River Guardian Yu: An Exploration of an Environmental Game Concept Design

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Acknowledgements

Abstract

Environmental digital games with interactive narrative methods can be a useful tool for conveying environmental messages to increase people's awareness. This is especially true for young audiences who readily accept new media in their daily life. This project was prompted by concern about the impact of water pollution on rare and endangered aquatic animals along the Yangtze River and internationally, and the role of humans in perpetuating the problem. I explore how folklore stories can be applied in a modern environmental game concept to transmit environmental messages so as to promote the traditional values of harmony between human and nature to audiences.

This research project adapts the Chinese folklore stories of Great Yu and the Classic of Mountains and Seas and integrates them through interactive storytelling in an environmental game concept about water pollution damage to underwater creatures. Within the paradigm of concept design, the project creates a modern environmental game case that explores these folklore stories together with the possibility of using environmental games for educational purposes. My game concept aims to promote and enhance young people's environmental education and raise their concerns about these important issues.

Key words: environmental game, Chinese folklore, game concept design, environmental education, educational storytelling

Section 4: Conclusion

Section 1. Introduction

1.1 Project Overview

This project is an exploration of a game concept situated between folktales and environmental games. By exploring effective storytelling methods for environmental education, an environmental game concept is designed to heighten awareness of water pollution and ecological impact. Water pollution is a serious environmental crisis not only for China but also for the world. While I take China as a reference point for the background story of my game, international audiences can still find some resonance in the project since this issue is a global problem for all aquatic animals and human beings.

My research aim is to probe and enable the educational role of the environmental game to enhance consciousness and convey environmental messages. This project will achieve this by combining Chinese folklore culture with some typical water pollution issues that affect our natural surroundings, particularly along the Yangtze River and the endangered or rare aquatic creatures that live there. By exploring the potential of concept design for environmental games, the project seeks to find a better pathway to create more awareness of the current situation of aquatic animals and serious water pollution problems. I also aim to provide an effective way for young children to learn more about environmental issues in an engaging and accessible way. The reason why I chose environmental games as a communication strategy, is because video games are enjoyed by young audiences. The project develops a game concept case, designed for a young audience, by engaging storytelling skills and an interactive learning experience.

1.2 Research Questions

1. How can environmental games become a beneficial instrument or medium to raise younger people's environmental concerns about the substantial harm that water pollution does to aquatic animals?
2. How can folklore stories conveying environmental messages be applied to modern environmental game concept strategies for educational purposes?

5

1.3 Context

1.3.1 The International Waste Problem

Our world produces an increasing amount of plastic rubbish or waste each year, with most of it ending up in the surrounding environment including landfills, oceans, or rivers. Plastic pollution is one of the most important environmental challenges since the world's ability to comply with waste requirements has been overloaded by the rapid development in disposable plastic product manufacture. Following concerns about climate change, plastic pollution has become the world's second-largest environmental disaster for our species (Seay 729). Plastic waste can entangle or be swallowed by fish, gulls, turtles, and aquatic animals, causing asphyxia, malnutrition, and drowning. The excess of plastic waste and the need to reduce it has become a global environmental concern. To assist in easing the problem and raising public awareness about the issue, I studied the present state of one prominent river in my country, China's Yangtze River, using it as an example. And I also studied the current status of other water bodies to help me better understand this topic.

1.3.2 Typical Water Pollution Problems and Environmental Consciousness in China

Water pollution is one of the most serious problems impacting China's people today. There are many sources of water pollution both in China and internationally. Determining the main pollution sources is very important, as pollution has a significant impact on the quality of the water environment and ecosystem. Based on the water quality data from prefecture level cities around the Yangtze River and the Yellow River between 2014 to 2016, agriculture, industry and households are the key sources of pollution that will lead to the deterioration of water quality (Xu et al.1). These sources are entrenched in daily life and originate from human activity; however, people may not realize the scale or seriousness of the issue.

Although Chinese public environmental awareness has recently improved, due to the defects of the environmental protection judicial system, the public's willingness to consciously participate in environmental protection is still insufficient (Hong 5). And as Hong (8) explains, there are cognitive differences between urban and rural residents regarding environmental problems. Urban dwellers tend to think the air pollution problems are more serious than water pollution problems since the urban air quality is worse and they have a better disposal system. Therefore, urban people seem to ignore the water pollution problem which might be affected by their daily activities. So, it is necessary to remind people, especially those who live in cities, about this serious environmental problem.

Taking China as an example for my project, people can get a glimpse of what the common water pollution sources are in our daily life. This research inspired the idea of my project and then I chose these typical problems and added them as themes in different game levels for the

audience to experience.

1.1.3 The Influence of Ineffective Treatment of Plastic Trashes on Water Bodies

The problem of plastic waste has become so pervasive that the United Nations is working to establish a global treaty in 2022 (The United Nations Environment Programme par.1). This pollution problem is most noticeable in underdeveloped countries with inadequate or non-existent garbage collection services.

Take my own nation, China, as an example: the Chinese mainland accounts for up to six seats in the top twenty of the globe's predicted plastic inputs (Lebreton 2) (Fig.1). An article from Nature Communications in 2016 indicates that around eighty percent of marine debris enters the ocean via rivers, while twenty percent is tossed from ships. Rivers can be regarded to serve a key function as a carrier during the process of plastic garbage movement into the sea. Their significance cannot be ignored or underestimated. The following chart shows Yangtze River was one of the most seriously polluted rivers in China in 2016.

Table 1 | Top 20 polluting rivers as predicted by the global river plastic inputs model.

Catchment	Country	Lower mass input estimate ($t\,yr^{-1}$)	Midpoint mass input estimate ($t\,yr^{-1}$)	Upper mass input estimate ($t\,yr^{-1}$)	Total catchment surface area $(km^2)^{21}$	Yearly average discharge $(m^3\,s^{-1})^{21}$
Yangtze	China	3.10×10^5	3.33×10^5	4.80×10^5	1.91×10^6	1.58×10^4
Ganges	India, Bangladesh	1.05×10^5	1.15×10^5	1.72×10^5	1.57×10^6	2.08×10^4
Xi	China	6.46×10^4	7.39×10^4	1.14×10^5	3.89×10^5	5.53×10^3
Huangpu	China	3.35×10^4	4.08×10^4	6.73×10^4	2.62×10^4	4.04×10^2
Cross	Nigeria, Cameroon	3.38×10^4	4.03×10^4	6.5×10^4	2.38×10^3	2.40×10^2
Brantas	Indonesia	3.23×10^4	3.89×10^4	6.37×10^4	1.11×10^4	8.18×10^2
Amazon	Brazil, Peru, Columbia, Ecuador	3.22×10^4	3.89×10^4	6.38×10^4	5.91×10^6	1.40×10^5
Pasig	Philippines	3.21×10^4	3.88×10^4	6.37×10^4	4.07×10^3	2.07×10^2
Irrawaddy	Myanmar	2.97×10^4	3.53×10^4	5.69×10^4	3.77×10^5	5.49×10^3
Solo	Indonesia	2.65×10^4	3.25×10^4	5.41×10^4	1.58×10^4	7.46×10^2
Mekong	Thailand, Cambodia, Laos, China, Myanmar, Vietnam	1.88×10^4	2.28×10^4	3.76×10^4	7.74×10^5	6.01×10^3
Imo	Nigeria	1.75×10^4	2.15×10^4	3.61×10^4	7.92×10^3	2.79×10^2
Dong	China	1.57×10^4	1.91×10^4	3.17×10^4	3.33×10^4	8.54×10^2
Serayu	Indonesia	1.33×10^4	1.71×10^4	2.99×10^4	3.71×10^3	3.70×10^2
Magdalena	Colombia	1.29×10^4	1.67×10^4	2.95×10^4	2.61×10^5	5.93×10^3
Tamsui	Taiwan	1.16×10^4	1.47×10^4	2.54×10^4	2.68×10^3	1.08×10^2
Zhujiang	China	1.09×10^4	1.36×10^4	2.31×10^4	4.01×10^3	1.33×10^2
Hanjiang	China	1.03×10^4	1.29×10^4	2.19×10^4	2.95×10^4	7.35×10^2
Progo	Indonesia	9.80×10^4	1.28×10^4	2.29×10^4	2.24×10^3	2.79×10^2
Kwa Ibo	Nigeria	9.29×10^4	1.19×10^4	2.08×10^4	3.63×10^3	1.92×10^2

Input rate estimates (in $t\,yr^{-1}$) are representative of mismanaged plastic waste (MPW) production and catchment runoff. A lower, midpoint and upper estimate is calculated based on three regression analyses accounting for uncertainties in our field observations data set.

Fig 1. L. LeBreton, *Top 20 polluting rivers as predicted by the global river plastic inputs model*,2016.

The Yangtze River, China's largest river for drainage area, travels across nineteen governorates from the beginning to its junction with the East China Sea. Along the river, there are a lot of people, and many of these locations have factories and farms. Plastic items are in high demand and the garbage is created from these materials, which makes this river a key plastic waste distribution hub in China (Xu et al. 9).

The Heinrich Böll Foundation and Ocean Atlas 2017(19) reported that China ranked first with the worst plastic waste management (Fig.2) since it incorrectly handles around nine hundred million cubic meters of plastic garbage every year, which is twice that of Indonesia. Huge

amounts of plastic waste are disposed of randomly because of the absence of recycling standard processes and environmental consciousness. As a result, people must be made more aware of the problem of plastic garbage and how it will negatively impact water bodies.

Because environmental issues are frequently tied to human conduct and how people interact with their surroundings, environmental consciousness is the most significant starting point for any thinking or problem. According to psychologist Barbara Markway (par.4), humans appear to face so many issues to be concerned about so it's hard for them recognizing ecological hazards that might not appear obvious in their daily lives.

Flawed environmental thinking may be partially responsible for people's negative sentiments or apathetic conduct towards reducing plastic waste. They may not realize the effect of plastic waste on living species, including themselves, including how things may alter in the future if they shift their ideas about how they look at or handled plastic issues. I am motivated to use my expertise to provoke or modify their opinions towards the environment because of this.
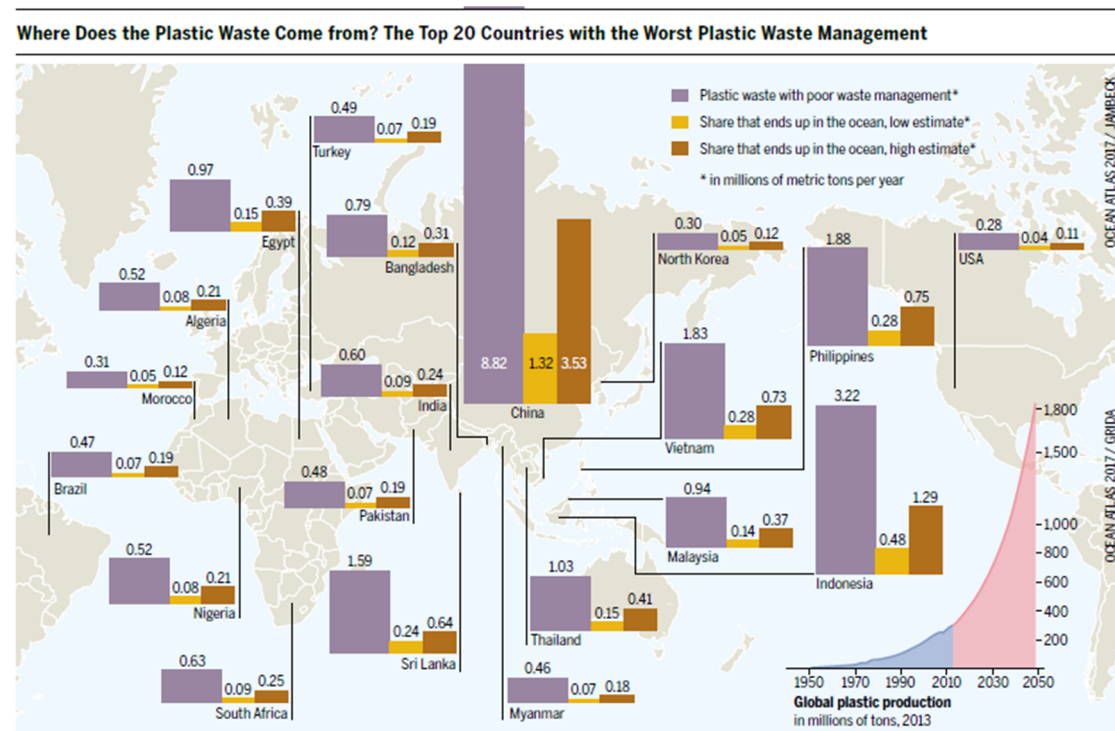

Fig 2. The Heinrich Böll Foundation. *The Top 20 Countries with the Worst Plastic Waste Management* ,2017.

1.1.4 Endangered and Rare Aquatic Creatures in China and the World

Numerous animals come to the river in search of food, capturing the attention and interest of millions of humans. According to Yangtze River Cruise 's introductions, around three hundred different kinds of fish can be found in the Yangtze River's basins (par.4). Ecosystems and food chains benefit from more numerous species and the Yangtze is one of the largest and most important rivers in China. Many typical or rare aquatic animals can be found in the region. Besides, several additional uncommon species throughout the world have piqued my interest and inspired me from the start of this project. This project encourages people to be aware of the current living situation of these animals. Here are some brief introductions of the rare and endangered aquatic creatures in recent years, some of which inspired me to design the key characters of my game.

• **Yangtze giant softshell turtle**

In China, the Yangtze giant softshell turtle (Fig.3) is considered an endangered species with a declining population. According to the IUCN Red List, the world's biggest freshwater turtle has been listed and recorded as a severely endangered species in 2022. As reported by Hance (par 5), just three specimens have been identified as surviving in their natural habitat. After the loss of the last known aged female Yangtze giant turtle at a zoo in China, only one male and some wild turtles remain. The demise of this species is now more imminent than ever. Softshell turtles differ from other turtles with a hard lamella in appearance. They have a large head, a porcine nose, and a robust, glossy shell. This trait allows the turtles to navigate more easily in muddy lakes and riverbeds. Furthermore, as Hance explains (par 39-48), turtle hunters have killed this species in the past in Vietnam. There is a hunter called Hoanh from there who claims this species hasn't been seen or found in many years.

• **Yangtze finless porpoise**

The river's other endangered aquatic species is the Yangtze finless porpoise (Fig.4), also named the finless porpoise. They are the most basic extant member of the finless porpoise family, according to genetic science analyses. It is said that the Baiji dolphin, their close cousin species, was considered "functionally extinct" in the same waters, leading specialists to think that the finless porpoise is the Yangtze River's only mammal since 2007 (Davison, par 2). As He and Chu explained (par.20-31), Chinese officials have taken a number of steps to safeguard the species, including avoiding water contamination, regulating ship activity, and monitoring natural areas on a daily basis. Davison (par 2) indicated that because this aquatic mamma, China's iconic animal, is on the edge of extinction, many Chinese recognize Yangtze finless porpoise as an auspicious symbol. China is their original and native home.

China Institute of Hydrobiology also conducted a survey on the ecological memory of the Yangtze River in 2008 and the result showed that although everyone is strongly aware of resource depletion and environmental degradation, only older people can really realize the

decline of species (Global Times, par.26-27). It seems that young people cannot recognize their disappearance since they have rarely seen these species. Therefore, one of the aims for my project is to help young people know more about these endangered creatures.

• Peach blossom jellyfish

Though peach blossom jellyfish (Fig.5) originated in the Yangtze River Basin of China (Didžiulis 2), now it can be found in freshwaters across the world. The survival conditions for this species are high and tend to appear in places with good water quality. It has appeared in several regions as well as in China's towns and provinces in recent years as the water quality in China has improved (Hou par. 1). As Hou reported, they are one of the smallest freshwater jellyfish on the planet, and yet they are also the most endangered organism as well (par 4-6). The ecological importance of the Peach Blossom Jellyfish is substantial. Its extinction would be a loss not just to China's biological diversity, but also to the world's culture. Chinese domestic intellectual communities have been outspoken in their support for the creature's preservation (Wang et al. 1-6).

• Dumbo octopus

The Dumbo Octopus (Fig.6) usually lives on the seabed under the water depth of around 400-7000 meters and has an average life span of 3 to 5 years. Their fins look like elephant ears, so they are named after the Disney character Dumbo. It was first discovered around 1883, however, people did not find the first sample of this species until the invention of the first deep-sea submersible in the 1990s (Ocean Info par 2). Luckily, although it is rare for people to notice them in the sea, they are not presently considered to be endangered since they usually live far away from the ocean surface and so haven't faced associated threats (Walker par.4).

• Japanese eel

The Japanese eel (Fig.7) is a kind of migratory fish which is born in the sea but grows in rivers and can be found in many Asian countries like Japan, Korea and Philippines by the study of IUCN Red List (Pike et al.). They are eaten as cuisine worldwide, especially in Asia and perhaps mostly in Japan. There is evidence found in Japanese tombs suggesting that eels have been eaten on the islands for thousands of years (South China Morning Post par.2). Due to the pressure on wild stocks from water pollution and overfishing, this species has been classified as endangered by Japan's Ministry of the Environment in 2013(Akihide Kasai 2).

Fig 3. Baidu, *Yangtze finless porpoise*, 2018.

Fig 4. Regina Bailey, *A Yangtze giant softshell turtle in Vietnam*,2018.

Fig 5. Kobe, *Freshwater jellyfish*,Suma Aqualife Park,2011.

Fig 6. Kristen Davis, *An Encounter with Dumbo!*.2014.

Fig 7. Temminck & Schlegel, *Japanese eel Anguilla japonica*., 2018.

1.1.5 The Possible Role of Environmental Serious Game for Environmental Education

According to the United States Environmental Protection Agency (par.1), environmental education is a process that allows individuals to learn about environmental challenges, participate in problem-solving, and take measures to improve the environment. People are better able to choose wisely and responsibly how to respond to ecological problems because they have a deeper awareness of them., allowing them to deal with those situations. I adopted environmental games as the medium to deliver environmental information in order to accomplish a similar goal for the aquatic animals impacted by water pollution problems. The key is people's interaction and involvement because it is difficult to draw audiences to important themes like environmental protection.

Fjaellingsdal and Klockner (2-4) explain that enjoyable environmental gaming is thought to have a major impact on later learning outcomes. An environmental game, according to Nico King (par.25), is a type of game that allows players to manipulate game elements in order to affect and impact the game's environment or settings. In environmental behavior research, digital virtual games like educational games are a promising new research tool, which has been proven to change behavior in real life (de Kort et al.1-2). Also, another related study discovered a link between a high level of game satisfaction when playing a game about local biodiversity (BioDiv2Go) and a later improvement in a positive attitude towards nature (Schaal et al.213-214). All of these studies demonstrate the educational value of serious games for improving audiences' environmental awareness.

Games are associated with having fun, but they also have the potential to convey information about the ecology and allow players to explore ecology in relation to the economy and humanism, though this topic is still developing. As a result, videogames may have a significant impact on people's lives due to their many applications, methods, and strategies, that could be applied to cultivate their science literacy, express ideas and feelings, and convey facts and messages in ways that other mainstream media cannot. Environmental education may be enhanced via using games as an interactive medium to attract audiences by maximizing the effectiveness of this goal.

Section 2. Research

1.1 Literature Review

2.1.1 The Potential Usage of Environmental Serious Game

To a certain extent, the mainstream media has a huge influence on how we see the urban environment. Video games have become one of the most popular media for people to spend their spare time these days and the video game industry is growing fast with 2.9 billion players helping the global markets in 2021(WePC, par 4). What's more, WePC also reported that the Asia Pacific region currently ranks first in video game revenue and China is estimated to reach around 50 billion dollars in the same year (Statista). It is becoming an important digital media for people's entertainment.

Video games are also used for educational purposes as well and this can be an added value for the player. There is a game genre named serious game and it has been proved that these games can change players' cognitive processes by affecting their motivation effectively (Wouters et al. 11). Ute Ritterfeld, a Professor of Media Psychology, explains serious games as providing "a thorough exploration of the claim that playing games can provide learning that is deep, sustained and transferable to the real world." (Ute Ritterfeld et al. xi).

For many years, researchers devoted themselves to studying how to use games to educate people about environmental sustainability messages like climate change and other related problems (Waddington and Fennewald 2). Games with this purpose and function can be described as environmental games, which pay attention to ecology mostly (King, par 9). As King explains, it is not so easy to attract people or audiences to this serious topic or to inspire them through traditional media compared with new types of media, but video games can be a really great medium or a tool to appeal to them for change (par 6).

There are some similar types of mediums and purposes in the video field. Cody (5) believes that those animations as a means to express ecological critique have started with the new word "eco-animation," which may be used to investigate various types of animation, and also ecological issues and environmental narrative. I found there are similar ambitions and characteristics between eco-animation and environmental games. Maybe an environmental game can be called an eco-game since it also aims to convey ecological messages and provide some direction of thinking for the audiences as well. Furthermore, because environmental challenges are always present and require greater attention, environmental games might become an ever-growing field to explore for this purpose.

2.1.2 Environmental Education's Intended Potential Audience

According to Braus and Wood (4), environmental education initiatives should target a few diverse audiences who can make efforts to address future environmental issues. Petito (5) highlights the need for educating youth, for example, about severe environmental challenges as today's youth might be polluters in the future. It will be hard for young people to save the environment if adults do not encourage them to do so and humanity's future will be gloomy if people do not value environmental education for children. Infancy, according to the National Association for the Education of Young Children (Copple et al. 2), is classified as the period between birth and age eight, with a focus on the preschool years. Early childhood is regarded as the beginning of cultivating environmentally aware, whereas preschool is generally where everything begins. However, these major early education activities might be conducted between the period children go to kindergarten and primary school (Merrick 32).

One of the most appealing aspects of video games is that they are an instinctive visual medium, which can always take the child audience straight to the point and make it easier for them to absorb the content through interactive playing or learning experiences. As Ritterfeld et al. continue to propose, "Children's play is inseparably associated with learning. Children explore and acculturate the world through play, extend their skills and competencies, and experiment with possible selves" (4).

Furthermore, well-behaving characters can offer a good example for children when they enjoy the environmental game, and unknowingly sow the beneficial seed of environmental consciousness, which may influence their conduct in the future to cope with these problems. Therefore, video games have the potential to influence a large number of individuals. My intended audience will mostly be children from primary school to the young teen years (approximately from 6 to 15), while other age groups of people might be my prospective audience such as preschool children with the guidance of their parents or teachers if they would like to play the game.

2.1.3 The Education Function of Chinese Folklore Stories

The function of folklore depends on its relationship with the needs of social life. The needs of human social groups determine the occurrence, development, evolution, and survival of folklore (Zhong 3). If folk custom wants to serve people's daily life, it must have certain practical value and adapt to the requirements of people's lives and thoughts at various times.

One of the great functions of folklore is its educational function. Folklore is considered one of the best teaching methods because it promotes oral communication and is considered a good way to narrow the gap between family and school for children (Mzimela 1). China's folklore has various forms, themes, and rich connotations for educational purposes as well. It can not only provide the content for initial education for children but also can offer a good code of ethics, which might shape a person's worldview for their whole life (Yin and Wang 3).

In China's traditional culture, folklore stories are the main structure. They have unique educational value. Effective application of folklore in preschool or elementary education can not only enrich children's educational resources but also be conducive to the cultivation of children's cultural literacy. In the process of learning folklore stories, teachers' effective guidance can not only stimulate children's awareness of inheritance and protection of national culture but also effectively cultivate children's character quality, moral standards, and innovation ability through the rich philosophy or character's good behaviors in folk stories (Hao 1). As Hao explains, children in their elementary education who are nurtured in the traditional culture can more easily form good behaviors in the future subconsciously (3).

As my project aims to promote people's environmental consciousness of the current situation caused by water pollution on aquatic animals, I chose two related folklore stories as my key references for the whole project. One is called 'Great Yu Controls the Flood' and the other one is 'The Classic of Mountains and Seas'. They are the inspiration sources influences on the story narrative and some concept design for the project.

• **Story of Great Yu**

The protagonist of my role-playing game is the guardian of the Yangtze River. Thus, I pick a famous historical figure named Great Yu (Fig.8) and he was a real emperor in imperial China. He was famous for his flood control work and established the Xia Dynasty (the first dynasty in Chinese imperial history) (Fig.9). He established China's dynasty system, upheld its moral standards, and played a significant role in the folklore story of "Great Yu's flood control". Great Yu's flood control is one of the famous myths and legends in ancient China and his deeds were recorded in many famous ancient Chinese books (Jia 1). Because of his heroic deeds, many people even serve him as a god so there are many mysterious folklore stories about him (Fig.10).

According to Chinese folklore stories (Qulishi), the overrunning flood was mischievous at that time. Great Yu's father Gun was instructed by the local tribal leaders to control the serious floods around the central plains. However, Gun tried to solve it for nine years and the flood still existed. Then he was deposed by the leader and the leader asked ministers for another suitable person for this task. It was very surprising that despite Gun not completing the job well, the ministers recommended Gun's son Yu to take over the job because of his good reputation and abilities. Yu was an able and virtuous man and he determined that he would try his best to control the flood and save people. He knew that was a great responsibility to take, so he said goodbye to his new wife with tears and began his journey to control the flood. He learned from his father's mistakes and finally adopted a new way to dredge the water channels and conduct the river to the eastern sea. He lived simply in a small cottage and ate worse than the local people but he was so generous that he continued spending money on controlling the floods. Nonetheless, he was painstaking with his work. He worked for 13 years and had passed his own home without getting back to have a rest. Through his unremitting efforts, the floods were finally under control and people lived a better life for a long time.

Therefore, Chinese people respect and worship him from ancient to current times. Great Yu represents the spirit of devoting oneself to saving others and his deeds inspire many Chinese people even now. He has such a high level of public adoration and respect that people refer to him as one of the Yangtze River's water gods (Dai Yi and Gong Shuduo 6).

I chose this historical and mythological hero figure to be the main character for my game because he is lofty and sacred in Chinese people 's minds and also because he had successfully overcome natural disasters. Nowadays, although floods don't occur frequently thanks to technology, he is a good moral figure for the audiences to think about the relationship between humans and nature. People can tap into the story to have different experiences and gain different understandings of the significance of the environment for humans.
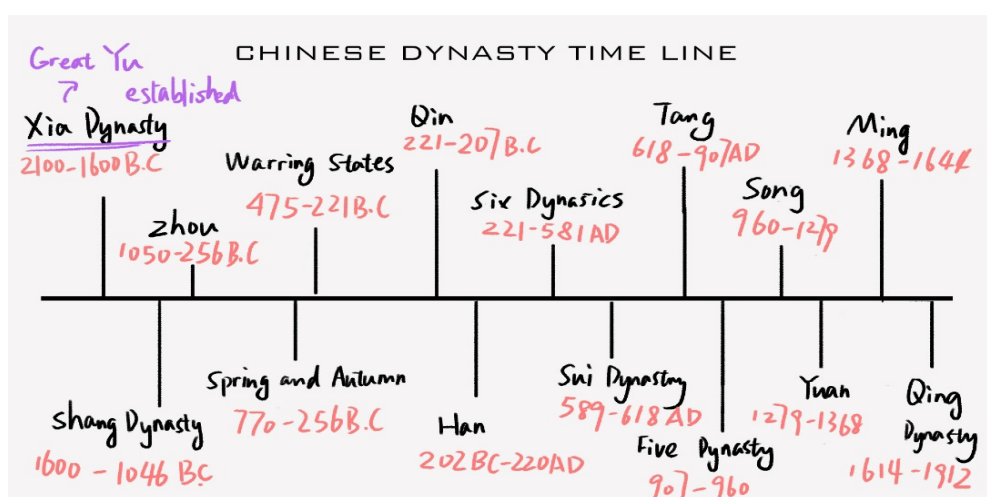

Fig 8. Images of Great Yu.

Fig 9. Chinese Dynasty timeline.

Fig 10. Photo of Great Yu's statues in the temple.

• *The Classic of Mountains and Seas* (*Shan Hai Jing*)

The Classic of Mountains and Seas, also known as *Shan Hai Jing* in Chinese (Fig.13), is one of the most well-known ancient Chinese books and the essence of Chinese traditional culture. It is an encyclopedia of ancient social life covering much content about ancient geography, history, mythology, astronomy, animals, plants, medicine and so on (Hu 97-103). It showcases the ancient culture and records the living conditions and people's ideological activities in the great wilderness. *Shan Hai Jing* outlines the civilization and cultural state in ancient times and provides a lot of useful information for future generations (Guo 2).

Additionally, it provides readers a way to understand the ecological environment in ancient times and the ancestors' understanding and imagination of some unknown things to a certain extent. *Shan Hai Jing* preserved a large number of myths and legends and among these stories, there are many mysterious and bizarre animals which inspire me a lot in creating the aquatic animals' figures because they have many similarities compared with our real-life animals. Most animals are a hybrid of several different kinds of species.

Among all these mythologies since ancient times, many tales are related to water as that is the curial source humans can't live without. And when speaking of water, floods must be mentioned as a key natural disaster and crisis in these stories. These flood myths also have very important historical and cultural values in contemporary times (Yan et al. 1 - 5). According to Jia, Great Yu's stories are recorded partially in this book as well, which inspires me to adapt a story and connect it to other modern tales for current audiences (1). In this project, I have picked several mysterious creatures to be my main creature characters which are all related to the stories about floods. Most of them are a hybrid of different aquatic animals and I believe some of them can be designed and adapted as familiar creatures to evoke more feelings in the audience about our endangered or rare aquatic creatures. The book is not only a masterpiece but also a kind of culture, which is embodied in all aspects. Nowadays, there are many successful works like picture books, video games (Fig. 12) or movies (Fig. 13) adapted from *Shan Hai Jing*.

17

Fig 11. Cover of different versions *Shang Hai Jing*.

Fig 12. Related artworks about *Shang Hai Jing*.

Fig 13. Related film (*Fantastic Beasts and Where to Find Them 2*) ,2018.

2.1.4 Dynamic Narrative and Educational Storytelling in Environmental Digital Games

Environmental games focus on design, mechanics, and visuals, and use games to increase audience knowledge of environmental issues. The major motive of these games is to arouse the players' curiosity, ingenuity, instinct, and curiosity (Lebowitz and Josiah 5).

It has been proven that some dynamic environmental games with interactive storytelling about environmental issues can educate people. Stimulating climate change scenarios in environmental games is an excellent method to attract players (Crookall 196). Their objective is to use interactive narratives to build immersive experiences and make connections to people's feelings. With these dynamic narratives and experiences, audiences can have more realistic and real feelings about the current issues more directly. They might accept some environmental knowledge more easily and effectively when they enjoy the game (Schaal et al. 213-214).

Games give us a sense of agency over something we can't control in the real world. They encourage audiences to take action and make some modest contributions to the game's universe rather than being a passive observer. Nowadays, increasingly schools are starting to teach good environmental habits and benefits from the very first day of class. Because of games, environmental education has been converted into a fruitful learning experience for pupils and educators. Nico King (par.33) also lists some reasons why people want to enjoy environmental games and one of them is the dynamic learning experiences for the players. I discovered that all of these reasons are about how environmental games can allow players to interact with an authentic virtual world based on the stories created by game designers.

Also, according to Lebowitz and Josiah (5), the capability of gamers to engage relies on their ability to create complex, layered narratives, which may be more difficult to tell or exhibit in other media. Although digital games are a fantastic medium with a wide range of stories, their interaction ability sets them apart from conventional media like novels or films. Lebowitz and Josiah mentioned that while players enjoy the fun of games like adventure and role-playing games, most followers of these kinds of videogames seem to have no enthusiasm for games that lack intriguing characters and narratives (8). Hence, I believe that a good tale can enrich nearly any game, or, to put it another way, an appealing narrative can become engaging. These two can cooperate closely together.

In other words, with intentional storytelling strategies, a story may be conveyed interactively in a game. People have utilized games or other similar forms for education, pleasure, and engagement for centuries (Martin 24-33). Presently, for younger generations, I believe this method is particularly appropriate for my project, the role of videogames can be activated through interesting storytelling in promoting consciousness to the younger generations about major water pollution concerns.

2.1.5 Educational and Motivating Influence in Digital Games

Many academics have identified digital games as a viable medium and tool for informing individuals. After completing an adventure education course based on digital games, Lin (60) argued, through a subsequent study, that completion of such games could allow for the creation of human collectives with distinctive traits and solid interpersonal ties. According to Arnab et al, psychologists in education fields say that bringing new technology into education, such as videogames, may increase students' engagement and enthusiasm to learn (27). Likewise, students' motivation degrees with various educational levels are connected to the utilization of digital games for the instructional purpose (Proulx et al, 80).

All of these studies revealed that videogames have excellent educational benefits and may drive people to alter their views and actions to some extent. As a result, I think that by examining the mechanisms and creative style while constructing an environmental videogame, a relevant serious game for players to get more environmental knowledge may be built and inform them about the present environmental issue.

As King explained, since environmental issues are often linked to human behaviors and interactions with the environment, environmental games may be a useful tool for disseminating environmental concepts (15). Environmental games have been demonstrated to be beneficial in raising everyone's environmental awareness in regard to educational purposes. According to Fjællingsdal and Klöckner, learning through the form of the game is an effective method for educating and promoting ideas to individuals (1-2). These researchers conducted research on an environmental game named *Eco* from players' feedback which demonstrated to be effective at spreading the environmental message (9). And there are many other serious digital games like *Plasticity* and *Beyond Blue* which try to educate or inspire players about environmental issues these days (Sutcliffe, par 1–10). That means video games could be a very effective tool to be used for educating people about ecological concerns.

Thus, it can be surmised that video games can be effective visual communication instruments for enlightening audiences about the tight connection between humans and nature. Although we do understand the educational value of environmental games, the role of narrative and aesthetic styles in their delivery may contribute to the essential nature of evoking audience empathy. According to a game designer named Bart Stewart, "Environmental storytelling is the art of arranging a careful selection of the objects available in a game world so that they suggest a story to the player who sees them" (par.10). Since the key function of environmental games is to raise people's awareness, their concept art should be a significant research element.

Precedent Analysis

The three precedents below will assist me in learning more about how to develop and mold a strong tale using various characteristics or strategies seen in good visual works. Many video games focus on concept art for an environmental game that directly addresses environmental concerns, so I have picked three cases to learn how a digital environmental game typically works for educational purposes. These are my environmental game precedents because they are notable examples that are particularly influential or popular serious games for bringing about public environmental awareness. These precedents of game design inform part of the project and provide a model of what a good environmental game would be. Also, it is important to analyze how other media encourage environmental education in China so I have studied other kinds of media for this purpose as it would be good to understand how environmental messages can be sent effectively or what other issues can be improved in this field.

2.2.1 Environmental Serious Games as a Genre

• *Plasticity* by *Plasticity Games*

Plasticity is a brain videogame about a place filled with plastic and players must try their best in order to rescue the city. Noah, an inquisitive little girl who has left her miserable home in pursuit of utopia and a brighter world, is played by the players. According to game reviewer King, Players' actions in this video game will continuously influence the game's and story's future directions, and players will embark on a sentimental trip around the globe (par.66).

One of the most appealing aspects of this game, in my view, is that the game creator allows gamers to actively experience and influence or preserve the environment rather than simply observe it and not do anything. I believe this game motivates people to take a more personal interest in our present terrible pollution condition and to take tiny steps to improve it. For instance, gamers can move garbage to prevent contaminated water from leaking, or they can assist animals in escaping from plastic containers in their jaws.

Furthermore, the creative style is different in that it employs minimalist art via the application of basic and rudimentary geometries, and the majority of the textures are made of solid color blocks and lack intricate patterns (Fig.14). Despite the game creator's passion for minimalism, the game nonetheless presents the audience with an overpowering plastic city image, which might confront them with plastic waste concerns and prompt serious ideas. The way players walk from left to right gives the game a great sense of story and is simple to follow with different game levels.

Fig 14. Stills in the environmental gameplay video of *Plasticity.*

• *Beyond Blue* by *E-Line Media and BBC Studios*

Beyond Blue is a story-driven adventure game. Audiences can discover the wonders of the sea from the perspective of a marine adventurer and researcher called Miley. She and her new research group are the main characters of this game. Her team employs cutting-edge technology to monitor, hear and engage with all aquatic species. As King explained, some of the top ocean specialists from this academic circle have collaborated to create this bizarre journey of an uncharted planet (par.73).

The game takes place in the not-too-distant future. One fantastic aspect of this game is that it not only allows players or audiences to experience joy while playing, but it also includes an encyclopedia in the videogame that contains all of the sea animals you may meet on your journey. These animals are exact replicas of real-life sea creatures. This game can be a swimming simulator for players since they can scan every sea creature they meet and take some samples or record them for research purposes in the in-game database.

Through vivid 3D models and similar lights in the underwater world, the game shows the insights and lenses of the prize-winning documentary *Blue Planet*, allowing its players to comprehend and explore our amazing ocean. Therefore, I think it is also crucial to apply some film technology to enhance the player perception in the exploration game. And also, this incredible 3D undersea world (Fig.15) has given the audience a more vivid and exciting experience, which might engage players more compared to 2D visuals.

After playing, I believe audiences will enjoy themselves in this beautiful sea world with all these amazing marine animals and this is no doubt a beautiful game. However, it doesn't emphasize environmental education enough and players can mostly only observe and collect data passively. From my point of view, what is missing is the information about sea creatures' current survival situation and also it could be better if the player can interact with these adorable species.
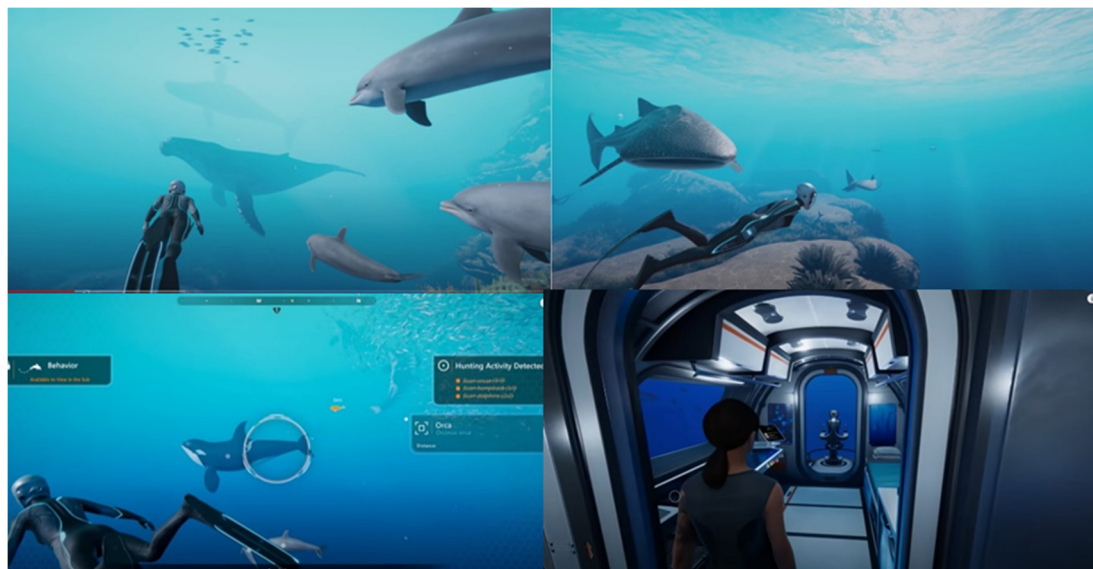

Fig 15. Stills from the gameplay video of *Beyond Blue.*

• *Save a Rhino* by *Hello There and Perfect World Foundation*

Save a Rhino is a smartphone game about avoiding the threats that rhinoceros face, and also provides information about current actions to keep the animal from extinction. Players can act as a rhino or elephants attempting to flee poachers. They can also assist the *South African Army* in stopping poachers from slaughtering rhinos across Africa's enormous flatlands. Rhinos are attacked and murdered continuously because of their valuable body parts, for example, their horns, which are sold on the black market for astronomical sums (King). *Save a Rhino* was created to raise awareness about rhino poaching and funding for the Perfect World Foundation's rhino conservation activities (par. 83).

The mechanism of the game is quite simple (Fig.16). The primary task for the player is to run fast toward the destination which is a gate of the foundation. During their routes, they need to run faster than the hunter and avoid obstacles like big stones or bushes in case they trip over. Also, there is a stamina bar for the player to see whether they have enough strength to run. Hitting the shining red flowers whose function is similar to herbal medicine, can replenish stamina. When the stamina bar is at a high level, the rhino can run at full speed, which is

23

interesting. The composition of its user interface (UI) is clean and stylish with almost all black icons.

This run competition mode reminds me of another famous game named Temple Run. As game reviewer Holt explains, this kind of game can tempt people to keep playing (par. 13). By discovering the beauty of similar work, I believe it is beneficial for a game to set some goals for the player to accomplish.

I found this method of letting audiences play the role of the animals to be effective because when they act as the characters, they will recognize themselves as them and feel more affected by their situations. This is likely to facilitate some empathy for players. However, I still see that there is some limitation to let players play as animals instead of human beings themselves since that is who we are in our real life. When acting as the endangered animals, players can hide and ask for help. Having the players acting as animals perhaps might sidestep the role of human responsibility in the problem. They seem unable to use their initiative very well. So, in my project, I will try to change this situation and let audiences exert more subjective positivity.

Fig 16. Stills from the gameplay video of *Save a Rhino.*

2.2.2 New Media for Environmental Education in China

In the Internet Era, the pattern of information dissemination has been reshaped, and the effective use of new media is a powerful starting point to improve the effectiveness of environmental publicity and education. Cote(par.1) proposes that new media means any digitally distributed media or any sort of internet-based communication. According to the 45th statistical report on the development of China's Internet by the China Internet Network Information Center, as of March 2020, the number of Internet users in China was 904 million, and the Internet penetration rate reached 64.5% (1).

In the Internet Era, the birth of new media has changed the original mode of communication. As Huang explained, the publicity effect of traditional media such as newspapers, posters, television, leaflets and exhibitions is getting weaker and weaker while other new media such as short videos like Tik Tok become more and more popular in China (1). Environmental education is valued gradually for young children. As early as 2003, China promulgated the special education outline for environmental education for primary and secondary school students, and set different educational content standards for primary, junior and senior high school students according to their age (Ma et al. 73–75). Whether primary school, junior middle school, senior high school, or university, they will use extracurricular activities to carry out environmental education after school. It will be a great opportunity for new media like environmental games to help promote environmental education in young people's spare time.

New media is imperceptibly affecting people's awareness of environmental protection. There are many forms of environmental education in our current society. Movies on this topic are quite popular in China. One example is an animation named *The Legend of Hei* (Fig.17) which intersperses long-standing ideas around the relationship between man and nature with stories about the contradiction between human beings and other creatures. The main character Hei is a black cat spirit whose home was destroyed by greedy human beings. It not only refers to the destruction of the character's home in the film but also reflects the emergence of environmental concerns in society. This movie can lead the audience to think more about the relationship between humans and the environment (Ma et al. 75). I believe environmental games with similar story concepts can achieve the same goal to affect the audience positively.

Another related example is the campaign named *Ant Forest* (Fig.18), which was launched on the Ali pay application. It is a simple mobile game that lets players plant and water the artificial trees in the application every day. When the artificial tree grows big enough, Ali company will plant a real one in China. Through taking care of the tree, people are encouraged to take part in these carbon-reduction activities, which is quite promising.

However, Zhengguo Ye, a Chinese researcher from the Yangzhou Institute of Environmental Sciences, has claimed that although the interactive relationship between environmental publicity, education, and new media is a promising avenue, there are limited options on the market (73). Ye emphasized that the application of environmental publicity and education in new media is very limited nowadays and making full use of new media for environmental

education is an urgent need (73). It is imperative to make full use of the characteristics of a wide audience and the interaction of new media to do a good job of environmental publicity and education. So, although there are many other new forms for encouraging environmental education in China, more applications in new media like environmental games should be explored as soon as possible. This is one of the reasons why I want to develop the project.

Fig 17. Poster of The Legend of Hei ,2011.

Fig 18. Screenshot of Ant Forest by Alipay.

Section 3: Method and Process

3.1 Design Approach

Concept art can be applied in many design fields and it is a crucial method for designing a game from the beginning as well. Game concept art is a design draft displaying particular game features such as characters, scenarios, objects, and so on, and it's a crucial and autonomous task that can assist industrial production and provide a brief feeling or understanding of the game concept for audiences (Xiang 419). As Xiang explains, game concept art not only influences the production mode, fabrication and cost in the mid and late stages to a great extent, but also has a significant impact on the game's final presentation (419–420).

Developing and expressing concepts is an important component of a concept artist's job. However, there is some misunderstanding about concept art. Kontkanen found that people tend to consider it as a collection of polished and meticulously created digital artworks (11). He emphasized that presenting and conveying the stories or ideas of a concept is a concept artists' primary task instead of creating perfect images.

The most common form through which to present concept art is painting. However, I think there are some other powerful methods that can be used for the same purpose. As Kontkanen explains (76-77), 3D techniques can be applied effectively in presenting digital game concepts. Additionally, other researchers also underline the effectiveness of animations for promoting environmental awareness (Ahmed 1-3). Animation is a useful tool for my project as well and it is used as a trailer and gameplay demo to demonstrate the game concept and give audiences some sense of the plots, mood and characters of the game about the project. Therefore, I decided to apply all these methods of concept in my game concept project. The below diagram demonstrates the flow of the project (Fig.19).
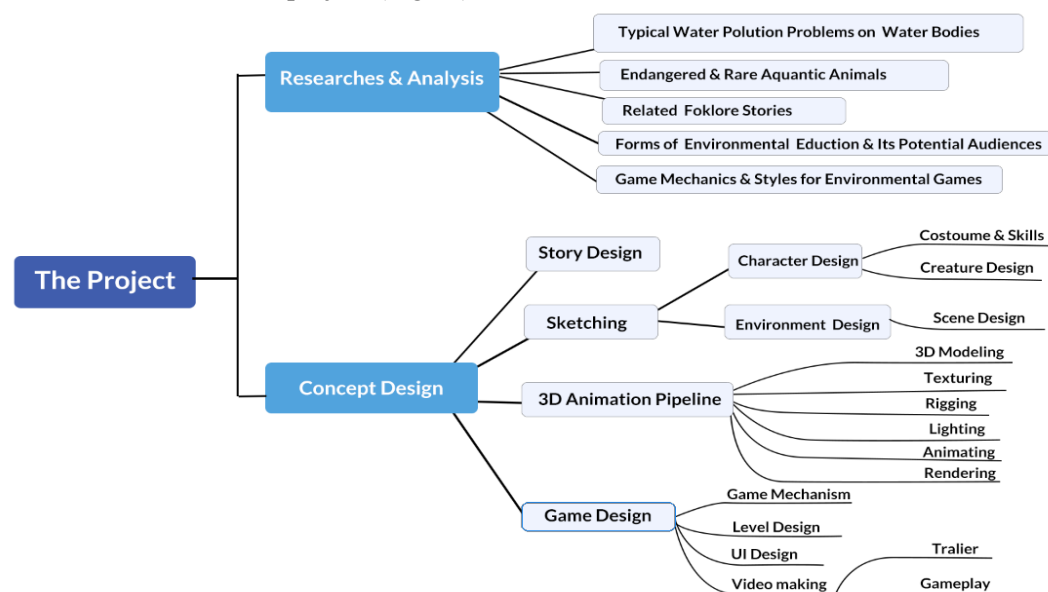

Fig 19. Flow of the 'River Guardian Yu' Project.

3.2 Game mechanism

As my intended audience would be mostly children, the game mechanism cannot be too complex for them to understand, players will be able to act as descendants of Great Yu to learn and solve the flood crisis. Players can go through the whole story about antecedents and consequences gradually by passing each game level.

Game levels are designed and separated as different parts with different storytelling purposes for the audiences (Fig.20). The first two levels would provide a background showing what is happening in the city. The second two involves calls to action for players and information on historical stories about their ancestor Great Yu. Then the following three level scenes will indicate the coming flood crisis to build the context for players. After they pass all the former levels, the main gameplay level will be ready to play which helps players to learn more about all these mysterious aquatic creature characters and the fact that they are suffering from multi-water pollution because of human activities.

One of the main incentives for players to pass all the levels is to attempt to do more good deeds being that the whole game is designed to encourage them to take more environmental action. However, this game does consider some other situations when players do not want to act positively. When they do bad deeds, the game will be over and they cannot continue to play. For example, in level 5, if they choose to pick up the axe to cut down the trees, they may get cautions and failed notices- "What you do will damage the rivers" (Fig. 21). While they will get more hints to pass the game if players try to do some actions like planting trees, picking up rubbish and so on they will help the environment to improve.

Obeying this rule is important when players go through the main level with aquatic creatures. They are always free for them to choose to act positively or aggressively, but they will need to face whatever subsequent caused by their own actions. Take one of the main game levels as an example, when the player first meets the creatures, they will find these animals are all in anger status. If they choose to talk and listen to them, creature characters will calm down gradually and stop attacking players. By lowering their rage, players can obtain a more favorable disposition from them and be able to pass by easily. Alternatively, arrogant or aggressive attitudes will make the creatures furious and more likely to assault human characters (Fig. 22).

Regarding the reward system, another key element for players is the ancient artifact which is an heirloom from their ancestor Great Yu. This artifact is missing gemstones that are needed to complete it and only by completing it can the player defeat the big boss in the final level. During the creature levels, game players would get gemstones as rewards. After collecting all of them, the power of this artifact will be activated.

Through this design mechanism, this game encourages players to understand that human activities may affect our living environment and to let young players know that the same rules apply to the real world as well. When players finally pass all the levels and complete the mission,

there would be a prompt box with a 'Explore more' button (Fig 23). If they click it, links to some websites with environmental messages will be provided for them to learn further. Thus, the game mechanism can help conduct environmental education.
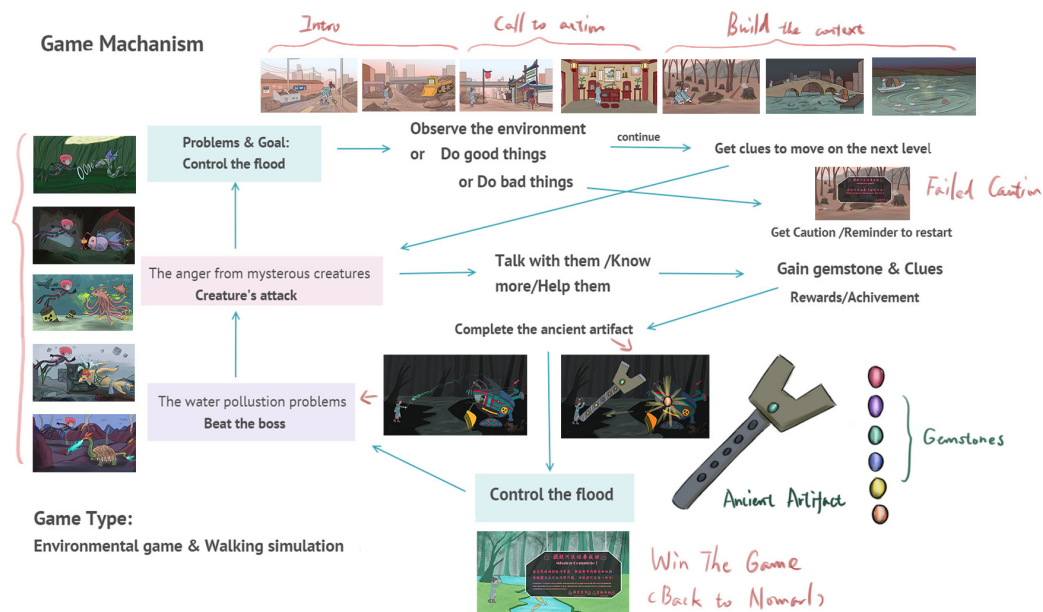

Fig 20. Game Mechanism Mind Map.

Fig 21. Outcome of player's action in the game.

Fig 22. Gameplay scene & rules with the creature He Luo Yu.

Fig 23. Game prompt box when players win the game.

3.3 Story Narrative

A good story for a serious game is important. As Luppa and Borst explain "One very clear definition of a good story requires that it has a hero who has a goal but who must face an obstacle standing in the way of reaching that goal" (39). The story for the game is not that complex to understand and it has a classic story structure (Fig.24). This allows room for players to overcome the problems or obstacles and experience development or growth along with the hero character they play. My game is about a hero trying to save the city from a flood crisis and during the process, players can act as the hero character to understand what caused this disaster and solve it. The main characters are designed as the descendants of the historical hero figure Great Yu. One boy and a girl come from this family and game players can choose to be either of them to experience the story. After I have initial ideas about the story, I started to draw some drafts of the key characters and scenes to develop it further (Fig.25). The project aims to combine this traditional culture and adapt it as a modern but interesting story to convey environmental messages.

The basic background story narrative is below:

In modern times, environmental pollution is becoming more and more serious, and extreme weather occurs frequently. One day, the worst flood breaks out. The water floods the whole city, and the people are helpless.

At this time, the boss of a major technology company claiming to have mastered a highly environmentally friendly technology steps forward and promises the public that he will thoroughly investigate the matter and help control the flood problem. He learns that Yu's ancestors used an ancient artifact to solve the difficult flood problem in ancient times, so he goes to Yu and hopes he/she can help investigate and solve it.

Yu once was told by his family about the story of his ancestors using artifacts to control water. His father told him that there are many magical supernatural creatures in the sea. They are likely to be the originators of the flood. At first, Yu did not believe the story and refused to help. Later, Yu goes back to their ancestral hall and gets more clues. There is a mysterious beast looming in the huge vortex. He begins to believe the story his family told him and is determined to investigate the incident.

During the investigation, he finds that the anger of the divine beasts is the direct cause of the flood disaster. After his direct contact with different sacred animals, he finds that they are the victims of the whole incident, and the boss of the technology company is the initiator of the flood. Because the boss always claimed that his technology company had a new technology that can dispose of garbage in a low-cost but environmentally friendly way, people believed him and gave him all the garbage for disposal, resulting in his fortune. However, it is found that his actual treatment method was to directly bury the garbage in the depths of the ocean with his moving factory, resulting in the suffering of aquatic animals, and the anger of supernatural

creatures living in the river, leading to the flood.

After Yu learns everything, he/she plans to expose the crime of the technology company together with the mysterious creatures. Yu decides to fight the boss. With the help of the creatures, he finds the source of the pollution—the boss's moving factory. Finally, Yu successfully defeats the boss and tells everyone about it. After people work together to clean up the garbage on the seabed, human beings and the creatures live together in peace, the flood faded, and the world returns to normal.
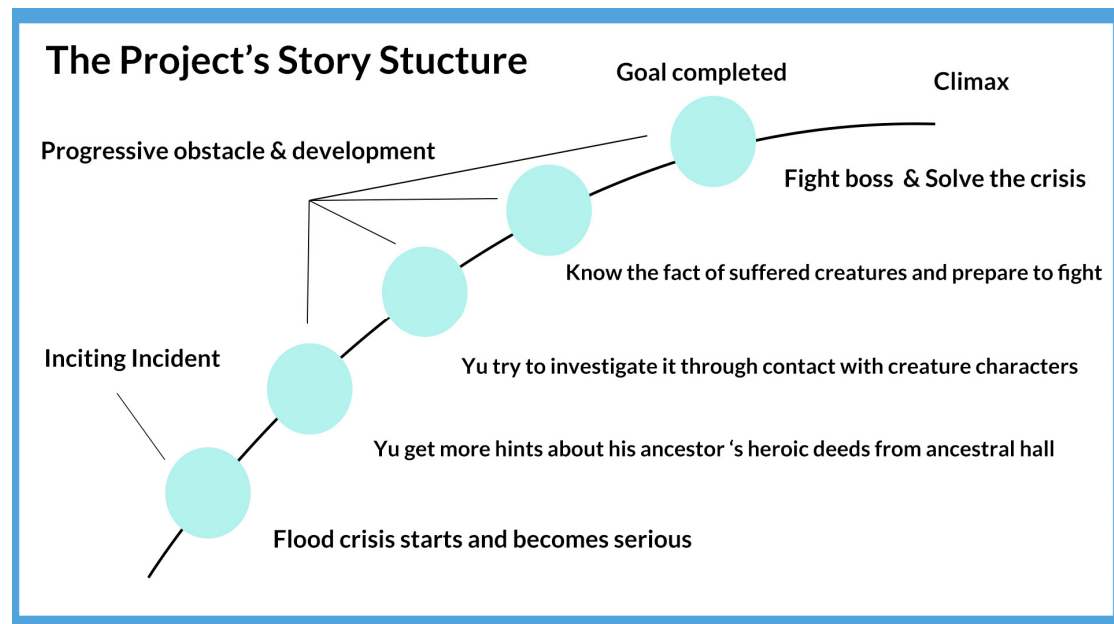
Fig 24. Game story structure.

Fig 25. Design modification process.

3.4 Character design

Character design is one of the most important parts of game design. The game character is the carrier of direct interaction between a game and players. Lankoski emphasizes the importance of character design since "Careful character design is a way to strengthen a role-playing game experience" (139). The image of game characters determines the player's first impression of the game and provides players with information about design elements.

A game can attract players only if it meets the needs of players. Once players enter the game, they will use the actions of game characters to meet their needs. The generation of game character needs is determined by the objective laws of the game world, just like individuals in our real life. In the project, the guidance and positioning of game characters, the main artistic style of game characters, and the development and growth of game characters are all effective means to attract players.

• **Main Characters**

In the project, there are many interesting characters for players or audiences to interact with. As stated above, the main characters are the descendants of Great Yu whose name is Yu so the traditional image of Great Yu (Fig.26) inspires the character design. Since they are designed for both male and female players, there would be two different gender versions of Yu in the game. One is a girl version and the other one is a boy version. Because Great Yu is a historical figure, some elements of Chinese traditional clothing would be important for his descendants. However, the story happens in modern times so the combination of traditional and modern aesthetic elements is crucial for the design of the main characters.

Therefore, traditional elements and some classic features of Great Yu can be seen in the main characters. For example, the elements of the cross collar, right lapel, sash and some embroideries (Fig.27) are shown in the costumes. Traditional features have been preserved but updated for a more modern clothing design. For instance, the design of the characters' daily clothing references the design of a raincoat (Fig.28). This design not only serves modern needs but also suits the setting of the story since the characters are trying to solve the flood crisis. Additionally, the important plow-like tool (耒耜) (Fig.26) Great Yu uses to control the water is designed as a key game pro (ancient artifact) for players to defeat the final boss so it is carried along with them(Fig.31 & 32).

In China, many traditional patterns (Fig.29) represent auspicious and good fortune so these patterns are very commonly seen in designs of clothing and furniture. In the design of the character Yu, this kind of colorful simplified embroidery pattern has been simplified without losing its original meaning.

Also, ornaments are another essential part of character design. One favored and important accessory for Chinese people is jade so each of Great Yu's descendants own one piece (see)

and it is one of the gemstones needed to complete the ancient artifact as well. Additionally, the turban on the characters' heads references the traditional headwear named Fujin (幅巾) (Fig.30) from the Han dynasty. In terms of the action design of Yu, the most common and simple moves of the main characters involve walking, running and swimming. Other possible moves have been considered for future game-level development, like pushing or jumping. Since characters need to dive into the water and meet the creatures, diving suits for them are necessary. To make these distinctive, identifiable features of each version of Yu's hairstyle and clothing are extracted and added to the design of the suit for the characters ' consistency.

The Boss (Fig.34) is the evil character in the game. He represents the corporate greed of human beings who only see the immediate and temporary interest instead of long-term interest and he will sacrifice the environment to get his way. As this is a negative example, the design of it should not look too appealing or respectable. There is a classic example in a film named *The Lorax*. The evil boss character named O'Hare (Fig.35) is designed with a funny haircut in a short figure, which gives the audience a bad impression about him and what bad deeds he has done in the movie. Sometimes they might look innocent and non-threatening (another example in the film *Zootopia* in Fig.35). In the project, the boss is designed to be an old businessman who has a slight figure and a funny, outdated hairstyle, representing what business he has done is an anachronism and should be eliminated or upgraded.

The project wants to let players know which developments in our growing industry may affect our environment, especially for the water bodies, so many design decisions are based on this starting point. According to the story, the Boss mainly deals with the trash and dumps the rubbish into the river with his truck as a moving factory. The truck's design (Fig. 34) has two different modes for the main functions of collecting trash from the land and dumping it in the river. Some inspirations for the basic shape of the moving factory come from the sea animal the shark since it always gives people a sense of danger and ferociousness (Fig.36). When it is on land, it would be an excavator with multiple tools like a dozer blade and mechanical arms. It's designed to deal with different kinds of trash. For instance, it has a chimney and tank for the storage of radioactive wastes and some of this multifunctional design concept draws from the movie *Howl's Moving Factory* (Fig.36).

Fig 26. The ancient image of Great Yu.

Fig 27. Chinese traditional female clothing.

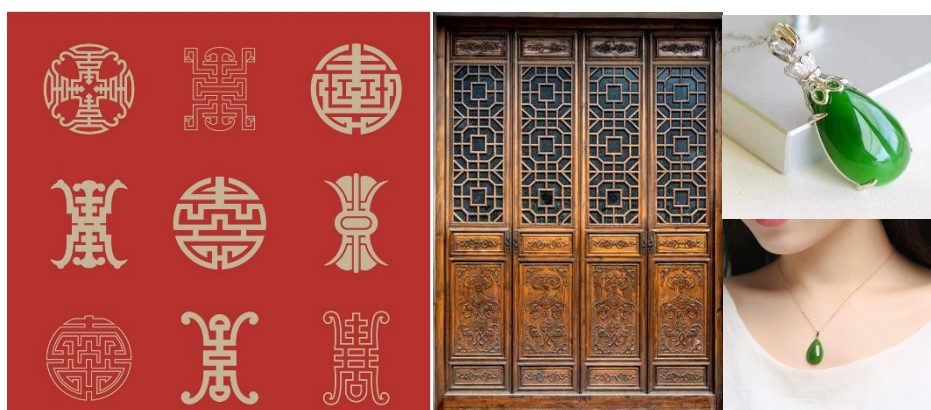Fig 28. Modern style of raincoat.

Fig 29. Chinese classic patterns and ornaments.

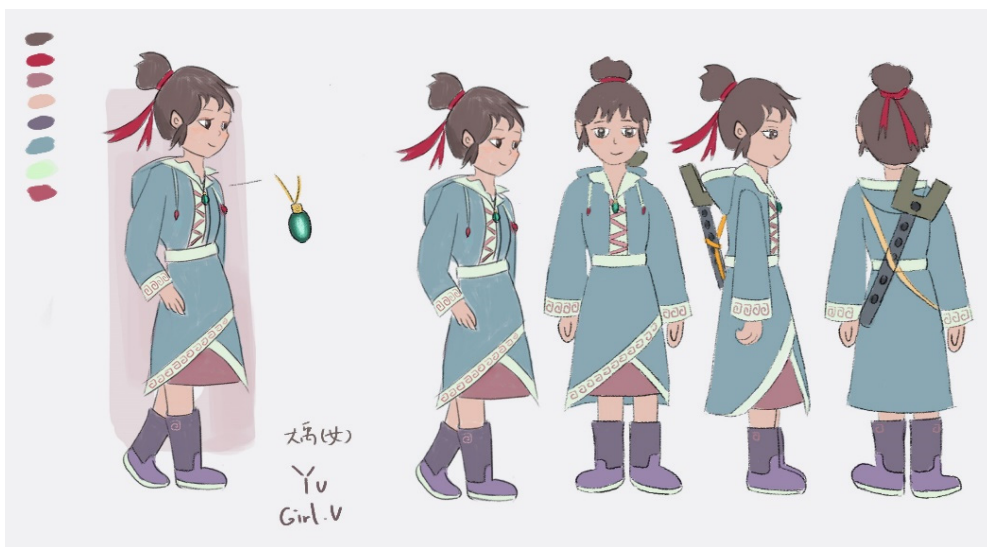Fig 30. Chinese traditional turban (Fujin) and modern turban.

Fig 31. Main character Yu (girl version).
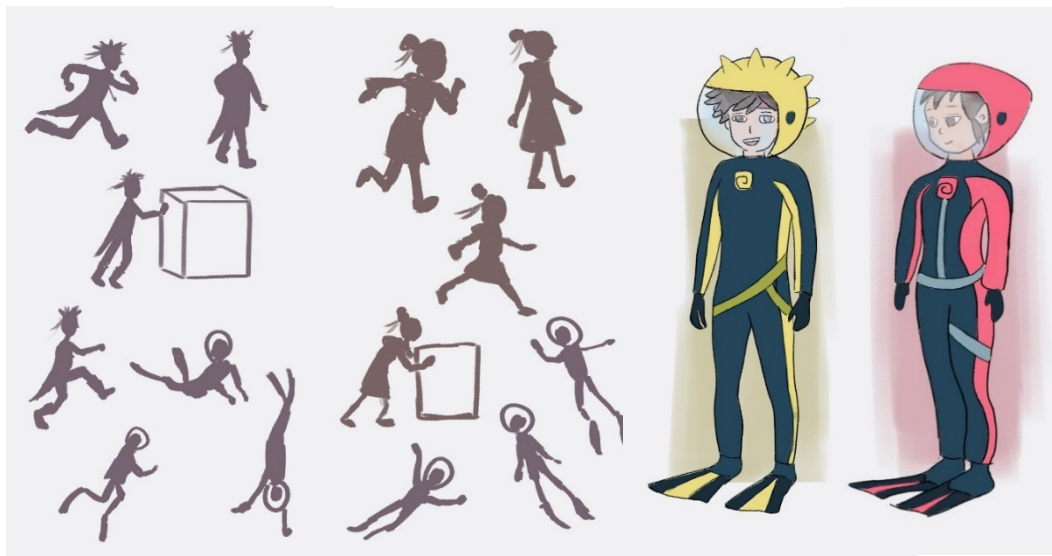

Fig 32. Main character Yu (boy version)

Fig 33. Action design & diving suit design.

Fig 34. Boss characters with his moving factory.

Fig 35. Classic examples for bad characters.   Fig 36. Design inspiration of moving factory.

• Creature Characters

Creatures are the other important characters of the project and they are mostly hybrid aquatic animals representing those living underwater and suffering from water pollution problems. Most inspiration for these character designs comes from real aquatic creatures and some folklore animals from stories of Shan Hai Jing. Based on the lore, these creatures are the most common hybrid aquatic animals to be seen when serious floods come. As there are too many endangered and rare aquatic animals, not all of them can be represented as their distinct species. Because the project aims to help young players understand or know different kinds of animals, many are designed as hybrid animals. Also, different creature characters are designed in different water polluted situations to allow young audiences to learn more about the different types of water pollution (eutrophication, fossil waste problem, radiative pollution, plastic waste and global warming problems).

According to the game mechanism, before players decide to listen to or talk with them, the creature characters stay in angry mode, primed to attack as they are hurt and suffering from the polluted and damaged living environment. When players understand them more, they will revert to their normal status and stop fighting, so each creature character is designed for two different forms.

The first creature is named Hua She (Fig.37). It is a water snake with bat's wings and snail's feelers and also some elements of eels since they have similar body shapes. It is facing eutrophication problems and its living room is occupied by crazy growing weeds. When it is angry, it will show its sharp teeth and emit light waves in attack mode.

The second creature character is Heng Gong Yu (Fig.38) which is a combination of catfish and lantern fish and is decorated with Chinese ribbons and beads to make it look more classic. Additionally, it usually appears in a dim or dark environment with its lantern to hide from the enemy. With this characteristic, this character is set to live in a deep river while its life is bothered by human oil drilling activities. In its attack mode, Heng Gong Yu will discharge electricity and its dorsal fin curls to terrify people.

He Luo Yu (Fig.39) is a kind of mysterious fish with one head and ten tails. Its body structure is similar to that of an octopus and jellyfish. In the game, it is designed to live in a radioactive polluted area of the river, which allows for its unusual physicality as that is caused by radiated variation. In its combat status, its sharp dorsal fins will stand up and the tails will turn into crab claws. It commonly squirts poisons as an attack.

Luo Yu (Fig.40) is another different kind of fish with a bird's big wings and a forehead bulge that can be seen in some breeds of goldfish. It's a kind of combination of bird and fish. Since the environment Luo Yu lives in is the most common place for dumping daily trash, it usually tangles with different trash. Its head has evolved to grow soft coral-like hair and it can spray water like a whale to protect itself from rubbish dumps and to keep its body clean.

The very last creature character is Xuan Gui (Fig.41) which is a hybrid species of phoenix, turtle, snake and dinosaur. It has a phoenix-like head, a long neck with fish scales and a hard shell that will hold up when it feels dangerous. Its habitat lies within a chain of volcanoes, which serves as an artistic metaphor for global warming. So, Xuan Gui's key skill is to spout ice flame when it faces danger.

Fig 37. Creature character Hua She.

Fig 38. Creature character Heng Gong Yu.

Fig 39. Creature character He Luo Yu.
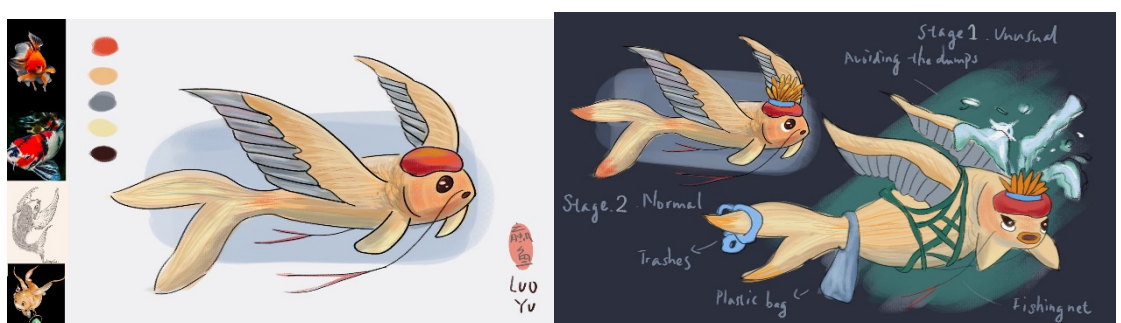
Fig 40. Creature character Luo Yu.

Fig 41. Creature character Xuan Gui.

3.5 Environment Design

The project's environment designs are based on each level of the game. Most of the designs are inspired by the real environments of China's cities to incite recognition. The scenes have been divided into several parts for different story components (Fig.42).

The first part comprises the background of the story to show the rubbish and pollution issues before the serious flood. The whole city is filled with garbage and it hasn't rained for a long time so most of the places are dry. These scenes of massive rubbish dumps and sprawling urban landfills provide players with information about relevant environmental problems and help them to connect these with real-life concerns (Fig.43 & 44).

Players will also explore the ancestral hall of Great Yu to learn more about history and folklore (Fig.45). This part focuses on showing audiences some of our religious and cultural traditions so there would be some designs based on traditional Chinese ancestral temples. This is meaningful for Chinese people because it records the history and glory of people's own families.

During this process, players not only learn more about the game situations but also gain a sense of belonging as Yu's descendants. This will encourage them to identify themselves as hero characters and accept tasks to solve the flood problems more positively.

The next scenes aim to show other suburban views when the flood is about to come (Fig.46). The scenes like bare trees in the mountain with one axe imply extensive deforestation and floating rubbish on rivers showcase the damage caused by humans and players can choose to make some efforts to improve the environment. As time passes, the water level is rising.

After players try to do more good deeds to make the environment better, the game will lead them to the river where the mysterious creatures live. Using the yellow gust of wind and light as hints for players symbolizes nature's guidance and willingness to help them in return. These designs indicate that a good guy can win and if we treat the environment better then the environment will repay us.

Players will gradually enter the main gameplay scene (Fig.47-49). Each scene for creatures represents different current water pollution problems and all the environment designs are based on these. For instance, to present the eutrophication problems, overgrown weeds are everywhere and in Hua She's entanglement scene, they blot out the sunlight to indicate the aquatic animals' impeded ability to survive. All of the main environments are designed to be a bit darker compared with the main characters to not only highlight the characters but to indicate polluted environments. For example, the final battle scenes (Fig.50) with the boss are the darkest gameplay in the whole game since players face the strongest enemy and the surrounding areas have been seriously damaged.
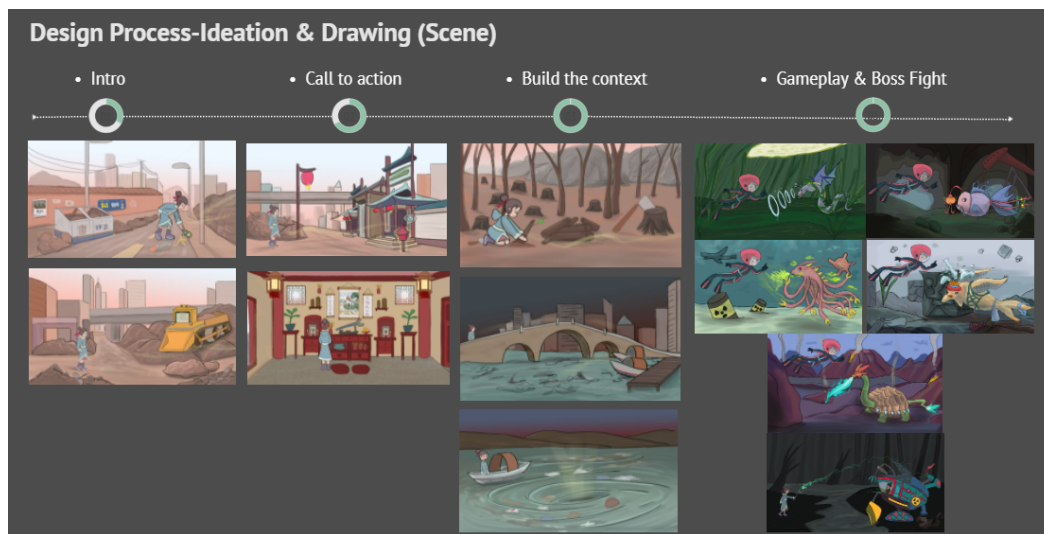
Fig 42. Scene ideation.

Fig 43. Reference scenes from our real life.

Fig 44. Scene 1 & 2 .
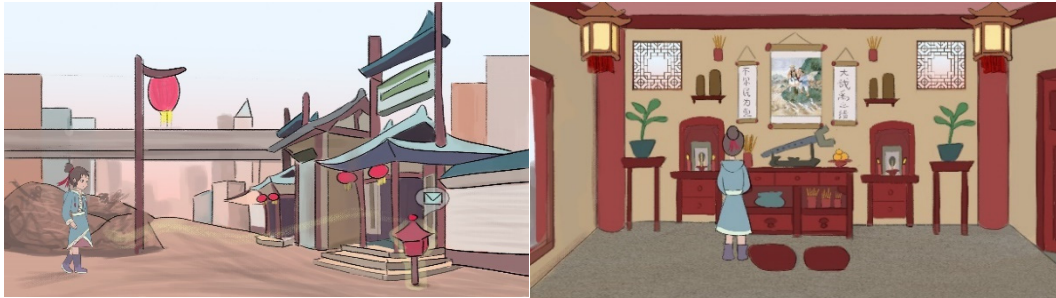
Fig 45. Scene 3 & 4.
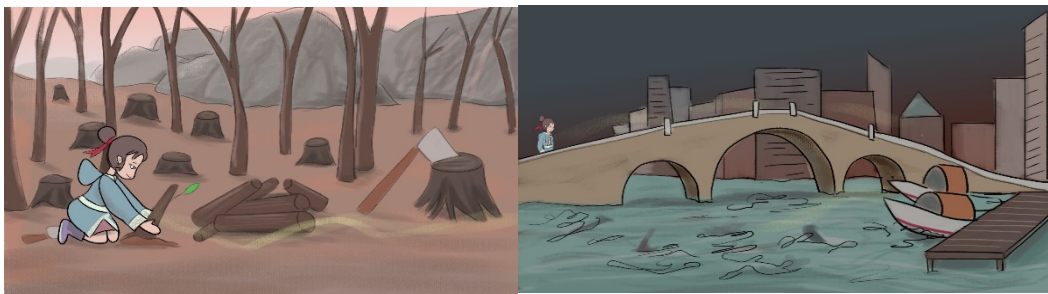
Fig 46. Scene 5 & 6.

Fig 47. Scene 7 & 8.
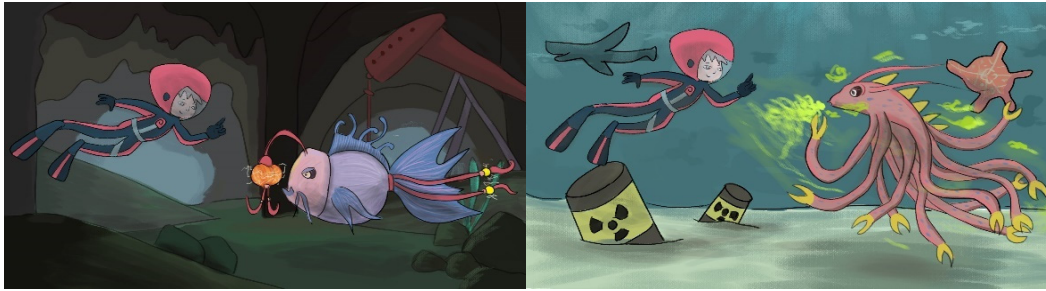
Fig 48. Scene 9 & 10.
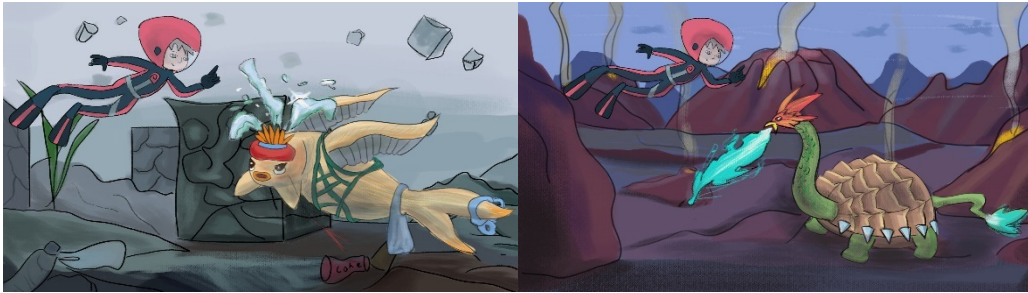
Fig 49. Scene 11 & 12.

Fig 50. Final boss scene.

3.6 Trailer making as a proof of concept

The project uses a trailer to portray the game concept as a visual story for audiences. Through the concept trailer, the whole story narrative and game concept can be conveyed more clearly as a whole. Also, this trailer set the tone for real gameplay.

The game is designed as a 3D adventure game which can also be seen as a brain game for young players. One of the reasons why I chose 3D as the main visual mode is that it is more realistic compared with 2D styles and it could provide a stronger visual impact on audiences. As Schwan (1) explains, "third dimension may be beneficial for building up appropriate mental representations" and 3D animation "allow for a precise definition of viewpoint trajectories that may guide the viewers' attention to relevant parts of objects or events". Thus, players are more likely to associate the 3D creatures with aquatic animals in the real world. The trailer was made in Cinema 4D for overall effect, After Effect and Premiere for post-production.

The project followed the 3D animation pipeline to make the trailer including modeling, texturing, lighting, animating and rendering (Fig.51-54). All the important scenes are shown in it and connected as a story narrative. In the trailer (Fig.55-65), I chose the girl version of Yu as the main character. To make the storytelling more vivid, I designed a script as a first-person narration with a little girl's voice to present the story. That could help create a more tangible feeling for audiences and help them get into the role.

Here is the narration (in Chinese and English):

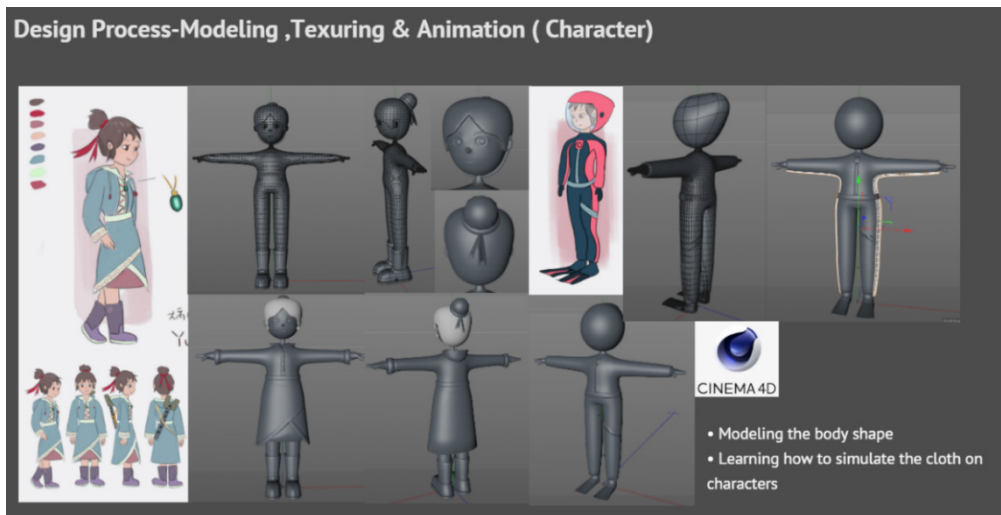|	
这是怎么回事？	What makes this happen?
来自神圣动物的愤怒？	Anger from sacred animals?
大禹的召唤？	A Call from Great Yu?
一件威力巨大的神器？	An Artifact with great power?
改变世界永远不会迟	It's never too late to make a difference
带着良好的行为和信念	With good deeds and beliefs
和他们谈谈	Talk with them
尝试去理解他们吧	Learn to understand them
做这条河的守护者	Be the guardian of the river
让我们一起拯救这条河吧	Join us to save the river

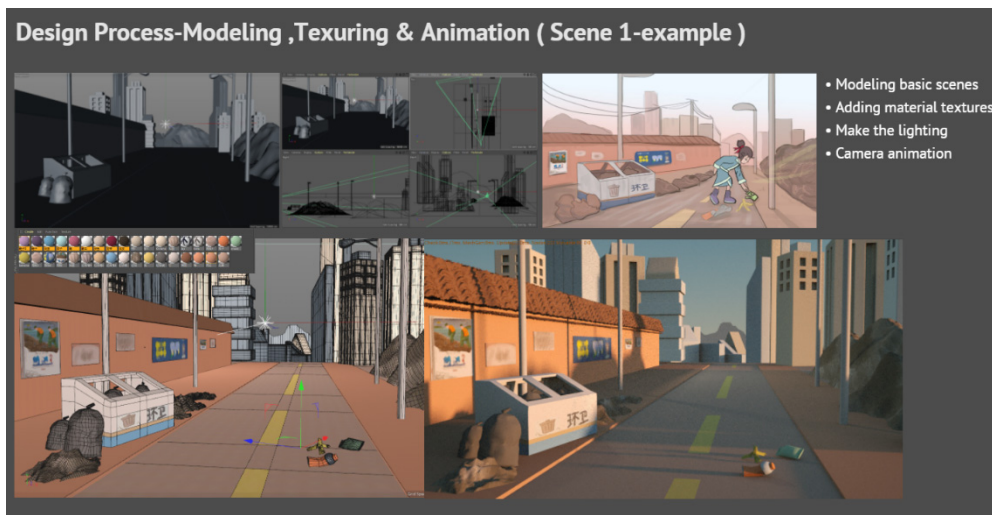Fig 51. Character concept design process.

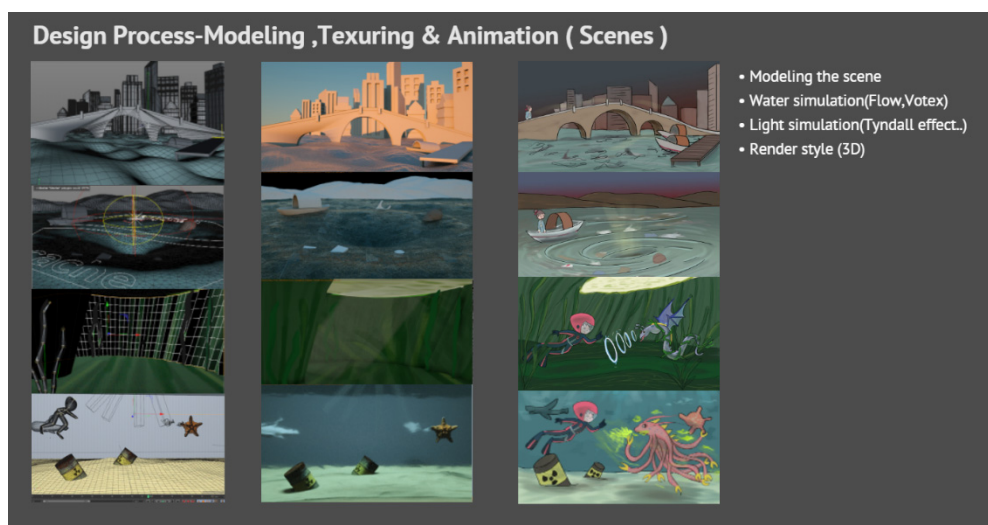Fig 52. Scenes concept design process (scene 1 as an example).

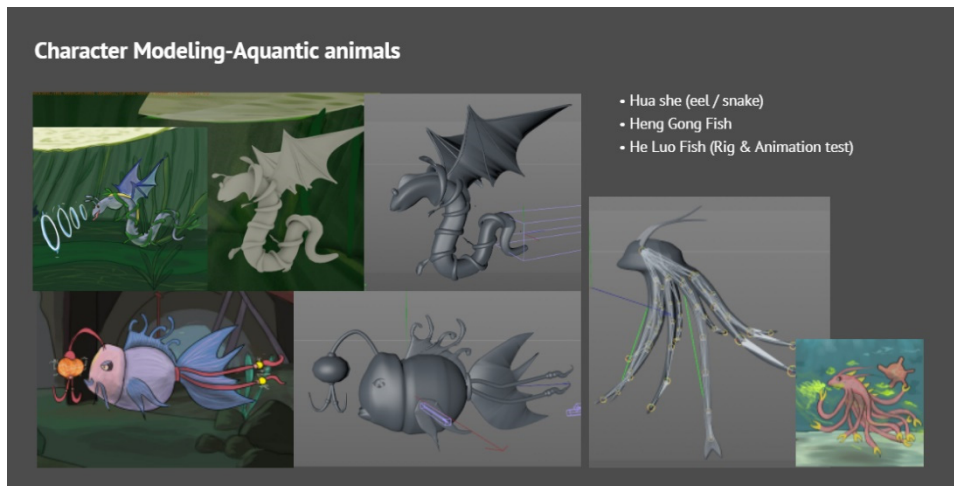Fig 53. Scenes concept design process.

Fig 54. Creature characters concept design process.

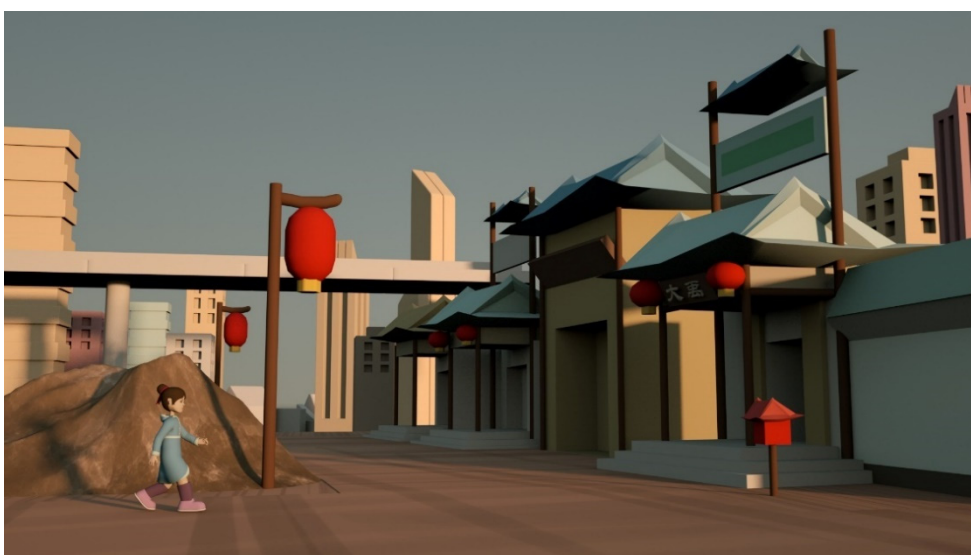Fig 55. Trailer scene screenshot 1.

Fig 56. Trailer scene screenshot 2.

Fig 57. Trailer scene screenshot 3.

Fig 58. Trailer scene screenshot 4.
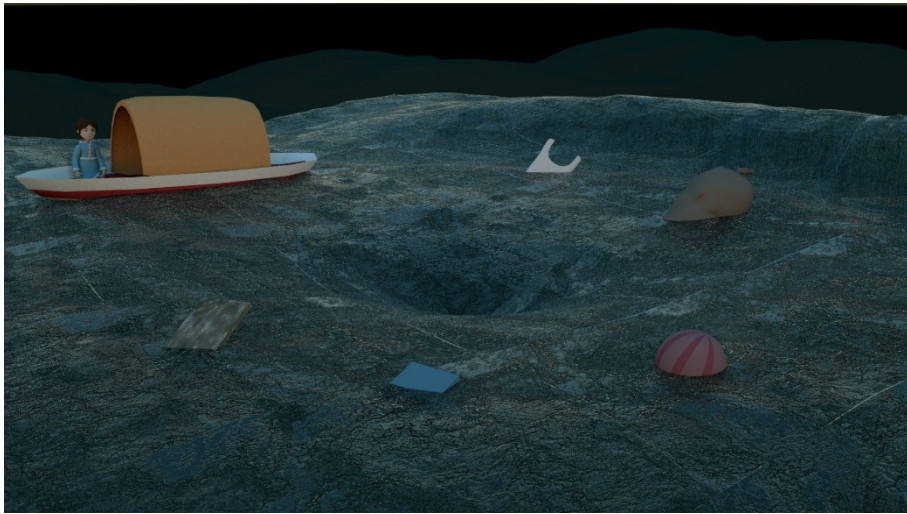

Fig 59. Trailer scene screenshot 5.

Fig 60. Trailer scene screenshot 6.

Fig 61. Trailer scene screenshot 7.

Fig 62. Trailer scene screenshot 8.

Fig 63. Trailer scene screenshot 9.

Fig 64. Trailer scene screenshot 10.

Fig 65. Trailer scene screenshot 11.

49

3.7 Gameplay video

After making a trailer to show the story narratives, the project also provides a gameplay video for players to see how the actual gameplay might look (including game mechanism & rules, user interface, and game interaction). I edited it by using Photoshops, After Effects and Premiere. The below figures (Fig 66-69) show what players might see when they interact with the creature characters. They can choose different options to talk or interact with the creature and different outcomes will come along with their own choice to guide them and educate them that nature will give back to you what you have given to them. For instance, if players choose to act more positively to talk with or help the creature characters, they are more easily to pass each level and gain rewards by this. I believe through these interactive game experiences can present the whole adapted folklore story to young audiences and engage them in it immersive, which might attract their attention to environmental issues.
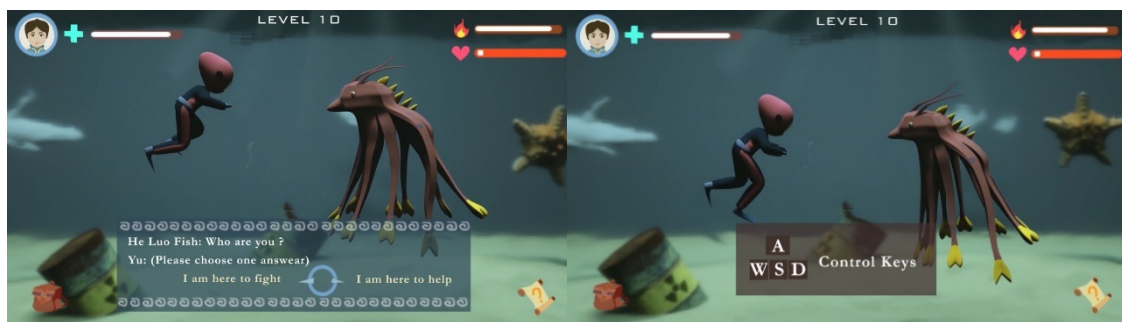

Fig 66. Gameplay video screenshot 1.

Fig 67. Gameplay video screenshot 2.

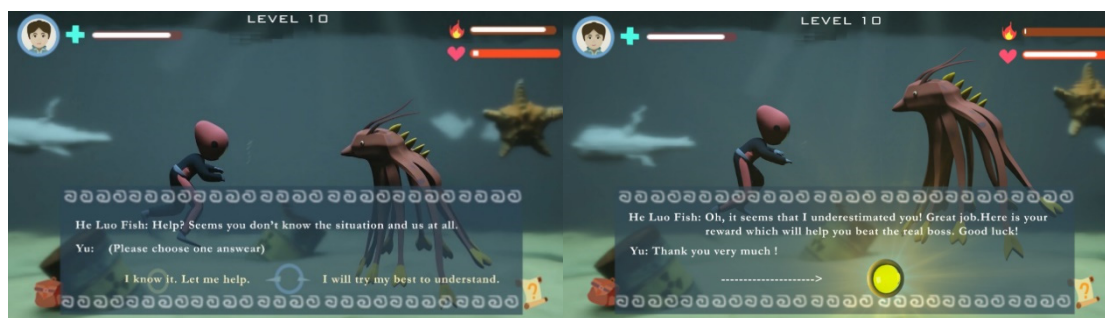Fig 68. Gameplay video screenshot 3.

Fig 69.   Gameplay video screenshot 4.

Section 4. Conclusion

The project was motivated by research on the impact of water pollution and plastic waste on our environment, especially for rare and endangered aquatic animals. It is an exploration of how a modern environmental game combined with folklore stories can convey or transform the environmental message in an interactive way to educate game players about the water pollution issues and help young Chinese recognize the importance of environmental concerns.

I chose the design drawings of the main characters, environments, one game animation trailer and a gameplay demo as proof of my concept design outcome in the final examination. The concept artworks connect Chinese traditional folklore stories with research on the devastating impacts of water pollution on aquatic and our environments.

To achieve the project's aim, I first investigated the current situation of some rare and endangered aquatic animals and water pollution problems. I argued that these serious environmental messages need to be conveyed to people more effectively. Then, I studied the educational function of some Chinese folklore stories, culture and environmental digital games. I found that environmental publicity and education can be effectively combined as a concept for a modern environmental game aimed at young audiences, since these kinds of combinations in new media are still limited nowadays, especially in China. Through the design process, I hoped to contribute by using digital games to promote young people's awareness of these issues through my specialty.

Through visual analysis and precedent analysis, the project investigates how the concept of various environmental messages applied in a digital game could engage people to realize the significance of protecting underwater creatures from water pollution issues. Following the guideline of concept design techniques and using the above study as a basis, I finally produced a series of game concept artworks for my modern environmental game with educational functions. The River Guardian Yu game concept attempts to foreground our hero character as a role model for the young audience and also evoke sympathy with the creature characters on

51

an emotional level to positively change their attitudes toward those serious environmental issues.

However, concept game research is a vast and complicated topic, River Guardian Yu's ability to meet the players' demands is still restricted at the moment due to time constraints and technical requirements. The ultimate objective is to create a real environmental game for audiences to play and to complete the production of an industrial game requiring constant developments and future iterations employing other professional knowledge in game coding, producibility, sound effects and so on. The project might require a whole team to produce a runnable game in the future.

This method of environmental communication through environmental games with combining folklore stories or culture as interactive narratives could be applied to other environmental publicity and education not only in China but also internationally since environmental issues are a significant and urgent global concern.

To summarize, the design of my project demonstrates that environmental games can be a potentially powerful new medium for conveying environmental messages with educational functions. With the combination of folklore stories, the story narrative may become more interesting and persuasive for audiences. Through integrating interesting folklore narratives within interactive game experience, environmental awareness may be increased. People may even decide to change their attitudes in more effective or positive ways.

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Fig.19. Flow of the 'River Guardian Yu' Project. Baoyu Deng,2022.

Fig.20. Game Mechanism Mind Map.Baoyu Deng,2022.

Fig.21. Outcome of player's action in the game. Baoyu Deng,2022.

Fig.22. Gameplay scene & rules with the creature He luo Yu. Baoyu Deng,2022.

Fig.23. Game prompt box when players win the game. Baoyu Deng,2022.

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Fig 32. Main character Yu (boy version). Baoyu Deng,2022.

Fig 33. Action design & diving suit design. Baoyu Deng,2022.
Fig 34. Boss characters with his moving factory. Baoyu Deng,2022.

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Fig 38. Creature character Heng Gong Yu. Baoyu Deng,2022.

Fig 39. Creature character He Luo Yu. Baoyu Deng,2022.

Fig 40. Creature character Luo Yu.Baoyu Deng,2022.

Fig 41. Creature character Xuan Gui. Baoyu Deng,2022.

Fig.42. Scene ideation. Baoyu Deng,2022.

Fig.43. Reference scenes from our real life. Pictures from Internet. Organized by Baoyu Deng, 2022.

Fig 44. Scene 1 & 2. Baoyu Deng,2022.