DECO3850 - Physical Computing & Interaction Design Studio

A3: D2: Proposal Report

Team Mars

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1. Concept Description

1.1 Relevance to Theme

My team is working on the theme, namely "Sustainable & Environment". What we are intending to do is to develop an education-oriented game for children, aiming to raise the public environmental awareness as well as the sense of sustainability, and then changing people's behaviors to accommodate resource reusing and energy saving. The game is intended to be experienced in exhibitions and museum. Considering the age group of our main target audience and the complexity of game rules and interaction approaches, at least one game assistant is required to explain and maintain order.

1.2 Game Rules and Mechanics

Basically, this is a resource management game. Players are required to balance the value of profit, resource consumption and pollution within an amount of time to achieve sustainable development. This will be a multiplayer game requesting two to three players to play in each round. In an exhibition, participants need to queue and follow instructions of the staff.

The game will start with a scene includes a forest and a factory. On the game screen HUD, there will be three horizontal bars (shown in figure 1.1), representing the three values mentioned above, two vertical bars, representing the amount of exhaust gas stored in the factory (gas bar) and the quantity of products manufactured (product bar), and a timer counting down from five minutes. At the beginning of the game, players are required to collect resources from the forest, put them into the factory and consume them to make product. By doing this, the product bar and the gas bar will increase and the resource bar will decrease. Once the product bar is fully filled, players can conduct a selling and make profit, which will increase the profit bar. When resource runs over, the factory will have no resource to consume and cannot make profit. The only way to regenerate resource is spending money to plant trees. When the gas bar reaches to 100%, the factor will not be able to run, unless players release the gas into the atmosphere, which will rise the pollution bar. As the pollution getting more and more serious, the difficulty to plant trees will increase. There will be two ways to release exhaust gas: one is releasing without process; another one is processing the gas before releasing. The second way will cost money but will not cause pollution. When the timer reaches to zero, the game will end and the system will trigger one of four endings, including deforestation, air pollution, bankruptcy and the achievement of sustainable development, according to the three bars.

Interestingly, each round will start with the ending status of last round, unless the environment in the game is completely destroyed.


(figure1.1 - 1.2 Game interface)

Each move will need an amount of time to finish. For instance, planting trees needs 20 seconds and consuming woods needs 10 seconds. This will require players to discuss and plan ahead before they move. It is important to note that the level of pollution will increase the required time to plant a tree, which will affect both the speed of resource regeneration and the efficiency on making profit. In order to balance so many elements in this game, making wise decisions together will be the winning key. Additionally, according to our plan, the control panel will be big enough

to force three kids to work separately in three zones with different tasks. For example, one kid will be responsible for cutting and planting trees in forest side and another kid will burning woods in factory side, which means they will have to cooperate to increase efficiency.

In order to encourage players to play until the end and attempt multiple times, cards related to the game will be given to participants as rewards. There are two ways to receive cards: one is triggering one of endings and another one is achieving hidden tasks in the game. Four ending has four corresponding reward cards and there will be a couple of cards representing to different achievements, such as planting twenty trees within two minutes. To collect all cards, multiple attempts are inevitable and targeted strategies have to be made via discussions even compromises during the game process.
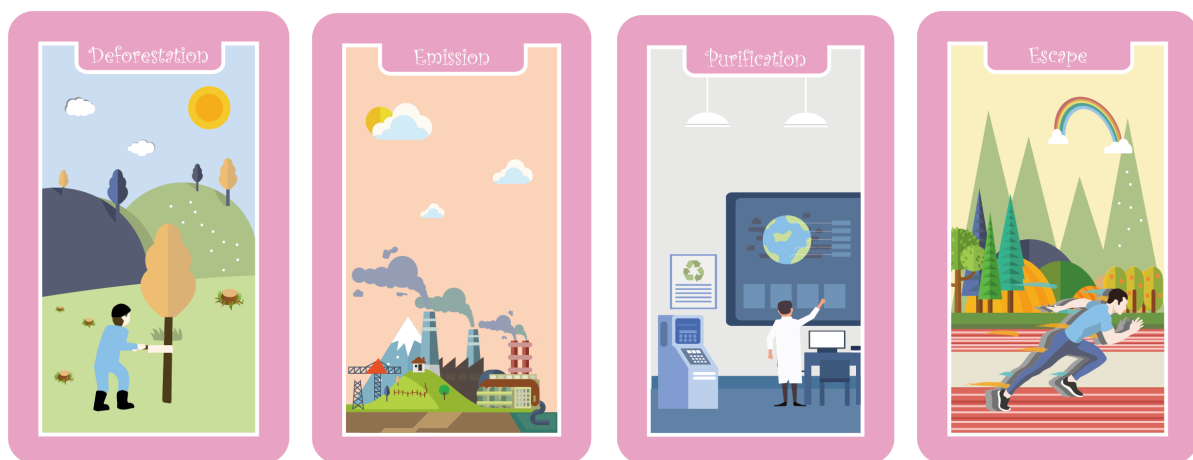
(figure1.3 - 1.6 Reward cards)

1.3 Physical Interaction Forms and Methods:

The game screen described above will be projected on a wall or other form that is easy to be monitored. Corresponding to the virtual environment on the game screen, there will be a physical control panel which is large enough to allow 2 - 3 kids to play together. On this panel, there will also be a factory and a forest that are made cardboards or plastic. In the forest area, there will be plenty of holes with sensors that allows players to plug or unplug tree models in or out, which represents the human activities of cutting and planting trees in the game. Because of the sensors inside those holes, the system will show the corresponding response on the game screen. Objects on the factory area will apply similar interaction methods and there will be three interactable objects: a chimney, a truck and a workshop. We plan to design a rotating mechanism for the chimney to turn on or off the air purifier, which corresponding to the concept of processing exhaust gas mentioned above. To release gas, players will simply need to press down the chimney to trigger the

function. Similarly, the truck can also be press to trigger the function of selling goods. In the workshop field, there will be several holes with the same mechanism of the holes in forest area. Players just need to plug trees into those holes, the game screen will show that the tree is being consumed and how long will the process be done. After the consumption process is completed, the player managing the factory area can pass the model of the tree back to the player managing the forest area to plant a new tree.

1.4 Workflow
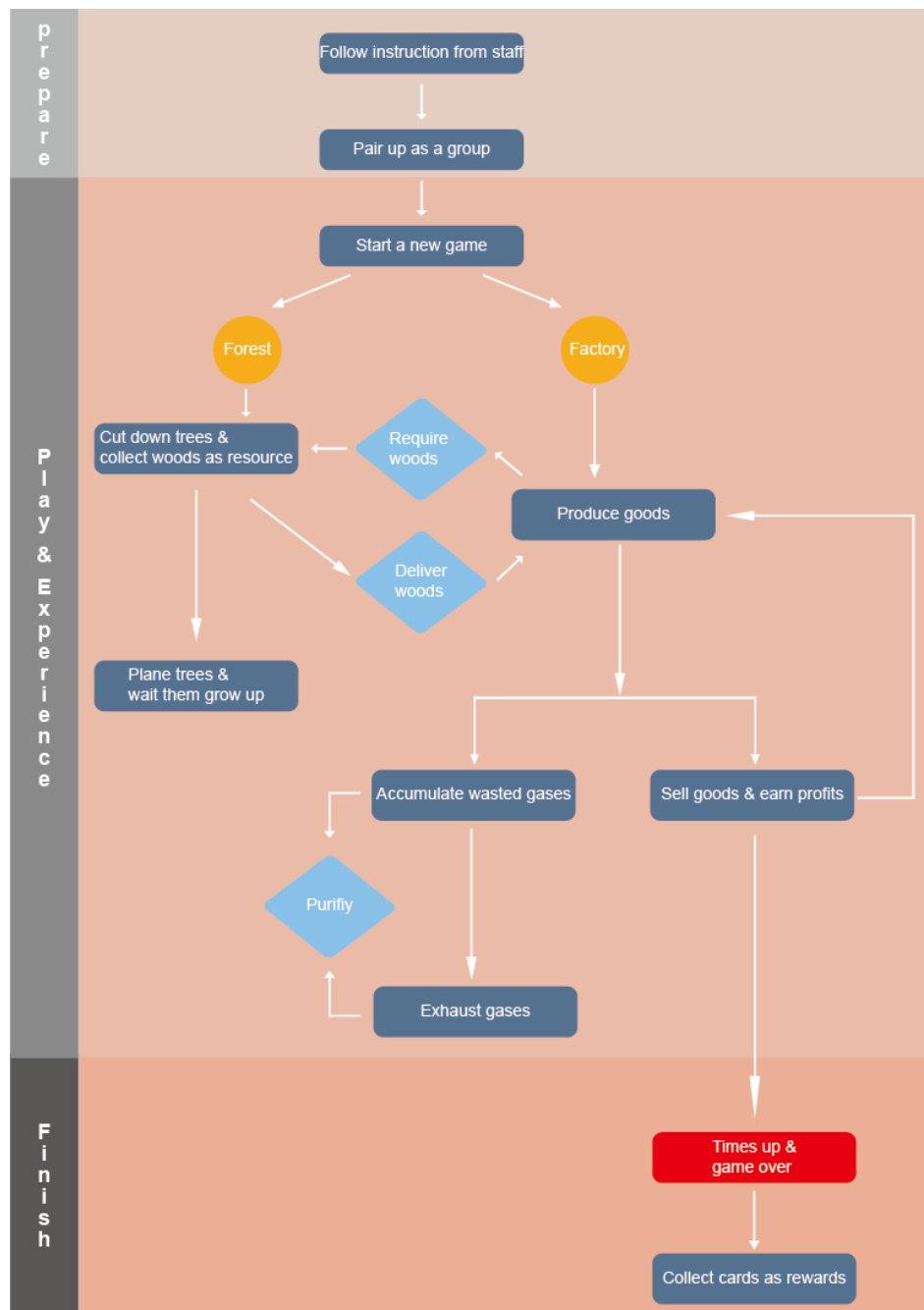
(figure1.7 workflow)

1.5 Storyboard

(figure1.7 storyboard)

2. Design Opportunity

2.1 Target Audience

Our target audience are children aged 9-12 years. Compared with other age group, children have obvious and different characteristics.

One feature is indicated by UX designer Dorottya: the children are able to learn new stuff faster than the adults (2018). We encourage children to study how to protect our environment in their prime of life. Early education plays an essential role in cultivating good habits and raising awareness because it might bring a positive and lifelong impact to people, especially for children. Also, children might have a better performance on cultivating new behaviours through education than adults because of their greater brain plasticity. According to Jesse Maleficio, a child's brain is like a sponge which soaks up all the received information (2018). We should help children be aware of the environmental challenges as early as possible, and then lending them into a relatively right direction.

Other characteristics is children have their ideas for coping with the surrounding environment (Deniz, 2016). Due to this reason, this open-end game is particularly designed for the kids. One appropriate way to educate them might is inspiring their natural curiosity to explore problems spontaneously. In the game setting, a mock-up ecosystem is created and young players are allowed to make own decision. Based on their activities, 3 bars keep altering and then triggering different endings. In this case, they might deal with variety of situations and adjust their conscious decisions.

More specifically, children who are 9-12 years old might behaviour more differently than younger ones. We should understand their patterns of behavior and carefully consider about their requirement, when we are developing this game.

Firstly, the kids at this age have already accumulated some common sense of environmental aware thinking. They may have a higher standard of requirement on enrich their environmental knowledge. Thus, it is a well-timed action to equip them with a an in-depth understanding of sustainability through educational game.

Secondly, it is no exaggeration to say that friendship becomes increasingly important for these children, and even becomes the center of their world. They speed more times on playing, accompanying and interacting with their peers. For adapting their social habits and structures, we try to engage them in a multi-players and collaborative game setting.

In conclusion, after we recognized the importance of early environmental education to children, we decided to target them as our audience. Then, we researched about their characteristics behaviours in order to design this game more suitable for them.

2.2 Intended Experience

We intend to engage with children by designing a playful and education-oriented game.

As mentioned before, the main purpose of this game is to raise children's awareness or to support their better environmental/sustainable behaviors after experiencing this game. Although we aim to educate children, we don't want to directly offering them skills and knowledge about environmental protection & pollution regulations. Our expectation is that players are able to explore the game and make decisions by themselves, thereby understanding the environment issues caused by their activities and minimizing their impact.

During the gameplay, we encourage players to gain profit as a motivation. Players allow to create profitable product, but it need to collect resources from nature and consume energy. In the meanwhile, environmental issues are caused by the pollution that result from the increasing number of players' business activities. Therefore, players need to consider about the balance among sensible resource use, environment protection and economic development.

Again, we want to promote them to make profits in a sustainable way. However, we don't want teach children that using resource to make profits is definitely wrong just because it might negatively influence the environment. In a real life situation, it is necessary and inevitable to consume energy for developing society and technology. The key is to help children understand how to develop sustainably.

3. Related Work:

3.1 Academic studies:

3.1.1 The definition of Sustainability and environment:

For developing a game which closely meet user requirement, we should keep doing more background research to deeply understand our problem space.

As for sustainability, it is described as satisfying the current human needs, without damaging the ability of satisfying the demands from coming generations at the same time (Purvis, Mao & Robinson, 2018) . There are three pillars, including economic sustainability, environmental sustainability, as well as social sustainability. If the three pillars are the fully sustainable, then we achieving the sustainability. Therefore, we decide the core of our game is to balance environment protection and economic development.
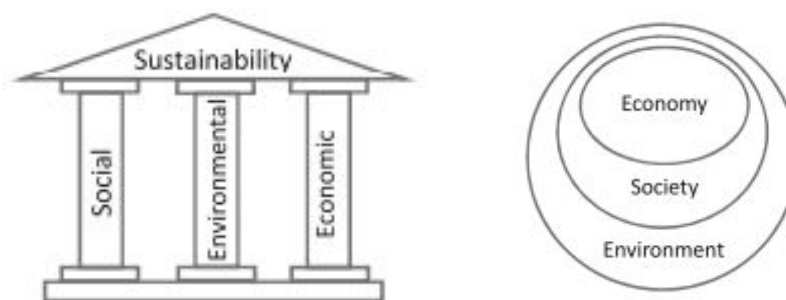
(figure 3.1 Purvis, Mao & Robinson, 2018)

Among these three pillars, the most essential one is the environmental sustainability. If we cannot achieve the sustainability on environment, the other two pillars cannot achieve as well. It is because the social and economic sustainability rely on environmental sustainability. Except this, it draws more attentions, such as some companies commit oneself to decrease the quantities of their carbon footprints, daily waste, and the resources usage to reduce their entire impacts on environment (2018).

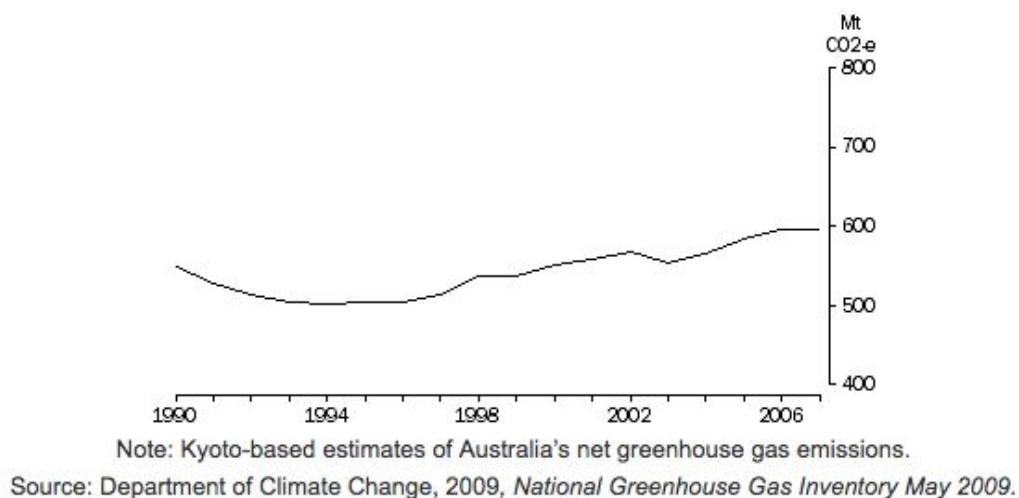### *3.1.2 The Impact of Human Activities on Environment:*

Human activities are restricted by the environment. For instance, the human economic activities consume resources, causes the water or air pollutions, and damage the eco environment. Vice versa. The rest resources will restrict the current and future economic development (4102.0 - Australian Social Trends, 1998). Especially the pollution of water and air, they are able to spread widely to the world, ignoring the borders, extending to the worldwide sea areas, the earth's stratosphere.

Such as the greenhouse problem impacts globally the level of seas and the climate of each countries.

Fact 1: Australian Greenhouse Gases Emissions

From the Australian Bureau of Statistics (2010), the human activities lead to the greenhouse gases, such as fossil burnt, or the agriculture, or land clean-up. Actually, that concentration changed automatically with the time past by. However, the concentration increases rapidly since 1750, caused by the human activities. Besides, nowadays, the concentrations of carbon dioxide is greater than the past 650,000 years.

AUSTRALIA'S NET GREENHOUSE GAS EMISSIONS 1990 TO 2007

Note: Kyoto-based estimates of Australia's net greenhouse gas emissions.
Source: Department of Climate Change, 2009, *National Greenhouse Gas Inventory May 2009.*

(figure 3.2)

Generally, for the emissions of greenhouse gases, Australia only occupies about 1.5% out of the global emissions, while it comes from the high consumptions on coal for electricity, as well as the farming with animal husbandry. According to statistics, the net greenhouse gas emissions, especially the carbon dioxide of Australian from approximate 550 million tonnes in 1990 increased by 9% to about 600 million tonnes in 2007.

3.1.3 Consequence of Environmental Issues:

Currently, the environment of this planet is facing an increasing number of environmental challenges (Narula, 2018). Pollutions not only causes of the global environment problems, such as global warming, climate change, water scarcity, natural disaster and etc, but also negatively influence every individuals. For example, pollution of the environment is the main reason behind many health issues like some types of cancer and cardiovascular disease (2018). There are many reason behind

above problems. The most obvious reason is that we are confronted with cause by the lack of environmental awareness among individuals. Another factor is that even though people believe individuals have the right to protect environment, they concern that only large organizations/institution, like the governments, are able to take the main responsibility for environmental protection because they have more power to tackle such global problems. In other words, what individuals can do/affect is small, and what individuals change/improve is also small.

Therefore, it is necessary to change people's attitudes and bring up the perception of protect environment we are living in, otherwise the effects will act on us.

3.1.4 The soluation with educational meaning:

Fortunately, more and more people have already recognized how important the sustainable environment is. For example, in Sudan, environmental movement started in 1975 with a growing awareness of the serious environmental issues such as desertification, deforestation, pollution, water contamination and etc. (Mohamed, Elagba et al., 2006). However, existing environment regulations on controlling pollutions are often disappointing. The most obvious reason is that these regulations are insufficient to handle with a great deal of environment problems . Although some countries, companies and non-profit organizations have initiated a number of eco initiatives expressed in terms of "green" to take the necessary precautions still they are not enough (Dr. Öğr. Üyesi, Kocaeli Üniversitesi, et al., 2018).

However, there are some useful solution we can learn, such as environmental education For instance, in Sudan,it is already infused in education programmes at the general and higher education levels. While the environmental education focused on the protection and improvement of our total environment, developing and conserving those components traditionally recognized as natural resources (soil, water, forest products), making the population aware of problems, skilled and willing to participate in environmental management. It also provides every person with opportunity to acquire knowledge, values, attitudes, commitment and skills needed to protect and improve the environment, and to create new patterns of behavior of individuals, groups and society as a whole towards the environment. In other words, the major goal of environmental education is to effectively prepare the populations to be capable and willing to implement behavior which improve and maintain healthy environment with high quality.

3.2 Inspirations:

3.2.1 The Biosphere's wastewater treatment plant

(Figure 3.2.1 Faena, 2013)

As wetlands are nature's filters, the Biosphere uses this natural system to clean the museum's wastewater, It's main purpose to generate awareness and encourage people action and become involved with environmental issues (Faena, 2013). This architecture rising people's awareness by providing a recycle system, it shows us a way that not only generate awareness through interaction with the project, but also through materials we use. To be more specific, we can use recycled paper to make the card as a reward and let children bring it back to home, it will bear in their mind using recyclable product are more environmental-friendly.

3.2.2 Connecting! Block Town

(Figure 3.2.2 Marina Bay Sands, 2019)

"Connecting！Block Town"is an interactive artwork reacts to participate input and ultimately response back with a vibrant, thriving cityscape. Participate can use physical wooden blocks to design and connect an evolving system of roads, rivers and railways to keep the ever-increasing traffic flowing smoothly (Marina Bay Sands, 2019). This activity inspire participate creativity and challenges them to keeping everything moving with the increasing amount of traffic. It inspire us with an idea that let participate could create their own "Forest" by moving physical components around. At the same time, participates needs to cooperate and communicate to ensure the whole system is keep running.

3.2.3 TPO Interactive Theater - Colors
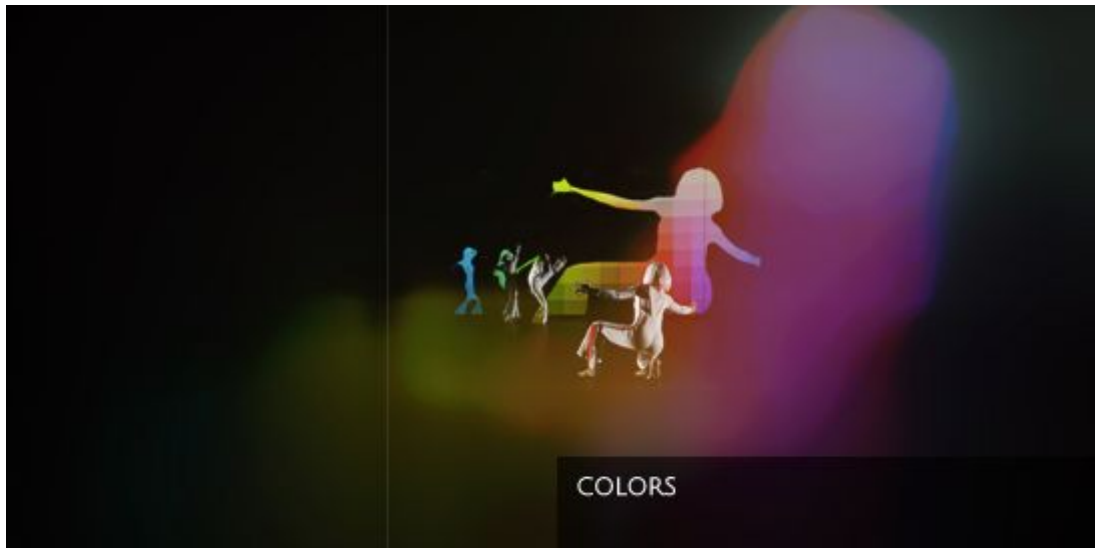
(Figure 3.2.3 COMPAGNIA T P O. 2019)

As an interactive theater, TPO utilise the perform (their bodies and actions) to draw pictures or play the musics. One of the popular one is Colors, which is a combination of dance, images, and design. Three dancers can draw by their bodies, with different meanful colors. While it devotes to invite children to explore the space dramatically, as well as benefits use their eyes and bodies.

3.2.4 Living Library

(Figure 3.2.4 Living Library, 2019)

As an interactive installation, Living Library is a large book projected the really book and corresponding pages on the screen. Accordingly, it has two cameras and a laser projector to achieve it, as well as provide an interactive experience. The users' hand will be tracked, and they can only turn pages to trigger animations to understand the plants and their living areas.

3.2.5 Studio Play
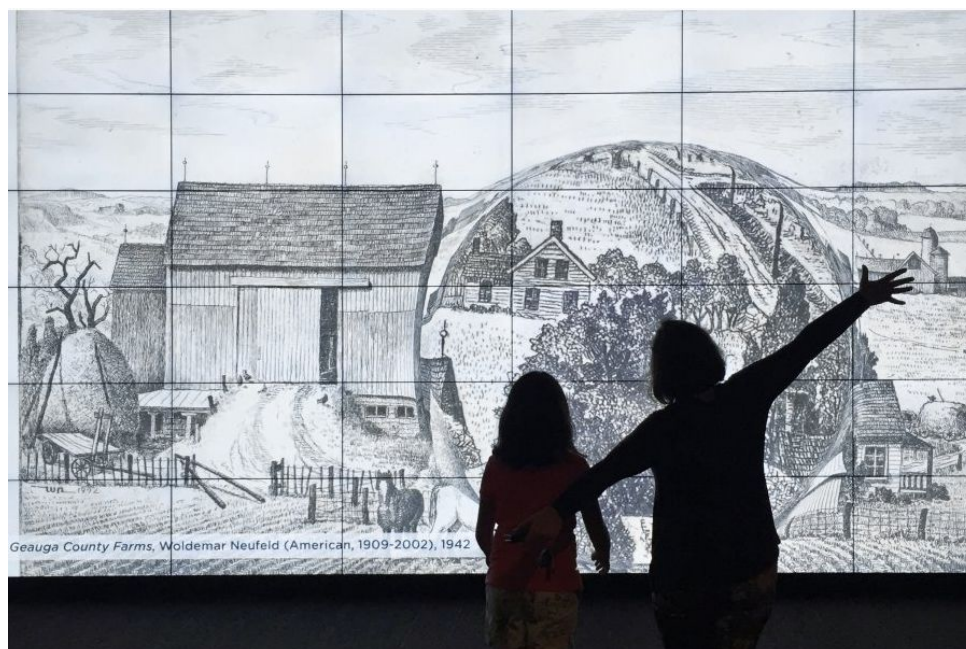
(Figure 3.2.5 Studio Play)

Studio Play located in Cleveland Museum, aims to provide a popular area for both families and children. It mainly creates for the whole family to connect the movements to the game. The visitors could use their body to demonstrate the artworks, or enlarge the artworks via the 4k video wall. They are also allowed to create their own artworks.

This creative design comes from the time-of-flight depth cameras, custom C++, as well as the real-time graphics united.

4. Project Achievement

4.1 Response To Feadback

Since we have presented our idea to studio and discussed with tutors, we received many feedbacks. The feedbacks they came up with are crucial for us to implement the idea, make it more user-oriented. Also, with our in-depth research during couple of weeks, we find more insights about our theme. In response to this situation, we could do several improvements for our design.

4.1.1 Initial idea

Our initial idea inspired by the "Land Simulator", is to design a single-player game for kids age 6-12 years old. The purpose is raising their environment awareness from educational aspect. The game provides a scenery of forest, including the mountains, trees, plants and a factory on the screen, as well as the multiple cards for players.

The players are allowed to cut down the trees to make profit, but the activities also causes the problem of environment meantime. For example, over deforestation causes land desertification. Also, the smoke produced by burnt wood could trigger air pollutions.   There are three bars, profit, quantities of the trees, air pollution modified after each step. Players are required to balance business needs with environmental consideration and develop their business in a sustainable way.

During the game, players use the multi-functional cards to represent the human activities, but only one card can be used in each round. When the several rounds end, the game ends. Players are free to use any cards, but every decision they made will lead to the different endings.

Scanning the card with colour identification or QR Code will be the physical input. Once the card identified, its corresponding effects will be applied immediately and

the scene will be projected on the wall which allows user have better view of the game.

4.1.2 Improvements

	Initial concept	Current concept
Target audience	Children aged 6 -12	Children aged 9 - 12
Number of players	Single player	Multi-players (2-3 people)
Physical iInteraction from	Cards only	Physical elements, Card collection

4.1.3 Justification

According to the feedbacks, our team decided to improve the game project in order to attract target users with more interaction.

Firstly, we could do some improvements for the game mechanisms, as the game was pointed out it lacks of the interactions. The previous card placement interaction will be replaced by the 3D physical elements representing the forest, factory, etc. The players are allow to do some actions on models, then the relevant impacts of their actions for environment will display on the screen. By the way of illustration, the players can get rid of the 3D trees from the physical environment, its corresponding response will be the trees reduced in forest on the screen.

However, we will keep the cards continually without trigger the human activities. The cards will be given to the kids after the game if they achieve the requirements. Such as the player can get a "Plant Trees" card with planting 10 trees.

Secondly, the target audience was the kids aged 6-12 years old at the beginning, but the children are changing during their childhood. The age group is too large to identify their demands from a game, especially their are totally different. In order to solve it, we narrowed down the age group to 9-12 years old kids. That will be easier to figure out the what kind of stuff we provided they accept.

Thirdly, we would change the game from single player to multi-players, currently 2-3 players. This is because, the problem of single player game is the engagement with others. Such as the single player would not have interaction or cooperation with others. If we increase the number of players, it would potentially improves the communication and playability.

More details were presented at the concept description of the report, referring to the introduction.

4.2 Method Of Discovery

In the further work, we would like to explore more details about contextual inquiry and project installation to understand how do the existing interactive designs work appropriately in appointed context, the target audience characteristics, as well as the implementation strategy.

These related works could provide us more inspirations for our project placement, target users, features build-in for the project, and iterations and etc.

4.2.1 Contextual Discovery

For the contextual discovery, we will take the actions on researching and observations. The former is to probe deeply into the existing installations, which are interactive, target-specific, user-friendly, playful, also with high popularity from the internet. Several elements included in the installation will be considered and analysed why it attracts the visitors walked in and stopped to play or enjoy it. Since our installation was decided to lay in the museum, how did the previous artwork integrate with the museum context is crucial to know. We will draw on the experience of that results. Except this, we may pay our attention on the propaganda to see which part they picked as their highlights.

The latter is observing the interactions between the human beings or with the installations in museum context. To achieve it, our group planned to arrange a visit to the Queensland Museum. Our main purpose is to learn a lesson from the current exhibition, especially the way each item used to attract visitors; what do visitors hope to acquire; how do people response; what did they get from display items, etc. This is because, we need to not only consider the size, place, and accessibility of our design, but also care about the solutions.

In addition, we also hope to find the appropriate way to place our installation through visiting the physical museums.

4.2.2 Target Audience Discovery

As mentioned before, our target users are the kids aged 9-12 years old. The kids during this age group are changing a lot. We are not sure what kinds of characteristics of these group have; what will attract them to play; what expectations they have from playing a game, etc.

Hence, there are two methods we picked up. One is the research work relevant to kids characteristics, what we can use to improve the learning ability of kids as more as possible. More important, the existing designs for the children will be explored as well to analyse which kind of the exhibits the most children appreciate.

The other one is interviewing kids aged 9-12 years old and other people who has close relationship with them, such as their parents, teachers to gain some ideas from them. As for children, the results of interviews would be accurate and efficient since they are directly interviewing from our primary target audience. One thing we need to be careful is the attitude and the way that we communicate with the kids. Because of the gap between the ages, our behaviours are easy to be misunderstood by them. In addition, if our performance is not friendly or politely enough, it might lead to the problem that they won't be honest to us and get unuseful, even negative responses. The best way to solve that is close to their communication habits.

For the other interviewees, such as the parents, teachers, they might know more comprehensive about the kids' values, attitudes, and behaviors. For the parents, we would like to know what kind of game is their favourite; do they try to do some actions to protect environment; do they have knowledge of environment awareness; some questions like these. Whereas for teachers, we would like to know which way is most acceptable way for kids to learn the new stuff, enhance their memory; or their attitudes of environmental protection; as well as if the schools provide classes helping kids cultivate behaviours.

4.2.3 Project Implementation Discovery

As the creators of the installation, it is hard for us to fully recognise the problem of it, as well as the thoughts were restricted into our four.

To solve that problem, we will have external discussions and run the user testing to figure out anything wrong, easy-misunderstandable, unachievable points.

For the external discussions, we will talk to the tutors and professor to ask their opinions and suggestions about the current work. That would professionally states our disadvantages, weakness, playful or not, etc. Besides, we have chance to discuss it with peers as well since we shared the concept to the class already. The combination of their feedbacks will be discussed again internal to see the which one we can adopt applying on our project.

Then, user testings take place after we have done the interface design, prototype, and the final product with the generate tasks. We are able to know if our installation

is interactive, attractive, playful, and educational via the user testing. We will try to find some kids aged 9-12 years old, from the public space to have user testings, seems like a kind of interview. But the testers will be given some tasks to do with the project. We will observe what they will do to complete the tasks and the complexity of tasks. After testing it, we could ask them some questions to see if our installation understandable, meaningful, and playful.

4.3 Project Constraints

Category	Issue	Rationale
Theoretical	Game rules	The game rules strictly allow and limit participants to have some certain ways of interaction, but it might reduces the joys of exploring and discovering when participants are playing this game. Also, these rules may be very complex for children to understand and follow. To solve these problems, a brief instruction will be provided before they play the game such as basic game rules step by step.
Methodological	Technical limitations	This project requires sensors to induce and response player actions, including pressing and placement. However, our team still confused about which kind of sensor we are going to use. Moreover, we want to utilise renewable or recyclable materials to build the project for emphasizing our theme. Therefore, we are still considering what kind of materials are the most suitable for this project. Our team decided to do further research on existing technologies to get inspirations. We also need to ask tutor's for suggestions about these issues.
Practical	Responsion	There are many situations in this game, which require responses from the computer. For example, placing a physical tree will trigger resource bar increasing. If time delay occur, the screen and the physical components might not run simultaneously when participates have physical interactions with the game.

		Hence, our team try to set time limitation after each action. To be more specific, players need to wait for several seconds before they take next action.
	Participate behaviour	There might have some unpredictable behaviours since our target audience are 9-12 years old children. In this case, some accident might happen without expectation. Thus, our team decided that let at least two staffs assist participants when they are playing. Besides, the responsibility for those staffs not only guide participants how to play the game, but also prevent potential accident happens or injury to participants. Additionally, further research about children behaviour is required to help us to predict their actions in order to reduce the possibility of accident occur.

4.4 Plan of Work

There are 5 key milestones including generating concept, developing, testing prototype, refining project and preparing exhibit. Each milestone occupies 2-3 weeks and weekly plans were listed below:

Milestone	Week	Task	Description
M1 - Concept	W3	● Team Formation	● Team meeting & greeting ● Initial team ideation & agreements.
	W4	● <u>Proposal Presentation</u> <u>(ddl: 19-20/3/19, in contact)</u>	● Response to feedback ● Concept improvement
	W5	● UI Design ● Project Proposal Report	● Finalisation of UI design ● Finalisation of proposal documentation
M2 -	W6	● <u>Project Proposal Report</u>	● <u>Submission of project proposal report</u>

Development		(ddl: 1/4/19, 11:00am) ● Front-end development	● Animation & Super effect
	W7	● Front-end development ● Back-end development	● Finalisation of front-end programming ● Build database ● Start back-end programming
	W8	● Back-end development ● Hardware development	● Finalisation of back-end programming ● Finalisation hardware development
M3 - Prototype & Testing	**Mid-Break**	● Implementation check ● User testing	● Finalisation of digtal prototype (front-end, back-end, hardware) ● Doing user testing ● Response to feedback
	W9	● <u>Prototype Demonstrations</u> <u>(ddl: In class)</u> ● <u>Prototype Appraisal Reports</u> <u>(ddl: 3/5/19, 2:00pm)</u>	● <u>Demonstration of digtal prototype</u> ● <u>Submission of prototype appraisal reports</u> ● Response to feedback
M4 - Refinement	W10	● Refinement	● Prototype improvement ● Technical issues fixing
	W11	● <u>Project Description Webpage</u> <u>(ddl: Interim, In Class)</u>	● Project web development
M5 - Exhibit	W12	● <u>Exhibit Finished Project</u> <u>(ddl: 28/5/19, At The Edge)</u> ● <u>Project Description Webpage</u> <u>(ddl: 31/5/19)</u>	● <u>Submission of exhibit finished project</u> ● <u>Submission of project description webpage</u> ● Exhibition prepareation
	W13	● EXHIBIT	● Finalisation of project webpage (add build/implementation description, photos from exhibit)

			● Clean-up
			<u>Underline</u> parts relat to assessment task.

5. Team Introduction:

5.1 Overview Insights of Team:

Our team are formed with members from diverse academic background, including designer, programer and researcher. It is our advantage. Also, we have a excellent cooperation experience in previous courses, and we knows each others' strengths and weakness

In this project, each member will contribute to the work equally and agree on the work allocation.

5.2 Team Member Statements:

Team Name: Mars		
1	Name:	Zhou Xia (Elijah)
	Duties:	UX/UI designer
	Statements:	I am the main UX/UI designer so I will take responsibility of animation effect and storyboarding, 3D modeling of terrain & environment for our game. I good at graphic design, basic web development and digital prototype because I have experienced in Adobe sets, HTML/CSS, PHP, Java and Unity in the previous courses. Also, II am familiar with HCI principles. However, my greatest weakness is in advanced programming, so I aim to improve my programming skills and contribute to my team wherever possible. For this project, I expect to design a playful & open-ended game by using interactive technology in order to raise people's awareness on sustainability and environment protection.
2	Name:	Hao Lin (Jason)

	Duties:	Unity Development and Hardware Programming
	Statements:	I will mainly be responsible for software development for this project since I can use Unity Engine smoothly with C# programming. Excapt this, I may need to work on hardware programming as well. For this project, I expect to gain more experience from Unity development process and learn how to use micro-controller and how to program them. Additionally, I hope that our team can actually create something impressive, then I will be able to put it inside my resume.
3	Name:	Jiaiqian Xie (Vivian)
	Duties:	Front-end programer & Hardware developer
	Statements:	My advantages are I have learned graphic design, HTML/CSS which will help my team on front-end development. Also, I have back-end skills like Java, php, SQL. I will be responsible for user testing, data collection and analysis for my team. My weakness are I am not confident with documentation and communication abilities. Because all our team members don't have much experience in hardware area, I am willing to learn that through and build the project with my team. Therefore, I will mainly work on back-end and hardware on the project.
4	Name:	Na Dong (Dorothy)
	Duties:	UX/UI designer
	Statements:	I have experienced the development of both front-end and back-end in the previous study, such as the website design, relational database, as well as the programming. However, I will act as the UI/UX designer in this project that I am good at Adobe Illustrator. I will contribute to the interface of the game, the animation after the actions taking, as well as the physical input from the real installation.

Reference:

COMPAGNIA T P O. (2019). Retrieved from https://www.tpo.it/htm/works/colors.htm

Definition of Environmental Sustainability. (2019). Retrieved from
http://www.thwink.org/sustain/glossary/EnvironmentalSustainability.htm

Deniz, D. (2016). Sustainable Thinking and Environmental Awareness through
Design Education. *Procedia Environmental Sciences*, *34*, 70-79. doi:
10.1016/j.proenv.2016.04.008

Design I/O - LIVING LIBRARY. (2019). Retrieved from
http://design-io.com/projects/LivingLibrary/

Design I/O - STUDIO PLAY. (2019). Retrieved from
http://design-io.com/projects/StudioPlay/

Dr. Öğr. Üyesi, Kocaeli Üniversitesi, et al. (2018). *The Environment Awareness In
The Context Of Art Of Photography.* Retrieved from
https://www.academia.edu/38154377/Foto%C4%9FrafSanat%C4%B1Ba%C4%9Fl
m%C4%B1nda%C3%87evreFark%C4%B1ndaI%C4%B1%C4%9F%C4%B1.pdf

Faena. (2013, Oct 26). *This geodesic dome contains cutting edge sustainable
technology and additionally teaches us how to use it.* Retrieved from Faena aleph:
http://www.faena.com/aleph/articles/biosphere-the-most-beautiful-environmental-mu
seum/

Marina Bay Sands. (2019). ArtScience Museum. Retrieved from MarinaBaySands:
https://www.marinabaysands.com/museum/future-world.html

Maleficio, J. (2018, Apr 11). *Green Schools Alliance*. Retrieved from School
Professional Blogs: https://www.greenschoolsalliance.org/blogs/60/628

Molnár, D. (2018). A UX Guide To The Child's Mind. Retrieved from
https://uxstudioteam.com/ux-blog/design-for-kids/

Mohamed, Elagba et al. (2006) *Environmental Education and public Awareness.*
Retrieved from
https://www.researchgate.net/publication/299389131EnvironmentalEducationandpu
lic_Awareness

Narula, S. R. (2018, Jul 27). Google Play. Retrieved from Environmental Awareness and the Role of Social Media:
https://books.google.com.au/books?id=OA1jDwAAQBAJ&printsec=frontcover&dq=environmental+awareness&hl=zh-CN&sa=X&ved=0ahUKEwj-__Wt9vvgAhVXVH0KHVtRDMAQ6AEIXTAI#v=onepage&q=environmental%20awareness&f=false

Purvis, B., Mao, Y. and Robinson, D. (2018) Three pillars of sustainability: in search of conceptual origins. *Sustainability Science*. ISSN 1862-4065
https://doi.org/10.1007/s11625-018-0627-5

The 3 pillars of corporate sustainability. (2019). Retrieved from
https://www.investopedia.com/articles/investing/100515/three-pillars-corporate-sustainability.asp

Uzunboylu, Huseyin, Cavus, Nadire, & Ercag, Erinc. (2009). Using Mobile Learning to Increase Environmental Awareness. Computers & Education, 52(2), 381–389. https://doi.org/10.1016/j.compedu.2008.09.008

Zhu, Zhengqiu, Chen, Bin, Reniers, G.L.L.M.E., Zhang, L., Qiu, S., & Qiu, Xiaogang. (2017). Playing chemical plant environmental protection games with historical monitoring data. International Journal of Environmental Research and Public Health, 14(10), urn:issn:1661-7827. https://doi.org/10.3390/ijerph14101155

4102.0 - Australian Social Trends, 1998. (2019). Retrieved from
http://www.abs.gov.au/AUSSTATS/abs@.nsf/2f762f95845417aeca25706c00834efa/a0e142fe1fc7738bca2570ec0019e8fb!OpenDocument

4613.0 - Australia's Environment: Issues and Trends, Jan 2010. (2019). Retrieved from
http://www.abs.gov.au/AUSSTATS/abs@.nsf/Latestproducts/4613.0Feature%20Article1Jan%202010?opendocument&tabname=Summary&prodno=4613.0&issue=Jan%202010&num=&view=#AusGHG