DECO3200 - INTERACTIVE PRODUCT DESIGN STUDIO

HIGH-FIDELITY PROTOTYPE DOCUMENTATION

THOMAS BRETTELL (TBRE2252)
CHRISTIAN CERDA (CCER2254)
ALANNAH FRANKEL (AFRA9213)

TABLE OF CONTENTS 02

INTRODUCTION 03

Core Background Research

The assigned brief tasked us with designing and developing an interactive web application to tackle misinformation perceived by the public about the Anthropocene. This misinformation is caused by the large amount of complex and sometimes misleading material (Andrews, 2019). The specific issue chosen from this focus area was personal carbon emissions.

To begin the design process, we conducted a thorough competitor analysis to identify key gaps in the current market. Surprisingly, there was a large lack of carbon emission focused games. This led us down the path to create an interactive educational experience to fill this void.

The first background research method we undertook was card sorting, which was utilised to obtain insights on how users perceive the carbon emissions of certain activities (see Appendix A). This process resulted in these 4 key takeaways:

- “I need a product or service to help me confirm or deny the myths I hear about carbon emissions.”
- “I need to be provided with simple and digestible general information about carbon emissions.”
- “I need to be provided with information about how the manufacturing of an item attributes to carbon emissions.”
- “I don’t want to be blamed for my actions, I need to feel reassured.”

INTRODUCTION 04

The second background research method used was a questionnaire. Which revealed the misconceptions Australians held about the size of their carbon footprint. 83.3% of participants assumed they held a medium or small carbon footprint, when the average Australian contributed 8.48 times the recommended 2 tonnes that is needed to keep global warming in check (Our World In Data, 2019) (Gruber, 2018). Another insight gathered from the questionnaire was one of accountability. When questioned about the CO2e per capita of Australia and other countries, most participants believed Australia was only a moderate contributor, with China and India being the worst. However in reality, when compared to other nations in 2017, Australia is significantly worse as it has an average of about 17 tonnes whereas China's is 7 tonnes and India's is 2 tonnes.The questions in the questionnaire can be found at Appendix B.

Rationale

Our end product, The Carbon Quiz, tackles misinformation perceived by the public about carbon emissions by first educating them on what they are and why they are important (accomplished through the beginning cut scene). The concept then informs them of any current gaps in their knowledge about carbon emissions of activities that they may have been unaware of.

This solves the main issue, discovered during low-fidelity testing (See Appendix C), that users do not want to feel blamed for their lifestyle choices. There is no concept that can force people to change their behaviour, however we can ensure that people understand the impact of their decisions and what carbon-friendly decisions are.

DESIGN PROCESS 05

Overall Process

Throughout the iteration process, our team looked at the concept from multiple angles and tested different aspects to fulfil the design principle of stickiness (Gladwell, 2014). This principle includes 6 elements:

1. **Simplicity** - the complex task (such as educating about carbon emissions) can be accomplished through simple interactions
2. **Surprise** - the concept should contain elements that grab attention
3. **Concreteness** - ideas are easy to understand and do not contain complex jargon
4. **Credibility** - the idea is backed by a trusted source to appeal to common sense
5. **Emotion** - the concept elicits an emotional reaction
6. **Story** - the ideas are presented in the context of a story to increase its memorability

The design process began with an idea to place the user in an immersive environment that would mimic their real life. The initial concept was a virtual reality (VR) based experience where users would complete a series of tasks. Throughout the iteration process the concept was refined in order to better fulfill the 6 elements above.

Methods

Different testing methods were used including storyboard interviews, paper prototype think alouds, wizard of oz prototype think alouds, and high fidelity prototype think alouds. These testing methods resulted in a variety of adjustments including changed iconography, user interface, heads up display (HUD), and wording of tasks.

DESIGN PROCESS 06

Iteration 1

The first iteration majorly altered the concept from a VR based game to a first person game. In this iteration, the storyline became free flowing, tasks were displayed in the top left corner and simple 2D pop up panels were added to allow for easier interactions. This gave the user more freedom and allowed for more interactability that wasn't capabale with with a VR based experience (such as interaction with the heads-up display).

ORIGINAL CONCEPT

- VR interaction
- User was placed into different scenarios
- Prompts were displayed at the top with step by step instructions on how to complete tasks
- Users only interacted with items in a 3D space

ITERATION 1

- First person interaction
- User can freely walk around
- Tasks are displayed in the top left corner and can be completed in any order
- Users move around a 3D space and interact with 2D panels

DESIGN PROCESS 07

Iteration 2

The second iteration included different iconography, a changed interaction on the "Make a Tea" panel, a changed task from "go to work" to "go to grocery store", and an added grocery panel. The icon differences were miniscule changes such as changing the "cooking" icon from a pot to a cookbook. Icons were adjusted to reflect properties of familiar objects in the real world in order to communicate their functions, coined as the design principle of mimicry (Lidwell, Butler & Holden, 2003).

ITERATION 1

- First person interaction
- User can freely walk around
- Tasks are displayed in the top left corner and can be completed in any order
- Users move around a 3D space and interact with 2D panels

ITERATION 2

- Changed iconography in 2D panels
- Changed interaction on "Make a Tea" panel from click to click and hold interaction
- Changed task from "go to work" to "go to grocery store"
- Added grocery panel to go along with "go to grocery store" task

DESIGN PROCESS 08

Iteration 3

The third iteration involved adding a screen at the beginning to advise users to make decisions in the game that reflect their real life choices. This was because users would make random or aspirational choices, which did not create a realistic idea of their carbon emissions. We also added some educational cards, that were shown after the users had finished with the prompts. These cards explained what they chose and what changes they could make to reduce their carbon footprint. This was done in order to address the need to educate the user on how to improve their lifestyle.

ITERATION 2

- Changed iconography in 2D panels
- Changed interaction on "Make a Tea" panel from click to click and hold interaction
- Changed task from "go to work" to "go to grocery store"
- Added grocery panel to go along with "go to grocery store" task

ITERATION 3

- Added a beginning screen
- Modified the wording of the prompts to be more specific
- Added an educational component that teaches users how to reduce their carbon emissions
- Miniscule changes to 3D assets and panel iconography

DESIGN PROCESS 09

Iteration 4

The fourth iteration, which was our chosen concept, involved a complete redesign of the gamified aspect of the product. Throughout testing, participants were unable to make choices which correspond with their lifestyle, making the product inaccurate. When they were given feedback on their choices, they were often defensive, and as a result sceptical of the information being presented to them. As a result we changed the nature of the game to be about the users demonstrating their knowledge on the topic rather than being critiqued on how they live their life. Additionally, instead of advising changes to the user's life, they are given information about why the choice they selected was right or wrong.

ITERATION 3

- Added a beginning screen
- Modified the wording of the prompts to be more specific
- Added an educational component that teaches users how to reduce their carbon emissions
- Miniscule changes to 3D assets and panel iconography

ITERATION 4

- Introductory education scene on climate change and carbon emissions
- Removed personal decision making and replace with 'quiz' on carbon emissions amounts
- Redesigned educational component to reflect the users incorrect answers

DESIGN PROCESS 10

Iteration 5

The fifth iteration was made before and during the creation of the high fidelity prototype. Prior to creation, our team sat down to discuss what tasks were going to be featured in the experience. It was decided the "Make a Tea" task seemed too miniscule in comparison to the others. Instead, it was replaced with a "Change lightbulb" task, that forced users to choose the most carbon friendly lightbulb. To help create an intuitive experience, participants were often asked to use the product and think aloud with no instructions. This resulted in error prevention such as a "You can't interact with this object" message and the addition of a "done" button once the user had seen all of the results for a task. We also added a series of panels at commencement which explains the product and how to use it before the game starts.

ITERATION 4

- Introductory education scene on climate change and carbon emissions
- Removed personal decision making and replace with 'quiz' on carbon emissions amounts
- Redesigned educational component to reflect the users incorrect answers

ITERATION 5

- Educational panels showed whether users got it wrong or right
- Added "This item is not interactable"
- Added introduction panels
- Added "done" button to results panels
- Added "Change Lightbulb" panel

CORE FUNCTIONALITY 11

What is it?

The Carbon Quiz is a first person interactive desktop experience that places users in an immersive environment to complete household activities and learn about carbon emissions first hand. The program begins with a short 45 second cutscene that introduces the topic of climate change with carbon emissions as the main cause (See Figure 1). This provides the user with context and motivation to change.

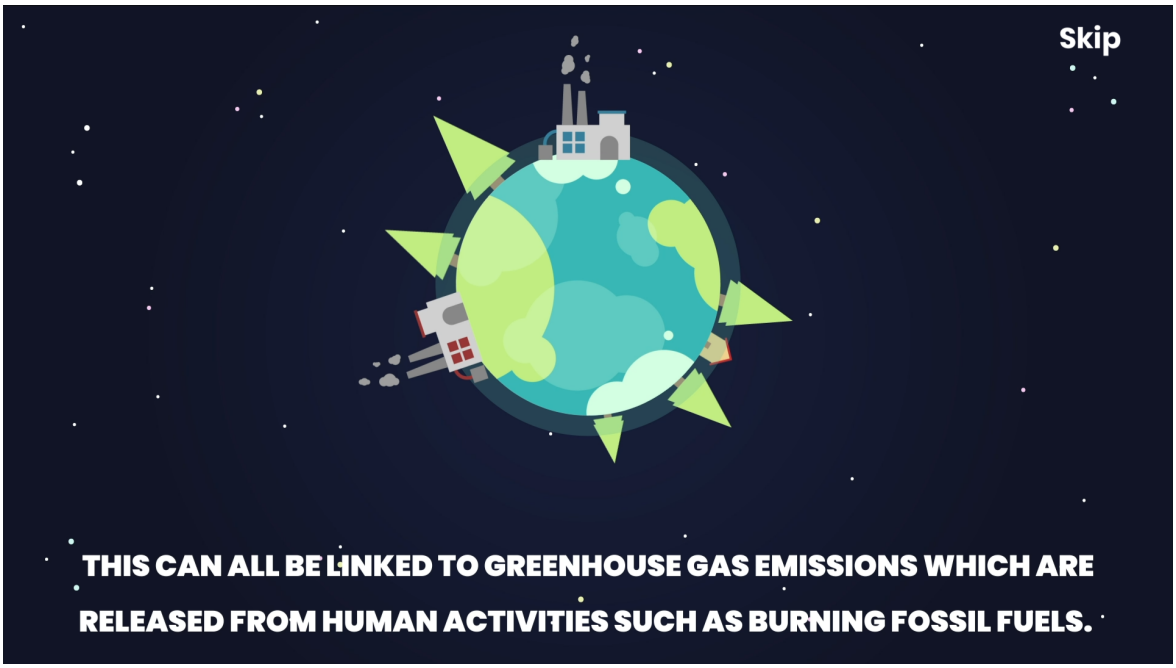


FIGURE 1 - Screenshot of the animated cutscene video.

CORE FUNCTIONALITY 12

With this in mind, the next aspect is the interactive portion, where users are challenged to complete a series of tasks in the most carbon friendly way. With a "To Do List" in the top right corner, users must navigate the house and click on objects that correspond to the taks they must complete. When interactable objects are clicked on, a 2D panel pops up where they can do their task (see Figure 2). Directly after finishing each task, the user is given information as to why they were right or wrong. When all the tasks are completed, the game is finished and the user is given their total overall score.

FIGURE 2 - Featuring the To Do List as well as the 2D interactive panel.

CORE FUNCTIONALITY 13

How does it work?

The experience was built with Unity and C# and was published to itch.io. Mesh colliders on every object ensured the user couldn't walk through items. Raycast allows Unity to register which item is being clicked on and if it is interactable, it will display the corresponding 2D pop up panel. When panels are open, Unity UI buttons are used to trigger actions such as close panel, continue to next panel and

When a task is completed a static integer variable counts, once it gets to 8, the end scene is triggered (see Figure 3). A similar system is used to calculate how many correct answers are chosen. In each if statement, a static integer variable counts when users choose correctly, and this number is directly fed into the end scene when their final score is displayed.

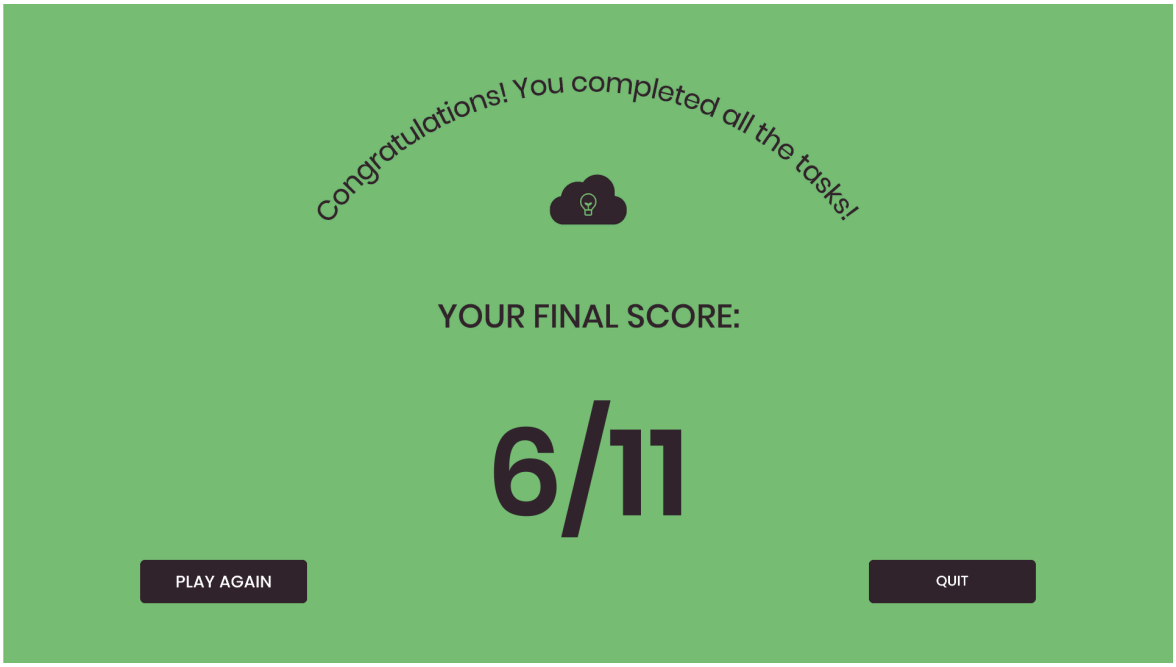


FIGURE 3 - Screenshot of the end scene, which displays the user's final score.

HARDWARE AND SOFTWARE REQUIREMENTS

14

Required Hardware

The required hardware is as follows:

- Desktop or laptop with any with either the windows or mac
- Keyboard
- Mouse
- Speakers or headphones

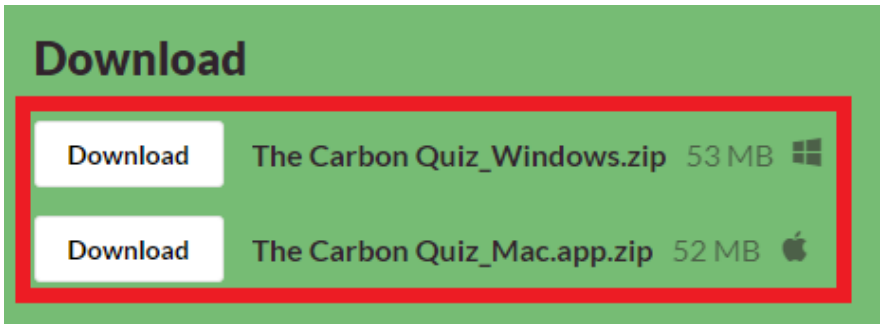
Required Software

The required software is as follows:

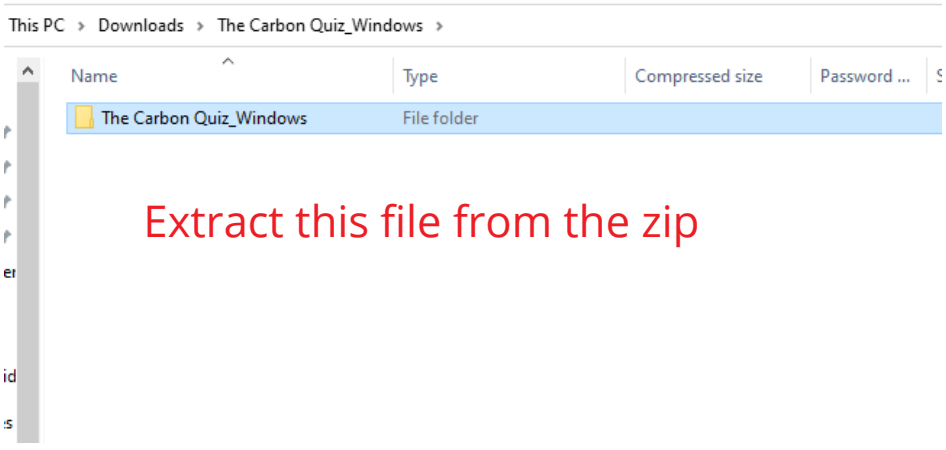
- TheCarbonQuiz.zip
  - In order to run the executable for The Carbon Quiz you will need to extract all the files from the zip file and then run the TheCarbonQuiz.exe or TheCarbonQuiz.app
  - This folder can be download from itch.io (https://thomasbrettell.itch.io/the-carbon-quiz) for your desired operating system

SETUP INSTRUCTIONS 15

1. Download TheCarbonQuiz.exe from itch.io (https://thomasbrettell.itch.io/the-carbon-quiz) for either Windows or Mac

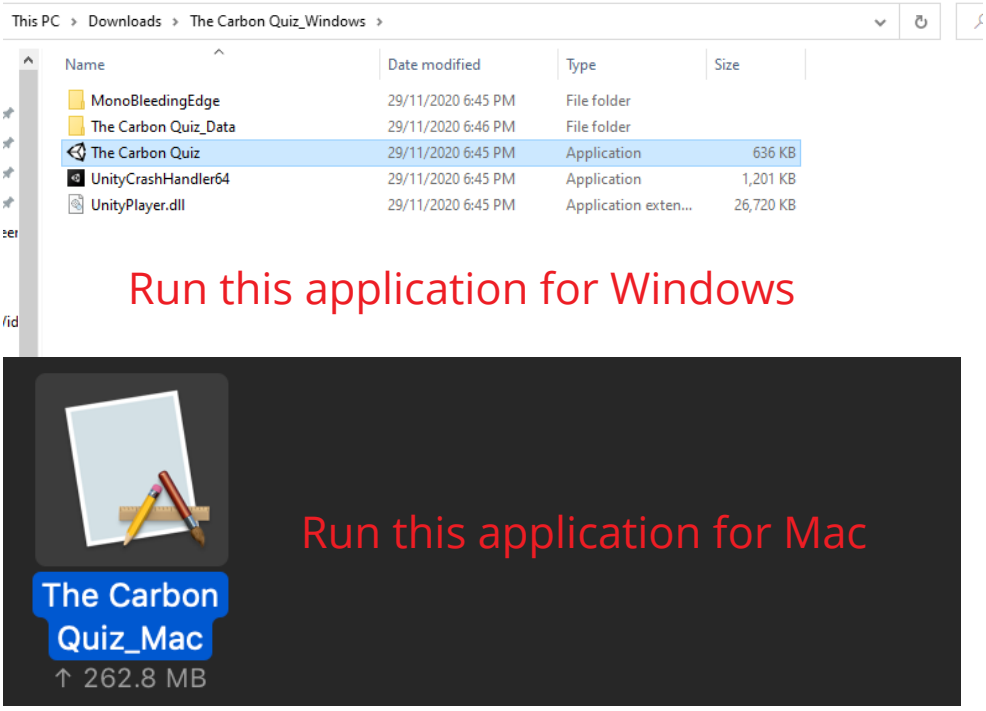


2. Extract the internal folder. This can be done in multiple ways. One option is to simply open the zip folder and copy the internal folder and paste it out of the zip folder, somewhere else on the computer

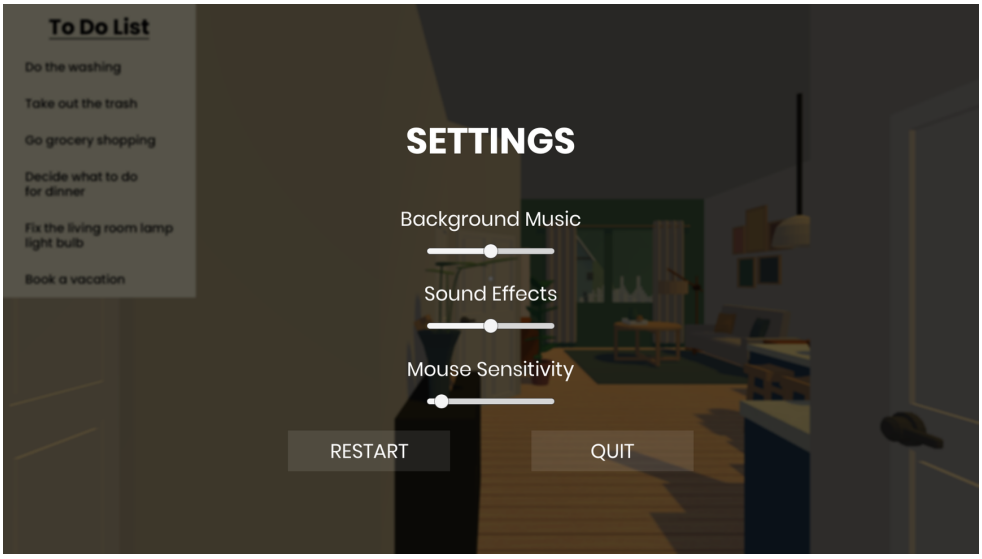


SETUP INSTRUCTIONS 16

3. Run the application. Double click on The Carbon Quiz inside the folder to run the application.

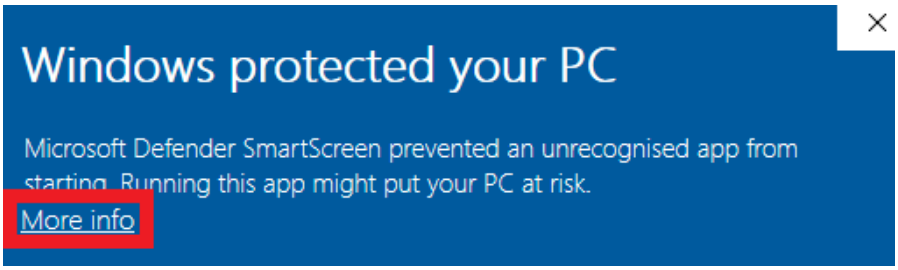


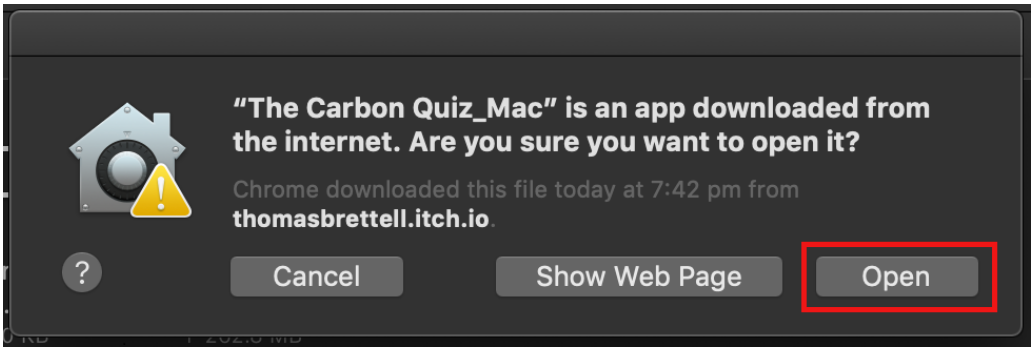
4. Remember that pressing 'Esc' allows you to adjust settings on your side such as turning up or down the volume or modifying the mouse sensitivity

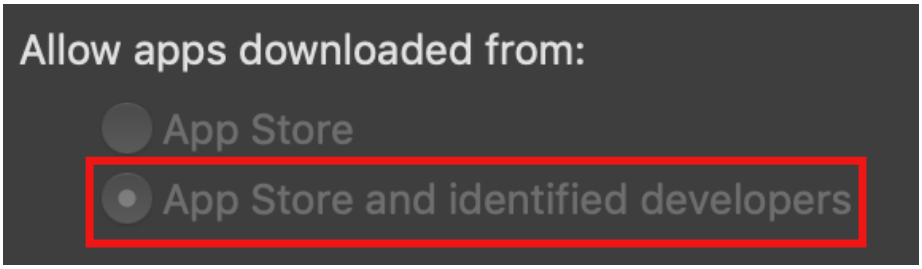


SETUP INSTRUCTIONS 17

5. (Optional) Allow permission for the application to be run. Your computer may prevent the application from being run as it is from an unrecognised publisher. In order to get around this on Windows you will need to click 'More info' then 'Run anyway'. On Mac select "Open' then make sure you have 'App Store and identified developers' selected in System Preferences > Security and Privacy > General.







KNOWN ISSUES 18

The only know issue is dependent on what size screen resolution you use. Depending on your screen size you're using some UI/2D assets may be slightly out of their intended place. For this reasons we recommend you use any 16:9 aspect ratio resolution such as 1920x1080.

FUTURE WORK

With more work our main aims would to be enable support for different platforms (iOS and Android) and operating systems (MacOS) to increase the products outreach. There was also many more tasks that we came up with but had to cut due to time and resource restraints, future work would include implementing these. Finally we would improve the lighting and post-processing, something we failed to achieve to the desired extent due to lack of knowledge and experience in this area.

Justification of Platform Choice

The platform that we developed this product for is Windows and Macs. We decided to not develop for mobile and tablet appliances at this time as the information displayed in The Carbon Quiz forces the user to walk around, thus requiring a keyboard. On a mobile device the controls, interactions and code would need to be different, and due to time and resource limitations we were unable to make this additional version. Despite this we still design the product with these platforms in mind so that it would be possible to release a version of The Carbon Quiz which works and could be run on these platforms once the necessary changes were implemented.

BIBLIOGRAPHY

ICONOGRAPHY AND TEMPLATE FROM CANVA.COM

Andrews, E. (2019). How fake news spreads like a real virus. Retrieved 25 September 2020, from https://engineering.stanford.edu/magazine/article/how-fake-news-spreads-real-virus

Gruber, K. (2018). Reducing Your Carbon Footprint. Retrieved 25 September 2020, from https://particle.scitech.org.au/people/reducing-your-carbon-footprint/#:~:text=It%20is%20estimated%20that%20the,2%20degrees%20Celsius%20by%202050

Lidwell, W., Butler, J., & Holden, K. (2003). Universal principles of design. Gloucester: Rockport.

Our World In Data. (2019). Retrieved 25 September 2020, from https://ourworldindata.org/explorers/co2?tab=chart&country=China~United%20States~India~United%20Kingdom~Australia~Afghanistan&Gas%20=CO%E2%82%82&Accounting%20=Production-based&Fuel%20=Total&Count%20=Per%20country&Relative%20to%20world%20total%20=

EXTERNAL ASSETS 20

Adobe Stock. (2020). Silver Fern [Image]. Retrieved from https://stock.adobe.com/nz/search?load_type=search&native_visual_search=&similar_content_id=&is_recent_search=&k=silver+fern&continue_checkout=1

AShamaluevMusic. (2017). Modern Corporate & Business Background Music / Presentation Music Instrumental - AShamaluevMusic [Video]. Retrieved from https://www.youtube.com/watch?v=s8SrerotCV8&ab_channel=AShamaluevMusic

Cabrera, A. (2020). Bulb icons set Free Vector [Image]. Retrieved from https://www.freepik.com/free-vector/bulb-icons-set_799033.htm#page=1&query=lightbulb&position=28

Cliparting. Eiffel Tower Clip Art - Image #9877 [Image]. Retrieved from https://cliparting.com/free-eiffel-tower-clip-art-9877/

Door. (2017). Retrieved 29 November 2020, from https://poly.google.com/view/aQp17eqOPFn

EXTERNAL ASSETS 21

IN, D. Food Delivery [Image]. Retrieved from https://thenounproject.com/search/?q=food+delivery&i=716976

In game music made with https://www.aiva.ai/

Kulikov, M. (2020). Milk Carton [Image]. Retrieved from https://thenounproject.com/search/?q=milk+carton&i=838357
Leaning Tower of Pisa. [Image]. Retrieved from https://www.pngitem.com/middle/ixwimhb_leaning-tower-pisa-tower-of-pisa-icon-hd/

Low Poly Ultimate Home Pack. (2020). Retrieved 29 November 2020, from https://assetstore.unity.com/packages/3d/environments/low-poly-ultimate-home-pack-164671#description
Plane. (2020). [Image]. Retrieved from https://thenounproject.com/search/?q=plane&i=2269302

US, P. Christmas Flake [Image]. Retrieved from https://thenounproject.com/search/?q=snowflake&i=2143766

GAME REFERENCES 22

Berners-Lee, M., & Clark, D. (2010). What's the carbon footprint of ... a cup of tea or coffee?. Retrieved 29 November 2020, from https://www.theguardian.com/environment/green-living-blog/2010/jun/17/carbon-footprint-of-tea-coffee

Climate Council. (2020). TRANSPORT EMISSIONS: DRIVING DOWN CAR POLLUTION IN CITIES [Ebook]. Climate Council.

City of Sydney. Recycle household waste - City of Sydney. Retrieved 29 November 2020, from https://www.cityofsydney.nsw.gov.au/waste-recycling-services/recycle-household-waste

City of Sydney. Order a garden organics (green lid) bin - City of Sydney. Retrieved 29 November 2020, from https://www.cityofsydney.nsw.gov.au/waste-recycling-services/recycle-garden-organics

How Energy-Efficient Light Bulbs Compare with Traditional Incandescents. (2020). Retrieved 29 November 2020, from https://www.energy.gov/energysaver/save-electricity-and-fuel/lighting-choices-save-you-money/how-energy-efficient-light

Lower Carbon Living: Waste Reducing and Recycling - Carbon Neutral Charitable Fund. (2020). Retrieved 29 November 2020, from https://cncf.com.au/lower-carbon-living-waste-reducing-recycling/#:~:text=For%20starters%2C%20recycling%20reduces%20waste,carbon%20emissions%20and%20energy%20consumption.&text=Food%20scraps%20that%20end%20up,trapping%20heat%20in%20the%20atmosphere

GAME REFERENCES 23

Our World in Data. Which form of transport has the smallest carbon footprint?. Retrieved 29 November 2020, from https://ourworldindata.org/travel-carbon-footprint

Ritchie, H. (2020). You want to reduce the carbon footprint of your food? Focus on what you eat, not whether your food is local. Retrieved 29 November 2020, from https://ourworldindata.org/food-choice-vs-eating-local

Stylianou, N., Guibourg, C., & Briggs, H. (2020). Climate change food calculator: What's your diet's carbon footprint?. Retrieved 29 November 2020, from https://www.bbc.com/news/science-environment-46459714

the Guardian. Tread lightly: Switch off your tumble dryer. Retrieved 29 November 2020, from https://www.theguardian.com/environment/ethicallivingblog/2008/may/02/treadlightlyswitchofftumbl#:~:text=An%20average%20drying%2Dmachine%20cycle,of%20CO2%20in%20a%20year

Wash your clothes in cold water. (2020). Retrieved 29 November 2020, from https://changeforclimate.ca/action/wash-your-clothes-in-cold-water

APPENDIX

To avoid excessive page counts, not all testing material was not included in the appendix. More screenshots, all inclusive calculations and full length transcripts are available upon request.

Appendix A - Card Sorting

Appendix B - Questionnaire

https://forms.gle/ZYs8BsFuTnz2pcyQA

APPENDIX

Appendix C - Low-Fidelity Testing Round 4

post question 1 How enjoyable was this experience on a scale of 1-5?	"I dunno, it did what it wanted to do. Like a 4, I wouldn't go out of my way to use it"	"10/10 I had a great time, it was fun and interactive and had a lot more choices I liked the shopping cart thing and how you cater to the different types of dietary requirements I feel like it caters to a lot of different lifestyles"	2 "because it seemed over.....uh it feels like uni students are pretentious about everything? it just feels like that, when you overthink everything and it's annoying	2.5 "it's not exactly the most riveting experience, could use more interactables, i wanted to drink my tea and watch the kettle fill"	4. 'it was fine'	3	
post question 2 Did you learn something new about carbon emissions?	"I can't particularly say I learnt anything. I could see what I was doing was on the better end but I cant necessarily say I learnt much. Maybe if there was screen after showing what I was contributing I might learn more. 2"	"Besides the transport thing, I honestly didn't think about carbon emissions in the other one I honestly didn't think of the impact and more so what do I do on a regular basis. I don't feel like I've learnt anything, its more I became more aware of where I currently sit 1"	0	4 "i didn't know that driving in congestion was bad"	2	2.5 i suppose. 'neutral'	
post question 3 Did you learn how to help minimise your personal carbon footprint?	"Ill say 2 again. I can see that what i'm doing that if I stay doing it led to the outcome but not what specific things led to it."	"3, I didn't even think about my other options to getting to work. I didn't even consider catching a train or bus to go to work. The fact that the options were there but I didn't actually think about them."	not much...0 "i'm still gonna eat carbonara i'm not gonna eat quinoa and tofu!! are you telling me that people who eat meat are assholes and are killing this world?"	3 "i learned that it means i need to eat plant based protein and that's not happening... I knew a lot of stuff already"	2-3 (2.5)	3	FINDINGS - had issues with navigating the 3D scene, even when instructed how - read the prompt at the beginning but still chose actions that weren't realistic - felt attacked and tried defend actions CHANGES
post question 4 How easy was this experience to use on a scale of 1-5?	"It was fine, very easy. 5."	"5, It was so super easy"	"it was easy so 3 but it annoyed me a lot"	2 "it wasn't hard but i thought the shoes meant leaving the house"	3-4 (3.5)	3	
8. General feedback			felt attacked				