER



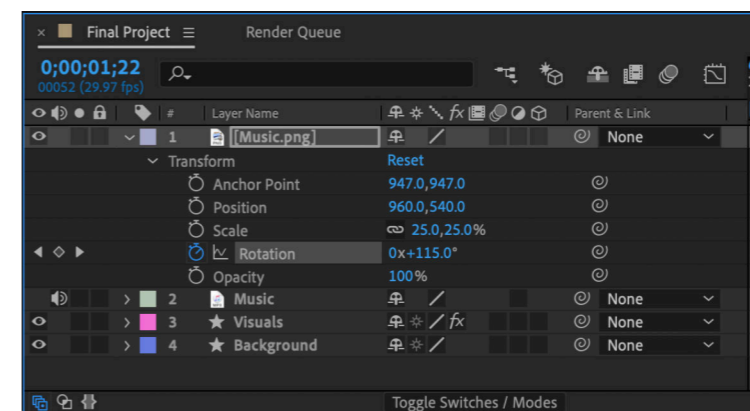
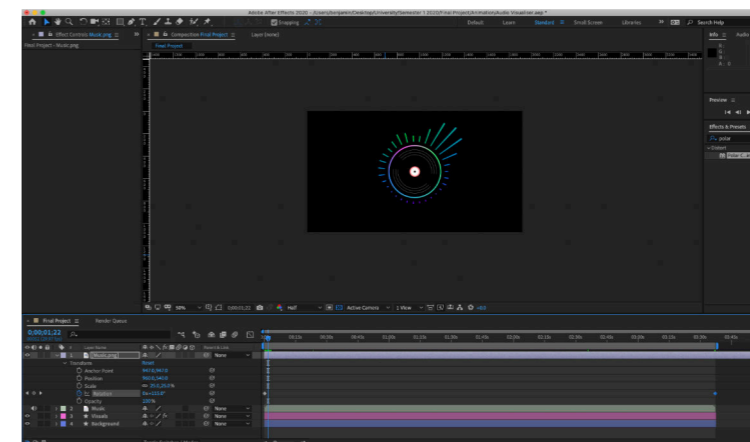
Going into the effects controls I set the audio layer as the music track I imported. Then edited the colour and effects until I had a good design.

I added the polar coordinates effect this means that essentially starts from itself. In the case of my effect it creates a circle effect.

ANIMATION - VINYL IMAGE



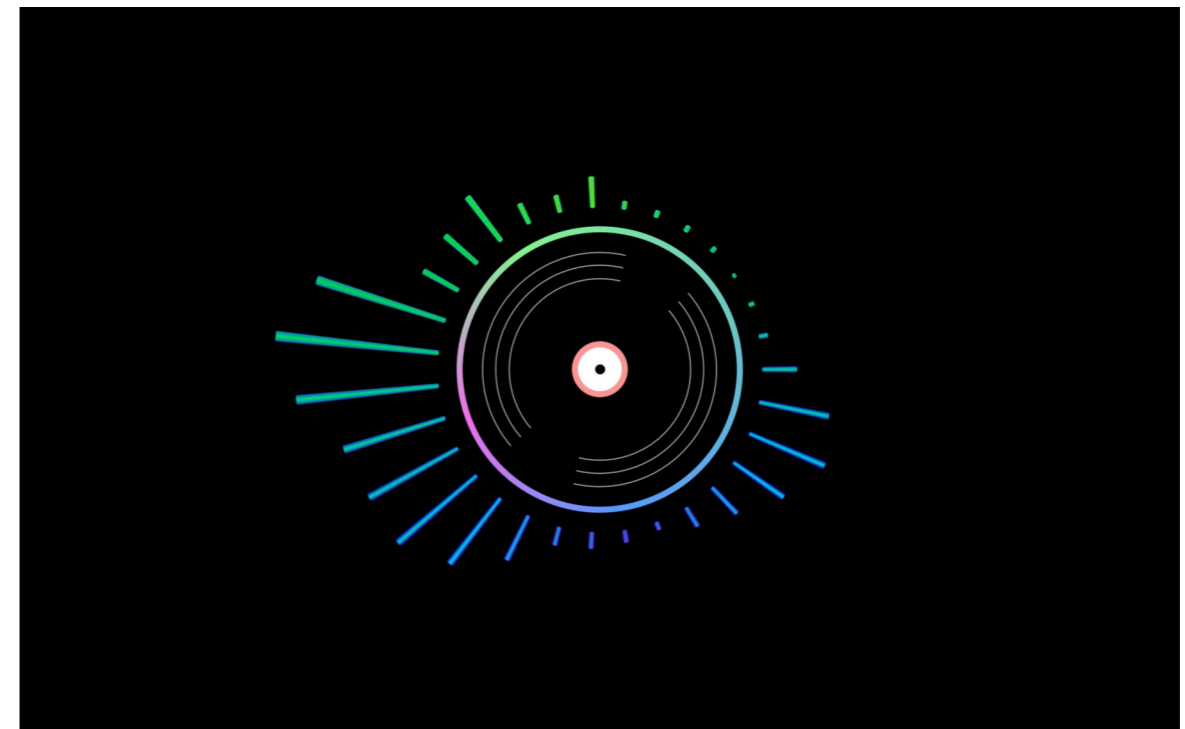
I felt the design was a bit bland with the audio visualiser on it's own so I decided to create an animate an image. I first started by creating the image in Sketch and then importing it into after effects.



I added a vinyl image I created and imported it into the composition with a similar process as before. I then scaled it down and key-framed a simple rotation animation.

ANIMATION

My final result for this one scene of the projection mapped project was good and it will wrap well to the wall I'll projection map on and give climbers a visual experience while they are climbing.

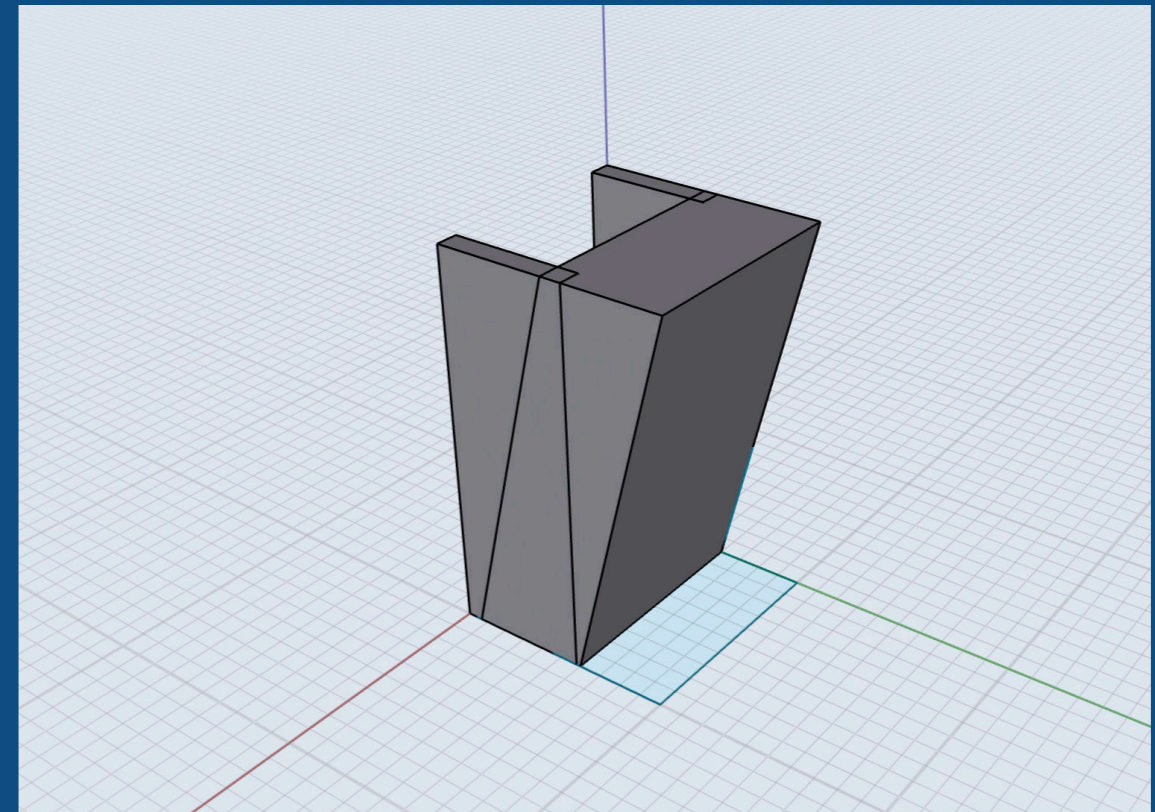
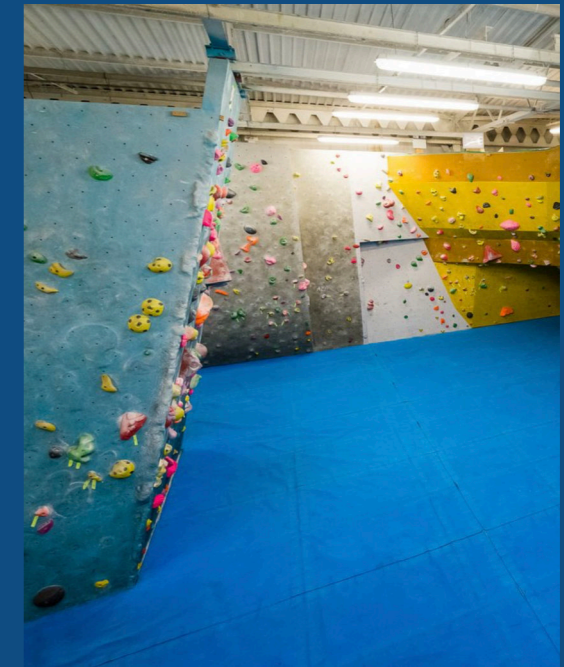


MODEL CONSTRUCTION

Starting with my project construction I needed to build a small model of one of the faces of the climbing wall to project my visuals onto. To do this I have built a 3D model of my design in to get a visual representation of what it could look like and if there are any adjustments I would like to make.

Once I am happy with the 3D model of my design it was type to draw up the measurements for each of the pieces and get the materials.

I have started by creating a materials list of what I will need to create my final prototype.



MATERIAL LIST

I was sceptical on whether to build my prototype out of high quality wood or something lighter like craft board. I decided to use craft board as it was easier to work with and as the model wasn't the main focus of the prototype it wouldn't be necessary to build it to a really high quality as I wanted to spend more time of the projection mapped visuals.

-Three Pieces of A4 Craft Board (Wall)

-Cutting Mat

-Mouldable Clay (Climbing Holds)

-Glue

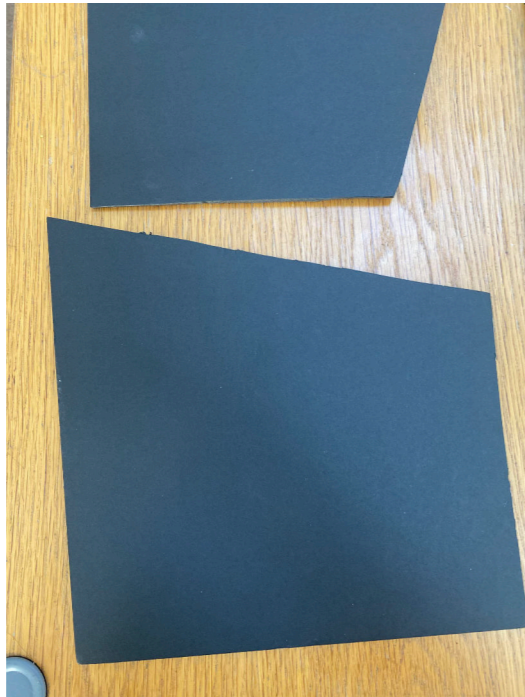
-Double Sided Tape

-Craft Blade or Stanley Blade

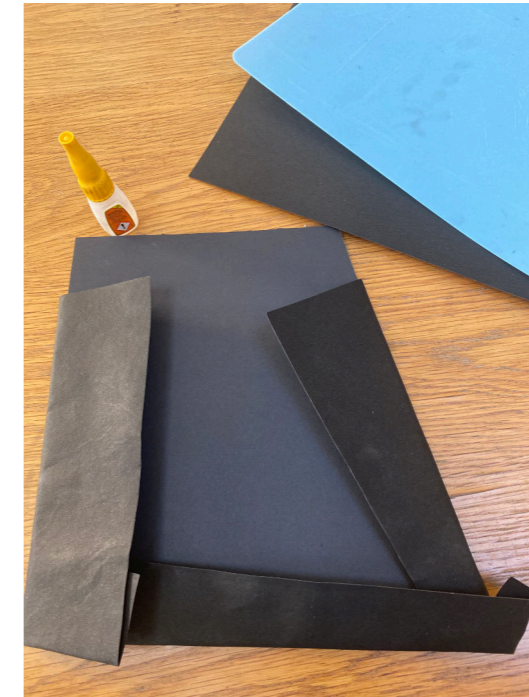
-Steel Ruler



MODEL - ROUGH CUT

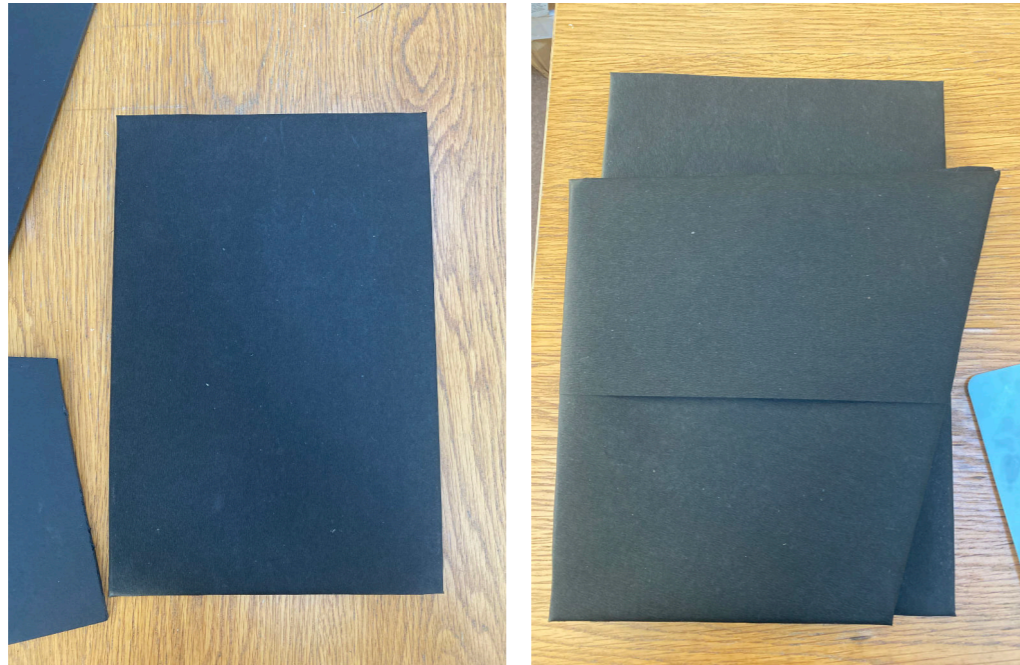


First I have started by measuring out all of the pieces ready for cutting. After a rough cut of the pieces then prepped them for wrapping.



I'm going to cut out some card and wrap the craft board in the card. The card has a much courser texture which will be easier to adhere the modelling clay to I will use for the climbing wall holds and features.

MODEL - WRAPPING



The final wrapped board provides lot cleaner cuts to build the model out of.

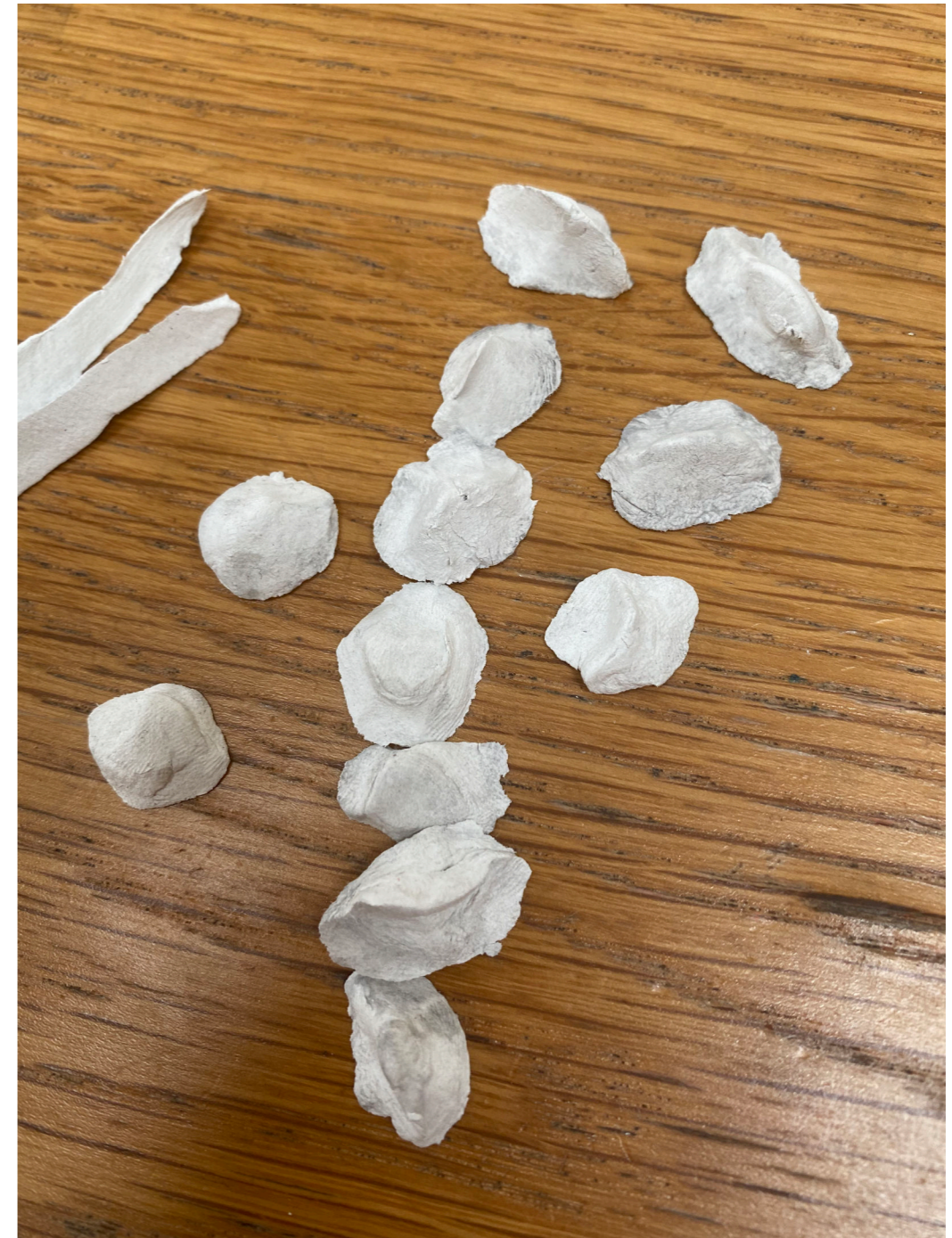


Next I set up a test piece of card to practice moulding some clay holds and to test if it needs extra adherence. I left these to dry for 24 hours.

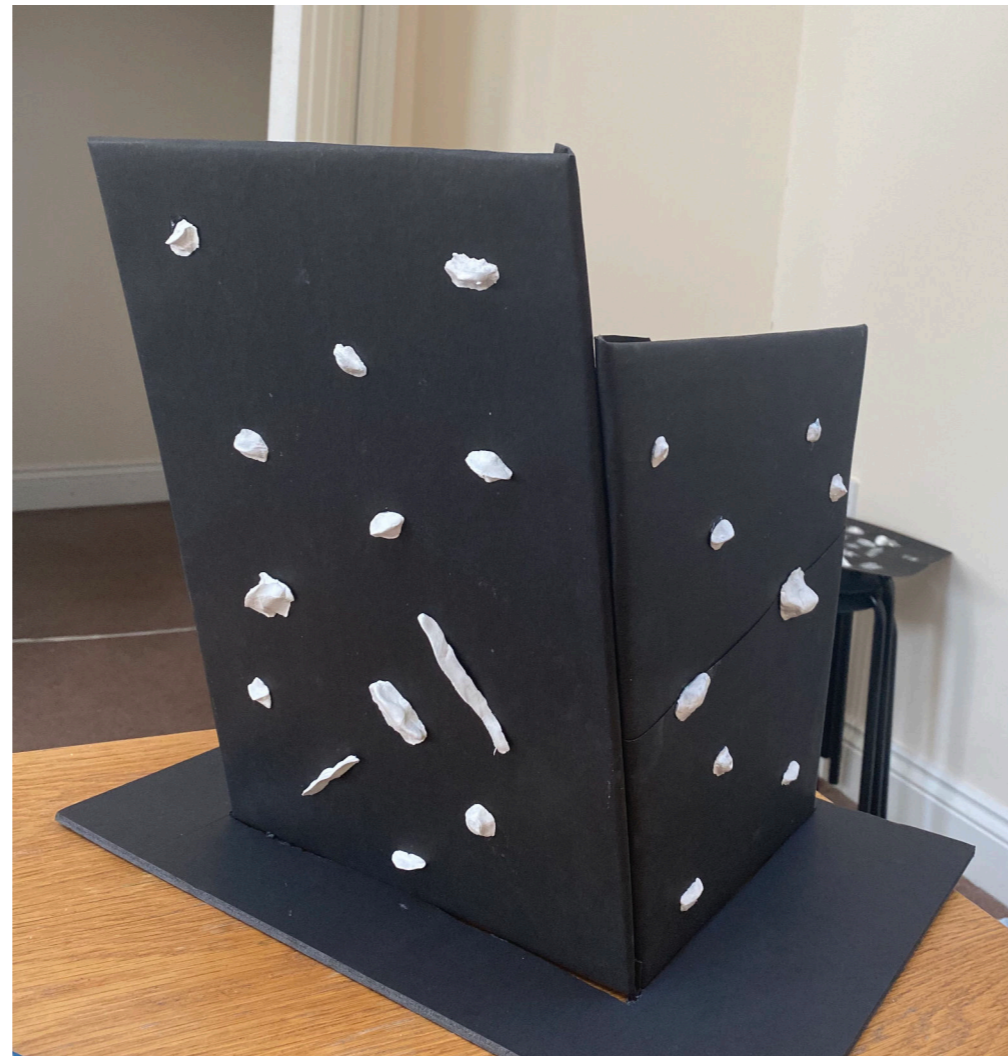
MODEL - MOULDING HOLDS

After practicing some moulding I found that the clay while fragile adheres well to the card texture. An oversight for me is that the clay leaves a lot of residue which doesn't show well on black card. I'm going to try and minimise this for the final model.

A friend of mine who is a better crafter than myself mentioned that I could peel off the clay then use glue to adhere them to the model. This would reduce the residue for a cleaner look.



MODEL - FINISHED MODEL



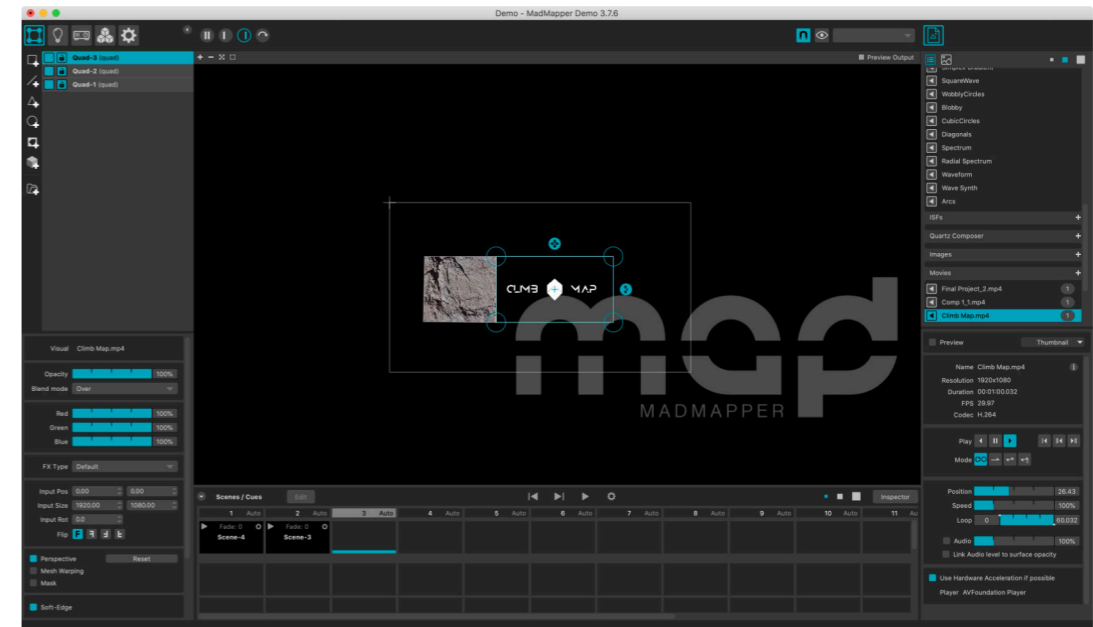
MODEL - FINISHED MODEL

For the final part of the development process I wanted to experiment with the software to check what is possible and how I can implement transitions or effects into the animation.

While this functionality will be considered design “fiction” and won’t actually interact with the projection mapping I wanted to make the fact that your interaction with the climbing wall is what will effect the projection mapped surface.

MAD MAPPER - INTRO

To projection map onto my model I wanted to use mad mapper because of its ease of use and ability to quickly make adjustments to the projection mapped surface on the fly. For this project I only had access to the demo version of the software which doesn't allow you to save a project and the projection mapping has a visible watermark which can be distracting at times. The lack of saving functionality meant there was a natural limitation on how expansive my project can be.



MAD MAPPER - TIMELINE

After using various animation techniques to animate my models projection mapped videos I tried using final cut pro to stitch all of the content together into a cohesive experience that flows well on the projection mapped mode.

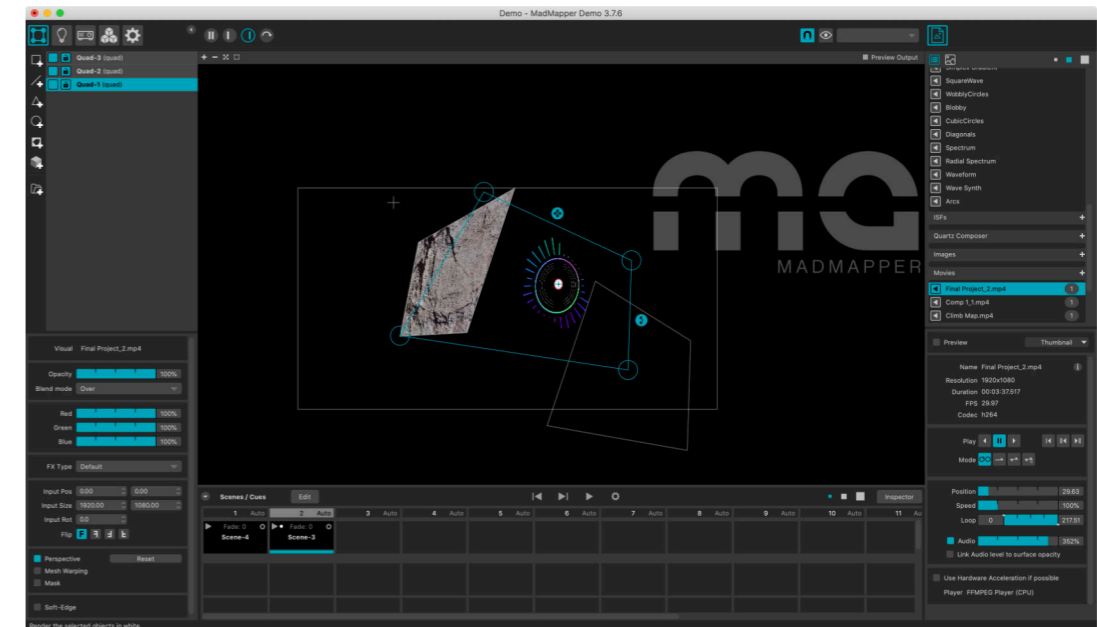
Projection Mapped Critique

After experimenting with the projection mapped software creating a single time-line for my project this introduced a lot of scaling issues for individual assets. While I managed to make the large and more immersive imagery match up well with the scaling of my model this in turn distorted the audio visuals map and animated brand logo. To overcome this problem decided to rescale each asset from scratch with this in mind. Rather than using editing software to stitch them into a time-line I decided to scale each individual component independently in mad mapper which fixed the distortion issue I was running into.

MAD MAPPER - SCENES

To wrap my projection mapping elements to the model I used a number of functions built into mad mapper. After placing the animations in the general area I used the mesh warping feature to distort the image in the software which fixed the issues with projection mapping on the actual model model.

For my video I wanted to set up at least two different scenes to show different aspects of the projection mapped experience. The two scenes I used was one displaying the logo and one displaying the visualiser setting up each of the scenes allowed me to quickly transition between them with a fade delay.



PROTOTYPE VIDEO - STORY

For the final video because of the limitations put on for acquiring actual real-time footage I wanted to mix stock footage with the limited real-time footage I could acquire then record a voice over for it with a high quality microphone. This allowed me build a story with high quality footage which could help me tell a story about my projection mapped experience.

Script

Climbing can be a wonderful experience.

However there are times that you can't get outside to practice the sport you love.

Indoor gyms have always existed but they haven't come close to replicated that feeling of immersion you get on a real wall. T

hey have only been around to keep your technique in check and fitness up to scratch.

Until we introduce climb map.

Climb map combines the latest technologies with climbing to introduce a more immersive experience to the climber overall.

Using projection mapping we can project experiences onto the climbing surface which is normally impossible.

This opens up the wall for new experiences such as games, education and fitness related activities.

With projection mapping the wall is a canvas which can be used to change the way we interact without introducing a physical limitation or device which could interrupt the experience for other climbers.

In the examples we are showing it can be used to project an audio visual element focused on exercise.

It can also be used to map an immersive texture onto the wall to make the wall look like a real climbing surface.

Projection mapped walls could also give guidance on following the many routes a wall has and guiding the user throughout.

This is climb map and this is the future.



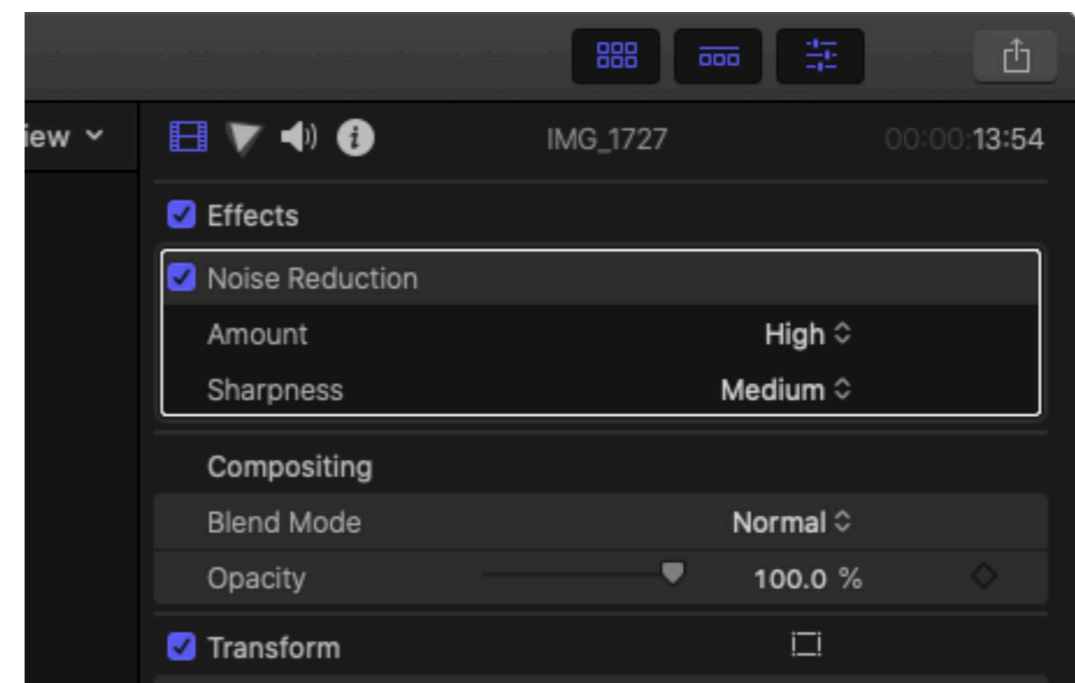
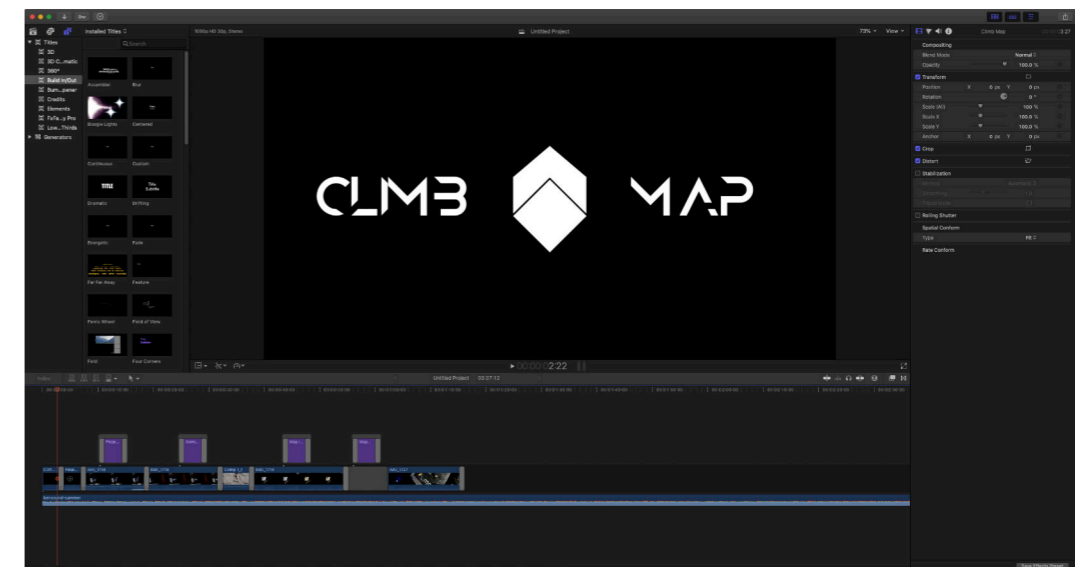
PROTOTYPE VIDEO - PRODUCTION

There was a few directions I could have gone in with showing off my final prototype. My video editor of choice was final cut pro and I went with the more information dense video type with a scripted voice over.

-Immediately after finishing my model I wanted to get some footage of my projection mapping project in person. After finalising the mad mapper set up and wrapping my animations to the climbing wall model. I set up a tripod set up with my phone. This presented a number of initial issues with the production process.

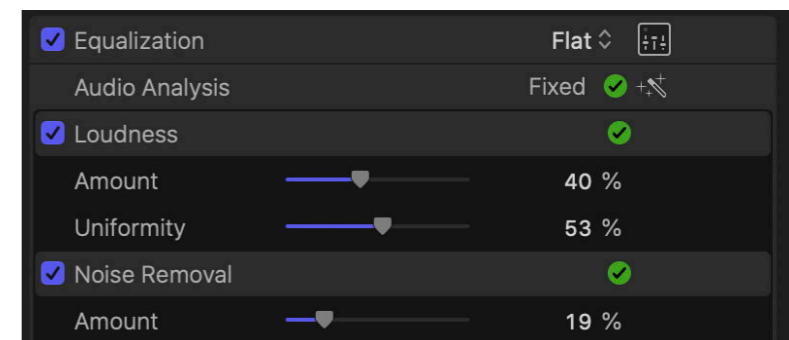
First was the projector I had sourced wasn't as high quality as I would have liked. The lumen count was also quite low and the focal range was small. Meaning my animations worked but it had to be in pitch darkness which presented an issue when it came to recording the video footage.

The footage I had recorded introduced a lot of noise so I had to apply an extremely heavy de-nosier for all of the footage.



PROTOTYPE VIDEO - VOICE OVER

To record my video I decided to use a high quality microphone which are good at recording incredibly good audio however this also means they are good at capturing everything else. To overcome this during my editing process I had apply a lot of audio effects to dampen the background noise while retaining the quality.





THE FUTURE

CRITICAL REVIEW

With this project I had a lot of trouble coming up with a concept as initially I wanted to focus on AR in conjunction with smartphones. However this would require me to do something completely from scratch and something I have zero experience with. I felt that coming up with an idea that I had experience with but could improve on would be best. So I settled on Projection Mapping.

With the restrictions in place this had a large impact on my project but I managed to come up with a hybrid design concept. While I couldn't fully realise my final idea because of its dependency on a public space I put together a model which replicated it.

While I managed to get my design across with a smartphone camera and low quality projector having access to the TRC would have increased the quality of my project tremendously. This would have given me access to a higher quality projector and camera and an easier to light space.

I felt that while my interview with the manager was insightful it would have been nice to ask actual climbers what they think of augmenting a sport they already enjoy and how that could effect their experience. This would have given me extra insight into the specifics on my project which could have also been adjusted with these things in mind to make it better.

FUTURE FUNCTIONALITY

Some functionality I would liked to add was some form of audio visualiser using lights or an Arduino. This would be hard to sync up with the projection map however as after doing some research Arduino doesn't sync up at all with Mad Mapper. This would mean engineering a new method which would take a lot of development and technical knowledge.



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