DESIGN REPORT

CREATING A DYNAMIC & ENGAGING EXPERIENCE FOR A MORE APPEALING SCHOOL ZONE CROSSING

PREPARED BY
PEDESTRIAN PLUS

DESIGN ABSTRACT

Testing/research focus: Creating a dynamic & engaging pedestrian crossing experience & appeal to promote safe behaviours of young students around school zones.
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PROBLEM

The current standard crossing environment has many important safety values in a school zone. However, a major point of concern is the ongoing exercise of risky crossing behaviours that underscores a **disconnecting experience,** due to the perceived **unappealing static assumption of pedestrian crossings.** Its contrast within the context of an active school environment **overemphasises** this issue, which was discovered in our conducted focus group and previous interviews from A1, placing road-traffic injuries as the leading cause of death for young Australians aged between 1 and 14 **[5].** This study, therefore, focuses on the **development of dynamic appeal** to enhance the school pedestrian experience and promote safety for increased usage of crossings.

APPROACH

The Pedestrian Plus team, consisting of researchers and designers, performed an overall SWOT analysis of the 4 proposed concepts, which highlighted their strengths and weakness and summarised the tutor feedback and the basic ergonomic assessment to refine down to 2 distinct concepts. A focus group with 8 participants provided additional feedback & understanding of current pedestrian crossing experiences in our problem context. The team then conducted usability testing of the 2 chosen concepts to assess their effectiveness in tackling the **disconnecting experience of current crossing environments,** with a convenience sample of a total of **24 school children aged 7-15 years, 5 school parents, 4 teachers & 1 school board member.** During this assessment, low-fidelity prototypes communicated the relationship between the users and the concepts to measure work flow, observations revealed aspects of behaviours to measure interactivity and engagement levels, post-test group interviews measured likeability and performance satisfaction.

SUMMARY

Overall, we have discovered the importance of user participation in driving dynamic but unobtrusive feedback for a more engaging & appealing school crossing.

OVERALL APPROACH TIMELINE

PHASE 1

Concept Proposal [4 concepts]
A1

1. Ask & Explore

Tues-Thurs, 3rd-5th Sept

Concepts:

Flow - automative pedestrian light system
Magic Crossing - gesture motion crossing
Pengate - pivoting gates with interactive floors & screens
The Duck - multi component alerting system

Software:

Blender - 3D computer graphics for rendered images of concepts.

Research:

Basic Ergonomic Test:
6 human performance principles affecting minors's ability to engage in using concepts.

Designer Feedback:
2 design tutors to assist with pre-emptive functional feasibility.

Focus Group:
6 school students (10-15 years), 1 parent, 1 teacher (exploring past experiences & understanding general users' current connections to school crossings)

Evaluation [4 concepts]
A2 (1)

2. Examine & Interpret

Thurs, 5th Sept

SWOT Analysis:
4 quadrants of strengths, weaknesses, opportunities & threats summary (engagement, functionality, and likeability related)

Design Needs:

To maintain engagement for our users, the designs need to:

Be intuitive enough to allow immediate user connection and sustain engagement.

Involve user participation/reaction for a collaborative connective experience.

Adapt in favour of pedestrian's convenience as to not deter engagement due to assumed time delay due to boredom of waiting.

Refining Concepts [4 to 2]
A2 (1)

3. Decisions (Iteration 1)

Sat, 7th Sept

Key Changes:

Refining from 4 to 2 concepts.

Fine-tuning 2 selected concepts.

Planning & Collecting Prototyping Materials

Creating parameters & goals for usability testing preparation.

Preparing a scenario for users to test concepts.

Scheduling 2 user testing sessions

Key iterations for chosen 2 concepts:

Magic Crossing - digital board is redesigned for a more engaging reactive interaction, personalised to users' movements. LED path is reduced to strips instead of a full path.

Pengate - interactive floor is removed for more focus on the interactive screens on gates.

Prototyping [2 Concepts]
A2 (1)

4. Model & Test

Sun-Fri, 8th-13th Sept

Paper prototypes:

Cardboard
PVA glue
Coloured paper
Masking Tape

Hardware:

Laptop screen
Tablet Screen

Software:

Processing draw game
Animated Panda video

Feedback:

Visual feedback - lights, screens

Research (Test):

Usability Test Session 1:
(Magic Crossing)
12 children, 1 board member, 1 teacher, 2 parents

Usability Test Session 2:
(Pengate) - 6 children

Direct Observations:
Touchpoint Tallies & Observation Notes
- 18 children, 1 school board member, 1 teacher & 2 parents

Post-test group interviews:
Questions & Participant matrix conducted during the above sessions.
- 18 children, 1 school board member, 1 teacher & 2 parents

PHASE 2

Evaluation [2 concepts]
A2 (2)

5. Examine & Interpret

Sat-Sun, 14th-15th Sept

Affinity Diagram:
Summarises main discovered key user needs and patterns that affect engagement, safety & long-term usability.

Decision Matrix:
Visually ranking the concepts' performance based on 14 important factors influencing the ability for the concepts to be practical & engaging, with a total score out of 165.

User Needs:

As users walk towards school crossings,they need to:

Have diverse interaction to add more engagement & instruction

Feel confident in approaching and using the interaction.

Experience a fast crossing experience.

Voluntarily want to comply with avoiding jaywalking.

Refining Concepts [2 concepts]
A2 (2)

6. Decisions (Iteration 2)

Sun-Mon, 15th-16th Sept

Key Changes:

Fine-tuning the 2 concepts.

Audio Feedback added.

Visual feedback using Processing for Pengate's screen is now fully working

Pivoted to small-scale prototypes of concepts to gage context of concepts better

Planning & Collecting Prototyping Materials.

Scheduling user testing sessions.

Key iterations for tested 2 concepts:

Magic Crossing - changed its scope to feedback instead of gesture motion, but kept the general motion sensors for an automated lit up crossing.

Pengate - redesigned screen on gates to a kiosk style screen to get rid of pivoting gates.

Prototyping [2 Concepts]
A2 (2)

7. Model & Test

Tues-Thurs, 17th-19th Sept

Paper prototypes:

Cardboard
PVA glue
Masking Tape

Hardware:

Phone Screen
Laptop Screen

Software:

Processing pattern
Animated character video

Feedback:

Visual feedback - lights, screens
Auditory feedback - sound

Research:

2 Usability Test Sessions:
- 6 children, 2 parents

Direct Observations:
Touchpoint Tallies & Observation Notes
- 6 children, 2 parents

Post-test group interviews:
Questions & Participant Matrix conducted during the above sessions.
- 6 children, 2 parents

PHASE 3

Evaluation [2 concepts]
A2 (2)

8. Examine & Interpret

Fri, 20th Sept

Affinity Diagram

Decision Matrix:
(total score out of 160)

User Needs:

As users walk towards school crossings, they need to:

Have a more subtle and unobtrusive way to feel connected & engaged, to want to continuously approach the crossing.

Feel curious & be able to share the experience with their friends.

Have a simple & clear feedback that can be enjoyed by a group of people.

Refining Concepts [Final Concept]
A2 (2)

9. Decisions (Iteration 3)

Sat-Sun, 21st-22nd Sept

Key Changes:

Merging the 2 concepts together.

Changed scope of combined concepts from predominant screen feedback to simpler feedback (reduced to light display) for a more easy-going fun interaction.

Sketches of merged concept.

LED Feedback coded and fully working.

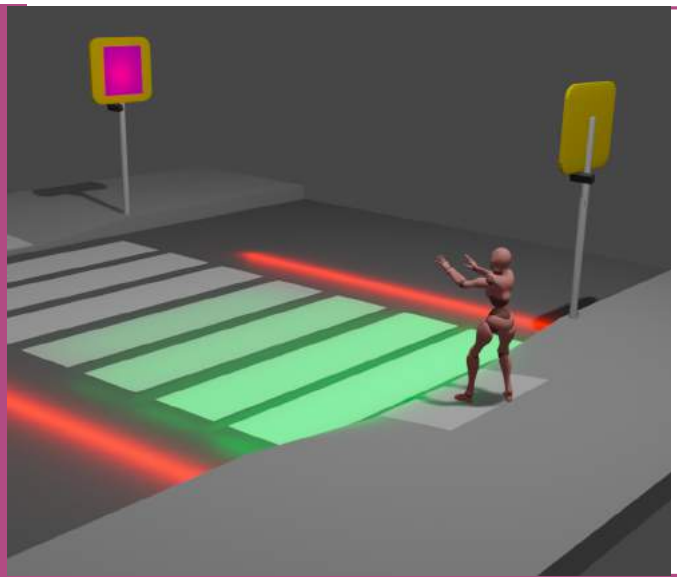
Key iterations for final concept:

Whirlpool (rename of Magic Crossing) - has now incorporated the likeable light feedback and creative contribution aspect from Pengate to replace the animation screen feedback for a more natural, less obtrusive visual display. Water has been added to contrast the intensity of the light feedback over time. The work flow, motion sensors, and reactive interaction has been kept the same from Magic, with the lights on the crossing now removed to solely focus on the visual interactive displays at either ends of the crossing.

ITERATION TIMELINE

MAGIC CROSSING

ORIGINAL CONCEPT



ORIGINAL DESIGN

Uses motion cameras to detect push motion which triggers the green lights on the crossing and RED LED strips either side to flow out.

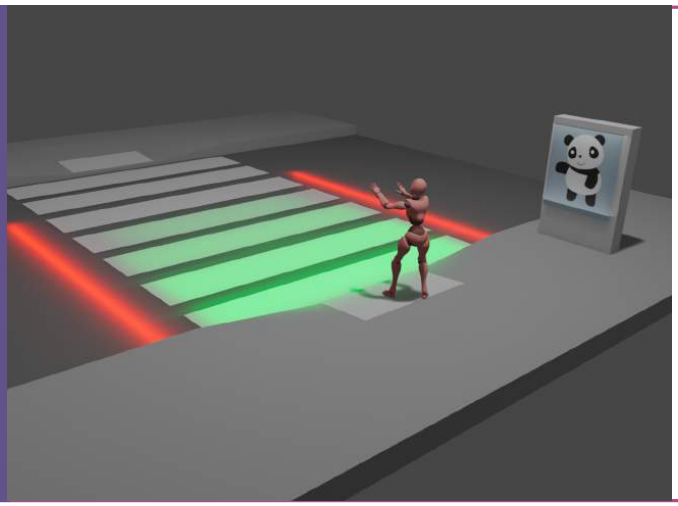
Crossing flows out when push motion occurs.

Animated stop signs stating when to walk and when to wait.

Zebra crossing lights up green after push motion.

Two red led strips either side light up to warn cars to stop.

ITERATION ONE



CHANGES IN DESIGN

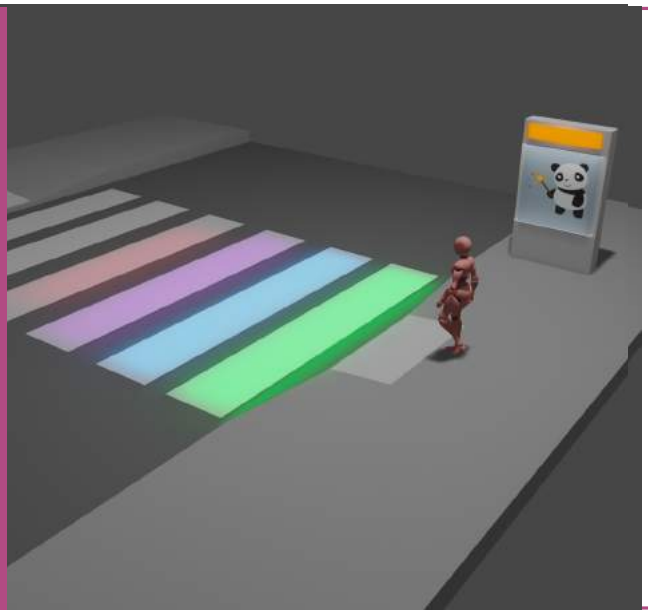
Still uses a motion camera (built into the billboard) to detect push motion and persons presence to trigger animations.

Animated panda to provide instructions and invite the user over to use it.

Same effect when the person does push motion.

Everything on the road remains the same.

ITERATION TWO



CHANGES IN DESIGN

Now uses motion sensors at set intervals leading up to the crossing to trigger the different animations.

Animated characters (we had more animations) to provide instructions and invite the user over to use it.

Now the animated panda causes the crossing to light up and flow out.

Road lights have become multi coloured.

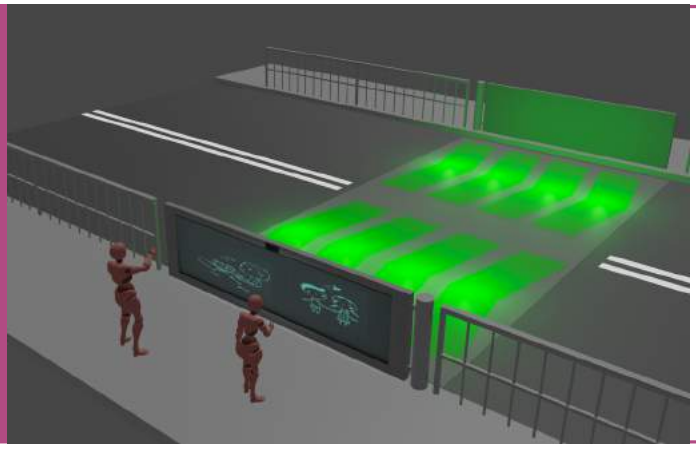
Red LED strips from previous design replaced by orange LED band flashing above the animation that notifies drivers when someone is approaching the crossing.

Next Page Pengate & Final Concept

ITERATION TIMELINE

PENGATE & WHIRLPOOL

ORIGINAL CONCEPT



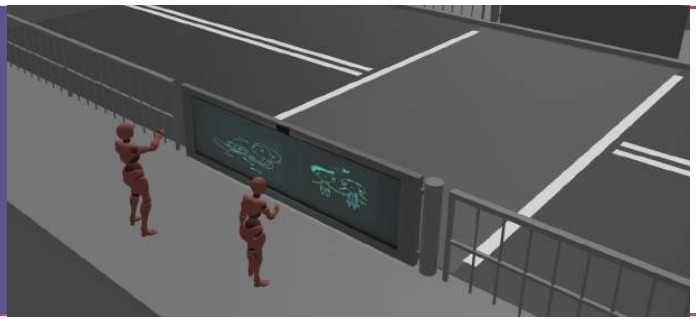
ORIGINAL DESIGN

Uses a physical gate that opens when it is time to cross and blocks cars.

On the gate is a motion detection drawing board which allows people to draw whilst waiting.

The crossing is an LED screen the directs traffic when the gates are shut and when open creates a ripple effect where people step on it.

ITERATION ONE

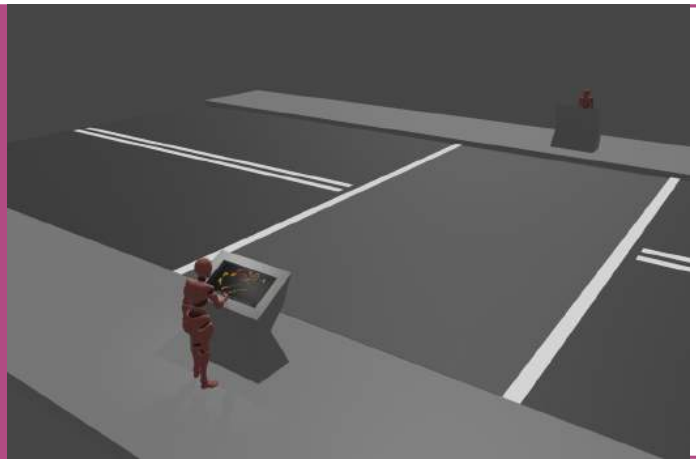


CHANGES IN DESIGN

This design takes away the LED road due to feasibility.

Everything else remained the same with the gate, keeping the motion detection drawing screen.

ITERATION TWO



CHANGES IN DESIGN

The entire gate and fences are removed.

The drawing screen on the gate becomes a kiosk style screen.

Instead of just a drawing board it becomes a game of pictionary where the two sides compete to draw something in the amount of time it takes for the lights to change. You then cross the road to see the other teams work.

FINAL CONCEPT

FINAL DESIGN

Operates on a normal zebra crossing.

Is a more natural design incorporating water and lights rather than a screen. Keeps the Orange LED strip idea from Magic Crossing at the top.

Uses motion sensors at set intervals to detect the proximity of the user, triggering the water feature in stages to do different things.

As the person goes past interval 1 it the lights begin flashing beckoning them over. Interval 2 the inner plastic cylinder begins to fill with water and creates a whirlpool. Interval 3, triggers as they go to cross, the water overflows and Interval 4, the lights do a spiral effect and make a victory noise; water also resides.

TYPE OF DATA COLLECTED

Overall, using a generative method for constant iterations, **qualitative data** was gathered to help inform the important user needs behind creating a more connective experience. We decided to focus on this data type, as we were more concerned with **exploring the process** that our users go through when walking to and from school crossings, rather than trying to confirm and deduct issues **[22]**. However, purely avoiding quantitative data is a missed opportunity to utilise the richness from interpreting the meaning of the data to help examine specific insights **[22]**. Hence the methods of **direct observations and group interviews** were used to not only draw out qualitative data, but to allow us to incorporate observational touchpoint tallies and frequency tallies for quantitative data to help **broaden** and **support** our discovered insights.

PHASE 1: METHODS

The focus this first evaluation stage involved cutting our concepts down, from our initial 4 concepts to 2 concepts using:

	ERGONOMIC TEST	TUTOR FEEDBACK	FOCUS GROUP
Participants Involved	Design team of 5	2 Design Tutors	8 participants (6 students ages 10-15, 1 parent 1 teacher)
Prototype used	3D render image	3D render image	—
Information Gained	Feedback on concept compatibility for our minor users	Opinions on the design & concept interaction	Opinions on why users feel disconnected

With our target audience being minors, we had to strategically plan out how to best explore our problem space with them, as we were challenged with their spontaneous attention span and their hard scheduling plans, since we had to go through their parental guardians as well. Therefore, rather than basing our first phase on user testing, we decided to focus more on evaluating from a designer's perspective, as well as gathering more data on users' current experiences with school crossings with the focus group. These were aimed to uncover potential conceptual-related issues that may affect our design focus. The methods assisted with fine-tuning the chosen concepts and to maximise our usability sessions with the children, without making them feel overwhelmed or agitated.

01 ERGONOMIC ASSESSMENT

WHY THIS METHOD?

Traditionally, most ergonomic assessments do occur after the design phase, which is the low-fidelity prototyping of concepts for user-testing **[10]**. It occurs after as it aims to improve the performance of systems by studying user-device interaction **[3].** Despite this, we **saw an opportunity** to use this at an earlier iterative stage, prior to user testing, to **better understand different aspects of human performance** **[10]**. This allowed us to:

- **ELIMINATE UNDESIRABLE AND UNCONTROLLED ELEMENTS OF THE CONCEPTS [3]**
- **HELP ENSURE OUR CONCEPTS ARE COMPATIBLE WITH OUR USERS ACCORDING TO THEIR SKILLS [3]**

- **DOES NOT HIGHLIGHT ALL PRACTICAL INTERACTION ISSUES**

  It is based on our team's evaluation and is therefore only a **pre-emptive assessment**. Further, we did not use the full extent of the assessment as we did not consider actual exact measurements of our users.

HOW WAS IT CONDUCTED?

The ergonomic assessment was conducted based on the provided in-class template of some general principles, which included considering the **fit, strength, clearance, reach, posture & sight-lines.** The tests were completed within our design team of 5 people, through **team discussion** and referring to our **rendered 3D images** of each of the concepts, allowing us to **explore different angles of our modelled ideas.** This provided us with **qualitative information** on how inclusive our overall concepts were, which led to a wider range of feedback from within the team on the **compatibility for engagement** of each of the concepts for our young users.

**REFER TO FIG.1 IN APPENDIX

PHOTO FROM UNSPLASH

02 TUTOR FEEDBACK

WHY THIS METHOD?

As Pedestrian Plus is not involving users testing at this stage, the team is challenged with a **bias design blindspot**, where we acknowledge that our conceptual map of the proposed ideas are different to those outside of the project. As a result, receiving **external feedback,** particularly from a more experienced designer, is able to help address this bias and further improve our concepts by:

- **OBSERVING AND IDENTIFYING UNFORESEEN ISSUES [9]**
- **CROSS-CHECKING OUR PERFORMANCE AND PROGRESS**

- **DEPENDANT ON THE PERSON GIVING THE FEEDBACK [21]**

  Tutors are still subjected to their own conceptual map. Additionally, they are also limited in pre-empting the engagement deliverable, as the tutor is not representative of our target users.

HOW WAS IT CONDUCTED?

**REFER TO FIG.2 IN APPENDIX

Using the **rendered 3D images** of the 4 concepts along with our explanation of what each of the concepts were, 2 tutors referred our concepts back to our problem space and target audience to pose challenges about them to our team, and made us consider the **MAYA principle** for social acceptance with some of our concepts. As they were brainstorming and challenging our thinking, we had one team mate record, allowing us to transcribe the important notes for our data gathering. This allowed us to gain **feedback** on the concepts and **opinions** regarding design and feasibility.

PHOTO FROM UNSPLASH

03 FOCUS GROUP

WHY THIS METHOD?

Adding in a focus group was aimed to allow us to gain a more **focused idea of the insights** into our problem space, as well as incorporate our **users' opinions & experiences** to assist with iterations **[19]**. We wanted to understand this to best prepare us for our usability testing preparations, as well as to help guide the changes to the chosen concepts to be tested in phase 2.

- HELPS TO BUILD EMPATHY OR UNDERSTANDING WITH USERS [19]
- ALLOWS US TO INVESTIGATE OUR GOALS WITH SEVERAL REPRESENTATIVE USERS FOR A MORE INSIGHTFUL DATA [19]
- EASY FOR ONE PARTICIPANT TO DOMINATE WITH THEIR OPINIONS [19]
- THE INFORMATION GAINED IS RELIANT ON WHAT USERS THINK THEY WANT, WHICH IS NOT NECESSARILY WHAT THEY NEED [19]

HOW WAS IT CONDUCTED?

**REFER TO FIG.3 IN APPENDIX

The focus groups consisted of **8 total participants.** Prior to the focus groups, a **pre-planned script** outlining key issues and addressing goals for the type of information to be gained was made. The sessions began with a broad general question into how participants **perceive** school crossings, and how they felt when looking at a basic school crossing. The questions then became more specific, such as asking them about which type of current crossing infrastructures that they felt would more likely engage/encourage them to properly use to cross the road. The more specific questions allowed us to access **tacit knowledge,** uncovering some past experiences that highlighted why they felt more connected to certain crossing facilities. The type of information that these questions aimed to attain was to **gain opinions** on why certain crossing experiences seem **unappealing**, leading to a disconnective crossing experience and therefore impacting on the usability of school crossings.

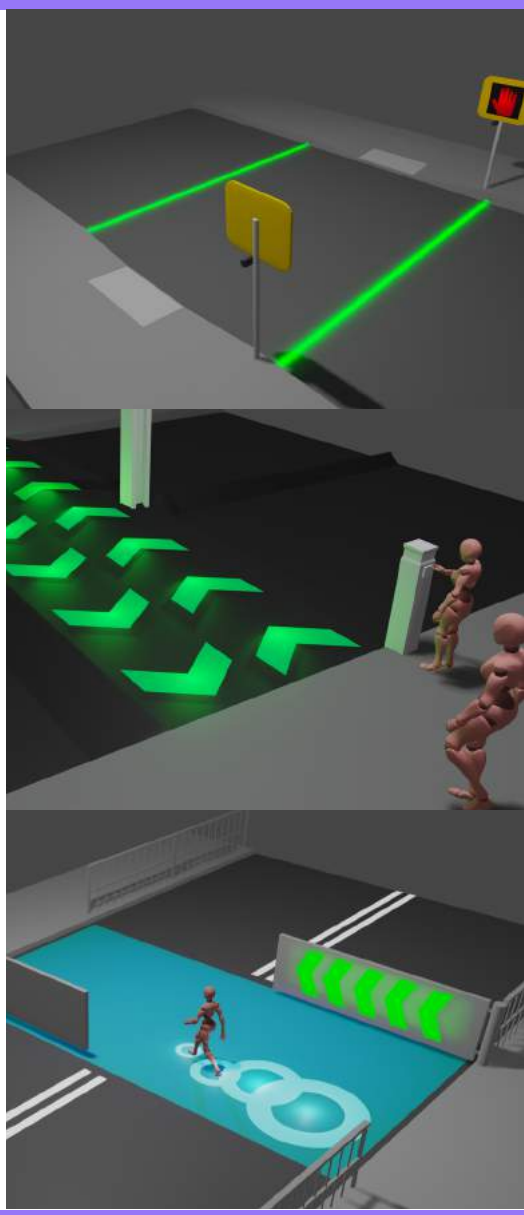
PHOTO FROM UNSPLASH

PHASE 1: PROTOTYPES

3D RENDER IMAGES

3D rendered images were chosen to be used as prototypes at this stage, as we wanted to explore more of the **conceptual principle**, rather than the usability flow, behind the proposed concepts by testing them through **verbal feedback**.

3D rendered images allowed for a **realistic visual representation,** making it easy to **communicate** concepts for conceptual feedback. Modelling & rendering was done using **Blender** as the software



PROS

- Useful for rapidly conveying a concept visually, and communicating the basic functionality within a virtual environment. [1]
- 360 perspective view that can be explored, making it easier to critique compared to standard 2D drawings.[1]

CONS

- Cannot be physically interacted with, as it is limited to the screen. [1]
- Does not consider all aspects of human interaction and is therefore limited in its use for usability testing. [1]

PHASE 1: EVALUATION METHOD

**REFER TO FIG.4 IN APPENDIX

SWOT ANALYSIS:

A SWOT analysis was used to summarise our collected key insights gained from the methods used in phase 1, as well as to ensure a broader coverage of the potentials and issues of the concepts. By having a condense summary, it was easy to identify common themes by:

- **EXTENDING OUR VISION TO EVALUATE THE DESIGN THROUGH FOUR KEY FACTORS [8]**
- **HELPING TO UNDERSTAND KEY ISSUES IN A QUICK MANNER [15]**
- **DOES NOT PRIORITISE THE ISSUES**

  It is hard to assess a hierarchy of importance, as the identified issues are not based on user experience and feedback.

PHASE 1: KEY FINDINGS

CONCEPT 1: FLOW

Flow's attempt to increase pedestrian connectivity and appeal is reliant on **automating the process** so that pedestrians feel more prioritised. However, due to its lack of potentials for a dynamic interaction, this concept was chosen to not continue onto the next phase.

KEY STRONG ASPECT:

Prioritises Pedestrians

- Should pedestrians need more time when there is a large group, the system will adapt & allow for that.
- Though in cases where only one child is waiting, the traffic light will go at a normal speed, as to give as much convenience to pedestrians as possible for a more connected experience.

KEY PROBLEMATIC ASPECT:

Low memorability

- It is extremely similar to the current timer crossing design. The only difference is the adaptive timing, requiring no buttons for physical feedback.
- Physically the archway is the only feature that stands out as completely different.

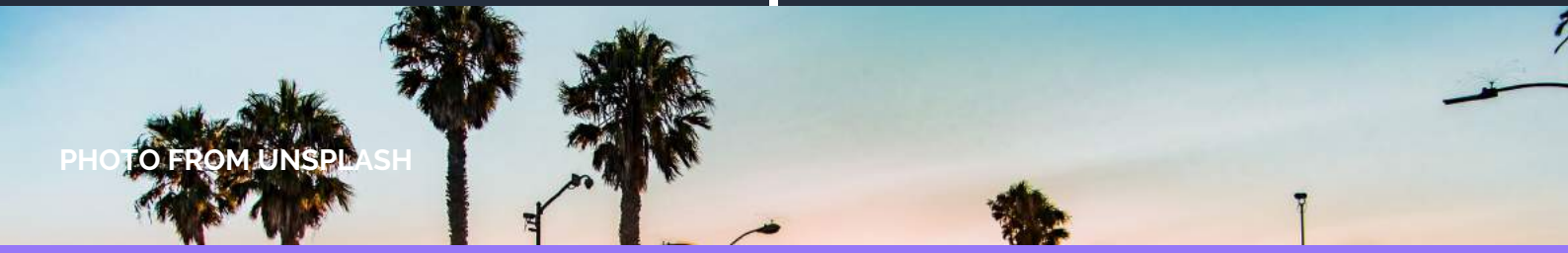


PHOTO FROM UNSPLASH

CONCEPT 2: DUCK

Overall, this concept showed to be the weakest to our design brief and was also chosen to be cut. Even though it attempted to engage users through dynamic sounds for a more connective experience, its basic touch screen function lacked long-term memorability and a purposeful experience for an appealing dynamic interaction..

KEY STRONG ASPECT:

Dynamic Warnings

- As this concept uses the audio instead of visual guidance, pedestrians are able to stay alert even if they are distracted and disengaged.There are dynamic options

KEY PROBLEMATIC ASPECT:

Low memorability

- Though it tries to engage users' attention through a dynamic warning design, its reliance on alerting users of their unsafe behaviours will risk developing an even more unappealing experience for pedestrians.

PHOTO FROM UNSPLASH

CONCEPT 3: PENGATE

Overall, this concept was the most controversial in its inclusion of brutal architecture to provide a physical safe guideline for pedestrians, but it had potentials to add a dynamic experience through its pivoting gates & by providing entertainment through interactive screens.

KEY STRONG ASPECT:

Interactivity

- All aspects of Pengate's design, both LED floor and the Gate's Drawing board provide high levels of interactivity.

KEY PROBLEMATIC ASPECT:

Feasibility

- The gate and road together require enormous amounts of technology and potential expenses. The floors display is the least technological feasible and most costly part out of all four concepts.

PHOTO FROM UNSPLASH

CONCEPT 4: MAGIC CROSSING

Overall, this concept had the most appeal in dynamically engaging pedestrians, through positioning them to contribute to their safe walking habits. The unique interaction combined with a flowing LED pathway appears appealing and removes static assumptions of standard crossings.

KEY STRONG ASPECT:

Pedestrian Empowerement

- Making the pathway flow out provides a personal responsibility/feeling of power to the pedestrian and involves them in the process of safe walking.

KEY PROBLEMATIC ASPECT:

Poor Intuition

- As the intuition of using the concept is poor, it may not be effective enough to appeal and intrigue pedestrians, as they won't even notice the crossing if they don't even know how to activate it.

PHOTO FROM UNSPLASH

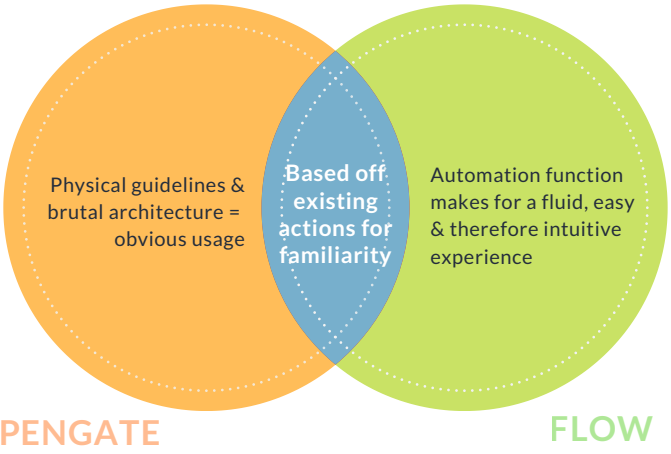
PHASE 1: SUMMARY

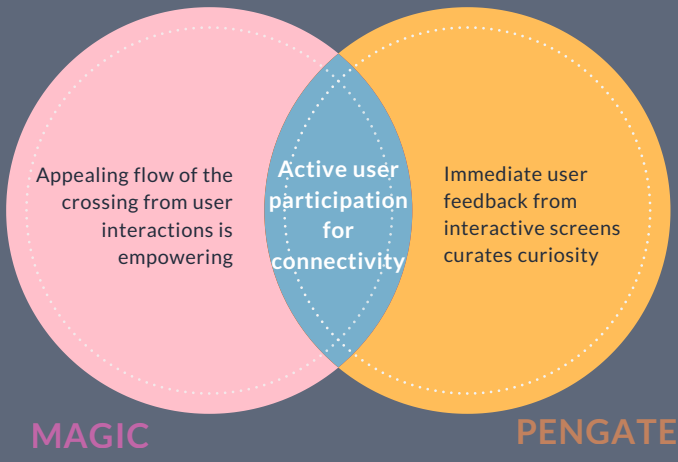
To maintain dynamic engagement & appeal for our users, the summary of the discovered key design needs based on the concept findings are listed below. As visually seen below, the **Duck concept** lacked strengths in all of the key areas, and **Flow** only qualified in providing an intuitive design. The areas in which the other 2 concepts lacked in was used as the foundation for the iteration changes.

1. INTUITIVE DESIGN

Pengate & Flow had the most success with its functionality and practical aspects, highlighting a key need for the designs to be intuitive enough to allow for immediate user connection & sustain engagement. Whereas Magic & Duck lacked the right indicators for an intuitive flow.

The strengths of Pengate & Flow in its intuitive design is highlighted to the right:



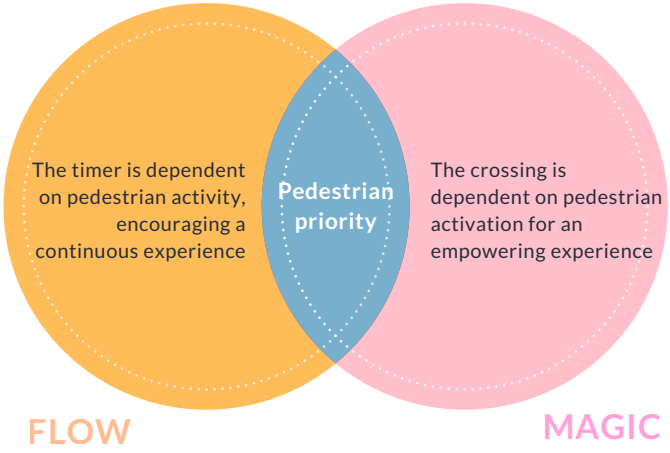


2. USER PARTICIPATION

Magic & Pengate showed the most potential in connecting with our users through incorporating user action/participation for a collaborative appealing experience. In contrast, Flow lacked user interaction as its whole process is automated, and Duck had interaction issues with its confronting focus on shaming pedestrians.

3. POWER TO PEDESTRIANS

Flow & Magic effectively adapts its design in favour of pedestrian convenience and activity, as to not deter engagement due to assumed time delay due to boredom of waiting. Whereas, Flow does not provide dynamic appeal to ease the impatience of waiting at the crossing. Duck confronts pedestrians too much, which undermines its attempt at increasing dynamic appeal.



ITERATION 1
MAGIC CROSSING

CHANGES MADE TO MAGIC CROSSING

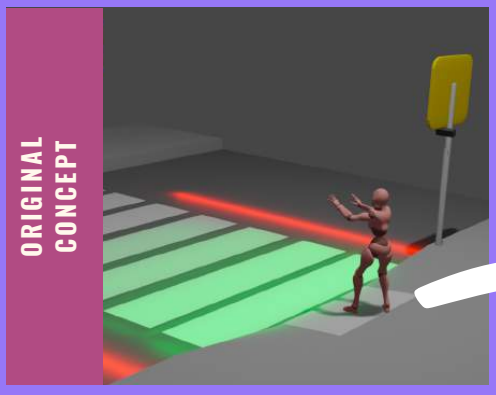
As a result from the findings

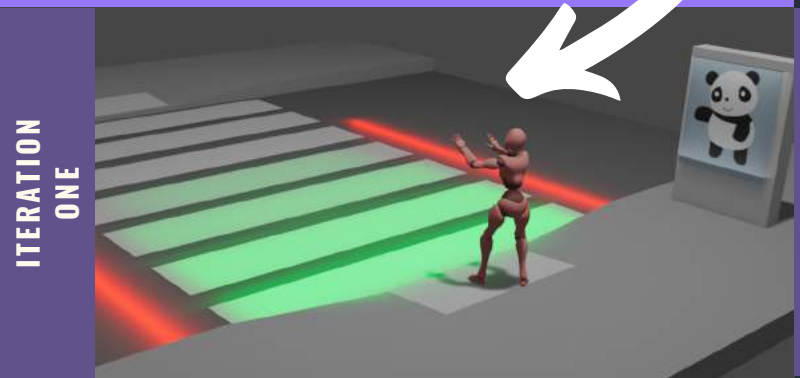
Re-designing the digital board

To better-utilise the digital sign as an indicator for the gesture motion activation, and to increase visibility appeal to increase curiosity and engagement, the digital board will now have an animated character that guides and interacts with pedestrians based on motion sensors.

Removed weight sensors and timer

To increase clarity of design so that it highlights pedestrian priority. Without the countdown timer, MAGIC will visually be more appealing to pedestrians and less likely deter them from perceiving MAGIC to be inconvenient.



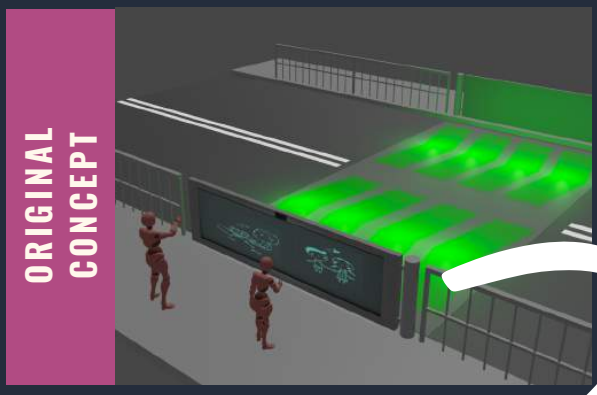


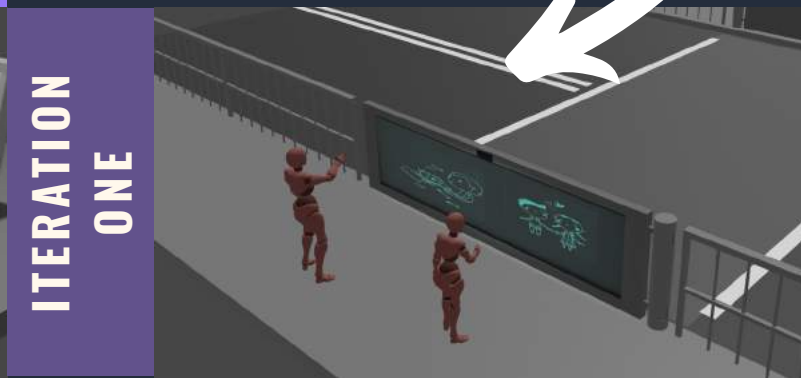
ITERATION 1
PENGATE

CHANGES MADE TO MAGIC CROSSING

Removed interactive LED crossing floor

Due to potential feasibility issues, the floor was removed to direct more focus on the gates & its interactive screen. Also, as the school context is active, we did not want to produce an overwhelming busy design that was distracting..





PHASE 2: METHODS

At this stage, our methods of evaluation were now centred around usability testing with school children ages 7 - 15, to meaningfully uncover the diversity of the participants' dynamic interactivity needs for a more appealing & connected experience with school zone crossings.

The methods were designed to further investigate our design focus of creating engagement and connectivity for pedestrian experiences at school zones, with specific goals of evaluating:

What kind of interaction do school children find the most appealing to better engage their attention when walking across the road to school?

What level of dynamic entertainment is required to address the current disconnecting & unappealing pedestrian crossing assumptions?

Which methods of encouragement are able to best deter school children from unsafe crossing behaviours?

The purpose of having the above specific goals for our user testing is to direct us on 'how to analyse the data, what to look for, what to leave out and what to communicate' to our users **[20]**.This was achieved using the following methods:

	USABILITY TESTS	OBSERVATIONS	POST-TEST GROUP INTERVIEWS
Participants Involved	22 participants (18 students ages 7-15, 2 parents 1 teacher, 1 board member)	22 participants (18 students ages 7-15, 2 parents 1 teacher, 1 board member)	22 participants (18 students ages 7-15, 2 parents 1 teacher, 1 board member)
Prototype used	Paper Prototypes	Paper Prototypes	Paper Prototypes
Information Gained	Feedback on concepts	Notes on user flow and interactions	Opinions & feedback on concept satisfaction

PHOTO FROM UNSPLASH

01 USABILITY TESTING

WHY THIS METHOD?

It is essential to involve our users to better understand how they interact with our concepts and gain tacit knowledge. Tapping into this knowledge space positions our design team to reveal insights into personal stories and experiences **[4]**, which contain the key user needs to drive a memorable engaging interaction. This method allows for a:

- **ALLOWS FOR EFFECTIVE ITERATIVE TESTING & EVALUATIONS, BY INVOLVING USERS 'EARLIER AND MORE OFTEN IN THE PROCESS' [7]**
- **IS ABLE TO IDENTIFY ISSUES THAT WILL AFFECT THE ACTUAL USERS OF OUR CONCEPTS, ALLOWING US TO ADDRESS THEM AS EARLY AS POSSIBLE [19]**
- **TIME-CONSUMING WITH ORGANISING AND CONDUCTING THE TESTS, PARTICULARLY WITH DEALING WITH MINORS AS THE USERS.**

HOW WAS IT CONDUCTED?

**REFER TO FIG.5 IN APPENDIX

Prior to the tests, we set out goals, scenarios and materials needed for the sessions, with consent approval forms for research participation. For privacy reasons, we have assigned fake names for anonymity in our transcripts. During the sessions, observations & post-test interviews were conducted on all participating usability testing users. Participants were given a goal to walk to school and choose whether to investigate and use the crossing concepts or to ignore them.

02 DIRECT OBSERVATIONS

WHY THIS METHOD?

Direct observations allows for real-time analysing and understanding of what our product would be like in its' real environment with the target users. We can then better understand their workflow to perceiving the conceptual prototypes. The benefits & limitations of this method are:

- IT IS A NON-INTRUSIVE WAY TO GATHER FEEDBACK FROM USERS' INTERACTIONS AND BEHAVIOURS [6]
- THE DATA IS FOCUSED ON USERS' ACTIONS RATHER THAN ON WHAT THEY SAY, WHICH IS ABLE TO REVEAL MORE ACCURATE INSIGHTS [6]
- THE DATA IS LIMITED TO 'PEOPLE'S BEHAVIOUR THAT IS VISUALLY ACCESSIBLE' [19]
- IT HAS A DEGREE OF BIAS, AS IT IS BASED ON HOW THE OBSERVER INTERPRETS USERS' ACTIONS WITHOUT THE CLARIFICATION OF THE USER [6]

HOW WAS IT CONDUCTED?

**REFER TO FIG.9 & 11 IN APPENDIX

As one of the aims of the direct observations during usability testing was to reveal aspects of behaviours, we created a list of potential touchpoints of user interactions. This was to help us observe the participant's actions during the user testing, and to tally up the level of occurrence of particular behaviours across all our participants, revealing any important issues or success with the concepts. Our other aim of using this method was to gain feedback on the concepts. This was achieved through having one team member writing observational notes on the participant's facial expressions, actions and hesitations, reactions to certain aspects of the prototypes and any important remarks that the participants would say during their experience.

PHOTO FROM UNSPLASH

03 POST-TEST GROUP INTERVIEWS

WHY THIS METHOD?

Conducting interviews after testing is able to help us 'gauge users' opinions about concepts' **[19]**. We can therefore understand the overall experience that participants had when they tested out the prototypes while it is fresh in their minds [12]. The benefits & limitations of this method is:

- **ABLE TO PROBE FOR INSIGHTS BEHIND WHY THEY EXPERIENCED PARTICULAR PROBLEMS DURING THE USABILITY TESTING [18]**
- **ALLOWS US TO CLARIFY AND HELP PARTICIPANTS GIVE A GOOD SUMMARY OF THEIR PROTOTYPE EXPERIENCE**
- **THE INFORMATION GAINED IS AT RISK OF SUBTLY BEING DIRECTED AND INFLUENCED BY THE MODERATOR, DUE TO THE STRUCTURED NATURE OF THE PREPARED QUESTIONS [18]**

HOW WAS IT CONDUCTED?

**REFER TO FIG.10 & 12 IN APPENDIX

With the goal of gaining feedback on the concepts and to better understand the participant's satisfaction with the concepts, we prepared 7 specific questions to ask them after their experience of interacting with the prototypes. The questions included short answer responses, as well as rating scale questions. These questions were conducted one-on-one with each participant to gather a personalised feedback on their own experiences. We had one team member ask the participants the set questions, while another team member typed out the response.

PHASE 2: EVALUATION METHOD

AFFINITY DIAGRAM & DECISION MATRIX

**REFER TO FIG.15,16, 19, 20 IN APPENDIX

Affinity was used to assist in grouping large data from our phase 2 methods, leading to formations of various levels of groups and sub-groups. This allows for easy and more direct common themes that reflect user needs **[16]**. Using it alongside a decision matrix allows for a a clear visualisation to support which concept was more successful in meeting these user needs **[2]** Pros & Cons of these include:

- **ABILITY TO SEE THE BIG PICTURE WITHOUT GETTING OVERWHELMED [16]**
- **ALLOWING FOR CLEAR GROUP ANALYSIS**
- **SUBJECTED TO POTENTIAL BIAS BASED ON HOW DATA AND SCORES ARE INTERPRETED**

PHASE 2: PROTOTYPES

PAPER PROTOTYPES

Paper prototypes were used for user testing to test and explore the usability flow of the chosen refined 2 concepts.

Paper prototypes allowed for a physical experience to help communicate the interactions and effectiveness of the concepts.

PROS

- Helps to identify usability problems at an early stage, even before coding is introduced **[17]**
- Allows for easy changing of design elements and 'avoids commitment to a design' **[17]**

CONS

- Cannot identify all usability issues and details due to its simplicity **[17]**
- Limited to not being able to test all functionality feedback **[17]**

MAGIC CROSSING

With the aim of testing the interaction between users and the animated digital board in guiding them to use the crossing, paper prototypes assisted to show light feedback on the crossing.

We added in a basic video animation prototype and used a laptop to visualise the digital board's screen feedback to our users.

PENGATE

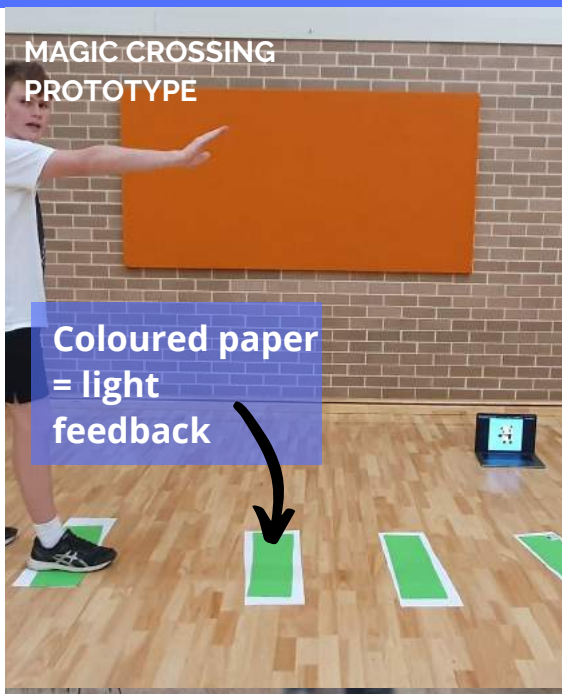
With the aim of testing the interaction between users and the responsive screen in distracting & entertaining them before crossing, a basic drawing video prototype was used to show the screen's visual feedback to our users.

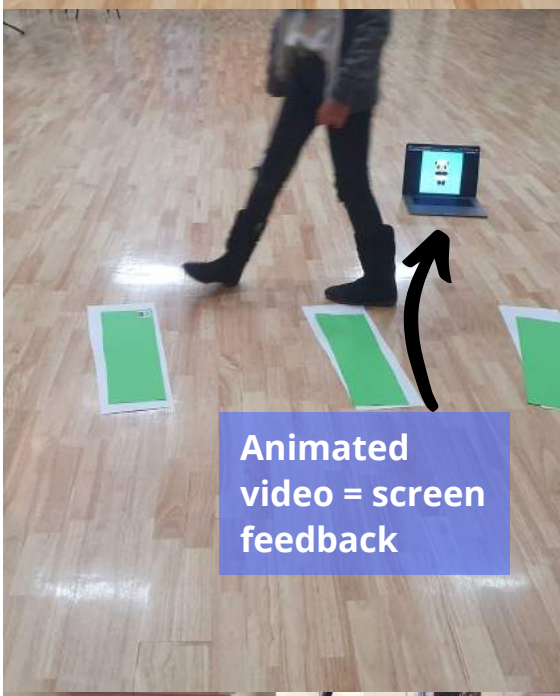
Testing the user's interaction with the gates saw us using paper prototypes to show the physical feedback of the enclosed gates.

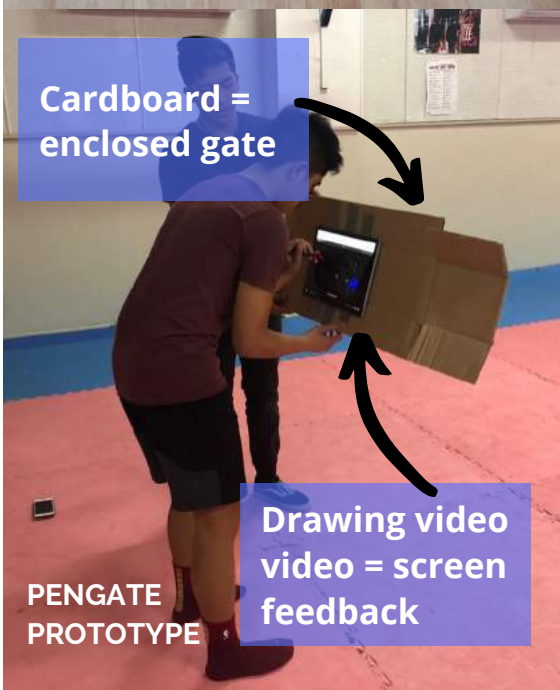
CONSTRUCTION

Paper prototypes were created using cardboard, coloured paper & masking tape

Videos were created using Illustrator & After Effects.







PHASE 2: KEY FINDINGS

CONCEPT 1: MAGIC CROSSING

Overall, Magic continues to see increased excitement, curiosity and effective engagement from our users, due to adaptive feedback that promotes an effective dynamic appeal for a more usable and likeable crossing experience. However, longevity issues are a key concern that needs to be addressed.

KEY STRONG ASPECT:

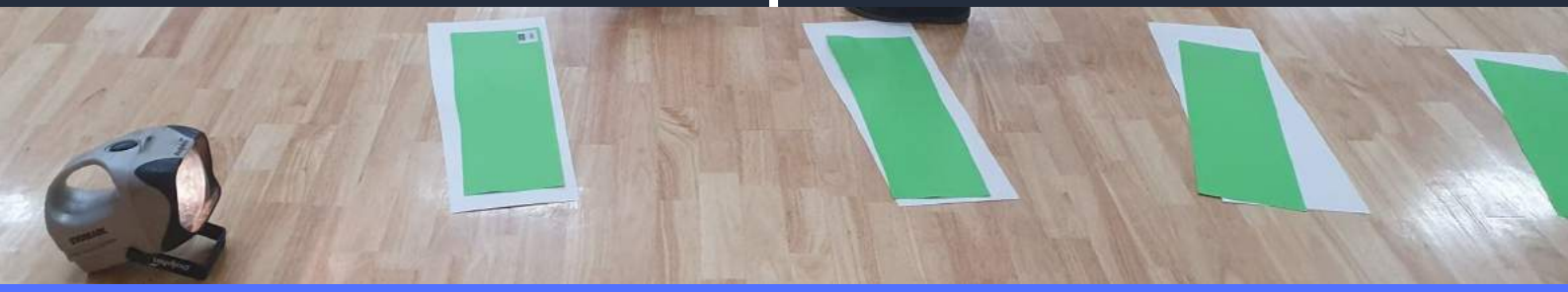
Memorability

- There is a personalised and likeable feeling to the whole experience with the adaptive panda animations, making the memorability and engagement effective and increases dynamic appeal.

KEY PROBLEMATIC ASPECT:

Limits user involvement

- Relying on gesture motion restricts the number of users that can enjoy the interaction, as users stated that they felt left out and disengaged when they weren't the first users to activate the crossing.



CONCEPT 2: PENGATE

Overall, the users enjoyed the creative freedom to leave their marks on the infrastructure as they wait to cross. This lead to the crossing to have more dynamic appeal, as the screen feedback relied on spontaneous feedback. However, this interaction was counterproductive, as users remained hesitant with the gates.

KEY STRONG ASPECT:

Creative Freedom

- The freedom to contribute to the infrastructure saw continuous engagement levels, leading to curiosity and creating a spontaneous appeal.

KEY PROBLEMATIC ASPECT:

Obtrusive Design

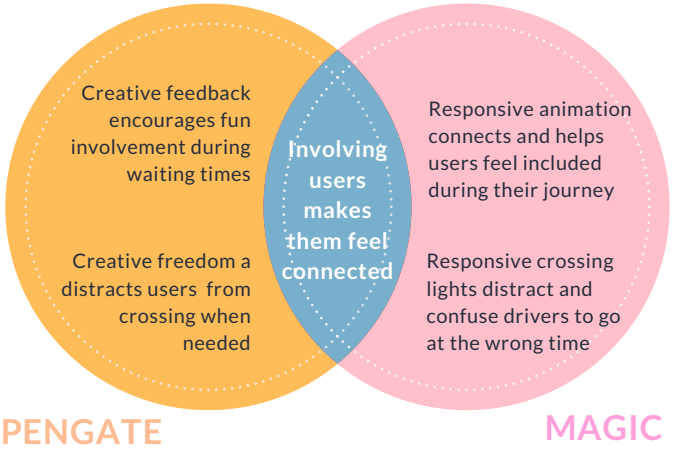
- The enclosed physical gates increased feelings of static appeal, despite the attempted interactive screens to distract & entertain users. Additionally, it poses some safety issues.

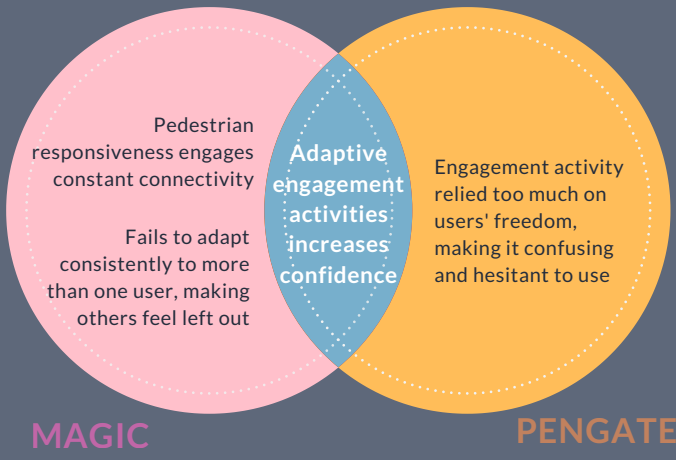
PHASE 2: SUMMARY

Both Magic and Pengate showed strengths and weaknesses in the 3 key themes identified through usability testing. The identified key user needs for a connective experience are to: have diverse interaction to add more engagement & instruction, feel confident in approaching & using the interaction, and to experience a fast crossing experience.

1. INTERACTIVE INVOLVEMENT

Pengate performed well in its ability to make our users feel creative through active participation, which allowed for a sense of connectivity while they wait to cross. This is opposed to Magic, which didn't elicit a sense of creative involvement, but rather pushed for a reactive involvement instead to make users feel connected to their decisions. However, both concepts had issues regarding risky distractions.



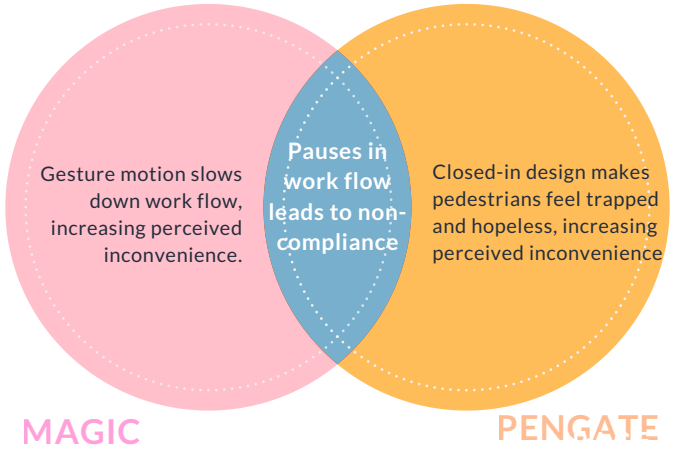


2. ADAPTIVE ENGAGEMENT

Magic's responsive engagement medium stimulated constant attention & increased user confidence, making it a more appealing concept. Unlike Pengate, as it didn't provide enough adaptation and spontaneity for the users to feel confident in using the interactions to the best of their abilities. This saw a few hesitant users who were overwhelmed with the interactive drawing screen. This hesitation decreased the appeal of the crossings.

3. CONVENIENCE

Magic experienced a safety problem with the unpredictability of using gesture motions, which saw users disengaged at times due to perceived inconvenience. Similarly, Pengate showed that its design to block off certain pathways to safeguard pedestrians was not practical & convenient, leading to users wanting to jaywalk. Both need to reconsider a more reasonable design to ensure better user compliance.



ITERATION 2
MAGIC CROSSING

CHANGES MADE TO MAGIC CROSSING

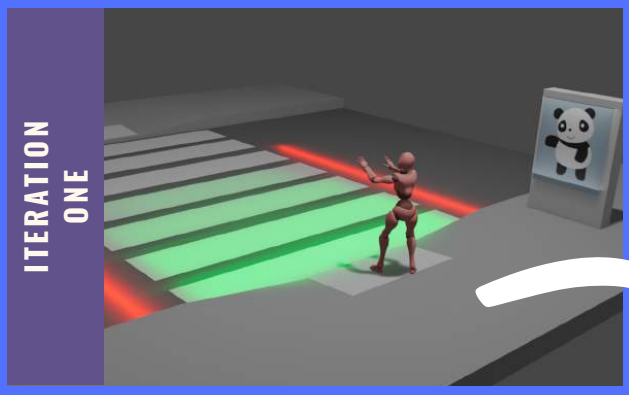
As a result from the findings

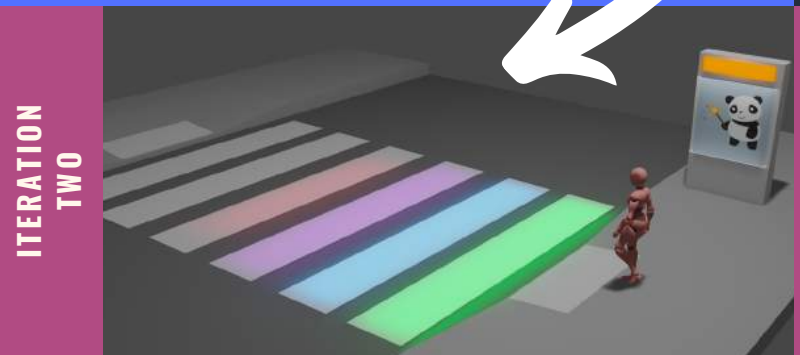
Removed gesture motion

The panda/other character animations are now responsible for lighting up the crossing through motion sensors to detect if pedestrians are standing at the entrance of the crossing This hopes to deliver a better flow to pedestrian experience.

Redesigned LED path

The horizontal line for cars is removed and designed onto the top of the panda screen for a clearer feedback to increase design appeal. The path strips will now add a more dynamic feedback to address this as well.





ITERATION 2
PENGATE

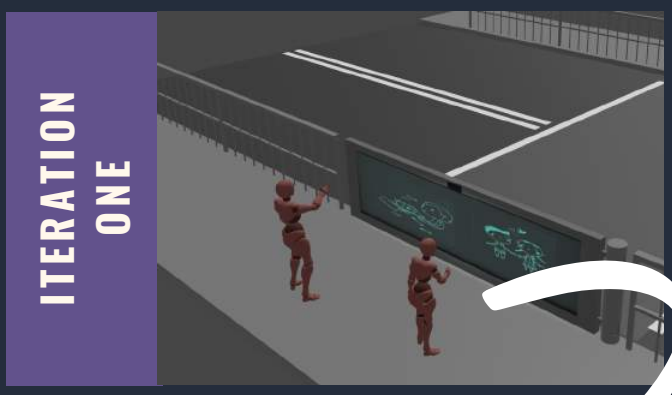
CHANGES MADE TO MAGIC CROSSING

Removed gates

Due to increasing a static unappealing experience, we have now removed the gates This will additionally help to focus more on the interactive screens for a smoother user flow.

Redesigned screen

The screen is now a kiosk style screen, aiming to curate more curiosity and familiarity to the concept. Additionally, a pictionary game has now been added to introduce a level of competitiveness for a more dynamic appeal & interaction.



PHASE 3: METHODS

The same methods from phase 2 were used in this section and conducted i the same way. The only changes are with our participants, as shown below.

	USABILITY TESTS	OBSERVATIONS	POST-TEST GROUP INTERVIEWS
Participants Involved	8 participants (6 students ages 7-15, 2 parents)	8 participants (6 students ages 7-15, 2 parents)	8 participants (6 students ages 7-15, 2 parents) **REFER TO FIG.22,24 IN APPENDIX
Prototype used	Paper Prototypes	Paper Prototypes	Paper Prototypes
Information Gained	Feedback on concepts	Notes on user flow and interactions **REFER TO FIG.21,23 IN APPENDIX	Opinions & feedback on concept satisfaction

Affinity Diagrams & Decision Matrixes were similarly used to evaluate our findings.

PHASE 3: PROTOTYPES

MAGIC CROSSING

The testing aim remained the same, testing the interaction between users and the animation in guiding them to use the crossing.

Changes:

- Used paper prototypes to construct a small-scale model
- Crossing light feedback has changed from coloured paper feedback to actual LED light strips
- Video animation now contains more characters with a more realistic background. A phone screen was used instead of a laptop to fit within the scaled model.

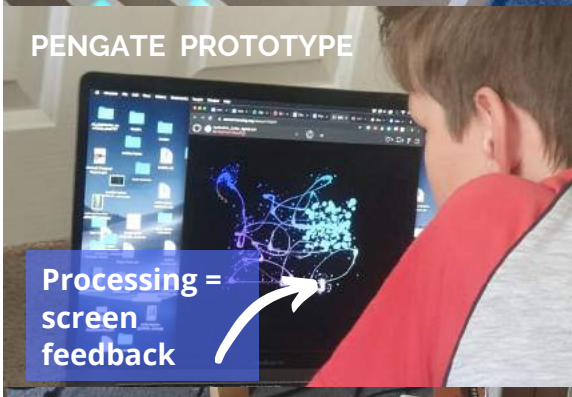
PENGATE

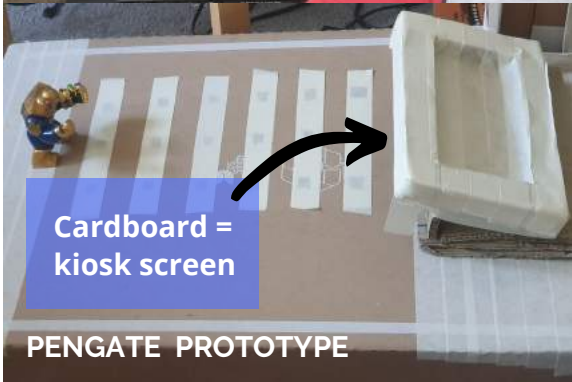
The testing aim remained the same, testing the interaction between users and the animation in guiding them to use the crossing.

Changes:

- Paper prototype was used to model a small kiosk screen holder
- Video animation is now replaced with a functioning processing interactive screen to allow users to experience the proper interaction functionalities through a laptop screen.

Videos were created using Illustrator & After Effects.
Interactive screen was created using Processing





PHASE 3: KEY FINDINGS

CONCEPT 1: MAGIC CROSSING

**REFER TO FIG.27-30 IN APPENDIX

Overall from this second user testing stage, the only key issue was the size of the screen feedback, leading to the risk of an over-dynamic appeal. This saw users challenging the longevity and engagement of the concept.

KEY STRONG ASPECT:

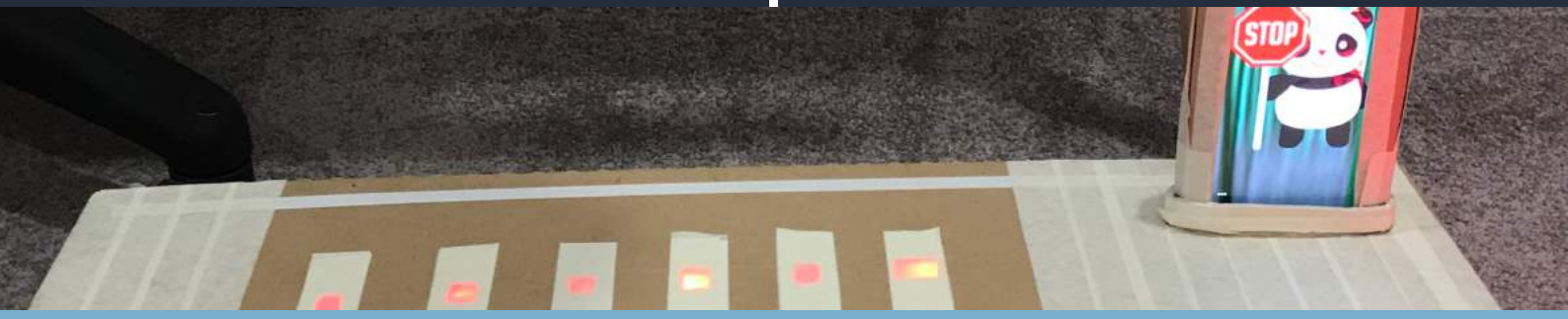
Changing feedback

- The changing feedback in accordance to user's movements made for a personalised experience, increasing the dynamic appeal of a crossing for increased usability.

KEY PROBLEMATIC ASPECT:

Obtrusive

- Many users found the size of the screen design to be too obtrusive, discovering that this has an impact on the long-term appeal and getting in the way for an ensured pleasant experience.



CONCEPT 2: PENGATE

Overall, the users enjoyed the creative freedom to leave their marks on the infrastructure as they wait to cross. This lead to the crossing to have more dynamic appeal, as the screen feedback relied on spontaneous feedback. However, this interaction was counterproductive, as users remained hesitant with the gates.

KEY STRONG ASPECT:

Competitive interaction

- This element led to this concept improving in its dynamic appeal, leading to a more engaging and confident user approach.

KEY PROBLEMATIC ASPECT:

Limits users

- Ironically, the competitive interaction backtracked this concept, where it now no longer can be enjoyed by everyone. Additionally, the word game limits students with dyslexia, decreasing the dynamic appeal.

PHASE 3: SUMMARY

The identified key user needs for a connective experience are: having a more subtle way to feel connected & engaged, to want to continuously approach the crossing, feeling curious & able to share the experience with their friends, and having a simple & clear feedback that can be enjoyed by a group of people. Going forward with the final concept, we aim to re-consider the screen engagements of both concepts to adapt it better for a more practical long-lasting idea.

1. CONSIDERATE ENGAGEMENT

Both concepts struggled in this key theme, as both introduced an obtrusive element, affecting the delivery of consistent engagement. Magic's screen size needs to be more physical considerate, whereas Pengate's interactive medium needs to be more similar to Magic & rely on adaptive visuals for all to enjoy.

2. SPONTANEOUS ACTIVITY

Pengate's competitive interaction elicits curiosity, which we found to have helped to increase engagement, as the interactions are spontaneous. Whereas Magic 's constant changing interaction throughout the journey is what makes it spontaneous for a constant curious excitement. Both offer a dynamic sense of experience, but only Magic is able to be shared and experienced by all

3. CLEARER FEEDBACK

Magic showed effective adaptation to users' actions and movements, which increased likeability and ease of use due to clear feedback. This was similarly explored with Pengate, which provided fun feedback when users went to draw and write on the screens. However, both concepts required a more effortless feedback at certain points. Magic required easier visual cues as to decrease chances of confusion for users and drivers, whereas Pengate needed more visibility to increase accessibility to more users for a more effective experience.

PHOTO FROM UNSPLASH

FINAL CONCEPT
WHIRLPOOL

Whirlpool is designed to compliment a standard zebra crossing in a school zone by better engaging school children for a safer pedestrian experience, through an increased desire to use the crossing. It is a cylindrical tube that uses a natural element, water, with light instalments for a calming and subtle design. This will provide an engaging yet pleasant and likeable experience over a long period of time.

The water and lights work together to show clear feedback, based on motion sensors that have been inputted at lengthy intervals at the designated footpath leading up to the tube/crossing entrance. The tube additionally has its own motion sensor, which will trigger the water and light display to spin victoriously, combined with a small bright sound effect as pedestrians start to cross.

TARGET AUDIENCE

AGES 7 - 15

Whirlpool is aimed at primary school and younger highschool students, as they are at greater risk of demonstrating unsafe crossing behaviours due to feeling disconnected and bored. The children of this age group have generally expressed feeling distracted when there is nothing to do, or look at, when walking to and from their school.

HOW CAN IT BE INTERACTED WITH?

01 APPROACHING THE CROSSING

At certain intervals of the designated footpath of where the entrance of the crossing is at, motion sensors will be subtly inputted on the side of the curb. As pedestrians begin to appear and are walking on the footpath, the sensors will feed this information to the tube at the entrance of the crossing.

02 CYLINDRICAL TUBE

Prior to the presence of pedestrians, the water in the tube will remain still, while the lights will softly appear to gravitate up and down. Once the first motion detector is activated, the lights will condense to the bottom, while the water lightly spins. The closer the pedestrian gets to the entrance of the crossing, the taller the lights will reach on the tube and the faster the whirlpool water will spin. The water level will also start to rise alongside the rising of the lights.

03 LIT-UP TOP ON TUBE

When pedestrians walk past the last few motion sensor detectors on the footpath, the top of the tube will appear orange and dim in and out as a warning to cars on the road that there is pedestrian activity nearby.

04 GETTING READY TO CROSS

At the stage where pedestrians are right in front of the tube at the entrance of the crossing, the whirlpool is overflowing and at its maximum speed, while the lights are fully on throughout the whole length of the tube. Pedestrians will use the zebra crossing as normal, with the yellow top lights helping to better inform drivers of oncoming pedestrian activities.

05 CROSSING THE ROAD

As pedestrians cross the road, the tube's motion sensor will cause the lights to animatedly spin across the tube, while a victorious sound effect will play out.

HOW DOES IT TACKLE THE PROBLEM?

The reactive and participatory interactions, from the tube, provide a feeling of creative collaboration, which creates a sense of curiosity to engage and encourage pedestrians to walk towards the crossing. This produces a connective experience, allowing school children to feel excited and empowered to use the crossing facilities, rather than conducting unsafe crossing behaviours due to feeling disconnected.

WHAT CONTENT DOES IT CONTAIN?

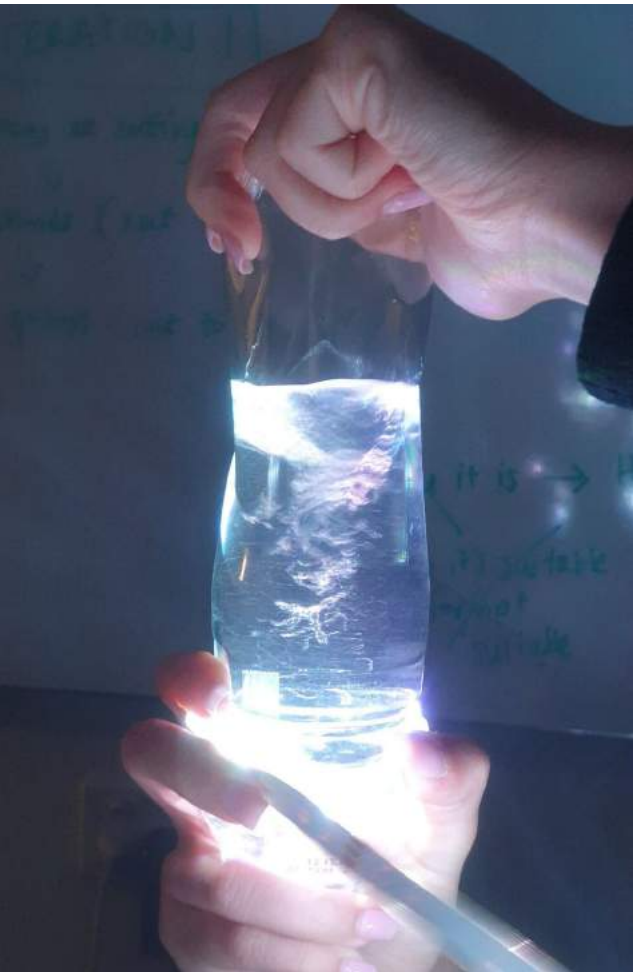
Large acrylic perspex tube (plastic) with LED top, and there is a smaller circumference tube on the inside.

The smaller acrylic perspex tube will contain water, and has LED lights lined up underneath its base.

There will be a submersible water pump to alter the water level The DC motor will have 2 magnets, which will be at the base of smaller tube. This will help to create the whirlpool tornado interaction.

There will be a square/rectangle metal base holding the tube up, and containing the lights, audio speaker, pump and motor within it.


PHOTO FROM UNSPLASH



SUITABLE AND NOT SUITABLE USERS

Whirlpool's subtle and natural design is suitable for most children and adults, even though it is aimed at a younger audience. This inclusion is particularly due to Whirlpool's engaging visual medium, which increases appeal and usability. Using the proximity of people to activate the whirlpool and lights, anyone, even those in a wheelchair or have other disabilities can still enjoy the experience of Whirlpool. The concept additionally does not require physical touch or strength, enabling anyone to use the design, regardless of their age, mode of transportation or if their hands are occupied.

However, Whirlpool's design is not suitable for people with sight disabilities, as apart from the sound at the end of pedestrians' interactions, there is a lack of alternative use of senses to support the visually impaired. Therefore, this group is unable to enjoy Whirlpool's design.

MOTIVATION FOR CHOOSING WHIRLPOOL

With this final concept, it maintains the strengths of both concepts in keeping the school students engaged during their crossing experience, whilst introducing a more natural and less obtrusive element of appearance for a more effective display. This was one of the biggest motivations for finalising this concept, as the less obtrusive natural interaction is able to sustain its connective experience for much longer over time. Further, this iterated feature is able to not only be accessible and enjoyed by a majority, but it keeps the likeable charm from Magic Crossing's progressive animation and empowers students to feel involved in the process.

Finally, as Whirlpool better addresses feasibility concerns, it is much more realistic and effective to maximise its design in the long run for Pedestrian Plus to make.

From our overall usability testing of our proposed concepts, the main key issue we needed to address was having a dynamic and subtle but clear design to fully engage students to want to cross the road. Overall, the principle of reactive involvement from Magic Crossing and creative involvement from Pengate was what stood out the most, in regards to delivering a concept that was engaging, practical, unobtrusive and long-lasting for an immersive and connective pedestrian experience. However, both concepts performed poor for feasibility and certain inclusivity limitations, which was outlined in our decision matrix and from some of the user comments in the post-test group interviews. Therefore, Whirlpool was created from merging the principles underscoring Magic Crossing & Pengate.

WHAT IS NEEDED TO BUILD WHIRLPOOL

Hard & Software Requirements

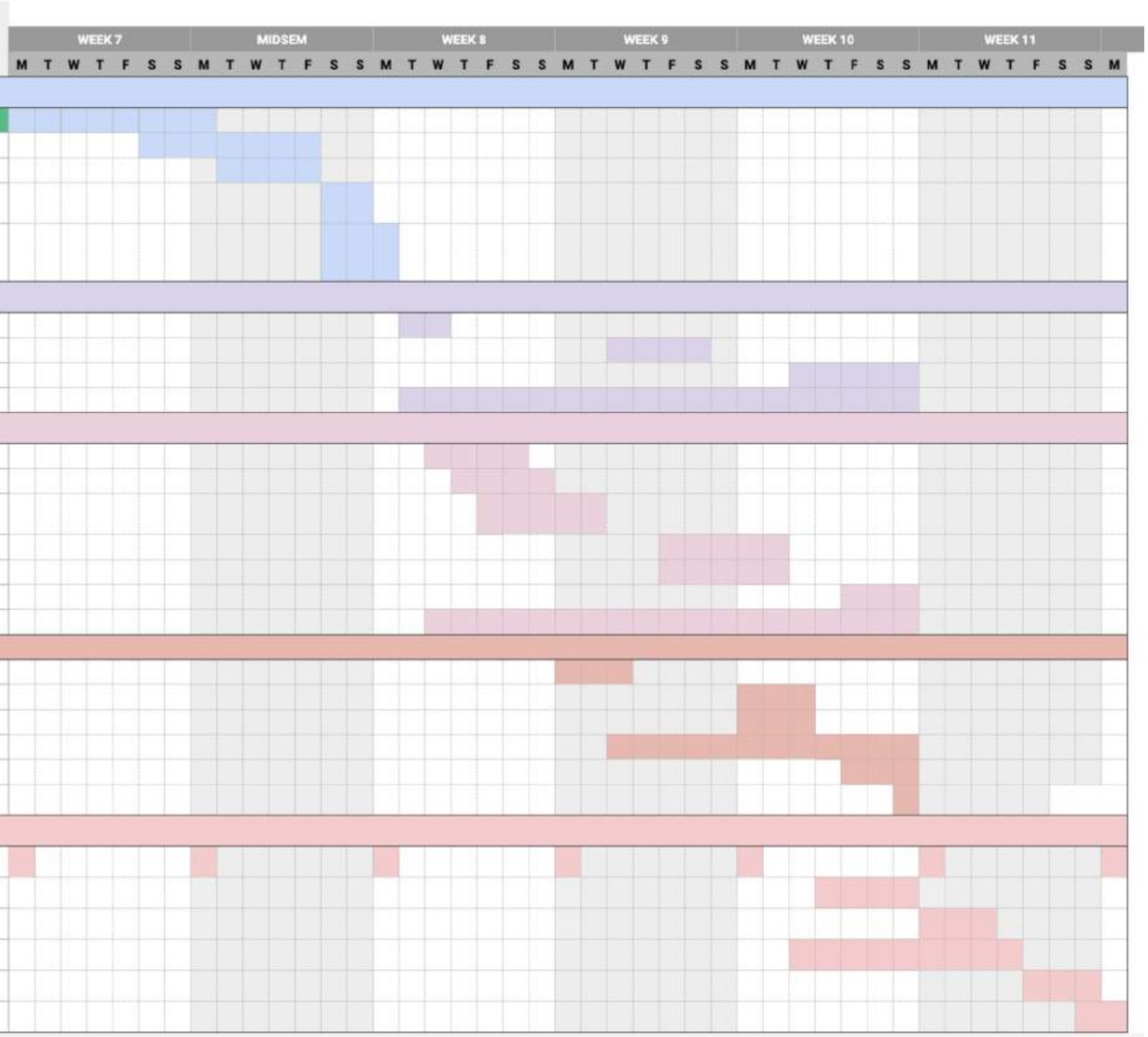
Hardware	Quantity	Cost	Link
Mini Fountain Water Pump	1	$2.00 - $15.00	https://www.ebay
PVC Flexible Plastic Tubing	2	$14.43	https://www.ebay
RGB LED Light Strips	4	$4.99	https://www.ebay
Large acrylic perspex tube (plastic)	1	$17.44 - $35	https://www.ebay
Medium acrylic perspex tube (plastic)	1	$18.89	https://www.ebay
Arduino PIR Motion Sensors	3	$3.84 each	https://au.rs-onlir
Arduino Extended Cables	120	$7.49	https://www.ama
Hot glue gun	1	Free	
Arduino Uno Board	1	Free	
Arduino DC Motor	1	Free	
Metal (For base housing + top)	1	$1.61 per 0.70m	https://www.cook
Solderless breadboard	2	Free	
Camera (filming)	2	Free	

Potential Hardware:		
Xbox Kinect	1	Free
Back Arduinos	2	Free
Plastic (In case Metal doesn't work)		
Metal Working		
Metal Guillotine	1	Free
Metal Welding Oxy	1	Free
Metal Rolling Machine	1	Free
Software		
Adobe After effects		Free
Logic pro		Free
Arduino IDE		Free

Team Schedule For Assessment 3

PROJECT TITLE	Operation Whirlpool	COMPANY NAME	Pedestrian Plus
PROJECT MANAGER	Victoria Tran	DATE	2019

	TASK TITLE	TEAM MEMBER	START DATE	DUE DATE	DURATION	% OF TASK COMPLETE
1	**PLANNING**					
1.1	Designing iteration		09/16	09/23	8	20%
1.1.1	Creating a blueprint		9/21/19	9/27/19	7	0%
1.2	Budgeting		9/24/19	9/27/19	4	0%
1.3	Gathering physical building materials e.g. Plastic Tube, Metal, etc.		9/28/19	9/29/19	2	0%
1.4	Gathering physical computing materials e.g. Arduino, Motion Sensor		9/28/19	9/30/19	3	0%
2	**BUILDING**					
2.1	Building skeleton		10/1/19	10/2/19	2	0%
2.2	Building frame		10/9/19	10/12/19	4	0%
2.3	Fully functional build		10/17/19	10/20/19	4	0%
2.4	Risk Management		10/1/19	10/20/19	20	0%
3	**CODING**					
3.1	Coding motion sensor		10/2/19	10/5/19	4	0%
3.2	Coding motor for whirlpool		10/3/19	10/6/19	4	0%
3.2	Coding motor to work with motion sensor		10/4/19	10/8/19	5	0%
3.3.1	Coding Internal Lights		10/11/19	10/15/19	5	0%
3.3.2	Coding Top Ring Lights		10/11/19	10/15/19	5	0%
3.3.3	Animating Lighting to Motion Sensor		10/18/19	10/20/19	3	0%
3.4	Debugging		10/2/19	10/20/19	19	0%
4	**TESTING**					
4.1	Test skeleton		10/7/19	10/9/19	3	0%
4.2	Test frame		10/14/19	10/16/19	3	0%
4.3	Check waterproofing		10/14/19	10/16/19	3	0%
4.4	Test Code		10/9/19	10/20/19	12	0%
4.5	Test fully functional build		10/18/19	10/20/19	3	0%
4.6	Evaluation methods		10/20/19	10/20/19	1	0%
5	**REPORT**					
5.1	Reflective reports		9/16/19	10/27/19	42	0%
5.1	Filming	Jared & Jayce	10/17/19	10/20/19	4	0%
5.1	Editing	Jared & Jayce	10/21/19	10/23/19	3	0%
5.2	Visual report		10/16/19	10/24/19	9	0%
5.3	Presentation report		10/25/19	10/27/19	3	0%
5.4	Submission		10/27/19	10/28/19	2	0%



IMPLEMENTATION PLAN + TEAM RESPONSIBILITIES