DECO3200

DOCUMENTATION

INTERACTIVE PRODUCT
DESIGN STUDIO

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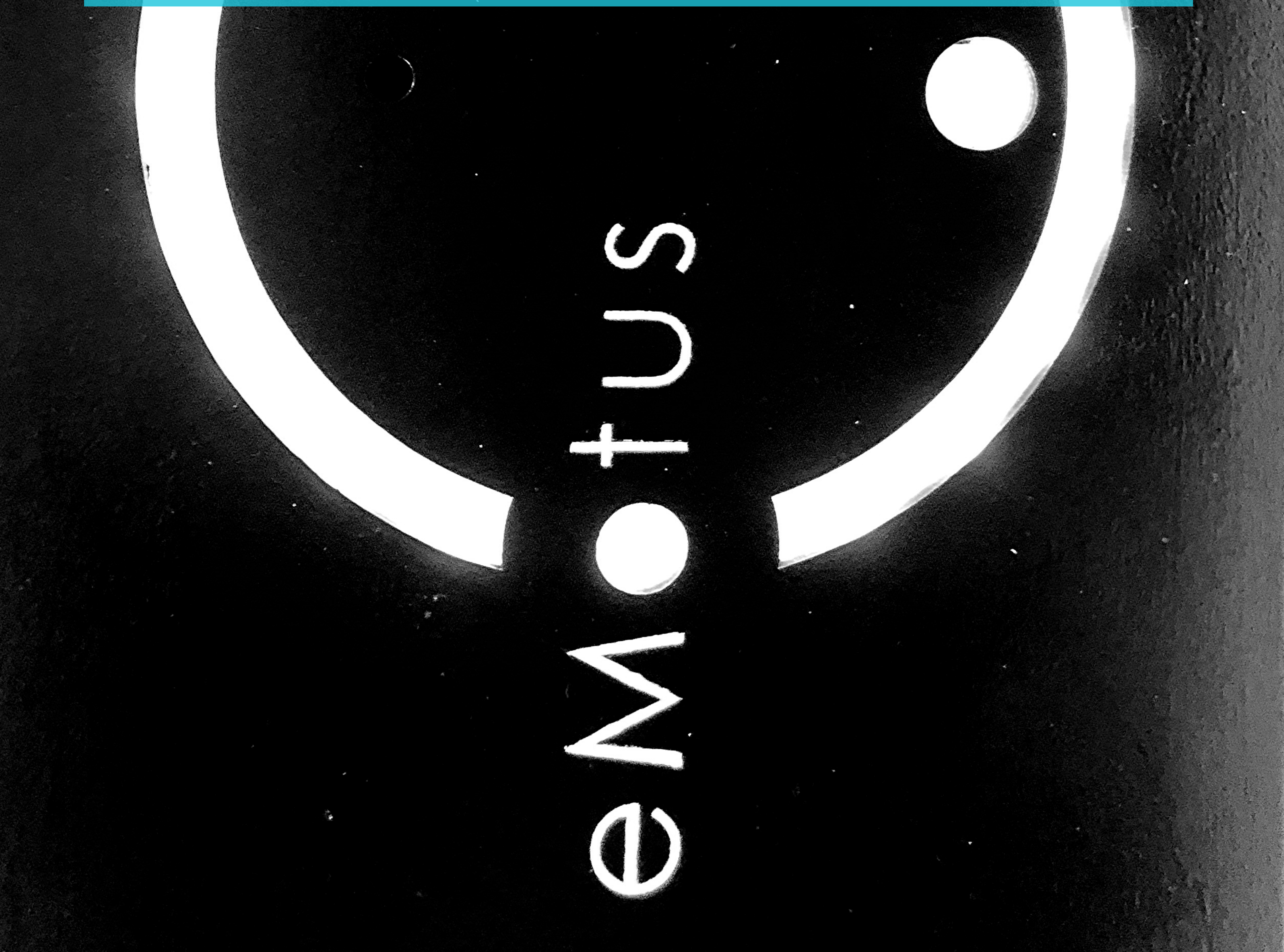

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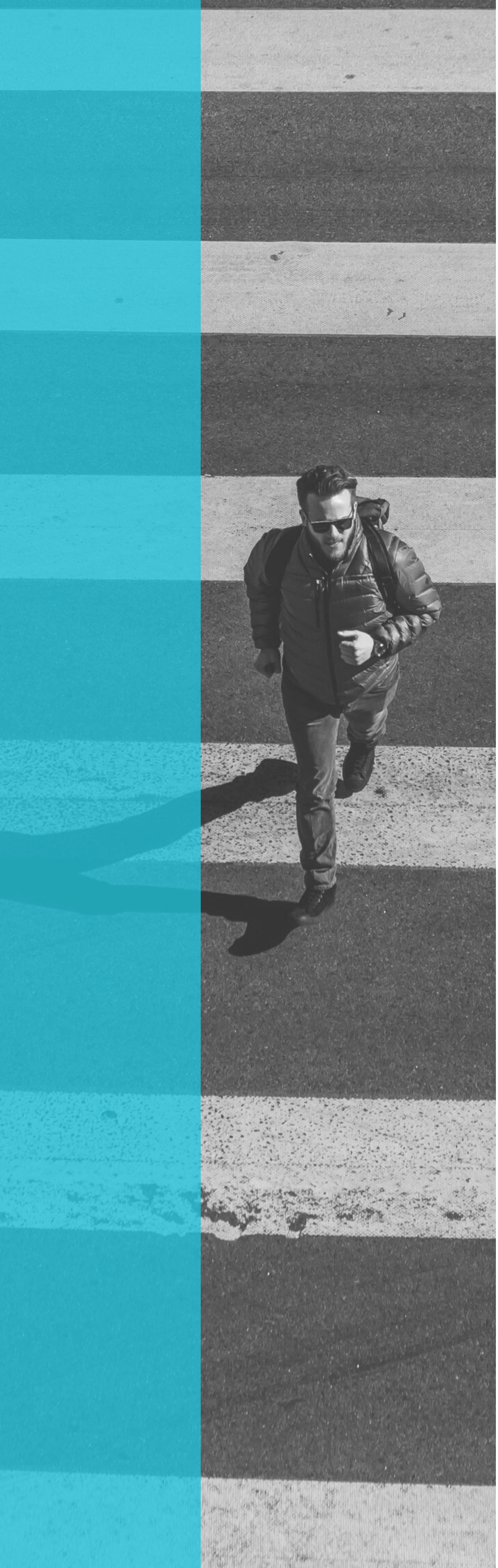


INTRODUCTION

As cities grow larger and urbanisation brings about concerns of congestion in cities, the walkability of pedestrians has become a key problem area that continues to fall behind. Congestion and a lack of walkability in cities is known to increase stress and anxiety for pedestrians, in turn creating a lack of empathy towards others.

To understand how to improve and augment this experience for people, our research delved into the ways cities can be made more accommodating, safe, attractive and easy to navigate for those who live within them. To increase walkability, we found that it isn't necessarily about reducing the number of people on the streets, but about reducing the impact of negative factors by improving things which make the walking experience more enjoyable.

A key factor which became recurring when talking about people in shared spaces and functional environments was the idea of empathy towards others. As people share streets and walkways for many different purposes, it becomes important to allow people to understand the needs of other pedestrians and create a sense of community for commuters to identify with those around them. We found that people generally like to engage with their environment, and engaging with the people in their environment even in a small way can do a lot to increase this idea of empathy in urban environments.

Additionally, when researching the ways people interact with their environment and what things draw attention of people in urban environments, it was found that music and colour can evoke strong emotional responses, that plain text or data may not be able to reveal. People intrinsically want to know about their environment, and providing interesting information to people without forcing it upon them in places where they may not be looking to engage was found to be vital in creating an experience people would willingly interact with. This research and understanding would prove to be a useful tool to steer us toward creating something that can not only provide people with a unique experience, but give a picture or perspective on their environment which may not be necessarily seen usually.

With this research as our foundation, we were ready to move forward with creating our interactive experience of eMotus.

Our Product : What is eMotus?

eMotus is an interactive emotion tracking and visualisation system is a method of augmenting urban experiences, to give people a new way to perceive the often unseen information of pedestrian emotion within these urban landscapes.

It is an interactive visualisation that detects the emotions of people passing by that engage with it. The emotion of the person interacting is determined and converted into a colour that best represents the data captured. This colour is then sent into the visualisation by the user, which then becomes a contribution to a larger picture of the emotions of the people in the environment.

eMotus is designed around increasing walkability through empathy and decreasing stress/ anxiety levels in pedestrians. Through this concept not only does walkability become stronger, but the way people think and feel about their environment and community throughout the day is enriched, promoting a healthy sense of empathy for their surroundings.

The placement of this display allows people to engage directly through the screen, drawing them away from the main points of congestion, as well as allowing people to understand and enrich their walking experience in a few quick moments while passing by.

This idea touches on most of our key findings from our research, including increasing walkability through ideas of empathy and pedestrian information, as well as the importance of colour in affecting the way people feel about their environment.

It allows us to give people in cities the tools and representation they need to create their own picture and understanding of their environment, without creating a sense of forced interaction which could ultimately result in a decrease in walkability. Instead, the core of the idea and it’s interaction revolves around levels of engagement; people can pass by and see the visualisation which ultimately increases walk appeal through its unique and novel presentation, or people can choose to move in and directly engage with the interface and contribute to the visualisation, ultimately learning more about themselves, their environment, and creating an interesting interaction for pedestrians.

To make sure this visualisation was efficient in creating this effect, we also researched the appropriate colours and iconography to use to represent the emotions of people as well as their connection to others in their environments. Our research also lead us to ideas about the best way to interact with this data, leading to us creating a minimalistic physical interface to reduce the stimuli which may confuse users, whilst maintaining a sense of understanding when being used.

To present the visualisation, we found that projection would work well for scalability and presentability in urban environments, without the need for huge installations or screens which could impact the potential use cases of such an idea. Using a projector enables us to potentially deploy this product in a number of varied environments, which could give users more understanding of different perspectives and experiences of a larger variety of people.

THE DESIGN PROCESS

To work towards creating our product, we initially started with 3 main concepts that we tested and iterated upon using low fidelity prototypes and user testing.

This testing consisted of observations, usability testing, and interviews which were undertaken for each of our 3 concepts. After this testing we broke the data down to see how effective our concepts were at providing an experience for users that was relevant to the ideas and problems brought up through our research. This was done through analysis of quantitative data through percentages and graphs, as well as more in depth look at interview results and perspectives through affinity diagramming.

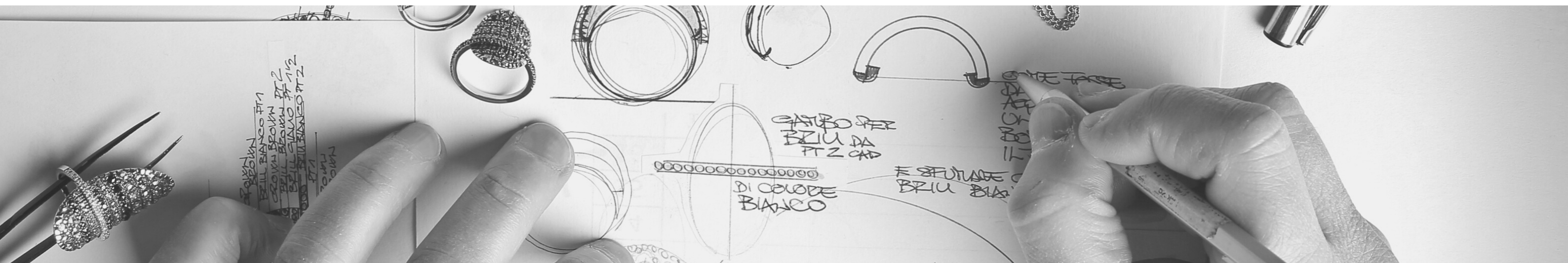
After iterating and repeating tests, we used a weighted decision matrix to decide which concept would be most fruitful for us moving forward, with a key focus on how the concept related to our brief, the ability to increase walkability, the overall usability and feasibility.

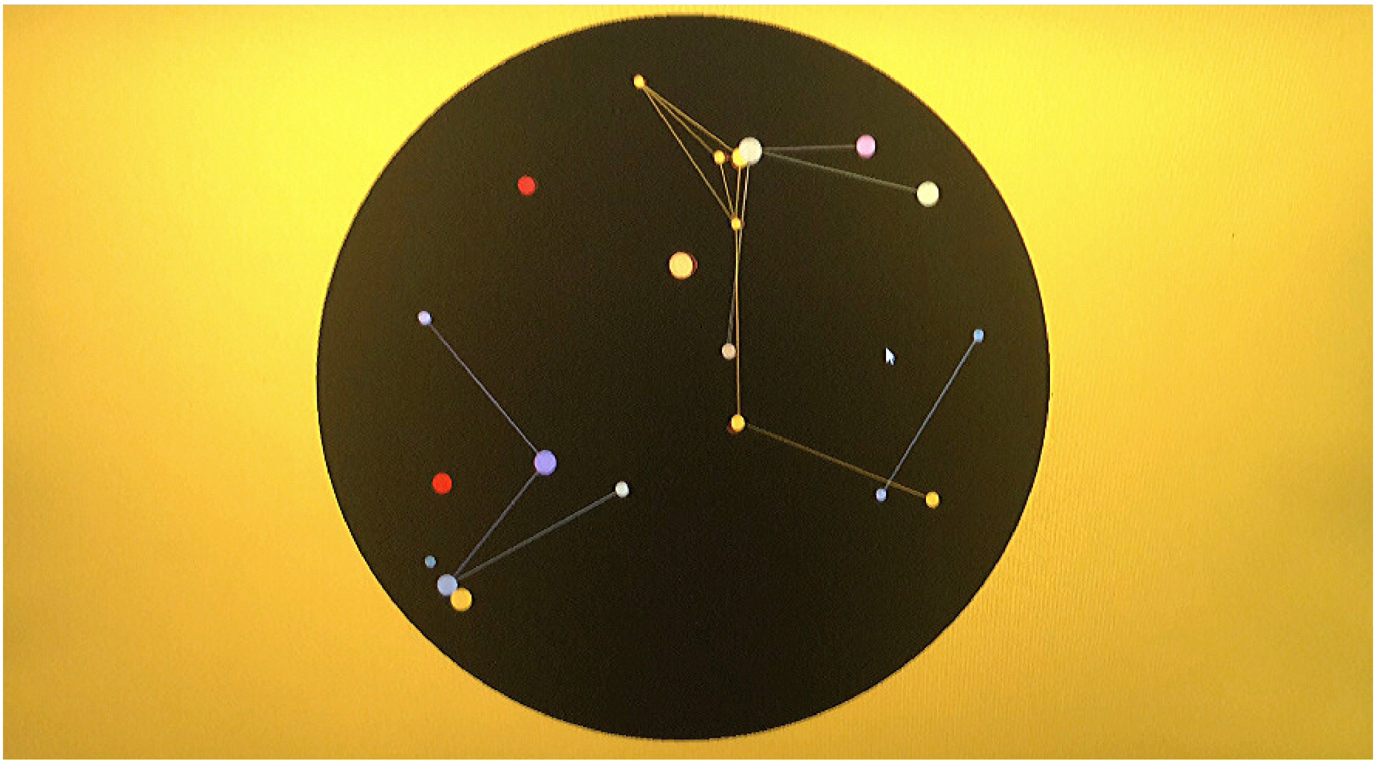
We found that eMotus as a final concept was most consistently scored over our criteria, and looked promising with its ability to get users to engage with the idea being presented, as well as promote a healthier understanding of people and their surrounding environment.

Moving on from low fidelity, we brought together our research and ideas for all of our concepts to create a product that implements the key concepts of our findings.

We also felt that based on our feedback, complementary material like a website of instructions could be instrumental in providing users with that extra level or interaction if they want.

Before creating the product we needed to look into the materials and software we'd need to bring it together (Hardware/Software section). We then worked on iterating with different designs for our interface, as well as what the visualisation would look like.





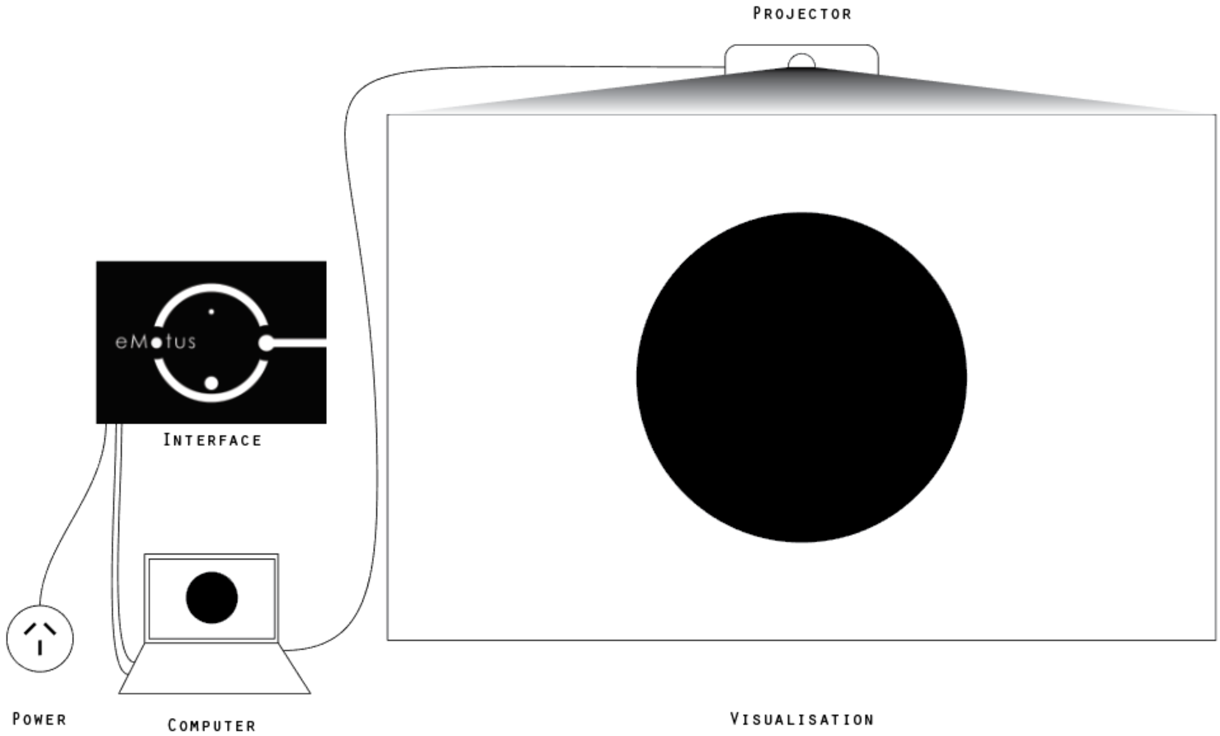
The visualisation originally was conceptualised as a mosaic or more static image of emotion, but after testing some different ideas we liked a direction of multiple objects existing within a dynamic space, settling on an orbital kind of representation. We felt that the recurring motion created by such a visualisation was extremely rewarding when animated, and allowed for different colours to interact.

We also wanted a semblance of connection between the elements in our visualization, opting for lines to be drawn between similar emotions to emulate a sense of connection between the other people in the community.

Additionally we wanted to keep the visualisation relatively abstract in its presentation, as to not be too forthcoming with what was being presented and encourage a sense of curiosity with people passing by, furthermore increasing the engagement people would have when trying to understand what the visualisation may represent. These ideas evolved as we brought the concept together, but formed the basis of what we were trying to represent visually.

CORE FUNCTIONALITY:

eMotus is a physical installation which gathers the emotions of people who pass by and interact, and creates a colour based on their emotions. This colour is then added to a dynamic visualisation to create a large scale visual representation of the general emotions within a community and environment.



It works through multiple pieces; Starting with a physical interface, people are prompted to stand in front as it captures an image of their face and sends it to an API which returns a general confidence rating of the different emotions the person may be experiencing. The API does not store images passed into it, meaning every image taken is not stored anywhere. After this, a colour is calculated based on combining different colours we assigned to each emotion and calculating a weighted average, which ultimately assigns each person with their own colour of emotion, meaning two different people will be unlikely to be assigned the same colour.

After the colour is created, the user is prompted to press a button which sends their emotion to the larger visualisation display which is projected/presented on a wall next to the physical interface. The visualisation presents a large animation on new animation entry, to show users their place within the larger picture of emotion of the environment.

HARDWARE / SOFTWARE:

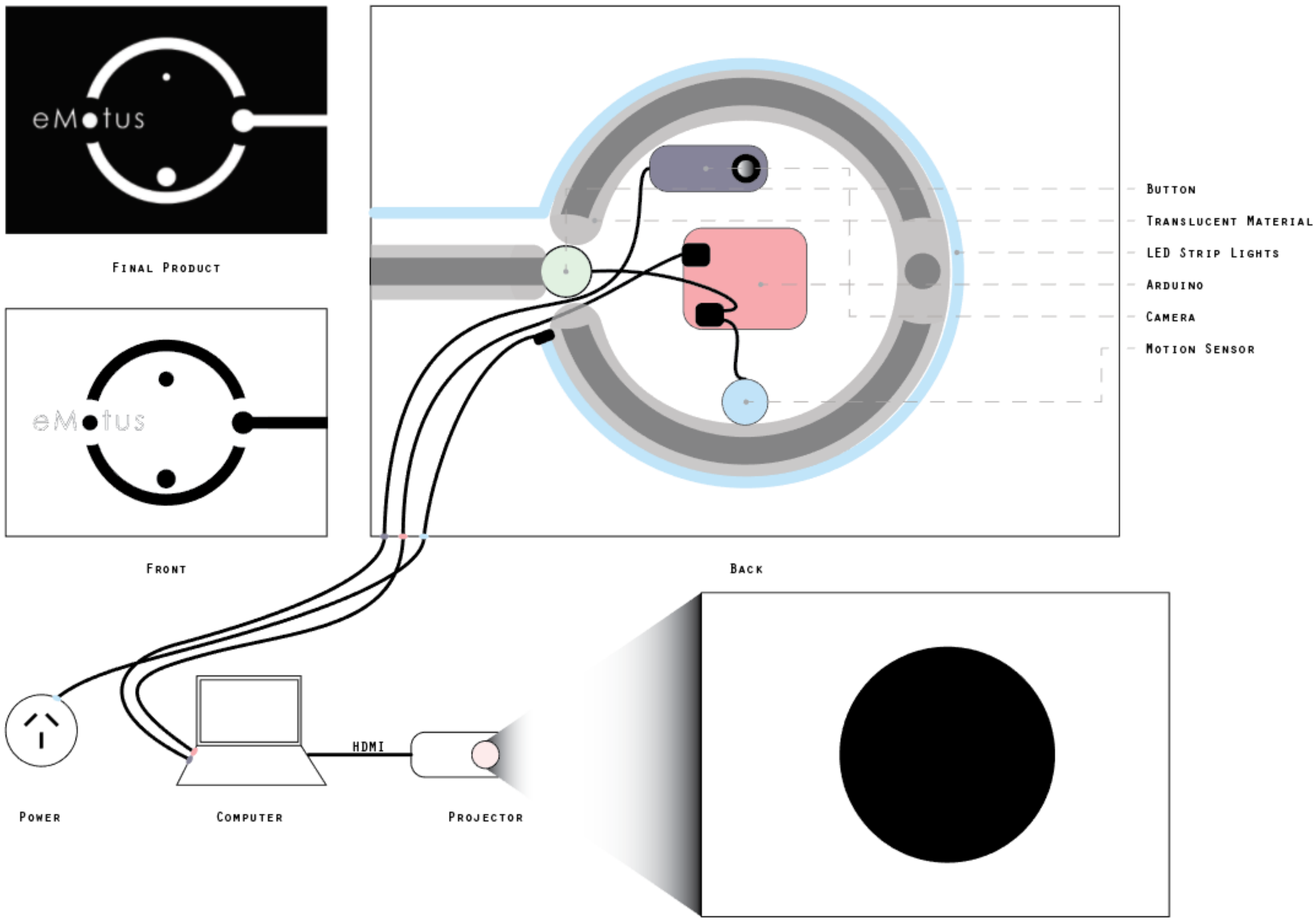
We gathered the various hardware and materials that would be needed to create this product, starting with the hardware, we decided to use an arduino paired with a motion sensor, button, camera and rgb led strip to power our physical interface. This was to be placed within a physical housing made of plywood and lasercut to allow for light to pass through. We also planned to spray paint the housing black, and coat it with a clear finish. We additionally needed to source cables and power supplies for all of these components, as well as a computer for the software and calculations to be run on.

Since this concept would be utilising multiple different types of media and resources, we would need something powerful enough to run multiple processes at once, as well as maintaining an ability to communicate with multiple devices at once.

Once we gathered the necessary hardware, it was time to look into the software required. From our research we found that Microsoft Azure's Face API would be a low cost and relatively user friendly method of gathering emotion data of people who would interact with our system. In order to interact with the API, we also found that using a Visual Studio winforms app, paired with the .NET framework would allow our camera to take images and subsequently analyse them for emotion data. This would also be communicating with the arduino over a serial port, to initialise the interaction and facilitate light animations.

To create our visualisation, we leaned towards using Processing, a visual programming language based on Java to create a dynamic and interesting visualisation. This would allow us to communicate with the emotion data generated by the winforms visual studio app, as well as continually update with new data.

ILLUSTRATED SETUP INSTRUCTIONS:



We came up with this circular shapes and rounded interface design to maintain consistency and an intuitive connection with the projected visualisation of emotions. We wanted the interaction of the button to ‘send’ the users generated emotion to the visualisation and the lights being a visual representation of the emotion being sent. We wanted the lights to seep through the gaps without showing the shadows casted by wires, hence we used tracing paper to cover the gaps and defuse the light creating a glow effect. We used laser cutting for precise, clean cuts and engraving of the letters. We then spray painted the front side black and hand painted the letters white. We then finished it off with a finishing spray, coating it multiple times to give it a polished look.

KNOWN ISSUES

Communicating between code:

One of the biggest issues we had to face was communicating between various mediums of code and hardware. Communicating between out processing visualisation and our arduino had to happen through the C# Winforms app as only one application can access the arduino serial port at a time. To solve this, we had text files being saved and overwritten to the computer which contained data. However, this solution meant at times button presses would be unresponsive and on rare occasions, cause the visualisation to crash. This was especially prominent when the visualisation would begin to lag which was another of our issues.

When too many entries were added to the visualisation, it would begin to stutter and slow down, which in turn would affect the timing of our animations and button presses, preventing the entire product from being responsive. We have already made moves to optimise the code, making the visualisation stronger and more efficient, and reducing the lag, however there will most likely always be an upper limit to the amount of entities the visualisation can handle due to the limits of Processing.

Additionally, the colours used for the RGB LED strip and the visualisation would sometimes not exactly match. This is due to the way that our RGB strip presents colours versus the full colour spectrum available on a screen. To fix this we would have to implement either more efficient lights, maybe with a white channel for more colour control, or through using a led screen for the physical interface instead of an rgb strip to keep colours consistent.

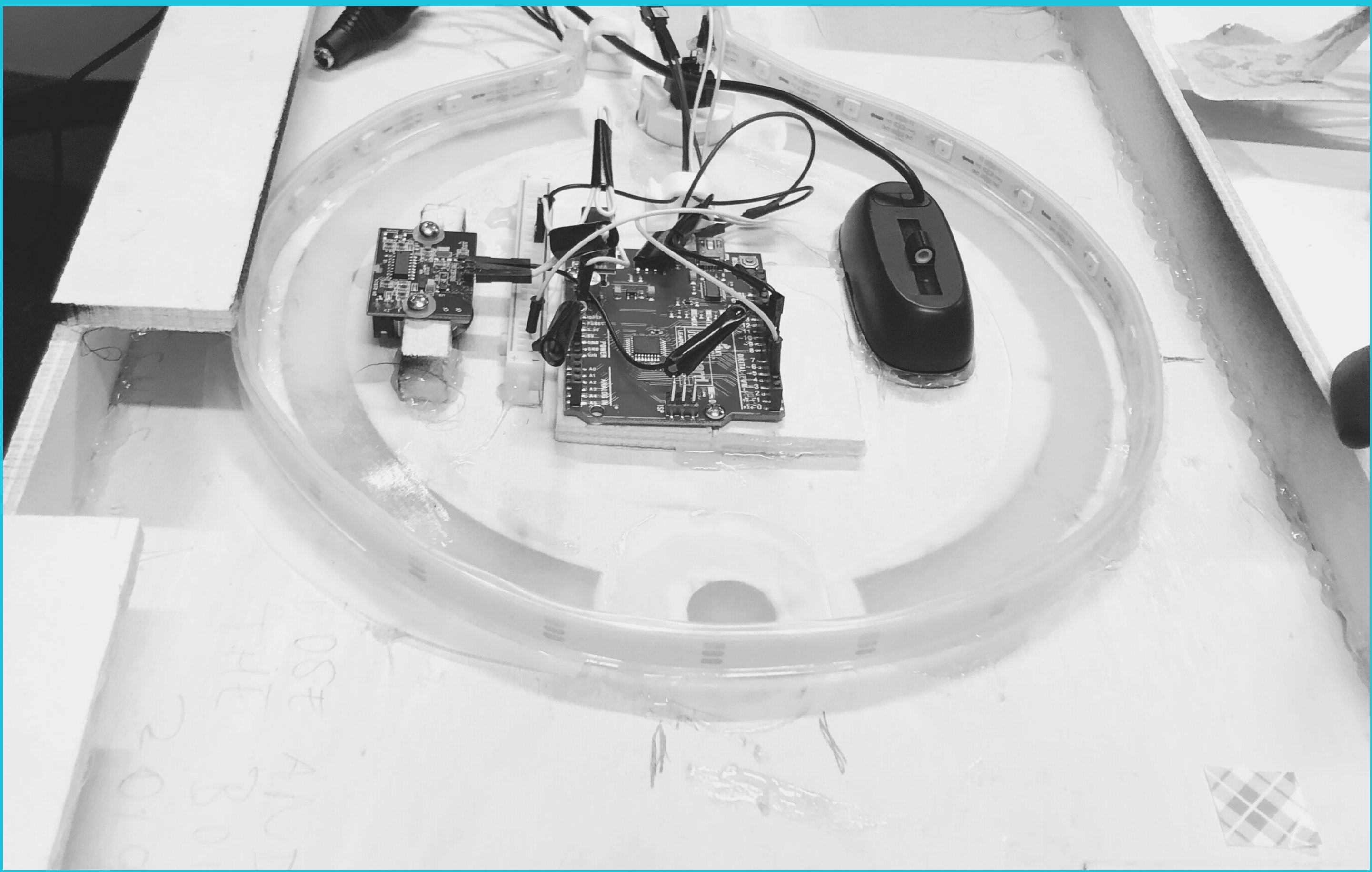
Emotion detection:

To generate various colors the users are required to be very expressive which tends to strain the users facial muscles. (if you're sad and have a slight frown the Api will detect only slight sadness and more neutral which will then create a more whitish blue color which may not be what the depressed user would be expecting.

Interface design issues:

Since the physical interface has gone through many revisions and iterations, we still have yet to find a good middle ground between an intuitive interaction that feels natural and is easy to understand, without forcing or straight up telling the user what they need to do. It's this balance which we feel is necessary to allow the experience to coexist in a busy environment without being obnoxious or an obstacle, but also leads to people being misled or unsure of what they need to do to progress the interaction. We can continue to improve this with testing and iterations on light animations, static instructions and maybe more feedback or prompts like sound.

Another issue we found was presenting what the colours mean to each person, leading to us creating a scale of colour to represent each emotion. However we found that this lead to a lack of understanding that each colour is calculated individually for each person, and something in between these ways of representing the meaning of the colour could bring the idea to another level of intuitiveness.



FUTURE WORK

With our current high fidelity prototype, the flow and overall experience and interaction with the project is staggered and slightly clunky. There are so many ways to optimise the code for faster and more efficient data reading, as well as optimising the rendering engine used to cater for an extensive amount of nodes.

In terms of the future progress of this project there are three aspects that it can be iterated upon or improved, in order to complete this as a high quality product. Firstly there is the back-end optimisation to hold more data entries and flow of the entire product; Secondly there is the Creative visual upgrades and other data interpretation methods that could be used, and finally redesigning the visualisation by changing the problem frame.

Optimisation

Optimising code

Currently the program is written in two separate sections, connected by writing and reading data from a JSON and txt file. The data-receiving end is written in C# with a Microsoft API which analyses face capture in order to determine the emotional state of the user. However, the front end design is written in Java within the Processing 3 library and there are sometimes crashes when a file is both written and read at the same time.

Due to the overcomplicated coding when we set the project up, the best solution for optimisation will be to convert the code in Javascript, which is both doable (but hard) and efficient for web

Fixing bugs

The most prominent issue, as addressed above, is when the two separate programs read and write to the files at the same time. Other than playing around with the delay, which is an ineffective short-term solution, the code should be written in one language to optimise the flow of data, as well as streamlining the experience.Most other specific bugs are based on visual output and glitches in the visualisation, especially when the program is first opened. Firstly, the program automatically starts with a single node with a random colour. This is not intentional, and we would rather it start with an empty canvas.

Secondly, when a new node enters the canvas, the flair created often leaves a permanent 'stain' with the background until another node enters. This hasn't been optimised before so it is understandable that there would be a few errors. Although it doesn't impede on the actual experience, after multiple repetitions it becomes more and more obvious. To solve this issue the flair method in the code should interact with the background to avoid overlays with the original colour.

VERSIONS UPGRADE & DESIGN

Making visualisation more responsive and dynamicWith the current design, we can alter and experiment with the algorithm that allows the particles/nodes to rotate. Currently it is using a template algorithm utilised when introduced to the particle system in processing. However there are many flaws with the calculations which limit freedom of input. One solution to this is to render as P3D and convert each node into a 3D space sphere. Although this is a lot harder, it means that the phong shader and ambient/specular maps can be used allowing the visualisation to have a stronger artistic presence.

Other creative opportunities or different responses to dataThere are different mediums that can be utilised to either receive or visualise data. During the original concept phase there was a lot of research done regarding sound and music influences for an interactive community engagement.

There was yet another concept which used pressure sensors to detect the distance walked by pedestrians in urban cities to emphasise value of walking instead of using transport vehicles. The data that can be gathered using different methods such as these can additionally support this current design solution.

Shifting the problem frame

From Urban Data to a harder focus on Community engagementAfter presenting our product and demonstration, we received multiple recommendations to look into reframing the design for empathy research in specific communities. This still aligns with the design brief and also allows us to expand towards empathy driven design in urban communities.

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