

ECO WARRIORS

Game Start

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PROJECT TRACK: USER INTERFACE AND USER EXPERIENCE



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INTRODUCTION AND OVERVIEW

Problem Identification

Our project was developed as a response to the Collaborate: Sustainable City brief that motivated us to contemplate the role of design and technology in enhancing the ecological future of Winchester.

By working together through Graphic Communication and Creative Computing topics and ideologies, we have a more focused lens on the factors that prevent the city from being sustainable and how the environmental issues, education, and community involvement are interlinked. At the very beginning of our exploration into this brief, we recognised a gap in participation for younger children in environmental matters. We realised that most current sustainability messaging is targeted primarily at adults and overlook the younger generation that will eventually become Winchester's future decision-makers. This helped us consider how the behaviours learned in childhood can shape the way people think, act, and make decisions later in life and we began to investigate an approach that targets formative ages.

In addition, we also considered the importance of circular economy thinking, regeneration, and community wide connection to the local environment. We concluded that sustainability is not only about the physical infrastructure and materials but also the mindset, knowledge, and manners of the people living in the area. A sustainable city is only as sustainable as its residents. Hence, we set out to devise something interactive, accessible, and fun that could help children connect with their environment in a lasting manner that carries into their adult habits.

This thought process distilled into Eco-Warriors, our AR application which brings young players around the city of Winchester through games and interaction to foster a sustainable mindset. Adopting the UI/UX path meant that we concentrated on the user experience aspect, the information delivery, and our methods of making learning engaging and interesting. This application with the help of Augmented Reality brings digital content into the environment including virtual

animals, tiny challenges and environmental facts. Allowing children to learn hands-on through exploration and self-direction.

Project Aims and Objectives

| Objective | Description | Method | Achieved? |
|--|---|--|-----------|
| Our application allows children to engage with sustainability topics | Introducing young children to environmental issues in a fun and approachable way | Research, child-friendly design and accessibility | |
| Our application connects learning with real locations across Winchester | Using AR to combine virtual components with the physical city to make learning as interactive as possible | Unity AR Foundation. 3D assets | |
| Our application is intuitive and accessible | Ensuring the application is easy and intuitive to navigate while being visual engaging | Wireframe, prototypes, Unity UI system | |
| Our application will encourage positive behaviour | Motivate children to adopt environmentally responsible habits through interactive challenges. | Gamified tasks, rewards | |
| Our application combines initiatives of both Creative Computing and Graphic Communications | Creative communication, visual design, computer science simultaneous approaches to the solution | Interaction with Graphic Communication Students during Lectures | |
| Our application has a functional prototype | Produce a working AR Unity application demonstrating core interactions. | Unity, AR Foundation, asset integration | |
| Our application supports Winchester's sustainability goals | Align the project with the principles of SDG 11 and the goals of local regeneration plans. | Extensive Research into SDG 11, and other Winchester sustainability strategies | |

Stakeholder Information

The Sustainable City project has many key stakeholders including Jigsaw, Igloo, and the Winchester City Council as development partners for the Central Winchester Regeneration project. This project aims to renovate Winchester into a sustainable and inclusive city. Some of the proposed developments is creating flexible workspaces, creating quality communal spaces for the public and expanding creative hubs for people to network throughout. Igloo, one of the key stakeholders has a gross development value of £120m and are planning 250 homes and 60000ft² of commercial space to be developed. They envision a pedestrian-led quarter with developments to Kings Walk, the demolished Friarsgate Medical Centre site and the bus station (igloo, 2024). Despite all of these proposed improvements we identified a gap in education and habitual change within the renewal plans. We wish to bridge this through creating an application which encourages children to improve sustainability practices in Winchester. Our application should encourage children in early learning stages to be more ecologically friendly and spend more time amongst nature and the outdoors, habits they should carry into adulthood.

Group Responsibilities

| Name | Role |
|--------|--------------------------------------|
| Haiden | Group Leader |
| Sahara | Meeting and Research Management |
| Taro | Design Leader |
| Aqdas | Resource and Presentation Management |
| Saph | Data and Assets Leader |
| Callum | Development Leader |
| Vidula | Assessment and Research Leader |

RESEARCH

Sustainability Goals and Aims

Within the brief, we learnt and explored what constitutes a sustainable city. We looked at the interconnection of ecological health and how to minimise environmental impact through a circular economy. The need for economic prosperity and fostering long-term stability, growth and social equity. Managing our resources effectively and reducing waste. All to ensure a high quality of life and inclusivity for everyone.

We chose user interface and user experience as our intended track, we prioritised aligning our sustainability goals to our target audience in the hopes of providing well-versed information and potentially long-term impact on the environment.

Environmental Issue and Solution

The project will focus on the environmental issue of pollution and littering around Winchester. The evidence that was gathered proved to show that the air quality within certain areas around Winchester were quite low, and from visuals and surveys there were further issues of littering and waste on roads and parks. Furthermore, taking the data, we were able to understand both the short- and long-term impacts that these issues can cause to the surroundings. Short-term impacts can include wildlife endangerment as animals can often mistake litter for food, potentially leading to ingestion and fatal consequences including entanglement, suffocation, drowning, maiming, or restricted movement (Green Paper Products, 2025). Plants can also be affected in the short term as discarded litter may block access to sunlight or water sources, causing knock on effects in soil quality and reducing feed of important nutrients, inhibiting plant growth (Environmental Volunteers, 2022). Pollution and littering can also cause negative societal effects, health risks as well as the general unpleasant aesthetic of litter within a neighbourhood. Littering can create breeding grounds for both pests and bacteria, contaminating water sources and air quality (Butler, 2024).

The long-term impacts may be even more detrimental than the short term effects. Waste can build up over time damaging ecosystems and local biodiversity, long term build up breaks down into poisonous components that harm key natural elements such as seawater and soil (Razzaq, 2024). Human health is both directly and indirectly impacted by pollution. In the long term, litter can release pollutants that can trigger respiratory issues from prolonged exposure to polluted air, risking long-term lung damage (Roberts, 2023).

Despite the wealth of information on litter's harm across the UK, we concluded that the public seem to be either uncaring for the environment or still lack awareness of litter's impact (to the environment and themselves). We discussed solutions to this problem and agreed we wanted to tackle this lack of awareness as early as possible. How early can we instil awareness? We looked at primary schools and how we may stimulate some understanding about the environment. We approached this not with the intention of replacing environmental education in the curriculum, but more so to assist teachers and allow a more efficient and hopefully more effective teaching process.

United Nations Sustainable Development Goal 11

The project brief discusses the aims of the United Nations (UN), referencing the UN Sustainable Development Goal 11: Make cities and human settlements inclusive, safe, resilient, and sustainable (United Nations, 2023). They define a sustainable city as one that is “dedicated to achieving green, social, and economic sustainability, facilitating opportunities that prioritise inclusivity as well as maintaining a sustainable economic growth”. As a group, we took this concept into account when creating our project solutions and consistently brought the discussion back to the UN Development Goal and a global context. We knew from the start that we wanted to be thinking on a higher, more global scale outside of just focusing on Winchester, the environment is a holistic system and must be approached as such. While our project is targeted to the City of Winchester we thought on a wider scale that narrows to Winchester specifically, accounting for all the components outside the city as well. The brief encourages the use of collaborative and critical thinking for a greater inspiration that

may develop from our projects in the future, here we are prepared to open the scope up again and involve all that global scale thinking we've already done.

Target Audience and Cultural Value

With our project solution in mind, the group looked at what age range where a targeted resources could achieve the biggest positive impact. A study had showed that the age of seven is where children start a phase of growth known as the 'Age of Reason', characterised by the idea of children expanding their capacity for rational thought, having a better 'internalised sense of right and wrong, and better impulse control, as explained by psychotherapist Dana Dorfman, PhD' (Nicolene, 2023). Another study had shown that child psychologists have stated that between the ages of 3 years and 11 years is an imprint period, meaning that the childhood experiences within this age range is likely to have an impact on who that child becomes, how they feel, behave and represent the world to themselves later in life (Bailey, 2018). If we target these formative ages the potential positive value balloons to an entire lifetime of sustainable habit, not just a few small instants.

The Use of Habits and Trends

We concluded our target audience would mainly focus on the early years of Key Stage 2, looking at Year 3 and Year 4, meaning we are pinpointing the age range of ages 7 to 9. Recent trends imply this age range is very intrigued with by video games, a study in 2024 showing that 24% of 5 to 7 year olds now own a smartphone, displaying that children are becoming increasingly present online (Ofcom, 2024). This rising trend may be viewed negatively as technology could be seen as limiting or inhibiting learning for children, however, as a group we disagree and believe technology can be an exceptional learning resource. We saw that children already enjoy their screen time so rather than wrestling them away from their devices we could encourage the same screen time be spent whilst being outside and amongst nature and the environment.

Through user interface and user experience we can carry the concept of our project to children who may struggle to digest the dense topic of sustainable development and practice directly but can

begin to understand simplified and decomposed samples through the game. Overtime we want to build a subconscious empathy with the environment and find joy in learning the key concepts that we want to present onto them.

A thesis studied the use of subliminal messaging in television and film, discussing the use of how advertising agencies and film and television companies make use of subliminal messaging in order to manipulate viewers' subconscious minds, and with the speed of subliminal messages being broadcast at microseconds, they are barely consciously seen or recognised, if at all. Children are described then to be most susceptible to subliminal messaging as they are the most vulnerable due to their lack of experience and knowledge of the world (Charvat, 2011). We wish to deliver positive subliminal messaging that fosters a greater awareness on environmental issues within children such that they hopefully develop longer-term habitual change to more sustainable practice. As these children grow the value of their better habits grows, leading to a net reduction in pollution and littering.

The Cultural Value within Children

Children's perception of the world varies massively and is naturally volatile within the formative years, however the research suggested children typically try to do more good than bad at earlier ages. We pursued this further as we wanted to understand how encouraging enthusiasm and children's interests effects learning and development, both personal and environmental. Research shows that children as young as three have a sophisticated moral understanding, being more prosocial, with toddlers tending to enjoy sharing and helping others. For instance, showing how young children can recognise or at least start to recognise that prosocial behaviours are a better justification for a transgression rather than individual desires (Reynolds, 2023). Furthermore, the majority of parents tend to instil these good moral values within children, focusing on these values such as respect, honesty, compassion, empathy and more. The role of parents toward their child or children is as their most important role model, a child will usually spend the majority of their early

development with their parents. It is described that the children will have the reflection of their parents, and the parents are the major source of shaping the children in the right way, symbolising the children as sponges absorbing what is there in and around the place they are in (Walkertown Academy, n.d.). Overall, we want to further influence these instilled positive moral traits within the children and use them to help the environment by making these children more aware and proactive in helping the environment.

Ethical Concerns

Several ethical concerns may be brought up when discussing the application in use. These concerns are critical to address since these are the questions that shareholders will also be asking upon proposal. For example, children roaming in the street may lure traffickers and other threats to the area which may make the overall safety of the area lower. This is because to provide a good service, Eco-Warriors would need to track the GPS location of the device. Not only can this attract bad actors which may attempt to track children's location, but it may be deemed unethical as having the location data for children may be frowned upon by parents. This may be a deterrent for some guardians to download the game. We would need to store location data in a secure place to comply with GDPR since this is valuable information that people with malicious intent can use (GDPR, 2018). A lack of safety features and advice may reflect criticism onto Eco-Warriors.

Some may also state that by making this an app on modern smartphones, the app would be based on a platform that creates tonnes of e-waste a year and uses up rare earth metals that will deplete eventually (Okon Recycling, 2025). This industry is also often harmful due to the multiple negative effects it has on communities local to the mining sites and etcetera (Gondwe, 2025). Furthermore, encouraging human roaming may also decrease the authenticity of nature and potentially add litter due to humanisation. Since the app will be encouraging more people to go to locations which are often not subject to humanisation, the area may become prone to human waste and other effects such as desire paths.

Winchester History and Pollution

We investigated Winchester's history and how the modern urban structure, built on ancient foundations, affects the local environment. Winchester dates back to the Romans and was later rebuilt, expanded and given the title of being England's capital city during the Anglo-Saxon and medieval periods. Winchester's medieval heritage has been inherited in its modern as the majority of core streets become narrow and constrained, constricting car traffic. This is clearly seen in Winchester city centre's one-way road, North Walls, where almost all inner-city congestion must navigate. As students living in Winchester, we see traffic here on an almost daily basis especially during peak transit hours between 7-9AM and 4-7PM.

This one-way system is also mentioned in the Hampshire County council's City of Winchester Movement Strategy (Hampshire County Council, 2019), which was initially proposed in Spring 2019 to help reduce city centre traffic and local emissions. Despite this, Winchester has become an increasingly car-dominated, and potentially car-dependent city. It's stated on Winchester city council's webpage that Winchester's new Air Quality Strategy 2025-2030 shows us that there has been some slight improvement, however there are still various areas of the city that have poorer air quality that must be addressed, especially regarding public transportation within the city. This one-way system forces high volumes of cars and buses in Winchester to hover and loop around the city centre, mainly around areas such as Friarsgate, Eastgate Street and Union Street, rather than taking more direct routes and this can be linked to higher levels of nitrogen dioxide, one of Winchester's main pollutants (Winchester City Council, 2025).

Beyond the roads, the River Itchen -a rare and precious chalk stream- is more vulnerable to the effect of contamination as the entire aquatic ecosystem is built on being clean and pure.

In September 2023 the council declared a nature emergency. Since then, they have sought to consider nature in all strategic plans and implement nature-based solutions (Winchester City Council, 2023). Winchester city council has launched various strategies to address and mend the

local environment. One civil project being the Winchester Movement Strategy where the council has sought to reduce car dependency in Winchester, potentially alongside the increase and improvement of local public transit and plans to develop pedestrian and cycle routes.

Throughout our research we realised the scope of these issues which far outgrow our potential impact. However, we can influence resident's lifestyle choices through educating young people about these problems. Winchester is a historic city with a rich past and hopeful future; we hope that our resource is beneficial and enables informed and responsible everyday decisions.

Public Area Research

To further compartmentalise the environmental issues along with our key demographics, we decided to carry out an informal public survey, local to the people in Winchester, to better understand the severity and intensity of the ecological concerns.

During the development phase of this public survey, we examined the principles outlined by Ranganathan and Caduff in 'Designing and validating a research questionnaire- Part 1' (Ranganathan, Caduff, 2023). This advice helped structure the design, clarity, and order of our questionnaire. We started out by carefully defining what our core constructs of measurement would be: local environmental concerns viewed from the perceptions of concerned citizens, the participants confidence in disseminating environmental knowledge to children, and attitudes towards digital educational resources. These items were directly associated the construct to maintain clarity and prevent redundancy. Ranganthan's discussion of designing response formats also influenced our inclusion of a mixture of open-ended items to balance qualitative depth with quantifiable data.

To properly conduct this public survey we adopted a small-scale, convenient sampling approach where one researcher was deployed to two locations in Winchester (Winchester High Street, Brooks Shopping Centre). Firstly, participants were approached then invited to answer a questionnaire that contained five questions. A total of 20 participants completed the survey; these were anonymous and recorded manually.

Questions

1. What do you consider to be the most urgent environmental issues facing Winchester today?
2. How confident do you feel explaining environmental issues to young people?
3. Which environmental topics do you think children struggle to understand the most?
4. How would you rate the importance of digital tools in helping children learn about the environment?
5. Would you support the introduction of an educational game in local schools to promote environmental awareness?

Key Findings

- The participants claimed that plastic waste and littering were seen as the most visible problem in their community, while 46% and 39% singled out climate change and the decline of biodiversity as the most deteriorating problem but quite obviously to a lesser degree compared to the first issue
- Only 29% of participants said they feel “very confident” in sharing knowledge on environmental issues as they were quite unsure on how to break down these complicated concepts such as carbon emissions for the younger audiences
 - More specifically, the topics climate change and long-term environmental impact were stated as the most challenging for children to grasp; many also suggested that children understand “what” but not “why”
- Over 71% rated digital and interactive tools as “important” and “very important” for child education, with comments involving the value of “hands-on experiences” and “visual learning”
- The participants reported that they would support or strongly support that making an environmental game as an educational aid to local school activities would be a successful

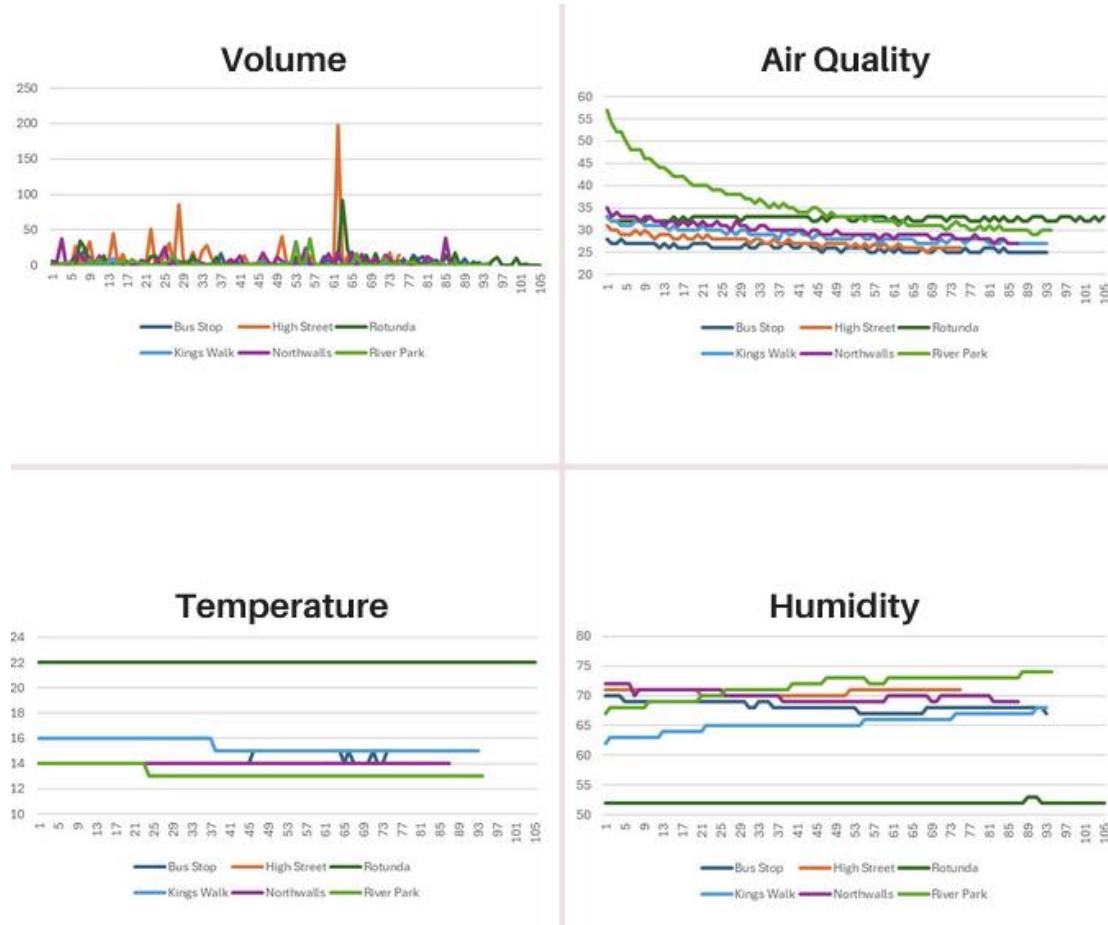
way of integrating both digital literacy and environmental awareness into children's education at a young, impressionable age

This Public Area Research further reinforces the need for Eco-Warriors to be clear, engaging and the strong public support for environmental issues and their solutions broadcasted on digital learning platforms validates our decision to pursue an interactive format and choose the UI/UX pathway.

Similarly, the identified knowledge gaps guide our selection of core themes such as recycling systems, climate change fundamentals and local biodiversity.

Data Collection

To gain a clearer insight to quantitative issues in Winchester we collected noise pollution, air quality, temperature and humidity data from six locations within the project catchment zone: River Park, Rotunda (Interior), Holy Trinity Church Winchester, Kings Walk, M&S High Street and Winchester Bus Station.



To gather this data, we used a bespoke Arduino based sensor kit that recorded data to a CSV. This data is generally accurate with only 1 notable anomaly (Highstreet Volume at the 61st reading, which we believe to be an erroneous reading). We see a predictable trend in other data in line with the days weather.

As the project has developed, we have shifted our focus away from these four data points, rather our focus has changed to direct local impact issues such as littering. Despite that, this data was still a valuable time investment as it provided useful experience for future data analysis.

Scope into Education and its Curriculum

We first investigated a variety of approaches to education, especially methodologies that incorporate play and self-direction since those translate easily into our UI/UX approach. One such method is Montessori Education developed in the early 20th century “It’s a specific child-centered method of education that involves child-led activities (referred to as “work”), classrooms with children of varying ages and teachers who encourage independence among their pupils.” (Meinke, 2019). Montessori believed that children learn better when they choose their subjects and her method focusses on holistic personal development, not just academic, which we found especially interesting as we are less focussed on teaching quantitative knowledge but rather social and emotional responsibility and positive habit. The Montessori approach is more successful at developing social skill through a “multi-age classroom, where the younger students look up to the older students as mentors. The students reinforce positive behaviour and remind each other how to care, how to respect themselves and their community.” (Princeton Montessori School, 2020).

Now there are issues in this approach both in the price to maintain unique workstations and bespoke learning development (potentially excluding lower income children which is opposite to the inclusive and diverse ideal) and in the reliance on the students to self-direct and retain focus. The first issue is less important within our context as our game is free to play and easily accessible, however the second issue is very relevant and the core focus of our design and development.

Kuzima, Trimingham and Bhamra studied Education for sustainable development (ESD) implementation in primary schools across England from a service design perspective, this research was pivotal to our approach to education and informed how we developed our game as an education service (Kuzmina, Trimingham, & Bhamra, 2020). Firstly, they acknowledged the “need to reorient formal education towards sustainable development prevails on the international level” (Mulà & Tilbury, 2009). These authors discuss the United Nations Decade of Education for Sustainable Development (DESD), its effectiveness, prospect and critiques, Kuzima, Trimingham and Bhamra elaborate upon this “with an agreement that this will require a shift in thinking learning, and teaching”. This paper phrases the issue from a perspective of meeting stakeholder needs, listing students, teachers, parents and the wider community as users of the school as a service, it elaborates to link value creation to a whole-school approach wherein ESD is pervasive across the entire school.

Our focus shares this pan-community influence through children’s play and education, parents, teachers and the community may not directly participate in the games use however experience the value generated through second hand education and ecological benefit. The authors separate the dimensions of a service into user facing services and technical structures that facilitate the former, “[the user facing services] innovate value propositions, with which users interact. The value-in-use is subjectively determined by service users whilst they co-create it [...] the latter two dimensions, organisational and technological delivery systems are ‘supportive’”.

Together, these influenced our direction and gameplay goals. Montessori methods informed our approach to self-directed learning where we considered our mini-games and elements as workstations, how those encourage learning and invite playful exploration. This was elaborated through organisational strategies that informed our service design and our intention of facilitating a community benefit through the game, placing our project within the concept of an implemented educational service.

Contacting Schools

In addition to the public survey, we undertook informal research, as it was important to seek the professional perspective of those who work with our target user group. To do this, we contacted Castleview Primary School in Berkshire, where one of our members had undertaken a placement, to ask if a Year 3 teacher would be willing to support us. We could therefore gain further pedagogically based information that would inform the educational accuracy and classroom relevance of Eco-Warriors (Center, 2023).

Before making contact, we developed a teacher-specific survey intended to capture more in-depth, curriculum-informed perspectives from the teachers. Unlike the public area research that looked at broad perceptions of environmental issues, this was structured to determine how environmental education is currently delivered, what challenges students have, and what the practicalities would be in integrating a digital AR tool into real classroom routines.

Structure of Questionnaire

1. Which environmental topics do you currently teach in Year 3 and how are they usually delivered?
2. What resources or activities do you find most effective when teaching these topics?
3. Which environmental concepts do your pupils understand well, and which do they struggle with?
4. How do you currently use digital tools in your teaching?
5. What potential barriers do you see in using an augmented reality tool to support education?
6. What features would make this learning tool most useful for your classroom?

Response from Primary School

You don't often get email from slough.castleview@outlook.com. [Learn why this is important](#)

CAUTION: This e-mail originated outside the University of Southampton.

Hi Vidula,

Thanks so much for sending this over I have filled in the questions below. I hope my answers are helpful for your project!

1. Environmental topics taught in Year 3 & how they're delivered:

In Year 3 we mainly cover recycling, basic climate change, habitats, food chains, and pollution (particularly water and plastic waste). I usually introduce these topics through whole-class discussions, short videos, and simple experiments. We also do a couple of outdoor sessions in our school garden where children look for mini-beasts and think about the impact of humans on local habitats.

2. Effective resources or activities:

The children respond really well to anything visual or hands-on. Sorting recyclable materials, role-play activities, and using the outdoor area works particularly well. They also enjoy short animations, as they explain abstract ideas in a child-friendly way.

3. What pupils understand well vs. what they struggle with:

They generally understand the idea of recycling and protecting animals. Where they struggle is understanding the scale of climate change and why small actions matter. Many think pollution "just disappears" once it's thrown away, so food waste and plastic decomposition are tricky concepts.

4. Common misconceptions:

The biggest misconception is that rubbish "goes somewhere far away" and stops being a problem. They often think all plastic can be recycled. Some also confuse habitats with individual animals, rather than seeing them as systems.

5. Current use of digital tools:

I use tablets for simple research tasks and interactive whiteboard resources quite often. We sometimes use educational games, but mainly for maths and spelling. Environmental topic apps aren't something we've used much beyond videos.

6. Benefits and barriers of AR:

<https://outlook.office.com/mail/0/inbox/id/AAQkAGI0YTbjM2JmLWY0MGY1NGlyMy1iOTQ2LWVNmZkMzUzZTczOQAQAPMVSwOJ%2Fd9AIrajtOKk...> 1/2

I can definitely see AR helping them visualise things they can't normally see: like how pollution spreads or what habitats look like in different parts of the world. It would make learning much more immersive. The main barriers would be time, number of devices available, and making sure the app is simple enough to set up mid-lesson.

7. Features that would be most useful:

Clear visual explanations, simple interactive challenges, and activities they can do in pairs or small groups. Anything that links to real-world actions they can take at school would be brilliant.

Let me know if you need anything else I am happy to help!

Take care,
Clarice

Significance for the Project

Although public research was helpful in establishing an understanding of how the community perceived certain environmental factors, it could only partially assist with providing specific knowledge required for lesson plans. For example, while it was important to discover how members of the public viewed the environment, it was more valuable to gain specific knowledge on how these students at this school comprehend curriculum-based knowledge and how they can optimally achieve it using an AR app like Eco-Warriors.

Design Research

Colour Research

With our target audience being primary school students, we wanted to design a game that would attract young children through both gameplay and aesthetics. Through secondary research, we found out that children are more likely to be drawn to bright colours as these colours stand out more in their field of vision (Pancare, 2022). Using bright and vibrant colours makes the game look fun and inviting, motivating the children to play the game more. We also investigated on colour theory and psychology as well to understand how colours affect mood and behaviour. We believe that colour is an important communication tool, as it is often associated to emotions and ideas. For example, the colour green is commonly associated with the concept of growth, health and wealth as it is frequently seen in nature or on money (Andersen, 2024). Therefore, we felt that it is essential for us to develop a specific set of colours for our game to clearly communicate its concept and theme to the players.

Art Style Research

Next, we identified the overall art style we wanted for the game. We gathered a mood board to assist us with this process. Using Pinterest as our main source, we researched on existing cute applications and games out there for inspiration. We then curated a collection of reference images

and placed them on a virtual board to better visualise the overall look and feel of the game. The art style we resonated the most with is an illustrative, vector art style aesthetic that uses bold and bright colours to visually engage players. We also aim to keep the assets simple, so as to avoid overwhelming the users and to ensure easy navigation within the app.

A key design reference for our approach was the art direction of Bluey (Drummond, 2025). Bluey was massively successful at creating a globally applicable children's TV show with recognisable and inclusive characters, enjoyed internationally by children and parents. Drummond's discussion of their approach was key to guiding our focus especially the details on shape language and layout as we found our project intentions aligned well with Bluey as a fun and educational piece of children's media.

Bluey uses 'Dollhouse' proportions, simple cute and designed to be played with, just like we want our mascots to be but not how we want our environments to be. Bluey's story is domestically focussed to the Heeler household and the family dynamics leading to cosy, enclosed spaces as the majority of locations where we want open space encouraging exploration and activity but still soft and inviting. The show is also internationally applicable but locally based in Brisbane Queensland exactly like our Winchester focus, blending a universal stylisation (everyone loves cartoon dogs) with distinct local identity. The show identified the unique visuals of Brisbane, especially the Queenslander style houses of Paddington (where the Heelers live in the show) with its steep hills and greenery. The team chose to "not only to simplify the details of our Brisbane setting but stylise and simplify how we portrayed 'space' in a more graphic, less literal way. Local Brisbane artists Katy Edwards and Debra Hood perfectly captured this idea already. The space and stylisation of their paintings are flat, stripping away camera angles and lighting to bring all the beautiful details of Queenslander architecture into full focus." (Drummond, 2025). An approach we can apply to Winchester.

Applications and Design Development Research

Some of the applications we used to develop the design of our game includes Procreate and Adobe Illustrator. For basic sketching and illustration, we use Procreate because it provided flexibility for freehand drawing and sketch planning. Procreate supports a smooth workflow from rough sketches to refined illustrations. The application offers a wide variety of brushes with different textures and thicknesses, allowing us to experiment with different illustration styles (Anniko, 2023). We can also export our project in multiple different file formats such as JPEG and PNG depending on our needs, making Procreate an ideal application for character design.

For creating the actual prototype of the game application, we used Adobe Illustrator. It is ideal for prototyping because it is vector based, ensuring that the graphics and assets remain scalable without losing resolution when resizing. This makes the assets more customisable and easier to adjust. Adobe Illustrator also offers high precision control over the graphics created in it. We can adjust every element such as lines, shapes, fonts, colours and more according to the way we want it to exact measurements (Hansen, 2020). General illustration/drawing applications do not offer this level of precision and editability, making Adobe Illustrator the most suitable for design prototyping.

As our development progressed into implementation, we chose to move our core 2D assets to 3D for the extra depth, detail and flexibility this offers, especially for animation. Earlier 2D prototyping encountered readability issues as there was not enough visual depth to immediately distinguish content without clunky borders, we found that using 3D mascots improved the visual distinction against the GUI and background. For this we used Blender, an open source and high versatile platform for 3D modelling, sculpting and texture painting with a vast wealth of learning resources to draw from. We considered 2D animation such that we could continue using our existing assets but decided that the production value of 3D was worth the investment.

Our design team was uniquely qualified for this task as our lead 2D artist (who has minimal experience with 3D design) was able to deliver clear quality reference material with multiple

perspectives to our lead 3D artist (who has minimal experience in 2D design). The group was involved in the entire process of iteration and review such that the outcomes fit the collective vision perfectly. Communication was constant and cooperative. The collaborative workflow was refined during the development period through experimentation and experience to find the best methods for rapid prototyping and quality outcomes across the team.

Similar/Existing Applications

Existing applications such as Pokémon Go! and Ocean Heroes Game are great points of research since they demonstrate a wide variety of points which we want to incorporate into our project.

Pokémon Go, an AR game which gained popularity in 2018, is widely seen as the most successful AR game open for public access. It is an augmented reality game where you have to catch creatures by physically walking around and going to the locations where the creatures are. Eco-Warriors uses the same catch loop as Pokémon Go where it uses Find, Catch, Train adapted into: Find, Solve, Learn where the player finds a task to do, solves the puzzle for it, and learns a fact about the environment. By using a tried and tested methodology in our application, it mitigates the chances of a failure since this catch loop is already proven to be successful (Dunham, et al., 2021). The AR segments in the two games are also similar since it follows the similar minigame approach as Pokémon Go.

Ocean Heroes Game is also a great example of existing applications since it plays around with the same ideas but instead applies it to ocean ecosystems. The game is built around similar ideologies as Eco-Warriors where the player has to restore ecosystems like coral reefs and mangrove forests by solving ecological challenges, similar to our idea of minigames where you do ecologically friendly tasks. The game is a modification of the popular game Minecraft which is already quite accessible to our target audience since it is arguably the most popular game for that age range (Suter, et al., 2023).

Software and Hardware Requirements

Mobile was the most applicable platform for our needs as movement is crucial to our game design.

Our step counter requires use of the onboard accelerometer whilst our AR game uses the rear facing camera. These features are almost universal on mobile devices. Our final install size is 96MB, comparatively small to other mobile games.

Android and iOS are the two most popular mobile operating systems accounting for 71.94% and 27.64% of global market share respectively, within the UK specifically Android accounts for 50.53% and iOS 48.95% (statcounter, 2025). Unity supports Android 6.0 “Marshmallow” (API level 23) and above (Unity, 2025) as well as iOS 13 and above (Unity, 2025), meaning that 99% of device operating systems are compatible with our application.

Overall, we are confident our game satisfies 99% of device requirements and during performance testing have not experienced any lag or excessive power draw on a 2-year-old entry level android device.

Essential Features

The goal of our game applications is to promote sustainability and educate children about the importance of being sustainable and how they can practise it in their daily lives. The application is a virtual pet simulation game where the players will have a virtual “friend” to accompany them through their sustainability journey and in completing game tasks. The gameplay centres around the idea of nurturing and maintaining the character’s health in the game, creating a sense of responsibility and emotional attachment. Players will need to care for the characters in the app by making it happy by performing various sustainable task. Through these tasks, users will naturally learn ways to become more environmentally responsible.

Based on the primary and secondary data we have collected and researched, we have split our gameplay into three main categories: water, air quality and green spaces. Each category will contain

a mini-game like activity where players complete tasks. These categories also function as the character's health indicators in the game. To ensure that the character remains happy, players will need to complete the activities in each category to keep their character in good condition.

For the water category, the activity will be an AR game where players remove trash from polluted water. This will immerse the children into a virtual ecosystem, allowing them to apply what they learn from the game into real life. Through this AR simulation, children will realise the impact of pollution as they observe the trash filled, dirty water. As the players actively clean the water, they practice the idea where individual actions can help improve the environment. When the water becomes visibly cleaner during the gameplay, this immediate feedback reinforces positive outcomes of sustainable behaviour.

For the air quality category, the gameplay uses a step tracking system that teaches sustainability through connecting real world actions to environmental impact. Encouraging players to walk instead of relying on vehicles helps children understand how their day-to-day choices can contribute to cleaner air. As walking does not produce any harmful emissions compared to cars or buses, choosing to walk allows players to directly contribute to reducing air pollution in an active way while developing a healthy lifestyle.

For the green space category, the gameplay encourages players to visit local parks and nature areas. The aim is to connect the players with nature and provide an escape from the pollution of the city life. By being physically active in these green spaces helps children appreciate the beauty and value of natural environment and builds a desire to protect it. Visits to parks also encourage outdoor activities such as walking and cycling, allowing children to have fun in a physical space while staying active. This emotional connection becomes a strong motivator for sustainable behaviour while also promoting healthier habits.

Checklist and Deadlines

The project deadline was set to be December 4th, meaning we had approximately just over two months to complete a prototype as well as the group document sketchbook and our own individual work as well. In order to manage this, a checklist was created with control deadlines for both of the group tasks – being the prototype and sketchbook.

The checklist consisted of tasks created for each team member for both the development and written sides. A control deadline was created for the development which was set on the 26th of November, and the checklist provided enlisted the details of who worked on which task as well as the start and end date of their development for the technical tasks.

| Task | Who? | Complete? | Date Started | Date Finished | |
|------------------------------|---------------|-----------|--------------|---------------|--|
| Make Unity Project | Callum | | 30/10/2025 | 30/10/2025 | Complete! |
| AR Game | Vidula | | 25/11/2025 | | Being worked on |
| Steps Game | Callum | | 24/11/2025 | 24/11/2025 | |
| Explore Game | Callum | | 25/11/2025 | 26/11/2025 | |
| Splash Screens | Sahara | | 25/11/2025 | | Not yet started |
| Info Screen | Haiden, Aqdas | | 25/11/2025 | 26/11/2025 | |
| Parallax System | Callum | | 26/11/2025 | 26/11/2025 | |
| Character 3D Modelling | Saph | | 10/11/2025 | | Behind/Urgent Work |
| Add members to Unity Project | Callum | | 18/11/2025 | 18/11/2025 | |

As seen, a colour scheme was followed to implement the progress of each task. Everyone was assigned to at least one task to ensure we all worked on the prototype together. On the day of deadline, if we were hit with any obstacles such as errors or some issues with the software we were working with, the 27th is put in advance to be used for any catch-up and further development for any incomplete code to ensure the prototype was complete.

Similarly, a checklist for documentation was also created with more tasks for each team member, with a control date of November 28th. The documentation had a bit more time than the prototype as we were required to talk about post development which obviously had to be written after the prototype was created.

| Task | Who? | Complete? | Date Started | Date Finished |
|--|----------|-----------|--------------|---------------|
| Introduction and Overview | | | 22/11/2025 | |
| Problem Identification | Vidula | | 22/11/2025 | 22/11/2025 |
| Project Aims and Objectives | Vidula | | 22/11/2025 | 22/11/2025 |
| Stakeholder Information | Aqdas | | | |
| Group Responsibilities | Vidula | | 22/11/2025 | 22/11/2025 |
| Research | | | 12/10/2025 | |
| Winchester History and Pollution | Sahara | | 20/11/2025 | |
| Sustainability Goals and Aims | Haiden | | 18/11/2025 | 28/11/2025 |
| Target Audience and Cultural Value | Haiden | | 28/11/2025 | 28/11/2025 |
| Ethical Concerns | Aqdas | | 21/11/2025 | 25/11/2025 |
| Public Area Research | Vidula | | 22/11/2025 | 28/11/2025 |
| Data Collection | Saph | | | |
| Scope into Education and its Curriculum | Saph | | 24/11/2025 | 25/11/2025 |
| Contacting Schools | Vidula | | 16/11/2025 | |
| Design Research | Taro | | 26/11/2025 | |
| Similar/Existing Applications | Aqdas | | 19/11/2025 | 25/11/2025 |
| Software and Hardware Requirements | Callum | | | |
| Essential Features + User map | Taro | | 27/11/2025 | |
| Checklist and Deadline | Haiden | | 28/11/2025 | |
| Group Meetings | Sahara | | 12/10/2025 | |
| Design | | | 28/10/2025 | |
| Assets Implementation | Taro | | 26/11/2025 | |
| Screen Design Prototypes | Taro | | | |
| Usability Features | Sahara | | | |
| UI/UX Development | Saph | | | |
| Decomposition Flowchart | Vidula | | 28/10/2025 | 28/10/2025 |
| Branch Table and Paradigms | Haiden | | | |
| Testing | Sahara | | | |
| Development | | | | |
| Prototype 1: Basic Layout and Design | Callum | | | |
| Prototype 2: Page Navigation and Character Customisation | Callum | | | |
| Prototype 3: Steps Counter and AR Game | | | | |
| Prototype 4: Explore Game | | | | |
| Prototype 5: Info Screen and Additional Features | Haiden | | | |
| Evaluation | | | | |
| Post-Development Testing | | | | |
| Limitations | | | | |
| Group Reflection | Everyone | | | |
| Bibliography | | | | |
| <i>REMEMBER TO REFERENCE</i> | Everyone | | 12/10/2025 | |

This checklist also followed the same colour scheme as the development checklist as well as the task assignment and start and end date. Similarly, a post-deadline day of the 29th was put in place for any late submissions from the control deadline.

Overall, this checklist was detrimental to the completion of the project as it kept everyone in check to complete their assigned tasks with a motivation to finish within the deadlines given.

DESIGN

Assets Implementation

Colours



Colours are one of the most important aspects when developing the game, as they determine the overall mood and energy of the game. Colours can influence emotions and can have a meaningful impact on a child's growth and development. Warm colours such red, orange, yellow often create a joyful and bright atmosphere. Whereas cooler colours like green and blue have a calming effect.

It is crucial for us to select a set of colours that emphasise the idea of sustainability while at the same time still feeling fun and cheerful. The main colours chosen are green and blue, as they are commonly associated with nature and are often used in sustainability campaigns. We then complemented these cooler tones with warmer colours such as orange and yellow to make the game feel more inviting.

Since we are using a combination of warm and cool colours, we specifically chose shades of green and blue with hints of yellow undertone. This adds vibrancy and liveliness to the cooler colours, aligning with the cheerful and energetic tone we want for the game. Although we aim for a bright and playful aesthetic, we avoided selecting colours that are too bold so that the visuals would not appear jarring for the user as they play the game. This carefully selected palette ensures that all the colours work in harmony together, creating a cohesive, fun and inviting visual experience.

Characters

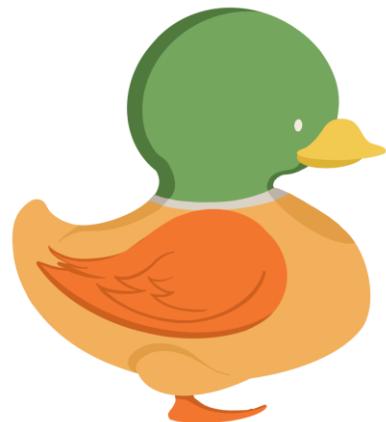
When designing the characters for our sustainability focused game, our main priority is to create figures that children can easily relate to. We want to provide them with a friendly “buddy” who will accompany and support them throughout their sustainability journey. These characters should feel approachable, engaging and appealing to young players, while also reflecting the core theme of environmental responsibility. We chose spherical design language, rounding all corners and bowing straight lines out to be friendly and soft but with hints of triangular shapes to be just a bit adventurous. We want children to feel like avid explorers, safe in the company of their buddies.



The arrow “buddy” is one of the first characters we designed. When people think of logo related to the word sustainability, common symbols such as the recycling arrows or plant imagery usually come to mind. To reinforce the theme and ensure that the concept is immediately recognisable, we integrated these familiar symbols into our character designs. We transformed the iconic three arrows recycling symbol into characters that will serve as guides or mentors within the game. With the title of the game being Eco-Warriors, we also designed warrior-like clothing and accessories for them, adding a playful and adventurous element to the experience.



Next, we wanted a symbol for nature within the game that encouraged children to act empathetically and sustainably towards the environment. To achieve this, we chose to personify nature itself and designed a cute approachable tree, presenting nature with literally a friendly face. We hope that children will see this tree as a friend to take care of and respect, as they learn about the environment, we hope they also see how nature takes care of them.



Fauna is equally as important as flora and Winchester is uniquely situated on the River Itchen, so we wanted a character that represented both the water health and local animals. The river is a rare chalk stream and Special Area of Conservation home to a large waterfowl population and was a key

point of interest to us. We chose a duck as the character, an icon of park spaces around Winchester reliant on water quality that is cute and approachable. n.



We design characters inspired by rubbish. The banana represents food waste, while the bottle symbolises recycling. As food waste and improper recycling are major sustainability challenges, including these characters helps bridge in-game learning with real-life habits. These are also items that children often encounter in their daily live as well, hence turning these familiar objects into characters makes it easier to for children understand and relate to sustainable behaviours.

3D Asset Design

These designs were used as the reference material for our 3D models. We were very happy with our initial designs and made no drastic changes to the models except for necessary alterations to fit the

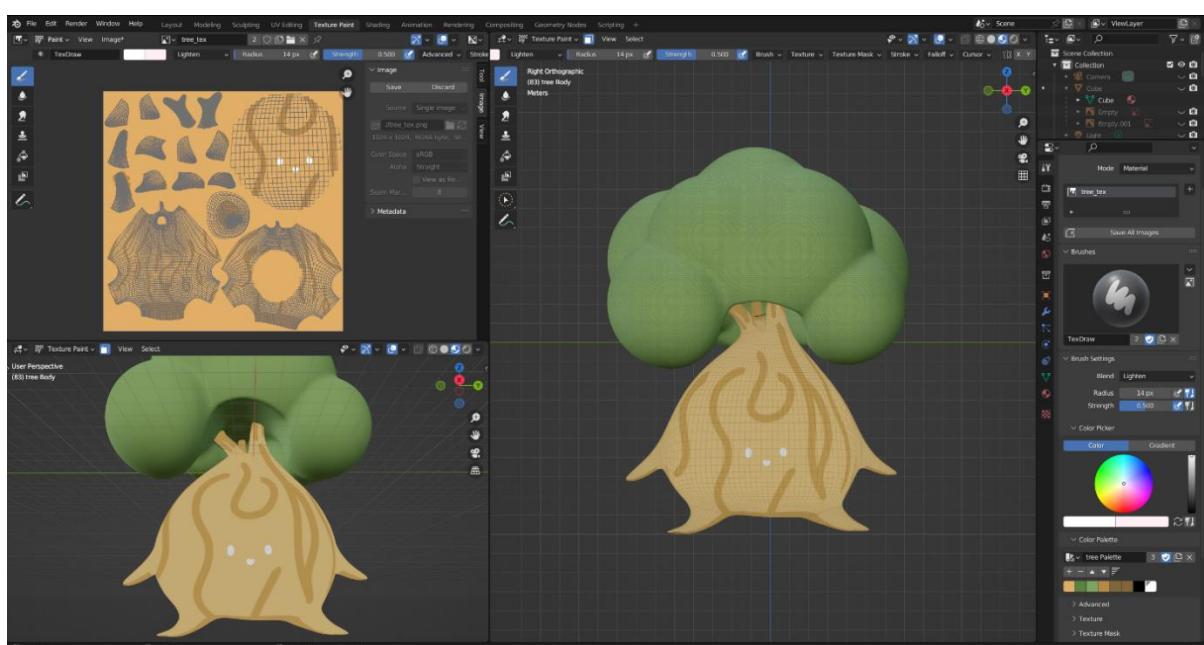
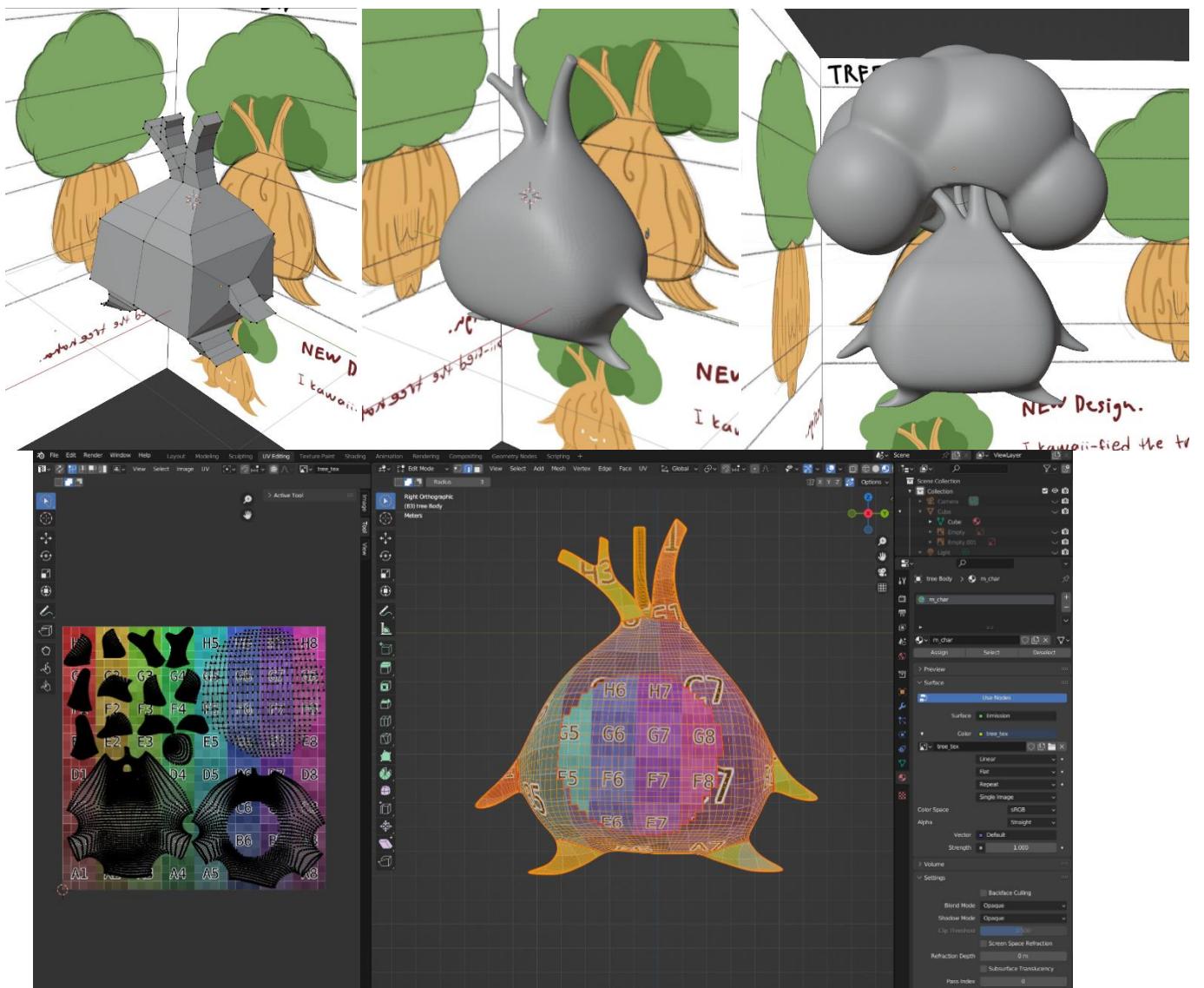


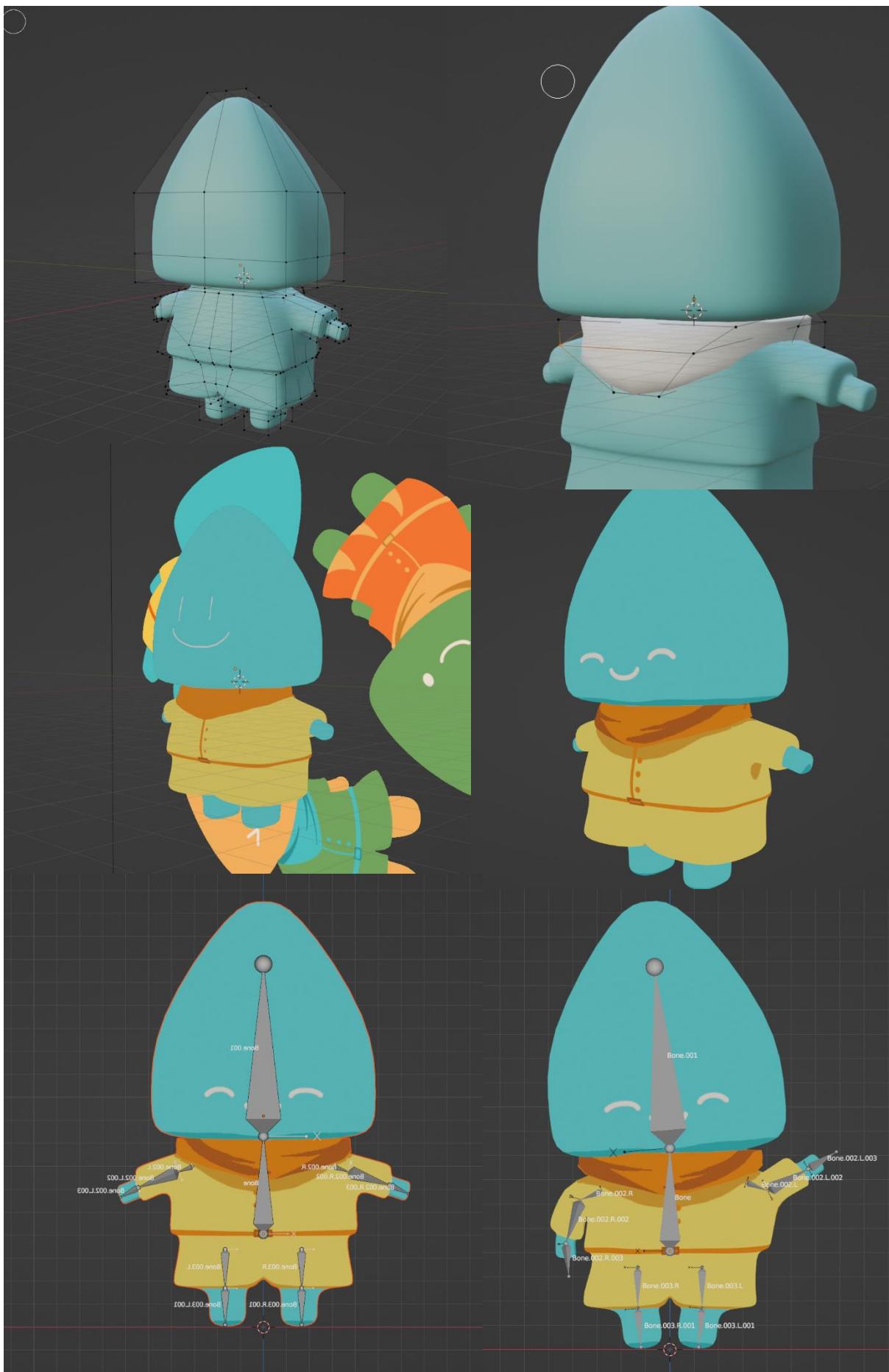
new dimension. Firstly, we produced reference sheets with alternate perspectives that could easily translate into models.

Models were then sculpted following the contours of the design in simple block shapes, subdivided to a smooth and soft mesh, UV unwrapped and painted. We focussed on making our models optimised for mobile applications and keeping the spherical shape design, we considered a more stylised approach to colours and materials including a ‘Claymation’ style but found the initial cell shaded cartoon worked best. The arrow mascot was the only character that required rigging for animations

We wanted an unlit style for ease of use in unity and stylisation so made our materials emissive (ignore outside lighting/shadows) and baked the shading into the texture. This allowed more direct control of the lighting appearance and saves us from needing to compute lighting in-game.







We feel our final roster of assets are cute, approachable and friendly, exactly as we had intended.



Branding

| | | | | |
|--|------------------------|-----------------------|----------------------|---|
| <h1>ECO-WARRIORS</h1> | | | | MASCOT Inspired by the recycling logo, the mascot will teach children how to be more sustainable |
| NATURE | RECYCLEABLE | FOOD WASTE | CITY ICON | LOGO Combining letters E and W to create a tree like symbol |
| COLOUR PALETTE <div style="display: flex; justify-content: space-around;"> #4bbfbf #74a65d #f2ca50 #f2b05c #f2762e #eddfdf </div> | | | | TYPOGRAPHY BOWLBY ONE <small>ABCDEFGHIJKLMNPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz12345678910</small> Lexend <small>ABCDEFGHIJKLMNPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz12345678910</small> |

After creating the main assets, we assembled a branding board that brings together all the visual

elements that we will use when developing the application. This branding board serves as reference point for the entire team, ensuring that everyone has a clear understanding of the overall aesthetic and design direction of the game. We also selected the fonts we want to use consistently, to make sure that everything from the game to the presentation will be standardised. Establishing this design direction early helps maintain a cohesive and unified look throughout the project, ensuring that the visuals of the game appear clean, professional and aesthetically aligned.

Graphic User Interface



With our main gameplay split into three different categories, water, air quality and green spaces. We designed an icon for each category. These icons are a crucial part of the gameplay as they represent the health of the characters and are at the foreground of the GUI. Our icons needed to clearly convey their meaning through colour and image, blue droplet for water, green leaf for nature and a warm orange gust for air.

Background



We wanted to make a parallax background for the application to add more dimensions to the game environment. A parallax background creates an illusion of depth in the game, through moving the different background layers at varying speeds. This makes the game appear more dynamic and visually engaging, making the digital world feel more alive and inviting.

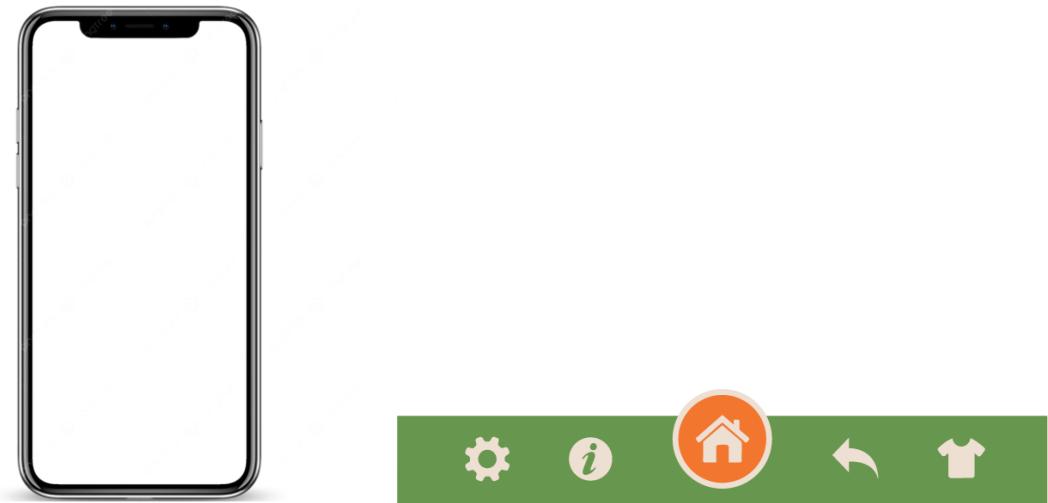
Since the game is based in Winchester, we designed the background to be inspired by the landscape of Winchester. With our target audience being children from Winchester, making a Winchester theme background strengthens the identity of the game and makes it more relevant to its users. The background features the iconic Winchester landmarks such as the Cathedral and the city centre. The aim is to foster a sense of local pride in their community while encouraging players to take care of their surroundings.

Logo Design



A good logo is crucial as it represents the identity of the application, it helps build recognition and create a memorable first impression for the users. Initially, we wanted to create a logo using the acronym of the application title, Eco-Warriors, which is the letter E and W. We design a tree like structure using these two letters. However, after further discussion within the group, we realised most of us did not resonate with the first logo. Therefore, we began brainstorming and designing other variations of the logo. We wanted to use one of the characters as the face of the logo since it serves as our mascot. We eventually chose the third design, as it incorporates the main colours of our game while remaining clean and not overly complicated.

Screen Design Prototypes

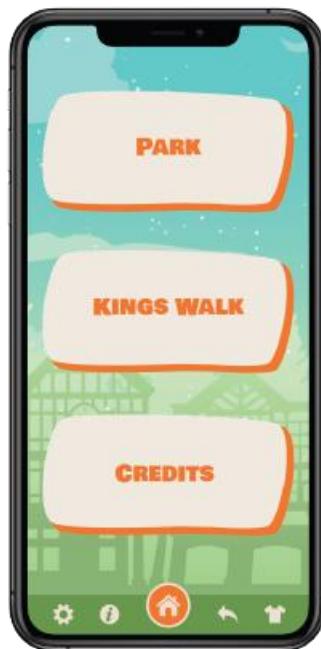


After creating the different assets for the application, the next step was to put them together to form a screen design prototype so that we could visualise how the application would look like. To begin the prototyping process, we first selected a phone frame to help us gauge the screen size and resize the assets accordingly. We then designed the navigation bar as this bar appears on every page of the application. Based on prototype 1, we refined and redesigned the overall screen aesthetic to ensure it matched the style of the assets we had created.

Final Screen Design Prototype







Usability Features

When working on the design for our games we had to consider the various usability features that would allow it to not only be a simple and easy game for children to use but also accessible enough so most if not all children are able to play Eco-Warriors, as this we want to educate all young people about sustainability, not just a small group.

Accessibility

For a game to become accessible, especially towards children we need to think about using large fonts and have wider spacing between the lines, as well as potentially having more contrast between the text and the background, as this will make it much easier to read text and understand what's going on. We can implement this in our game through the 'How to Play' or tutorial sections by having less text and ensuring that there is a higher contrast on these UIs. Companies such as Microsoft have an accessibility checklist in which they recommend adjustable font sizes and readable menus (Microsoft, 2023). In addition to this they have various questions that we should be asking when it comes to considering accessibility within a game, especially if we haven't done a project similar to this beforehand.

Is the game you are making today accessible?

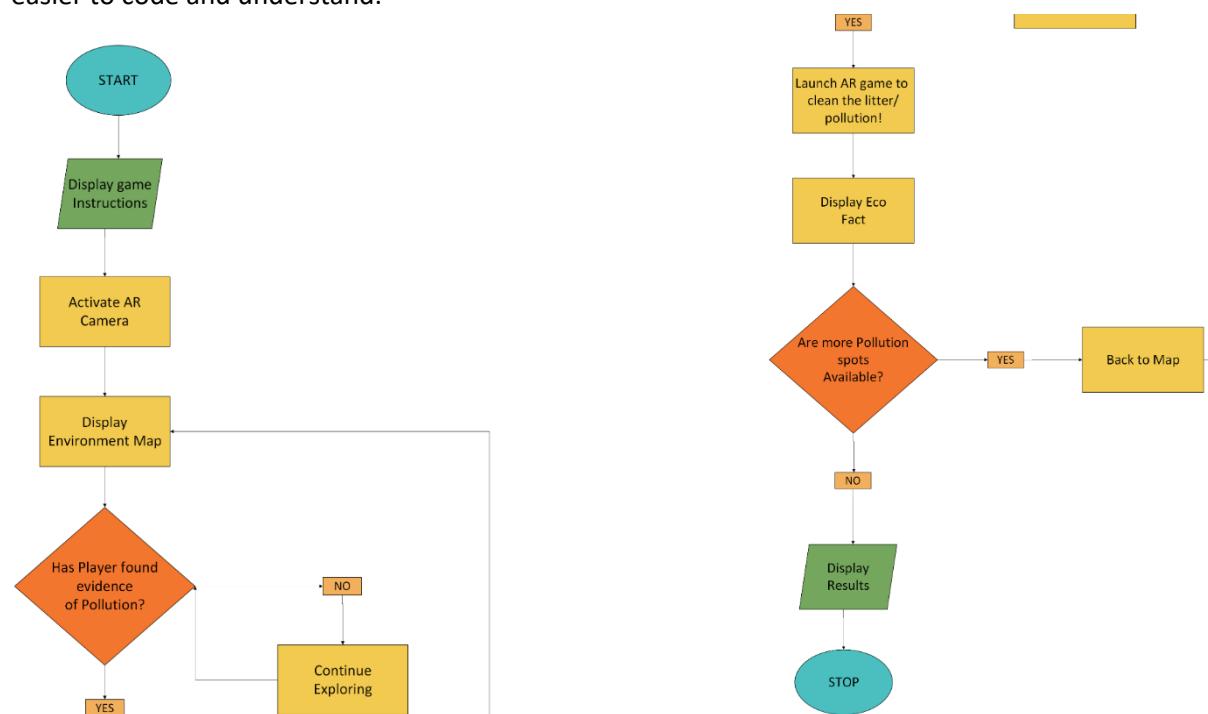
- Can you complete the game using a single hand?
- Can an average person be able to pick the game up and play?
- Can you effectively play the game on a small monitor or TV sitting at a distance?
- Do you support more than one type of input device that can be used to play through the entire game?
- Can you play the game with sound muted?
- Can you play the game with your monitor set to black and white?

- When you load your last saved game after a month, can you easily figure out where you are in the game and know what you need to do in order to progress?

After reading through these questions, we realised that we may not be able to include all of these features now due to time constraints. However, if we were to further develop this game, we would be taking all of these into consideration, as accessibility isn't a want in our game, it is a need. As a group, we decided to add simpler forms of accessibility to start off with such as potentially enabling a colour-blind filtering system, allowing music to be muted and avoid having a cluttered display to not only keep the screen clean and cohesive, but also be easier for players that may be more sensitive to flashing/strobe effects. In addition to accessibility, we agreed on having a more kid-friendly interface, this includes having minimal but very clear buttons for the various tasks in the game, having the buttons be very clear in what their actions are. We also wanted to use plainer and age-appropriate language, not to simplify the meaning of the game, but rather phrase it in a way that 6–7-year-old children would understand.

Decomposition Flowchart

This initial flow chart was created as a response to decompose the process of the game to make it easier to code and understand.



Branch Table and Paradigms

| Branch Title | Description |
|---------------------|--|
| /main | The mainframe of the app, will hold all the other branches within it |
| /AR | Controls the camera part of the phone for the app, allowing for AR game to work |
| /Steps Game | Creates a step counter that deducts how many steps the user has done on a daily basis |
| /Explore Game | The main game of the app, uses the AR branch to allow user to explore through their phone visualising assets to interact with |
| /Splash screens | Movement between main screen and branches, allowing for more visual aesthetic and smoothness between branches. |
| /Info Screen | Holds other options such as 'How to Play' and 'Learn about Winchester', additions to app. Also contains settings such as mute button |
| /Parallax System | Moving background for added aesthetics for app |

In terms of the programming paradigm, we decided to work with, we chose object-oriented programming (OOP). This is because of the amount of external and internal assets we plan to use, and we plan on working on Unity, which is quite user-friendly toward OOP. OOP is easier for group work as well as it allows us to simultaneously work on different branches at the same time without overlapping each other in the code.

DEVELOPMENT

Prototype 0: Initial Conceptual Development

When conceptualising the game, we sought to encourage healthy behaviour by motivating players to go outside and engage with the world around them. Mobile is undeniably the best platform for this as any stationary platform (console, PC, etc) is counter-productive to our goal of getting active.

We considered age ranges next from an impact perspective, who would most benefit from the game's educational intention? Children stood out to us as an ideal demographic; formative ages are perfect for instilling positive habit and kids are eager to play; they are a captive and adaptive audience. We considered different school age groups further, reception and key-stage 1 are unlikely to have access to a mobile device, and we think that children older than year 6 are too mature to engage with this style of game. This lands our age group in the ranges of year 3 – year 5.

We considered other games that were popular with this demographic. Tamagotchi-style games stood out as these encourage caretaking and empathy within their players; Pokémon Go (2016) is similarly built on empathy and encourages activity through using walking as a key part of the gameplay cycle. The core of these games is keeping your creature happy, could we apply this to ecofriendly actions?

Prototype 1: Basic Layout and Design

For our initial design ideation, we started working on our initial sketches using Draw.io. We created a simple mock-up of a phone layout, showing where the icons would go and where the mascot would be placed. These sketches were very basic—mostly stick figures and simple black-and-white icons.

Since the game is designed for young children, we want the environment and interface to be accessible and creatively engaging. By simplifying and combining our ideas, we aim to make learning about nature fun and interactive, rather than something that feels like a chore.

To achieve this, we added three sets of games, each represented by a different icon. We believe these activities will encourage curiosity, promote healthy behaviour and habits, and strengthen the player's connection with nature.

Game Concept

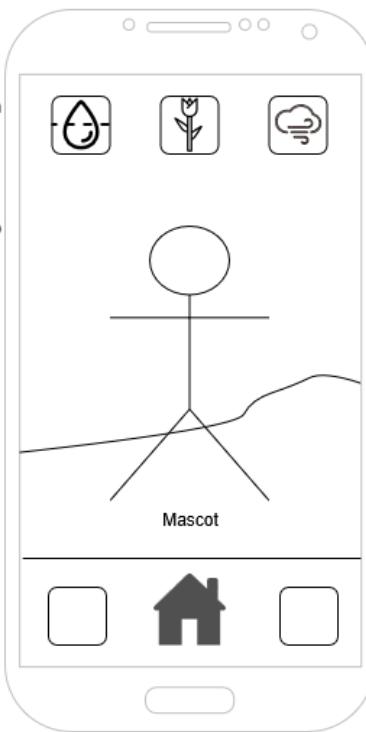
The idea for the game is to engage young children with the environment through an interactive experience that encourages them to think about nature and sustainability.

The plan is to create a series of fun mini games where players keep our mascot alive and healthy. This provides an exciting incentive for children to learn about and help protect the natural world.

Icons

Clicking on the icons will provide a more detailed breakdown of each environmental stat, showing the current percentage value and overall status. Each stat is tracked out of 100%, and selecting an icon changes the screen to match that theme. For example, clicking on the Water icon takes the player to a river scene set in Winchester.

The Home icon allows users to easily return to the main screen at any time, making navigation simple and user-friendly.



Stats

In this game, we will track three key environmental stats: Air Quality, Water Health, and Green Space Health.

These stats will slowly decrease over time. As they drop, our mascot will appear sadder but as players improve them, the mascot will become happier and more energetic.

Water Health: Players will take part in a mini-game where they remove trash and clean polluted water.

Air Quality: This will be improved by tracking real-world steps taken, encouraging players to walk instead of using cars.

Green Space Health: Players can visit local parks or nature areas to boost this stat, helping them connect with nature and escape the pollution of city life.

Prototype 2: PowerPoint Prototype

We then moved on to creating the PowerPoint prototype. Once everyone approved the layout and systems from the Draw.io version, we decided it was time to begin prototyping. The purpose of the prototype was to provide a clear visual representation of our game for the presentation and inform our development approach. We built this using PowerPoint with our initial 2D art designs because we could simulate navigating the application. Having an intuitive early design was very useful as a proof of concept and dev tool.

We designed a straightforward version of the app where each stat had its own page, complete with themed visuals based on the activity. For example, the explore page included different characters, while the steps page featured arrow characters circling the step counter. Our goal was to make the game visually engaging and appealing for our players and we continually refined our design with cross-group review and feedback.

We also added an information screen, similar to the one planned in our Draw.io prototype. This page gives players and parents helpful details about how to play the game, as well as background information about locations in Winchester. It also includes developer credits to acknowledge the team behind the project.



Prototype 2: Feedback

Once this development phase was complete, we demonstrated the prototype during our presentation. Overall, the group was happy with what we had created however there was some debate as to whether our project fit the category of gamification or more towards being a traditional game. Our position at the time was that the core of the project was to facilitate positive environmental habits – to encourage children to explore nature and engage in sustainable behaviour. The feedback we received showed that game elements were more prominent than educational aspects, which led to some disagreement in the interpretation and ultimately a change in our project outcome from gamification to UI/UX.

Our team had a short discussion to decide what additional features we wanted to include. Our first idea was to add a splash screen for each main page which appears the first time a player opens a page and provide a simple explanation of how the game works. This should make the game more accessible especially for younger players.

We also wanted to improve the visual quality of the game and plotted out our design improvements and timeline. Additionally, we planned to implement parallax scrolling in the background as we felt this would add depth and movement to the environments. Our hope was that more engaging visuals would increase user attention and visual clarity.

Another feature we discovered was a customisation screen, which is a common element in Tamagotchi style games. Allowing kids to customise their mascot with earnable cosmetics gives them a reason to return to the game regularly. For the prototype phase, all cosmetic items will be unlocked; However, in the final version we want to link some customisation options to achievements. This should encourage progression and long-term commitment, the longer a player's attention is retained the more they should learn and personally develop.

Prototype 3.0: Early Unity Engine Implementation

We streamlined our workflow for the Unity development phase beginning with a group restructuring as we moved our focus from holistic design to focussed development. Callum, as the most experienced with Unity, worked as our lead developer and set up the project file with version control to ensure smooth collaboration. Once they had implemented the basic scaffolding, we distributed tasks across the group such that each member focusses on a specific application element. This significantly accelerated the development process and allowed us to work effectively as a team where each members specialisations were fully utilised.

With the basic layout in place, we created a central script called **GameLogic**. This script stores all core variables, including environmental stats and the current game state. Game states—such as *Explore Mode*, *Steps Mode*, and *Home*—determine what the game is actively doing at any given time. By referencing these states, we can control which features and systems should be running.

After that, we implemented functional UI buttons by creating a second script called **ButtonFunctions**. This script handles all button-based interactions and is responsible for switching between the different game states. Once the buttons were linked to their functions, we had a simple but fully operational prototype that allowed us to navigate between modes seamlessly.

Next, we focused on implementing the hybrid button–bar system for displaying stats. Each stat bar is built directly into its corresponding icon such that the bar slowly decreases over time as the associated environmental stat drops. This feature was implemented early in the development process and proved extremely useful for testing, as it allowed us to see how different game functions interacted and updated in real time.

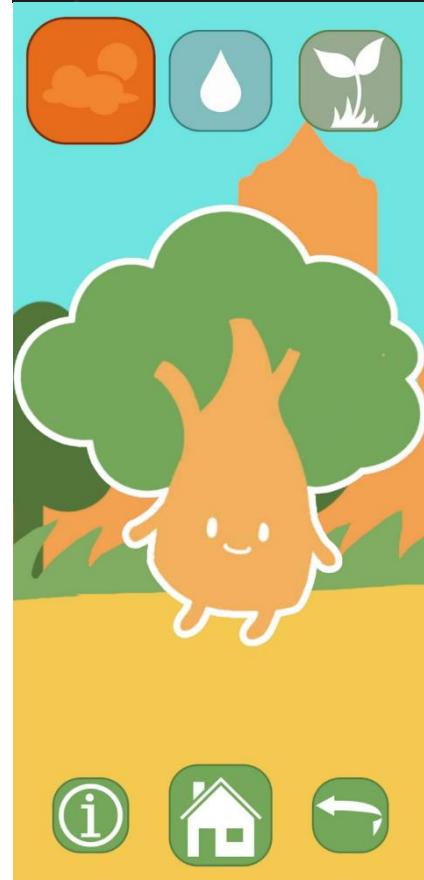
After that, we developed the **BackButton** functionality. The system works by saving every navigation action to a stack. When the player presses the Back button, the game pops the most recent entry and switches to the corresponding game state. This creates a simple, efficient state-based navigation system that efficiently mirrors how a typical mobile app handles backtracking.

We found this very useful for intuitive navigation.

```
0 references
public void HomeState()
{
    if (gameLogic.gameState != 0)
    {
        AddstateHistory();
        gameLogic.gameState = 0;
    }
}

0 references
public void StepState()
{
    if(gameLogic.gameState != 1)
    {
        AddstateHistory();
        gameLogic.gameState = 1;
    }
}

0 references
public void ARState()
{
    if(gameLogic.gameState != 2)
    {
        AddstateHistory();
        gameLogic.gameState = 2;
    }
}
```



```
5 references
private void AddstateHistory()
{
    if (stateHistory[stateHistory.Count - 1] != gameLogic.gameState)
    {
        stateHistory.Add(gameLogic.gameState);
    }
}

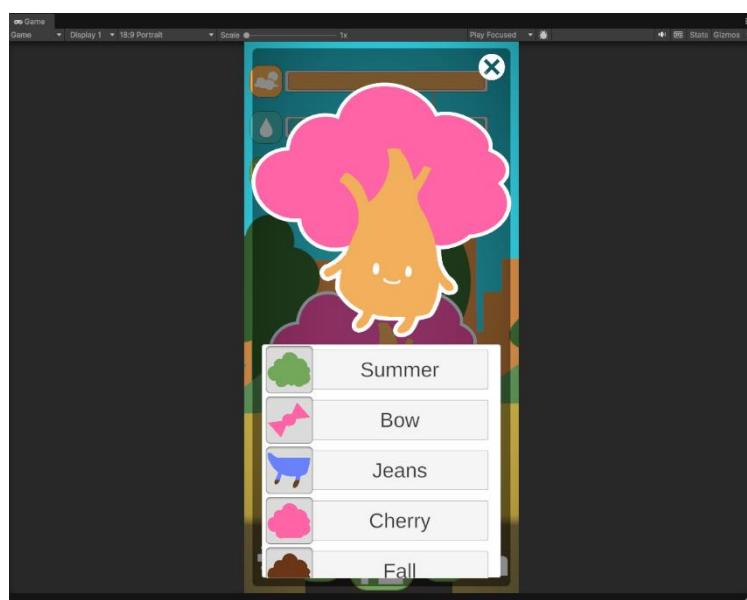
0 references
public void BackButton()
{
    gameLogic.gameState = stateHistory[stateHistory.Count - 1];
    stateHistory.RemoveAt(stateHistory.Count - 1);
}
```

We divided the work into several feature specific branches: **InputScreens**, **StepGame**, **ExploreGame**, **SplashScreens**, **Parallax**, and **SettingsScreen**. To support team members who were less familiar with Unity, we documented our planned functions and behaviours in a shared Google Doc. This provided clear guidance and ensured that everyone understood the intended purpose and structure of each system. As a group we each wanted our own technical challenges but always collaborated in-case of any issue and frequently exchanged our tasks, so problems were seen with new eyes and our code received peer review.

Prototype 3.1: 2D Customisation Implementation

With both state switching buttons and dynamic stat bars working, we moved on to developing the Character Customisation screen. This feature was fairly straightforward to implement: the character sprite is swapped out with the selected variant whenever the player chooses a different option. To support this, we added a scroll box allowing players to browse through available skins.

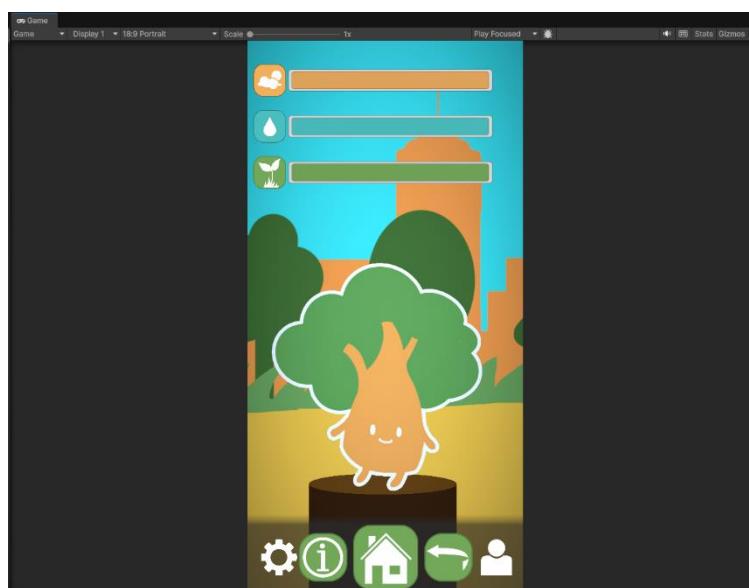
For testing purposes, we created a set of basic placeholder sprite variations in Photoshop. These simple developer art versions gave us a clear idea of how the customisation system would look and behave once assets were updated with their final look from the design team. We knew early on that we would be updating this to use 3D assets and designed this system as a framework that could be changed for 3D later on.



Prototype 3.2: Updated UI and Visuals

After receiving additional feedback from the group—and reviewing the new concept art created by our designers—we decided to update our button and bar hybrid system. Instead of combining the two, we shifted to using bars that function as buttons. This approach aligned better with our visual direction and created a cleaner, more readable interface. We reworked and adapted the layout so that the bars matched the updated design style and fit seamlessly into the new UI.

Once the revised layout was implemented, we enhanced the visual presentation of the game by adding post processing effects. These included subtle colour correction, a slight bloom effect, and a vignette. Together, these effects helped unify the visual style and made the game feel more polished and cohesive.



Prototype 3.3: Steps Counter

We wished to implement a step counter to track player movement and activity. The hope is to encourage fitness and dissuade car use and as such fits best under our air icon as it should minorly reduce exhaust pollution. Although we realistically predict this to have a minimal impact on air quality, the physical health benefits of encouraging children and their guardians to get active should not be understated.

The step counting mechanic works by detecting movement of the phone: when the device moves a certain amount, the system registers one step and increases the player's distance travelled. This distance value will be used later in the Explore Game. We originally planned to use GPS data to achieve more precise tracking, but due to resource and permission limitations, this wasn't possible. Despite this, our movement-based method works surprisingly well when tuned with the correct sensitivity settings. These sensitivity settings define the limits of motion such that small shakes and moving the phone in your hand do not count, the advantage of this approach is that vehicles do not trigger steps, avoiding any exploits.

Prototype 3.4: Explore Game

The Explore Game is built on top of our step counting system. Although the original plan was to link distance travelled to real ecological locations on a map, we were unable to implement the map functionality for this prototype. Instead, we set a fixed distance requirement. For every 30 units of real-world movement (approximately 30 metres), a new character spawns on the screen. The range threshold is planned to be tuned during testing.

When the player interacts with one of these characters, they receive a short piece of information related to nature, local Winchester ecology, or general environmental facts. These interactions are designed to make learning feel natural and engaging, while also encouraging curiosity about the world around them.

We found that introducing NPC encounters was an effective way to keep players interested. Meeting new characters adds variety to the experience and provides a fun, narrative method of delivering educational content through conversational learning.

Prototype 3.5: AR Game

We wanted to create an AR style activity where children can 'collect' trash around Winchester in a safe, virtual way. Representing this environmental challenge under the water icon felt natural and

meaningful as water pollution is a major issue for Winchester. For our audience, perceptually linking littering with environmental damages is an impactful message – hopefully encouraging proper recycling habits.

On launching the game, the phone camera is enabled with virtual entities of litter projected over the real world in random positions across the user's environment. Our intention by playing the game within reality, and not a purely virtual environment, is that players consider this from a real-world perspective. The game is played as a scavenger hunt, encouraging play and exploration of the local environment by making the user move through the space. Players need to 'clean' the litter, reducing a local count while simultaneously gaining point scores. Through immediate positive feedback for their positive action, we hope to increase users' enjoyment from cleaning and protecting the environment. We want to teach that small actions can produce large effects.

We cannot actively endorse children to pick up litter as it may be unsafe. However, children will very likely be accompanied by adults who can be trusted to have proper judgement of the situation, either permitting children to collect litter and ensuring they do so safely or by collecting litter themselves. In a way, we intend to indirectly influence adult's behaviour through the actions of the children playing.

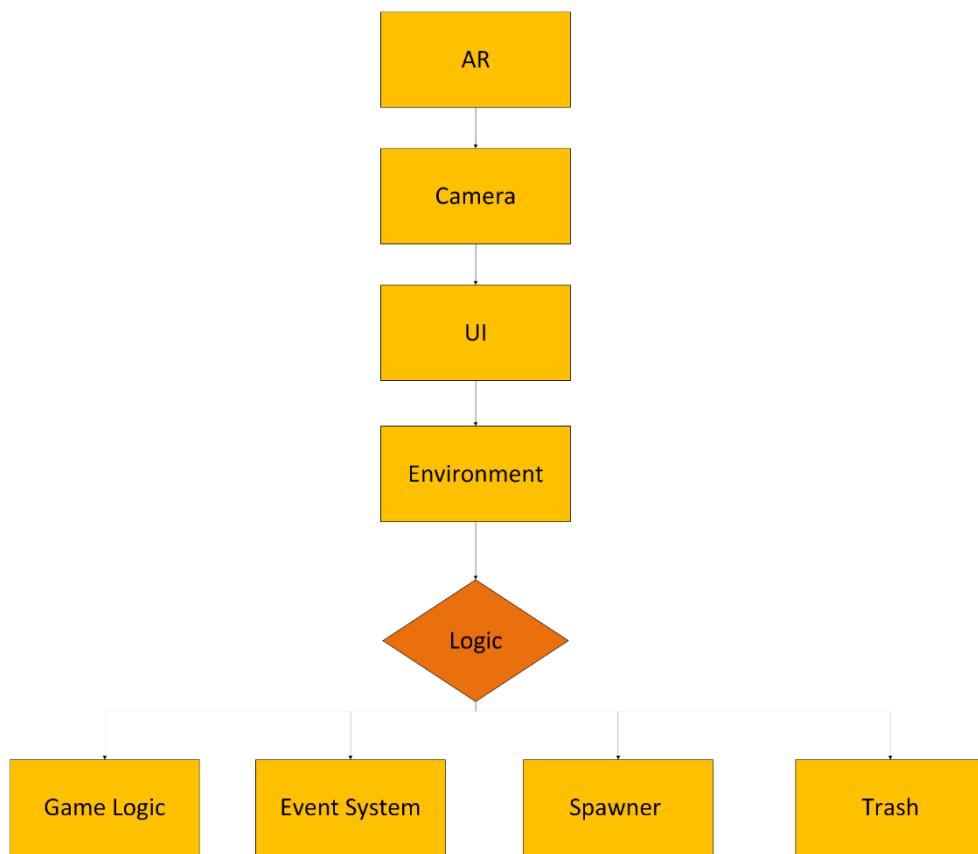
Should a player ignore their duties their water score (represented as a blue horizontal bar) will decrease overtime, and their mascot will become visibly sad.

To implement this, we began by installing Unity's AR packages to enable augmented reality features. However, we quickly ran into hardware limitations as none of our available testing devices were compatible with the AR framework we installed. Since we didn't have access to devices with proper AR support, we adapted our approach.

Instead of using full AR, we opted to use the mobile camera feed directly. We attached the camera output to a texture that was displayed on an in-game object rather than a UI panel. This gave us much more freedom for positioning gameplay elements in front of the video feed.

With this system in place, we created a trash spawner that generates interactable objects over the live camera view. Players can tap these objects to collect trash, earn points, and increase the blue water quality meter at the top of the screen. While not full AR, this solution still provided an engaging interactive experience that aligned with our gameplay goals and worked reliably on all of our devices.

Hierarchy Flowchart



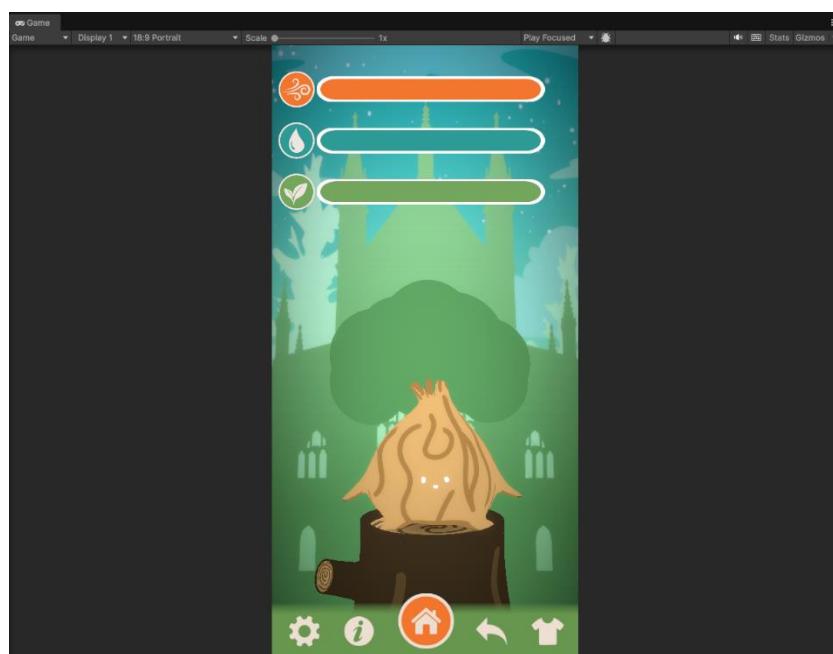
Game Logic controls the overall AR gameplay loop, while the Event System handles player interactions and UI events. Spawner generates trash objects into the scene, and the Trash node manages their behaviour, cleanup, and interactions with the player.

Prototype 4.0: 3D Porting and File Restructuring

As development continued, our design team completed the updated graphics for the project. With these assets ready, we began gradually replacing the placeholder art with the final visuals. This transition significantly improved the overall look and feel of the game, making it much more polished and visually appealing.

As the project had grown, the number of scripts, sprites, and prefabs became harder to manage, so having a proper folder framework became essential. We used the GgCore library with the extension Folder System, a file organising tool, to help structure the project more effectively and tidied unused or redundant code.

Once our organisation workflow was set, we integrated the 3D models created by our 3D asset lead. They provided the model .FBX file, UV layout and texture. After importing everything into Unity, we encountered an issue with lighting: the game had originally been built as a 2D scene, meaning the 3D models responded to lighting in a way that didn't match the rest of the visual style. To fix this, we modified the shader settings, so that models were unaffected by lighting. This allowed them to blend seamlessly into the game, maintaining the 2D cartoon aesthetic we had established from the start.



Prototype 4.1: Splash Screens and Tool Tips

We wanted navigation to be seamless and intuitive, our design process had made a great effort of that, but we wanted to be entirely clear since our young audience may misinterpret or struggle to understand the application without explicit prompts. To remedy this, we added some helpful splash screens which appear the first time a player opens a specific mini game, providing a brief explanation of how that activity works. After the splash screen has been viewed once, it should not appear again unless the application is restarted.

To achieve this, each splash screen is controlled by a Boolean variable. When a player opens a mini game for the first time, its splash screen is displayed, and the corresponding variable is switched to false. The next time the player opens that mini game, the system checks the variable, recognises that it has already been shown, and skips the splash screen. All splash screens reset only when the app restarts, ensuring they appear only once per session.

Prototype 4.2: Parallax Implementation

We wanted improved visual depth and definition as the game visuals felt a little flat even with the new 3D models. We decided to implement a motion parallax background to add some separation and improve the appearance further.

Parallax refers to the difference in the apparent position of an object from two different perspectives; it is partly how our brains interpret depth perception by comparing each eye's perspective. In animation this can be used to create visual depth through motion parallax where near objects move fast relative to the observer's motion while far objects move slow relative to the observer's motion.

We split our background into near, middle and far elements. For each game state, we defined anchor points—specific positions that the background should move toward. Foreground elements follow these anchor points closely, while objects further in the background move at increasingly reduced rates to create the illusion of depth.

For example, the clouds move at approximately 50% of the anchor point's movement speed. This layering technique helped make the environment feel more dynamic and visually engaging.

To further enhance the atmosphere, we added a particle system to match the concept art's snowy setting. The particle system simulates gently falling snow across the entire screen, giving the game a cosy winter aesthetic that blends well with our background art. In the future we may add different particle designs for each season, bringing greater attention to nature and Winchester throughout the year.

Prototype 4.3: Updating Customisation

The next major task was developing the new customisation screen, replacing the temporary placeholder version from earlier in the project. Now that we had the final 3D models, we created multiple materials to represent the different leaf colours for our main Eco Warrior character—the tree. We also added support for swapping to the arrow shaped characters, each with their own set of materials and visual variations.

With the updated models and materials, the customisation screen now looks significantly more polished and visually appealing. To improve the user experience, we also modified the layout so that the stat bars at the top of the screen are temporarily hidden while the player is customising their character. This prevents UI overlap and ensures that the player has a clear, unobstructed view of their character while browsing different customisation options.

This is a small but meaningful change as customisation and achievements are a key motivator within our game and we wanted to have the system fully implemented.

Prototype 4.4: Final State

Our most recent updates were some minor visual enhancements to give the player a bit more feedback. Characters now look like they're facing toward the statistics, visually linking the characters emotional state to the stats. Display texts have been updated to look like speech bubbles making the experience closer to a conversation.

After final flares we felt the game was almost complete. We worked on the app icon to make it adaptive where rather than a flat image we have a foreground element and a background element, and it combines them together to make the app icon. This allows it to work on many devices and app icon shapes, such as circles and squares interchangeably.

EVALUATION

Limitations

As a team we felt we satisfied the projects intention, but we definitely made cuts to our potential outcome to fit our scope to the time constraints. Many ideas were floated in discussions that we had to trim from our development to focus our efforts on the key-stone features and overall deliverables. With more time and agency we would be very interested in first hand research and deployment, seeing how an audience responds to our project and then iterating on their feedback.

Post-Development Testing

Once our application was developed, we conducted two quantitative hardware tests, firstly on a Samsung Galaxy A7 and then on a Google Pixel 7 Pro. We wanted to do a test with an iOS device but had no easy access to a test bed however we are confident the results would be similar. All features of the game we had outlined were functional on the Google Pixel whilst the A7 had one error with the AR game implementation due to an operating system compatibility outside of our control due to it being an older model of phone.

Ideally, we would perform a gameplay test with a beta cohort of children in our age ranges and assess their interest and learnings. However, given the short timeframe between final prototype and submission there was no available time to ethically approve, successfully host and assess our findings from a beta test. Rather, we organised an internal test where two members of our group used the application for a few days and discussed their experiences.

We must state that this test was never going to be perfect as the participants have a vested interest in the product as well as falling over a decade outside our target audience age. That said, the results were generally positive and our two participants found themselves stepping outside and exploring Winchester after feeling motivated by their pocket buddy.

We hope this indicates that our project is at minimum a functional game that does motivate some positive habit.

Project Evaluation

We as a group set out to build a fun, engaging and educational game for lower key-stage 2 aged children in Winchester. We feel we have met that goal.

As developers, we all see areas of improvement in our game, but such is the nature of developing a project you care significantly about. There is always more to do and further details to hone.

Members of our group have openly expressed this being one of their most proud creations and one of the few internal disputes we had was a team member getting too excited and doing more work than they were set to do.

We absolutely could do more work and have highlighted the areas we felt limited in however the shape of the project is in a finished and presentable state. Our second round of feedback was exceptionally positive and affirmed our position, giving us just a few things to tidy up before submission.

GROUP MEETINGS

Meeting 1: Discussing ideas for a Winchester-based project

Attendance: Vidula, Sahara, Sin Xuan, Callum, Saph, Aqdas, Haiden-Ruiz

In this meeting, we discussed the project brief, talking about the tracks, aims and goals of this project and what we wanted to roughly do for it. From this, we had a few possible ideas that we thought would be suitable – the majority of which didn't focus on the key areas that they felt could be improved such as King's Walk, Coitbury House and the Old Antique's Market. If anything, we wanted to be able to have our project contribute to the city of Winchester rather than one specific location within it. We initially spoke about potentially about having more spaces that are open to the public within Winchester, that not only boost aesthetics but are also useful / convenient, this could include various seating areas or playgrounds built into artistic structures. At the end of the meeting, we set up our communication channels (Discord and WhatsApp), so it would be much easier for everyone to be on the same page for the project, and we could also discuss and have online meetings.

Meeting 2: Discussing ideas cont'd

Attendance: Vidula, Sahara, Sin Xuan, Callum, Saph, Aqdas, Haiden-Ruiz

In this meeting, we concluded that we wanted to have our project be connected to a primary school in North Walls, as we thought that a good way to improve sustainability within the city of Winchester would be to educate the children who live here, teaching them different ways that they can be sustainable in the city that they are growing up in but also in a fun way, through a game. We realised that one of the biggest problems is that we feel as though children aren't able to learn the full extent of environmental sustainability as it's not necessarily integrated into their curriculums, However, if we have a game that can help teach them key habits that they can involve in their future actions in regard to being sustainable.

To start off with this idea, we wanted to collect data such as air quality, noise pollution, CO₂ emissions etc. in various, frequented locations in Winchester. These include Winchester Bus Station, North Walls (Opposite WSA), River Park, City Centre (High Street) and the Rotunda (at WSA). Saph will take lead and use an Arduino microcontroller connected to a few sensors that will collect this data, compare them to each other and how we can then use it in our project.

Meeting 3: Integrating ethics into our outcome

Attendance: Vidula, Sahara, Sin Xuan, Callum, Saph, Haiden-Ruiz

In this meeting, we discussed ethical considerations into our project, this was especially needed as we wanted to give primary school teachers a survey about their curriculum, what they taught their students in regard to the environment and sustainability but also ask if the concept of our application would be something that their students would enjoy or find useful. We also needed to think about ethics as our main target audience is children, so we would need to gain consent from a parent or guardian so they would be able to use our application but also ensure that we are keeping them anonymous and safe. In addition to this, we wanted to ensure that our game wouldn't be a replacement for primary school education but rather be an extension of it.

Meeting 4: Discussing outcome, assigning responsibilities

Attendance: Vidula, Sahara, Sin Xuan, Callum, Saph, Aqdas, Haiden-Ruiz

In this meeting, we finalised our project idea – Eco-Warriors, a mobile game targeted towards primary school children which further educates them about the environment and sustainability, with Winchester as the main theme. Here we outlined the key sections of our project: research, design, development, documentation. Each member of our group was assigned a role according to their strengths; however, everyone would also be taking a part in every section of the project even if they aren't assigned to that section. The roles are:

Group Lead: Haiden, Design Lead: Sin Xuan, Assessment and Research Lead: Vidula, Research and Documentation Management: Sahara, Development Lead: Callum, Data and Assets Lead: Saph, Resource and Presentation Management: Aqdas

Meeting 5: Working on Interim Presentation

Attendance: Vidula, Sahara, Sin Xuan, Aqdas

In this meeting, we discussed what slides each person should take for the presentation, ensuring that we don't go over time yet also talk about the message that we wanted to communicate for this project, from why we chose gamification / UI/UX design as our track, our target audience and how our project can help Winchester's sustainability issues. We also discussed the design for the presentation, reorganised the slides and ensured that everything we needed was there and ready. By this point in the project, everyone had at least worked on / was starting to work on something – so we assigned the slides in respect to that:

Issues of Winchester: Sahara, Data collection: Saph, Target Audience: Aqdas, Mood board (designs): Sin Xuan, Sustainability Issue: Haiden, Our Solution: Vidula, Prototype: Callum

Meeting 6: Contacting primary school, working on research and unity.

Attendance: Vidula, Sahara, Sin Xuan, Callum, Saph, Haiden-Ruiz

After our presentation, we had a meeting discussing our feedback and what we could potentially change to align with the company's thoughts. We started off with having Vidula contact a primary school, in hopes that they would be able to answer our survey questions and started working on the development of our game. Callum, our development lead, chose the game engine Unity, as we were all familiar with it and it would be much easier to build to an android or potentially iOS device if needed.

Our group lead, Haiden, introduced a traffic light checker on excel, where we would all be able to claim tasks and track our group's progress in regard to documentation and development. In addition

to this, we had two deadlines (development deadline: 26th November, research deadline: 28th November) that we wanted to follow so we would also have time to read through everything, ensuring that all references have been properly cited but also give us time to work on our individual journals and the final presentation.

Meeting 7: Reading Week – working on individual journals

Attendance: Vidula, Sahara, Sin Xuan, Callum, Saph, Haiden-Ruiz

During our reading week, we spoke briefly about our progress – using our traffic light checker to highlight each of the tasks that have been completed, are currently being worked on or what hasn't been started yet. We also started working on our individual journals – to make sure all our work was cohesive and aligned properly. We also decided that we wanted to have smaller meetings for the 3 main sections of our project to ensure that everyone was up to speed, especially in the sections that they didn't fully contribute to, since we only had 2 more weeks before the deadlines, we set ourselves.

Meeting 8: Development Meeting

Attendance: Vidula, Sahara, Sin Xuan, Callum, Saph, Haiden-Ruiz

This meeting was dedicated to our Unity prototype for Eco Warriors. We realised that only 3 people could have access to the Unity project (without paying), so we divided ourselves into groups where we could share our logins and all work on the prototype together. There are various branches that we created for each feature of the game so everyone would at least have something to work on independently or with another team members. We used this meeting to also ensure that both the development team and design teams were on the same page.

Meeting 9: Research Meeting

Attendance: *Vidula, Sin Xuan, Callum, Saph, Haiden-Ruiz*

In this meeting, we focused on the research aspect of our project, consolidating all the topics that we wanted to discuss and ensuring that they linked to the development and design side of the project. A significant part of this meeting was how we could make sure that Winchester's environmental situation and history wasn't completely discarded, as this is a Winchester focused project and although what we are creating isn't necessarily Winchester-specific, we don't want to forget that this city is the centre piece of our game.

Meeting 10: Design Meeting

Attendance: *Sahara, Sin Xuan, Callum, Haiden-Ruiz*

In this meeting, Sin Xuan, who is our design lead, showcased all of the UI designs, characters and features that she designed that we wanted to implement into our game – We then turned these all into assets which we would be able to import into Unity, so the application is not only functional but aesthetically pleasing for children. These were all loosely based on the prototype that Callum had created before our Interim Presentation. This has us caught up and finished with designs.

Meeting 11: Work check-in and final presentation

Attendance: *Vidula, Sahara, Sin Xuan, Callum, Saph, Aqdas, Haiden-Ruiz*

This meeting was a check-in to keep track of everyone's progress, especially with the deadline and final presentation coming up relatively soon. We reviewed the current Unity build – as all the development tasks for the Unity prototype have been completed at this point, and research tasks are just about completed too. We started to discuss what we wanted to do for our final presentation, as we thought to discuss our feedback from the Interim Presentation to show how we've further developed our project. This time around we also wanted to implement a script so we wouldn't get off track and repeat our points. By the end of this meeting, we were on track to having

everything done before the final presentation and be able to be complete with our documentation at least by the 3rd of December.

Meeting 12: Final Feedback and Presentation

Attendance: *Vidula, Sahara, Sin Xuan, Callum, Saph, Aqdas, Haiden-Ruiz*

We met ahead of our days presentation to make sure we were set on our presentations structure and talking points. Our feedback was very positive, and the panel was very engaged in our work, they affirmed our progress and highlighted a few points we needed to completely clarify. We were surprised by the unilaterally positive feedback and quickly tidied our final submission requirements including a group submission review after our presentation where all our documentation hand in content was checked and approved.

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