
Serious Game: A Game Helps Junior-high-school Students to Learn Money Management Skills

By

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Abstract

The ubiquity of computers and smart devices allows people to have more chances to get information worldwide, and serious games, as a newly developed concept, have shown their significant potential for educational purposes. On the other hand, recent studies show that millennials lack experience while handling financial challenges, suggesting a significant need for financial education among young people.

This dissertation discussed the recent criticism on the serious games and educational games and concluded an approach of designing a serious game that could improve the game's performance being used to educate its audience. Following knowledge from education, finance, game designing, and Human-Computer Interaction area, the author has developed a serious game that aims to educate junior-high-school students in developing money managing skills. The product is a 2-D pixel style game developed based on the Unity engine.

An experiment involving twenty-four junior-high-school students' parents was conducted to assess the game's performance. The experiment includes two individual interviews for each participant and one demo-playing week. The results suggest that although most of the participants did not know about serious games and their potential for educational purposes, they were willing to hold an open mind on its prospect after being explained the application of serious games. In addition, the results suggest that the production game of this project is successful in educating players in financial management knowledge. However, it still has room for improvement in both game-play system and UI designs.

Dedication and acknowledgements

I would like to thank my supervisor, Professor Chris Preist, for his guidance throughout the project.

I would like to thank my previous junior-high-school teacher, Mrs Li, for helping me to recruit the volunteers for the experiment.

I would like to thank to all the participants for their voluntary participation in my experiment.

Author's declaration

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's Regulations and Code of Practice for Research Degree Programmes and that it has not been submitted for any other academic award. Except where indicated by specific reference in the text, the work is the candidate's own work. Work done in collaboration with, or with the assistance of, others, is indicated as such. Any views expressed in the dissertation are those of the author.

All of the assets used for game development, including the sprite images and sound effects, were downloaded from the Unity assets store.

SIGNED: JINGXUAN LIU DATE: 16/MAY/2022

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Chapter 1

Introduction and Background

This chapter will introduce the motivation of this project, followed by a brief discussion on the potential of computers and serious games as a powerful educational tool. The chapter will also reflect the contradiction of serious game and provide my approach to designing a serious game.

1.1 Motivation

The motivation for developing a serious game came from my career pursuit as a game designer, while the focus on helping the young to learn money management skills came from a discussion in a peer tutorial in the Human-Computer Interaction unit. Our group discussed the possibility of technology being used on educating children to spend money wisely and finally concluded that an educational game might contribute to forming good spending habits for children. Therefore, the curiosity about how successful a serious game could positively impact a child's habit of spending money led to this project.

My original focus group was elementary school children instead of junior-high-school children. However, the content design would be significantly confined by their comprehension ability and social experience due to their young age. Therefore, I had put my concentration on the older-aged group so that I could have an opportunity to involve more complex and comprehensive content in my game.

1.2 Computers as Educational Technology

Computers have been more than widespread since the Millennium, with the statistics[11] suggesting the percentage of British households owning a home computer has increased to almost 90% in 2018, compared with only 44% in 2000. With the penetration of powerful hardware and high-speed broadband in people's lives, the masses can disseminate and obtain information through computers and the internet, which empowers computers with great potential in education. An enormous number of free or payment-required online lectures and tutorial

materials worldwide in different areas can be achieved through just a few taps on the mouse and keyboard. From unwieldy desktops to portable smartphones, computers support people's everyday lives in different forms and on various occasions.

The public is starting to realize that computers can be a powerful tool for educational purposes since the pandemic period. Benefiting from the ubiquity of computers, lectures and tutorials were conducted online due to the policy of home quarantine. Homework and exercises were shifted online. As well as the online meeting software, applications that have specific purposes like Duolingo made a significant contribution to supporting people to learn. Computers are becoming a crucial role in the process of learning.

1.3 Significance of Financial Education

The importance of money management skills to the individual should never be underestimated. Research[9] shows that taking effective education on finance, the elementary school children perform significantly better than their peers in a financial literacy test, regardless of the educational background and the economic condition of their families. Another paper[10] suggests that financial education could enhance one's financial knowledge and lead to more positive attitudes and intentions. However, a recent study shows the millennials are lacking experience in responding to financial challenges, and both themselves as well as their parents are regretting their neglect of teaching about money. It also demonstrates the process of achieving positive financial well-being is complex, demanding joint efforts from formal education, family education, and the surrounding environment of an individual. In a conclusion, an early and diversified education in finance could have a crucial influence on improving one's financial condition and achieving overall life success in his adulthood.

1.4 Serious Games

1.4.1 Definition

Although experts in different areas have tried to define the nature and application of serious games from various perspectives, their suggested definitions share common essence. Serious games are treated as games designed not merely for entertainment purposes but also to provide a cost-effective opportunity for, including but not limited to, educational training, military, and medical purposes. One research[15] suggests that since the 1980s, some satisfactory results have been achieved through the broad application of serious games in plenty of areas. Developing in an almost six times faster speed than entertainment games, some researchers believe serious games may launch a evolution in which take technology as a media into education process.

1.4.2 Criticise on Serious Games

Despite most of the comments on serious games being applied to education being positive, some voices still question the attempts to burring the boundary between game and pedagogy. An indie game developer points out that some educational games failed to provide an engaging and effective learning experience because the developers of such games discarded a wide variety of mechanics and systems that can make the learning process more enjoyable[13]. Some designers and technologists describe these failed games with unnatural game-play as "Chocolate covered broccoli" to emphasize the inherent contradiction in such games. Take figure 1.1 as an example; this game intends to teach children about math by letting them click the correct answer card below. The scene and the pictures in this game look beautiful, however, the nature of the task is simple. The repetition in single game-play may produce fatigue and boredom to the learner and thus would fail in the ultimate goal, educating.



Figure 1.1: Bad example of serious game

1.5 My Design Approach

To avoid the failure in design mentioned in the previous section, a study team in Netherlands[4] concludes that the design of serious games needs to balance three aspects: fun, learning, and validity. From my perspective, as well as taking account of the professional knowledge in the field it educates people, a successful educational serious game should also involve varying existing mechanics and game-play design in the video game industry. The serious game is a subclass of the traditional video games; hence it should inherit some main designing principles. On the other hand, since serious games are invested with a specific function, education, in this case, the player should learn skills or knowledge from the enjoyment they designed to achieve. Therefore,

CHAPTER 1. INTRODUCTION AND BACKGROUND

while designing my own game, I first focused on creating an engaging and delightful experience and then worked on adding up with the educational benefit. Various theories and experiences on helping junior high school children to develop money management skills suggested by studies and research will be adapted to my game-play and mechanics design. The game will create challenges based on these theories to encourage the players to manage their money wisely.

In addition, considering the audience for the game are junior high school students, who are defined as "the vulnerable group" both in terms of law and moral rules, my game design will be extremely careful on ethics. Due to the immature mentality and intense curiosity, children in this age group are believed to be unable to protect themselves from being hurt. The game will be designed following a series of developed and examined rules thought out areas including finance, psychology, pedagogy, and game designing to prevent bringing any mental harm or leaving a negative impression on the players.

Chapter 2

Theory and Methodology

This chapter will first demonstrate the theories supporting the design and development of my game. They will be sorted into three classes: game designing theories, UI and UX designing theories, and theories on educating junior high school children finance. Finally, I will conclude my final design thoughts by synthesizing these theories.

2.1 Game Design Theories

2.1.1 SGDA Framework

The study conducted by Singapore-MIT GAMBIT Game Lab demonstrates a Serious Game Design Assessment Framework[8] (will be noted as SGDA in the following content) to analyze serious games, which shares many ideas with assessing traditional video games. Therefore, I use these criteria as a guide to my design. The SGDA suggests seven dimensions for assessing a serious game:

- Purpose
- Content & Information
- Game Mechanics
- Fiction & Narrative
- Aesthetics & Graphics
- Framing
- Coherence and cohesiveness of the game system

Although the concept of this framework overlaps other theories that I am going to demonstrate in the following content, this framework gives me a template for how to design a successful

serious game at the very beginning of development. The framework suggests a holistic perspective for analyzing a serious game, emphasizing the coherence and cohesiveness of the game system as a whole. On the other hand, this indicates that a successful serious game should synthesize all the elements, including game mechanics, framing of the target group, background content, and aesthetic characteristics, to propagate a specific purpose to the player.

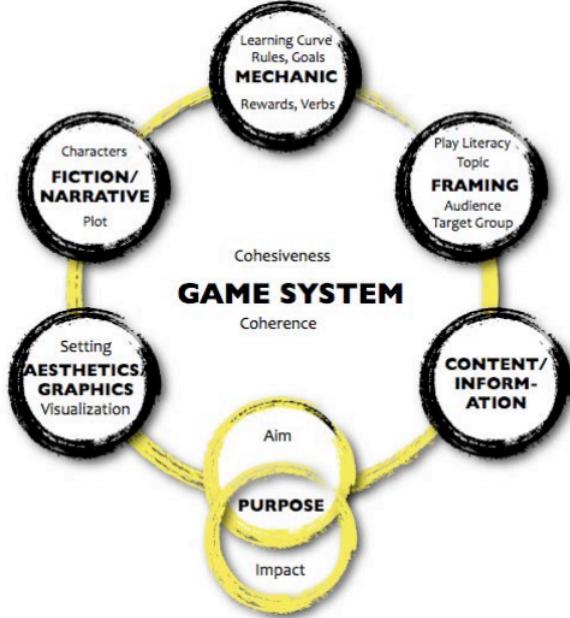


Figure 2.1: SGDA framework

2.1.2 Advice from Guidebook and Game Industry

The following tips come from the game designing guidebook *100 Principles of Game Design*[1] as well as from experience shared by game engineers currently working in the game industry. These tips more or less inspired my design and were reflected in my final work.

- **Koster’s Game Theory:** In his book *A Theory of Fun for Game Design*, Koster has pointed out that games are low-risk learning tools. An enjoyable learning experience would biologically please the player and attract people to continue playing it. Once there are no more new things the player can learn from the game, they will feel bored and quit playing it.
- **Lazzaro’s Four Key Elements in Fun:** Lazzaro suggests four different kinds of fun a popular game should bring to its players. The easy fun stimulates the player’s curiosity and makes them addicted to playing the game. Hard fun sets a pursuable goal for players to gradually achieve; they will taste the epic victory when they overcome the challenge. This fun makes the feeling of victory stronger when the players are playing with others.

Finally, the serious fun describes how a game may change the players in themselves or their surrounding environment.

- **Mechanics, Dynamics, Aesthetics:** This theory could answer varying questions for game designers while designing a new game. The theory will predict players' behaviour during their playing and exam whether these behaviours meet the designer's expectations.
- **The Player is Always Right:** The game itself should not stop the player from doing the thing they want to do in the game. If the player meets an obstacle, that means there is a flaw in mechanics or source code.
- **Negative learning:** People learn from their previous mistakes. These learning experience usually leaves a deeper impression on their minds.
- **Core Loop:** The core repeating process that offers the experience should be simple to understand and operate for the players. It also has to be enjoyable, flexible and extendable so that the core loop can adapt to different scenarios and be added extra content to support other loops in the game.

2.2 UI and UX Designing Theories

User Interface (UI) and User Experience (UX) Design are always crucial elements in a game. An intuitive design in UI and UX will significantly facilitate the playing processing hence bringing a delightful experience to the players. In contrast, a chaotic design will confuse the player, make them frustrated and they may eventually give up playing. When designing the interfaces in my game, theories that I studied in the HCI unit have offered considerable guidance.

The most helpful theory I want to include in this section is the notion of affordances and their implication on design. Gaver suggests four classes of affordance separating from the perceptual information available about them[7] and this gives me the criteria for assessing whether an interface design is tangible. When I was designing my UI, I tried my best to make sure every affordance was perceptible, and if not, a reminder or guidance would be found to imply the hidden affordance. Together with the notions of affordance, Nielson's 10 Usability Heuristics for User Interface Design is another helpful tool to guide my design. A deeper analysis of how these two theories were applied in my design will be introduced in Chapter 3.

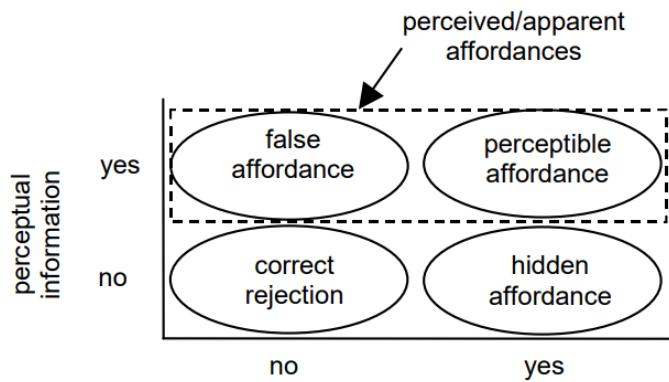


Figure 2.2: Gaver's notion to affordance

2.3 Theories on Educating Junior High school Children Finance

As a serious game, the purpose of its design is to educate junior high age children to develop money management skills. Therefore, it is necessary to understand the what learning pattern and approach are effective for educating children in such age group finance. Base on my research, several key strategies that will lead to a positive financial well-being of a junior high age children were concluded as the follows 6 goals:

- 1. 1. They need to understand prioritize. Sometimes one thing is more urgently needed than others.
- 2. They need to know that once their money is spent, they cannot have anything else. However, they can always achieve other goals by earning and saving money.
- 3. They need to learn to plan their budget and have an organized saving plan.
- 4. They need to make their own decisions. Children learn the most from personal experience and especially from mistakes.
- 5. They need to learn comparison shop. In such a way, they can make the best use of their money.
- 6. They need to understand that earning money takes one's effort. There is no free lunch in life.

These essential goals were concluded from several papers written by specialists in Utah State University[2][3][6] and will be used to guild my game-play and background. A more detailed demonstration of the application of these strategies in the game design will be found in Chapter 3.

Chapter 3

Implementation

3.1 Unity Engine

The game will be developed in the Unity engine because of its mature community and the vast tutorial materials that can be found online. This is my first attempt at developing an independent game on my own hence everything would be brand new knowledge to me. On the other hand, I certainly would benefit from this challenging game development experience as the Unity engine is still a very popular game engine for both individual game developers and the game industry. Such experience would bring advantages to my pursuit in career and future game design learning.

The unfamiliarity with the engine itself and the supported language, C#, has brought me significant challenges initially. Also, vast concepts like blend tree and state machine in animation, and collision detection, flood into my brain while investigating game developing techniques. Therefore, to decrease the learning cost and as well as to ensure the completeness of the game, the game will be a 2-D project. However, such compromise will not be an obstacle on achieving the entertaining goal and the educational goal. Firstly, results of an research[12] implies a significant risk that video games may induce motion sickness, suggesting a roughly 50% chance of causing sickness and dizziness while 40 college student volunteers playing 3-D and virtual reality games. Secondly, the quality of a game is not depended on whether it is 2-D or 3-D. Take *Getting Over It with Bennett Foddy* as an example; this is a 2-D style game where the player controls the character to climb a mountain with a hammer and crouch in a water vat. The player enjoys the challenges created by its mechanics and continue to climb up while they may fall to the original once and once again; hence the game received 85% positive comments by the time this dissertation finished. Therefore, the more focus on the game-play and mechanics design in my game could compensate for the less complex game development techniques.



Figure 3.1: Getting Over It with Bennett Foddy

3.2 Game-play Design

A good approach to starting designing is to find existing games with the same purpose as mine since they will bring me experience summed up by predecessors. An educational game developed by a team in a Taiwan University suggests a good attempt to connect the game with the reality[14]. Their game, as shown in Figure 3.2, has created a background where the player will act like a dog's owner in a town, making money to bring the dog a happier life. Although the game is a picture clicking game, this background creates a feeling of identification that the events player would encounter in their game may happen in real life. Such an attempt increases the game's realism and thus makes the skills the player would learn from the game closer to the real world. With the inspiration of this game, I decided the background of my game to be a farm owner, Phil, pursuing the happiest farm owner title of a small town. On the way to completing Phil's pursuit, the player needs to reach particular goals by learning financial management strategies and using them in practice.



Figure 3.2: An educational game developed by a Taiwan team

In addition, the educational game developed by them also tries to separate the concept of saving and cash, as shown in the upper box at the bottom left corner in Figure 3.14(b). This introduces the idea of money management to the player so that they will understand they can make more money from their current wealth instead of spending money on buying stuff. This design was brought to my game but with changes, where I have substituted the idea of budget for cash. As shown in Figure 3.3, the finance loop of the player will be: all the income will go directly into the savings bank account, whereas all the spending will come from the budget. The player can transit money between two accounts by making a deposit or a withdrawal. However, the play can only make free withdraw on Monday and Thursday, and on other days it will charge a 10% service fee. This rule aims to encourage the player to plan their spending budget every week. Although withdrawing is allowed on other days, they have to pay the price as a consequence to failed to make a good weekly budget plan.

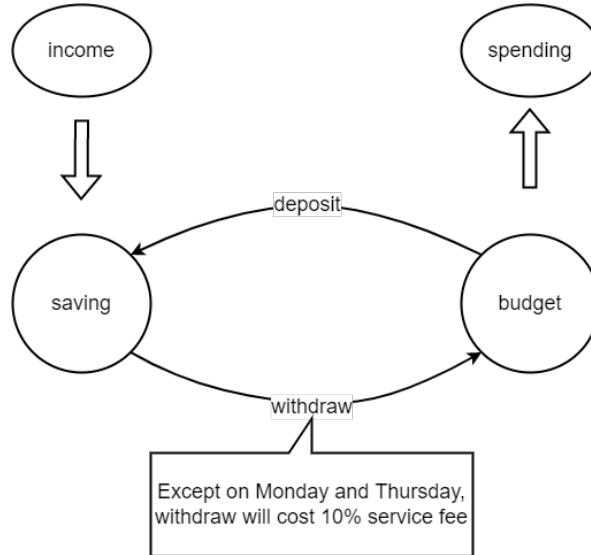


Figure 3.3: The finance loop

As mentioned in Chapter 1, the game-play and mechanics will be built on the economic and educational theories previously mentioned. My thinking is that the game needs to provide opportunities for the players to develop these abilities in praxis; in the meantime, the game also needs to guide the player in making wise decisions while spending their virtual money. According to the Negative learning theory mentioned in Chapter 2, it is believed that experiences learning from mistakes may have a more profound impression than those gained in a usual way. However, the point is that the player should first realise they have actually made a mistake so that they can avoid doing the same thing next time. Therefore, it is crucial to offer a standard of right and wrong in the game to help the player to evaluate their decisions. To achieve this goal, I added an everyday quiz feature to the game, where the player can answer one simple true or false question every virtual day in the game. These questions are about spending money wisely,

and the player will get a certain amount of money reward by giving the correct answer. By this mean, the player will be encouraged to take the quiz every day and hence be expected to build a healthy spending concept.

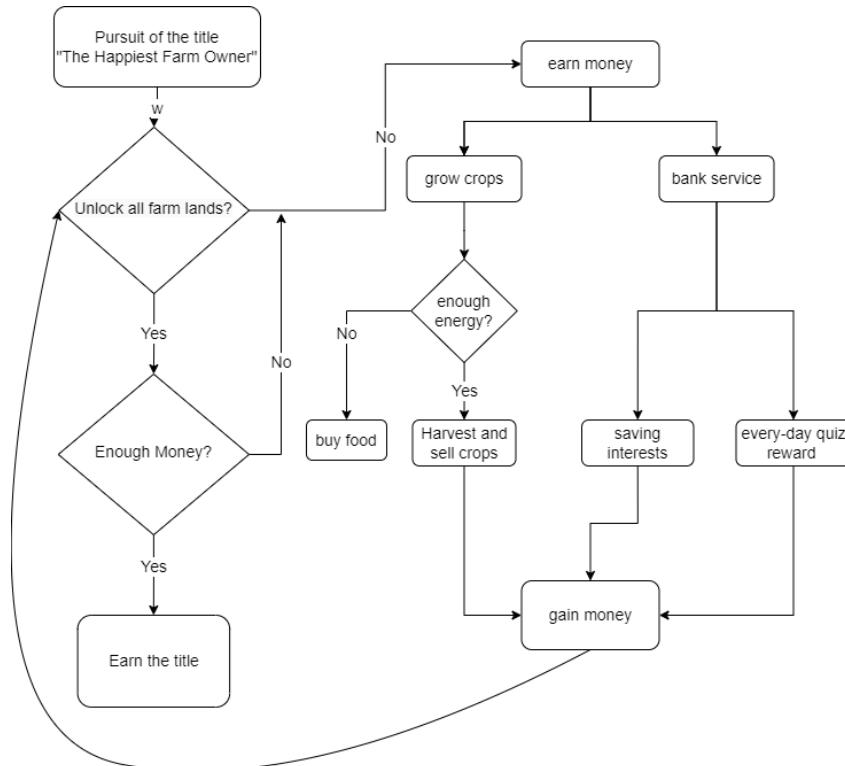


Figure 3.4: The goal-driven economic system model

Taking the previously mentioned features, my game's core loop was designed to be a goal-driven economic system model. In order to achieve the ultimate goal of winning the title, the player has to unlock all seven farmlands and build up a certain number of savings. Each time the player unlocks new farmland, the price for unlocking the next will increase, creating a climbing difficulty in the whole loop. However, this does not mean the process of buying the next farmlands will be harder since the player can earn money in various ways. Figure 3.4 shows that in the goal-driven economic system model, the player can earn money by working on the farm and taking bank services. If the player buys new farmlands, he will get six more fields to grow crops so that the income from selling the grown crops will be increased. This will provide positive feedback to the player's revenue and maintain the difficulties of the game to be challenging but not frustrating. In addition, energy, as shown in the economic system model, is another attribute of the character in the game, which is spending on doing farm work. The increment in the number of farmlands will also increase energy costs. Therefore, the player is expected to spend more money buying foods to recover energy. This, together with the growing cost of unlocking new farmlands, will perform as negative feedback and neutralize the advantage the player will get from the positive feedback; hence the difficulty of the core

loop will be equilibrated.

As a reflection of this section, the player is expected to experience a goal-driven economic system model core loop while playing the game. By getting involved in this loop, the player will have the opportunities to learn to achieve a long term financial goal, to learn to separate the concept of saving and the disposable incomes, to learn to achieve a long term financial goal, to be guided to build up wise spending habits, to develop skills on planning their budget and spending, and may learn from the bad decision in their playing process. The core loop will bring the player an engaging learning experience by creating challenging goals for the player to pursue, which will also provide scenarios for the player to understand basic financial management rules related to the real world.

3.3 Programming Challenge and Function Implementation

I would describe this game's programming and developing process on the Unity engine to be challenging, especially for a non-experienced beginning learning learner of game development. Tutorials from a video-maker channel have offered me considerable guidance on implementing various systems in the game. Also, the official guidance from the Unity engine resolved most of my confusion on game development. Such programming experience offered me an excellent opportunity to get familiar with the Unity engine and develop a small game project. Several main game functions were implemented through the engine to support the designed game-play and mechanics in the game, and detail will be explained in the subsections.

3.3.1 Scene

There are six scenes in my game based on my design; they are house, town, market, bank, restaurant and farm, which is the main scene and the spawn point (see Figure 3.5). The scenes were built using the built-in Tilemap system in the Unity engine, where I draw the scene tile by tile with the asset I found online. Each scene uses a unique style of Tilemap sprites to make the scene looks more fitting to its name and function. 2-D Colliders were also added to the interiors and furniture to confine the moving areas available to the player. Each scene will have a different function, and the scenes are connected to each other. When the player steps on the entrance or exits another scene, the script will assign a password to the player so that at backstage it will be used to check which scene the player is going to and switch into the scene with a fading effect.

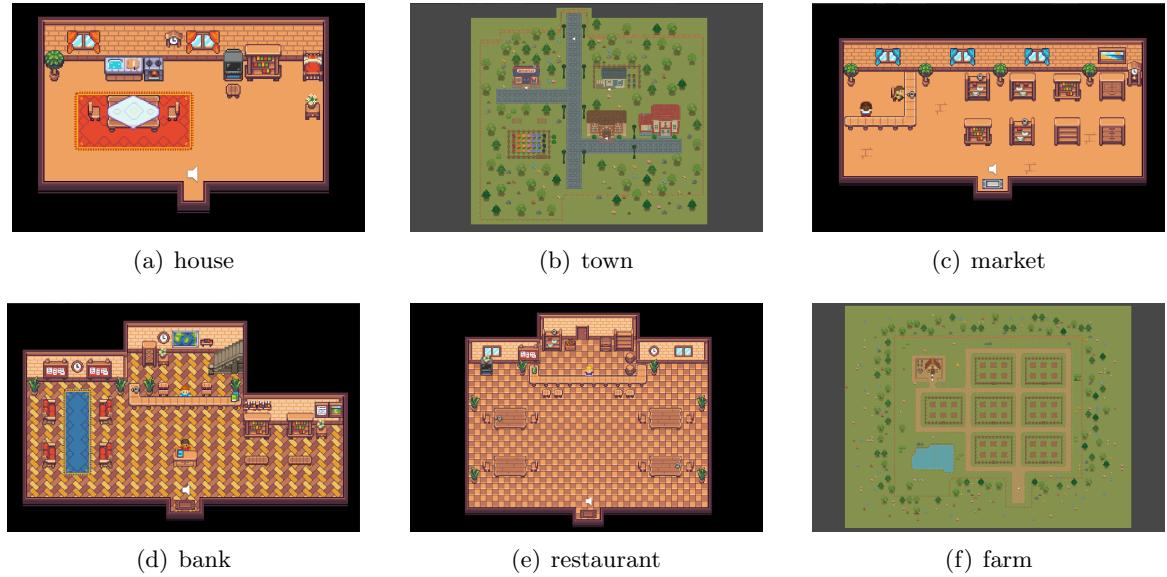


Figure 3.5: Scenes

3.3.2 Inventory

The inventory system reminds the player what item they have at the moment and also allows the item to be added or removed from the character's backpack. The player should press button "B" on the keyboard to call out the UI panel for the Inventory; the layout is shown in Figure 3.6. There are three types of items that the player can put in their backpack: foods, seeds, and grown plants corresponding to the first two, middle two, and last two slots in the top row, respectively. These items were programmed as inheriting scriptable objects, an existing class in Unity's API that performs as a data container that allows the programmer to store various data in an instance of the class. Each type of item has distinctive attributes, and this UI panel will acquire all these data. Therefore, the player can distinguish the items they have by looking at the image shown in the UI panel, and they can see the amount of a particular item in the backpack. The player can always click the cross button on the top-right corner in each slot to remove one item at a time. The player can also interact with the slots occupied by an item by clicking the item image. The logic is: suppose the item the player is clicking is food. In that case, one piece of that food will be consumed, restoring a certain amount of energy to the character, and the UI panel will give some notification to inform the player what food he has eaten, restoring how much energy. In contrast, clicking items that have other types will not give any response.

3.3. PROGRAMMING CHALLENGE AND FUNCTION IMPLEMENTATION



Figure 3.6: Inventory

3.3.3 Farming and Energy

Farming and the energy system is one of the most significant functions supporting the core loop in my game since a considerable amount of income comes from growing plants, and buying food to restore energy also takes a great portion of spending. This function took the most significant proportion of my overall development time because the logic behind the code is complex. The increasing price for buying farmland is implemented by dynamically updating. When the player stands near the gate, a detector would be triggered, and the algorithm will calculate the correct price for the purchase by acquiring the amount of the unlocked farmlands(see Figure 3.7 where the second purchase costs 500 more than the first purchase).

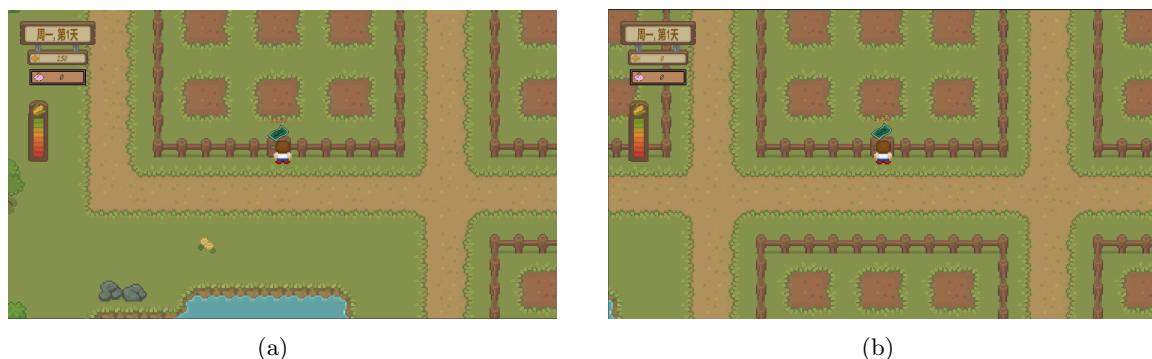


Figure 3.7: Unlocking new farmlands

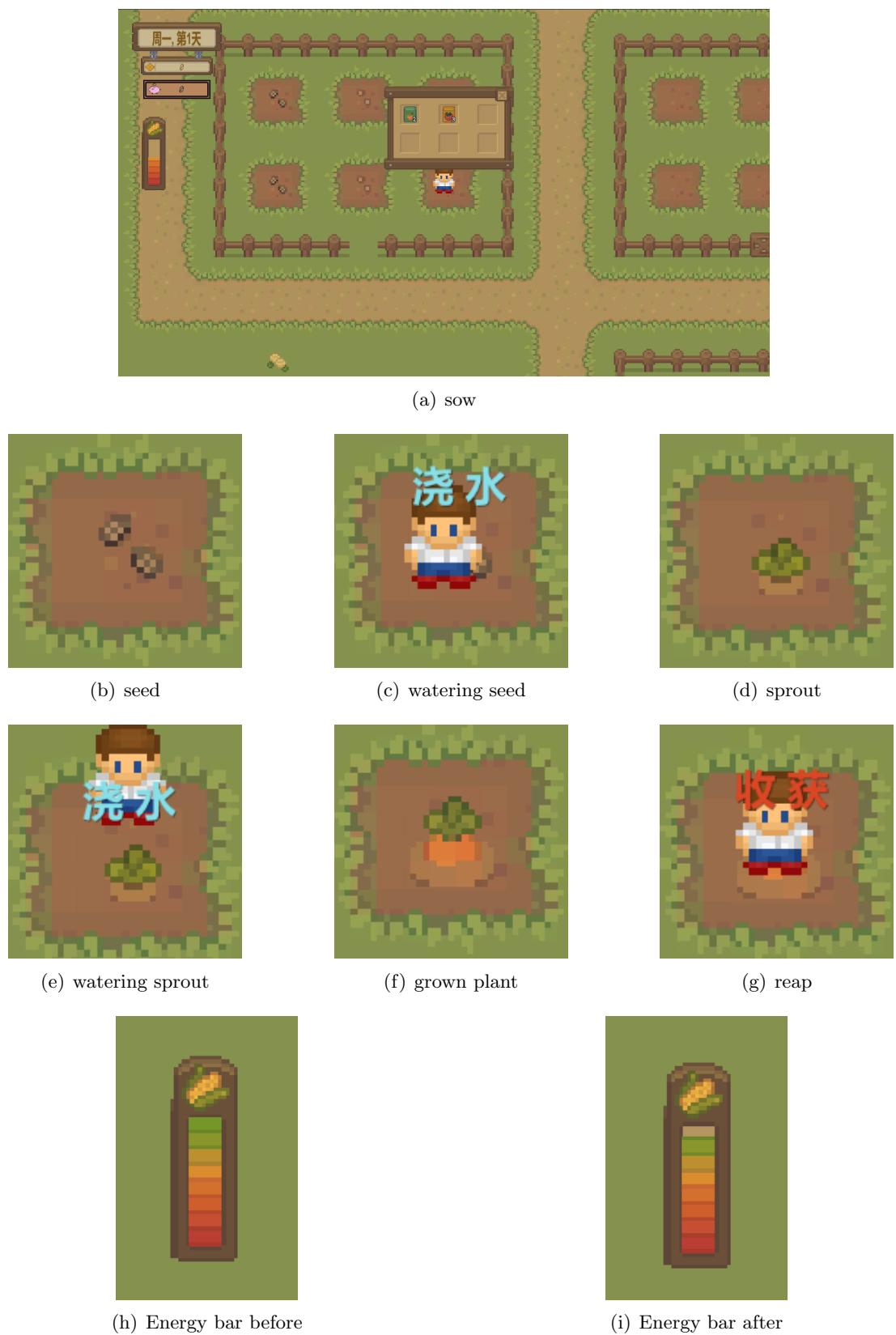


Figure 3.8: Growing plants

The process of growing a plant is divided into seven stages (see Figure 3.8). When the player steps on a vacant farm field, a UI panel will filter and display the seeds in the player's backpack (see Figure 3.8(a)) and clicking the seed image, the seed will be sowed into the soil. The player needs to water the seed and the sprout every day until it has grown to ripen; Figure 3.8(c) and Figure 3.8(e) shows the UI prompt reminding the player that the plant needs to be watered and Figure 3.8(f) shows the UI prompt indicating the plant can be reaped, the player should left-click the prompt to water or reap the plants. Sowing the seed and watering the plants will cost a specific amount of energy; this will be updated in the energy bar shown on the left side of the player's screen (see Figure 3.8(h) and Figure 3.8(i)). If the player does not have enough energy, then the character can not finish any actions that consume energy, foods are needed to restore some spirit.

A fair amount of time was spent on thinking of balancing the income and expenditure for the farming system, attempting to maintain the challenge in the playing. My thinking is that, ideally, the interval between unlocking two farmlands should be one week in the game so that the player will not spend too much time pursuing one intermediate target. Since every time the player needs to save 500 money more than the last time, the net revenue for each piece of the field in the farmland every day should be around twelve, where the net revenue is calculated by taking the abstraction of the average profit per day and the food expense to restore the energy. Considering the average cost for restoring one point of energy is set to one, watering and sowing cost 10 points of energy; the amount of money that the player should get from selling a grown plant is calculated by: the price of its seed plus the day it takes for growing multiplies by ten and add 12. Although this model may be simple, the main focus of this game is to create an environment for the player to develop a money management experience; this simple model is adequate to achieve this goal.

3.3.4 Item Trading

Figure 3.9 shows the Trading system in the game, there are three interactable NPCs for the player to sell or buy items. Figure 3.9(a) indicates the process of buying seeds in the market. By moving the cursor on the six images of the seeds on the left side, an enlargement of the image and the description texts will be updated on the right side. Then the player can click the left-hand side images to buy the seeds they desire. A similar design was applied to the process of selling grown plants, where the player needs to interact with another NPC in the market and buying food in the restaurant.

3.3.5 Dialogue

There are several NPCs that the player can talk with in the game in all scenes. The player can walk to an NPC and call out the dialogue panel by pressing button E. Every NPC has been given unique lines, the script will acquire the lines belonging to the NPC the player is

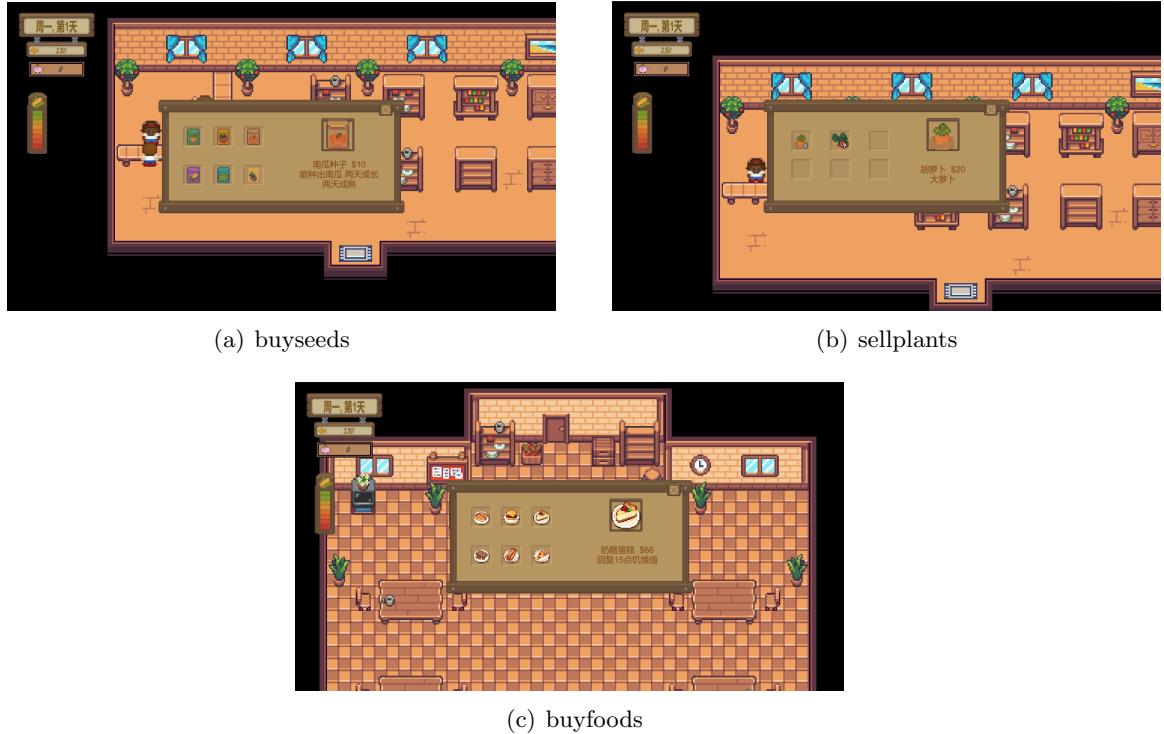


Figure 3.9: Trading system



Figure 3.10: Dialogue

talking to and print them out character by character. The player can switch to the next line if the dialogue has not been over by clicking the left mouse button. Most of the dialogue aims to encourage the player and to give hints on how to play this game.

3.3.6 Audio

The sound effect in this game includes background music and interaction sound effect, these audio assets came from the Unity asset store. The background music will be a piece of bright music looping the whole time the player is playing the game. Almost all interaction processes, including clicking the UI button and scene transition, were set with a sound effect so that the player would get feedback on their operation.

3.3.7 Save and Load

The player may quit and continue playing. In addition, one feature of the Unity engine is that when switching to another scene, all data apart from those belonging to a singleton instance will be destroyed. Therefore, there is a need to store the game data. Data including balance, the status of farmlands, the status of the growing plants, and the date and items in the backpack will be stored in a single file every few seconds while the player is playing the game. These data will be loaded the next time the player is playing.

3.4 UI and UX Design

As mentioned in Chapter 2, the UI and UX design in my game used notions of affordance and the Nielson's 10 Usability Heuristics as references. These theories have concluded valuable experience for designing a tangible interface, and most of them proved to be extremely helpful and hence are popular in the industry. The following subsections will highlight the most relevant theories that I have applied in my design.

3.4.1 Affordance

I had put great effort into making sure the affordance in my game was perceptible, attempting to make the function to be clearly presented to the player. This concept was widely applied in the farming, and trading system, where the interaction was designed to match the conventional thinking and the game's purpose so that the player would naturally think of the function the system would support. Although, it is proved there could be some false affordance corresponding to the interior in the scene, the participants tend to interact with the interior in the scene, which did not design to be interactable. The original intent for adding these interiors to the scene was to make the game more beautiful and make the player more involved in the game.

3.4.2 Visibility of System Status

This concept suggests: "The design should always keep users informed about what is going on, through appropriate feedback within a reasonable amount of time."^[5]

This is applied to the scene's transition, where a fade-in and fade-out effect would inform the player the switching the scene. Due to the size of the game, the loading and saving process would not cost much time; thus, there is no need to show the progress of loading and saving.

3.4.3 Match Between System and the Real World

This concept suggests: "The design should speak the users' language. Use words, phrases, and concepts familiar to the user, rather than internal jargon. Follow real-world conventions, making information appear in a natural and logical order." [5]

This point mainly applies to the image and text used throughout the entire game. The most conspicuous example is the UI status panel that records the energy status and the balance in the player's account. The ideal situation is that the buttons and other UI designs should use skeuomorphic icons that would naturally associate with their function. However, in my game, sometimes it is not easy to summarise an abstract or complex function in one single icon, this suggests the necessity of the literal instructions. Therefore, some attempts were made to make the text to be more straightforward. The language used in the game is Chinese, regarding the participants' first language in the evaluation stage. The words and phrases used in the button and description were all daily expressions so that the juvenile audience group would easily understand.

3.4.4 User Control and Freedom

This concept suggests: "Users often perform actions by mistake. They need a clearly marked "emergency exit" to leave the unwanted action without going through an extended process." [5]

In my game, where there is a crucial decision to be made, there are always striking buttons to let the player have a second thought. In addition, in the UI panel, the user can always go back to the previous panel, which gives the player the ability to correct their mistakes by clicking the wrong button. The design of using different colours on buttons would make the player unconsciously relate the consequence of clicking the button to the colour. This can be seen in Figure 3.11, where the green button says "Confirm" and the red button says "Back", the green colour would give a feeling of "safe" relating to the player making up their mind to withdraw the particular amount of money they have typed in the input box, by contrast, the red colour would produce a feeling of "negative", relating to the player giving up withdrawing and go back to the previous page.

3.4.5 Consistency and Standards

This concept suggests: "Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform and industry conventions." [5]



Figure 3.11: Withdraw UI panel

Examples of this point can be found on the UI panel of trading. All the three panels, as shown in Figure 3.9, were divided into two separate areas. The left-hand-side area shows the items that the player can purchase or sell, whereas the right-hand-side area will present an enlargement version of the image of the item that the player is currently interested in.

The same shape and image were used on buttons across the entire game, such as the UI panel in the bank and the UI panel asking whether the player wants to end the day, they also share the same feedback effect by clicking.

3.4.6 Recognition Rather Than Recall

This concept suggests: "Minimize the user's memory load by making elements, actions, and options visible. The user should not have to remember information from one part of the interface to another. Information required to use the design (e.g. field labels or menu items) should be visible or easily retrievable when needed." [5]

This concept can be seen in the design of the UI interfaces. Essential data such as balance, energy and data will be shown in the UI panel so that the player can easily acquire this information by glancing at the specific area on the screen. Also, the description of the item can be seen when the player moves the cursor onto its icon on the trading menus.

3.4.7 Help and documentation

This concept suggests: "It's best if the system does not need any additional explanation. However, it may be necessary to provide documentation to help users understand how to complete their tasks." [5]

As Nielsen suggests, ideally, the system does not need to provide any additional explanation. Considering the games, the most popular method for teaching the player the game-play and the mechanism is to create interlude animation. However, this was not applied in my game due to the fact that this approach requires a considerable amount of scripts and the coding challenge it may produce. My solution to this is to provide a description before the game starts, and the game is launched, a menu will come out, telling the player their tasks and the basic game-play, see FigureA.2. In addition, I added a help menu that the player can access anytime while they are playing by click the highlighted button in Figure 3.12(b). This help menu will show the short-cuts for different menus and other guidance that may help the player while they are playing. The English translation can be found in the appendix.

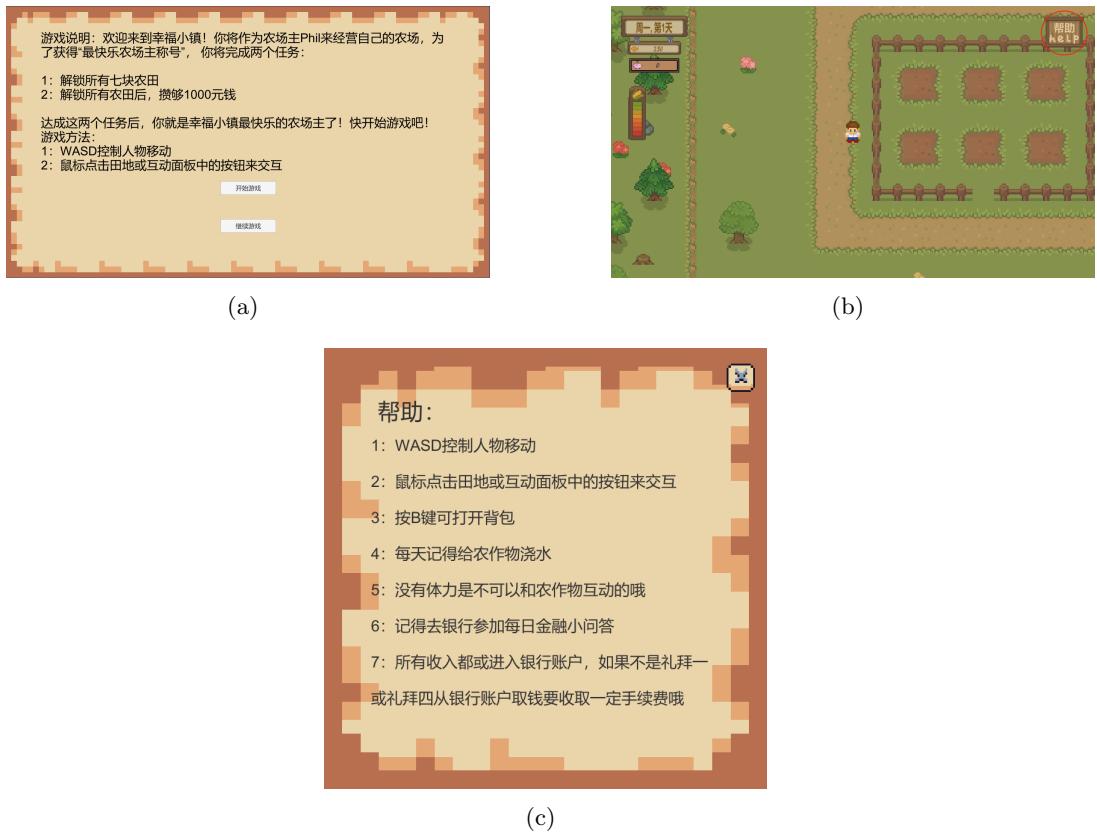


Figure 3.12: Help documentation

3.5 Comparison Between a Previous and Present Development

Last year, I developed a simple game with the same thesis as my project. Despite the game being not finished and the game-play design was not as well-developed as that in my project for this year, developing it gave me vast experience in getting familiar with the game engine and the programming language it supports. This year's project inherited most of the game-play

3.5. COMPARISON BETWEEN A PREVIOUS AND PRESENT DEVELOPMENT

and mechanics from my last year's progress, whereas some features were abandoned after consideration.

3.5.1 Upgrade in Assets and Arts

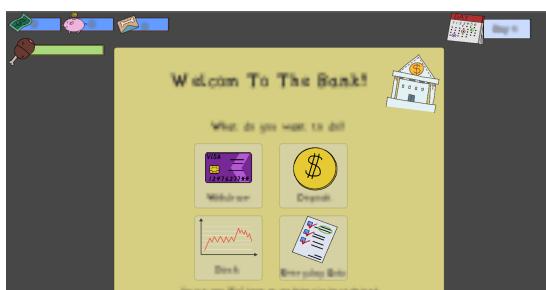
The first change in my project for this year is the assets. Most of the assets and arts used in my last year's development were drawn by myself using an application called Aseprite. In contrast, I chose to use the asset package created by the unity community this year. A comparison between the art style of my old and new design can be found in Figure 3.13. Figure 3.13(a) presents the scene of town in my last year's design, and Figure 3.13(b) shows the same scene in my game for this year. It can be clearly seen that not only does the new scene have the more beautiful assets, but there is also a growth in the richness of the scenery. Also, Figure 3.13(c) and 3.13(d) shows a better-looking UI layout and more tangible UI designs this year.



(a) town-old



(b) town-new



(c) UI-old



(d) UI-new

Figure 3.13: A comparison between old and new development

3.5.2 Abandoning Stock System

The second change is that the stock feature was removed in this year's design. In the old design, the player could invest their money in the stock market, as shown in Figure 3.14. The original

intention was to introduce the concept of investment to the player by playing with a stock system, which is simplified from the real world stock market. This system has four stocks for trading, and every day the price of each stock was programmed to fluctuate between 10 and 20 randomly so that the player could profit from buying and selling these stocks. This feature was finally abandoned due to the concern of developing the so-called “free lunch” thought. The design of this stock system underestimates the complexity of the stock market in the real world and may leave an impression to the player that earning money could be labourless. The imperfection in this system is that when the player invests a considerable amount of money in the stock market, he could earn a living merely on pure luck without engaging other features in the game. This contradicts the theory mentioned in Chapter 2, which suggests that children should realize that money should be earned by putting effort. By contrast, in my project for this year, the player can only make money by growing crops and taking bank services, both requiring the engagement of the player and asking the player to cost labour. Therefore, the stock system from last year was removed in the new design and the economic system was optimized this year.

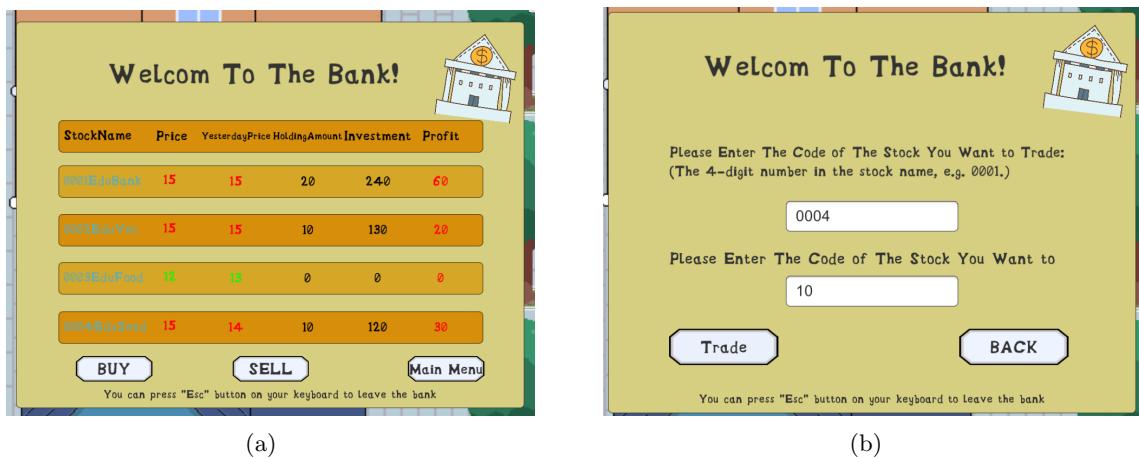


Figure 3.14: Stock system

3.5.3 Abandoning Pet System

The other feature in my last year’s work that was removed this year is the pet system. As shown in Figure 3.15, there would be a pet dog programmed to follow the player all the time, and the player can interact with the pet.

The player can also feed the dog, wash the dog and give the dog a heal-check in the pet centre, as shown in Figure 3.16. This design attempts to introduce the concept of contributing to the family to the player, which is suggested to be helpful for developing a child’s financial management concepts[6]. The other design in the pet system that is worth mentioning is the petcard, shown in the UI panel at the top-left in Figure 3.15. The petcard is designed to be

3.5. COMPARISON BETWEEN A PREVIOUS AND PRESENT DEVELOPMENT



Figure 3.15: The pet dog

a pet centre membership account that the player could top-up and spend the money in the account to purchase the service in the pet centre. The advantage of using this membership card is that when the player tops up the petcard account, The actual increment in the balance will be 120% of the amount the player has paid. This feature aims to encourage the player to use the petcard account for buying services for the dog instead of using the cash balance. By doing this, it is expected that the player would build a concept of spending their money wisely and make the best use of their money.

However, this feature was removed in this year's project because it may distract the player and makes the whole game-play system complex. In the new design, adding this feature would make the player have to have the attributes of the pet in mind. The player needs to consider if the dog needs to be fed, cleaned or applied for a health check, these considerations will occupy a lot of concentration of the player. I did not want to overemphasise the feature of the pet system and lose the focus on helping the player build financial management skills.

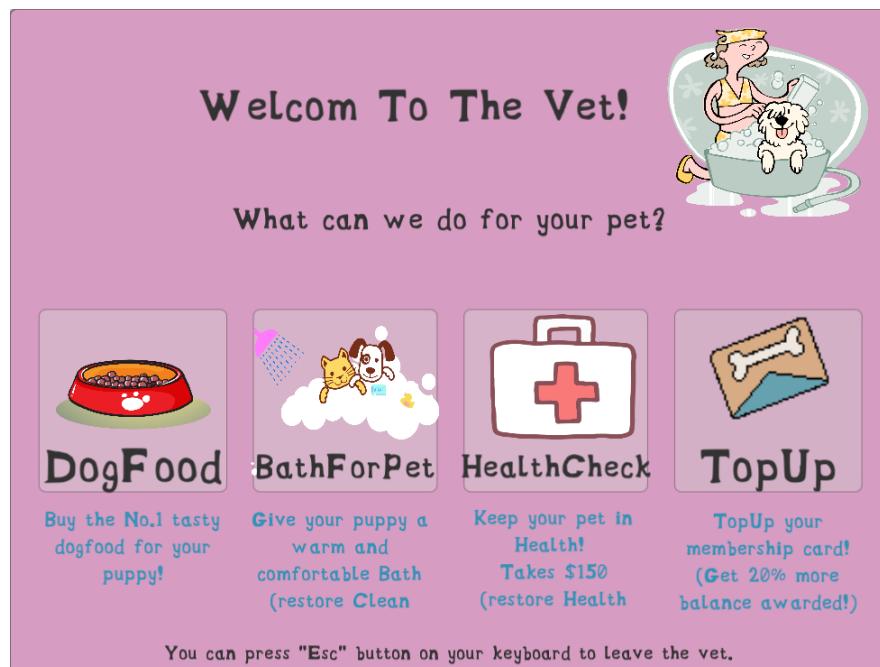


Figure 3.16: The pet centre

Chapter 4

Evaluation

This chapter will explain the experimental purpose and some obstacles I have met while designing the experiment. Then I will introduce the experimental procedure for evaluating my game and conclude the effectiveness of the game in educating junior high school students on financial management skills, supported by presenting feedback from the participants and data analysis. In addition, some interesting discoveries were found and will be discussed in this chapter as well.

4.1 Purpose and Constraints

The experiment will have two primary purposes. The first purpose is to evaluate the effectiveness of the game in helping junior high students develop their money management skills, the other purpose is to evaluate the UI design in the game.

Ideally, all participants should come from children around junior high school age because they were designed to be the primary audience to this game so that the feedback and result that would get from the experiment will fit the purpose. However, children in such an age group are defined as a "vulnerable group" since owing to the immature mentality, children may fail to protect themselves. The law and the university regulation have a number of restrictions on experimenting with children, and these could lead to the refusal of my experimental ethical application after months of examination. Therefore, I took the advice from the unit director to involve the parents who have junior high age children as participants to mitigate risks. Twenty-four parents volunteered to participate in the experiment, and all of their children are studying in a Chinese junior high school. Due to the factor that they are all in a different country, the experiment will be conducted online.

4.2 Experiment Procedure

The experiment procedure can be divided into 3 phases: two online interviews and an in-between demo playing week.

Participants will first be invited to join an online interview, where they will be introduced to the concept of a serious game and share their feedback on some of the basic UI designs of the game. The participants will be asked their opinions on serious games because, conventionally, teachers and parents tend to discourage children from playing games in Chinese society. This is due to the intense pressure from the competition in the senior high school enrollment exam and the entrance exam for universities. Therefore, understanding the parents' attitudes towards serious games is crucial for predicting how likely the parents would allow their children to play this game in the future. Then, a number of in-game screenshots will be presented to the participants to collect their responses on UI designs. The screenshots can be divided into two types as follows, and for each type, the participants will be asked to give their opinions on different aspects.

- **Screenshot of a scene:** There will be six screenshots taken from the six scenes in the game, corresponding to the farm, player's house, town, market, restaurant and bank, respectively. The participants will be asked their assumptions on which scene is shown in the picture based on their first impression of the screenshots. Then the participants will be asked which particular area or non-playable characters(NPCs) in the scene can be interacted with. The purpose of this is to identify whether there could be any hidden affordance or false affordance in the scene design that may confuse the player.
- **Screenshot of UI panel:** There will be some screenshots taken from some main UI panels in the game, including the inventory panel, shopping panel and banking business panel. These screenshots will be shown to the participants, and the experiment conductor will highlight some specific areas on each picture in order to ask the participants to give feedback on these areas. The participants will be asked to tell their expectations on what events may happen by interacting with the highlighting area in the screenshot. The point is that the participants do not know the actual event that will happen in the game after interacting with the particular area. Therefore, their answers would reflect the most natural consequence of that interaction in the players' view. The purpose of this is to assess the tangibility of the UI panel and identify any false affordance that may mislead the players.

After the first interview, the game may be slightly modified based on the comment gathered from the participants and be sent to the participants. Considering the participants may have to work in the daytime and supervise their children after work, one week will be given to them to play the demo. The participants do not have to achieve all the goals designed in the game.

Finally, the participants will be invited to join a second online interview and share their playing experiences. In this interview, the participants will be asked to comment mainly on the feasibility of the game being used to educate children on money management skills. The questions will focus on what part of the game they think can effectively teach children and what kind of financial skill the children can gain from that particular part. The participants can also share any comment they think to be worth mentioning.

4.3 Results and Analysis

This section will present the feedback and the in-game data acquired from the interview and the demo playing.

4.3.1 Results from First Interview

There were 24 parents in total volunteered to join the experiment. During the first interview, without introducing the definition and application of serious games to them, there were 17 out of 24 parents said they had not heard about serious games before this experiment and 12 among these 17 parents disagreed that a game could educate children. These 12 parents believed that video games ought to be designed for amusement purposes, and children are wasting their time playing video games because it would occupy the children's learning time. One parent argued with raising the example of a video game, Honor of Kings, which is popular among both Chinese adolescents and adults. He suggested that the government's newly carried out regulation is restricting the juveniles' playing time. The game would force the player to log out if the player is identified to be under 18 years old and has been playing for more than an hour on weekdays. In addition, the parents suggested that having the children play games on digital devices may cause them to stare at the screen for a long time, and this may lead to poor eyesight. However, by introducing the purpose and application of serious games and educational games, only one parent sustained an objection to allowing his child to play an educational game. He believes his child is addicted to playing video games, and due to his work, he cannot supervise his child and prevent the child from playing too long. The rest of the parents in the 12, who did not support the opinion that games can be educational, would agree to let their children try to play serious games or educational games in the future.

This result suggested there could be a neglect of the potential of games to be a powerful educational approach among Chinese junior high school students' parents. The reason for this neglect could be the conventional thinking and the negative propaganda of the video games from school and the game industry itself. The Honor of Kings example given by the parent illustrates that some policies introduced by the game companies may encourage the folks to resist their children from playing games. The intent of anti-addiction to video games is good, whereas such an extreme policy may leave an impression to the parents that having their children play

video games would do more harm than good, whence denies the positive consequence of playing games, such as gaining pleasure and knowledge.

On the other hand, the shifting attitude of the parents after understanding more about serious games and educational games suggests that parents may hold an open attitude to these games. Although the interview reflected that most of these parents did not know much about serious games, they are willing to have their children try serious games in the future. This indicates that it is necessary to popularize the knowledge of serious games and the educational function of games so that the mass would consider games as an approach to education.

However, these conclusions may have limitations since the experiment did not investigate the education and social background of the participants, which could be a significant contributor to the results. Moreover, the amount of participants is small, which may not represent the general public.

The experiment also investigated the participants' experience of playing video games. Among 24 participants, only six said they usually play video games and 18 participants claimed they seldom play video games. This suggests potential challenges in understanding UI and game-play designs since three-quarters of the participants may not be familiar with the modern game's famous design. According to Gibson's notion of affordance, Gibson gave an example of a baby and a ladder. The baby does not have enough experience to support him to recognise the affordance that the ladder can be used to reach high. A similar concern in this situation would be the parents may fail to find the affordance designed in the game. Nonetheless, this concern was proved to be redundant later since the participants could easily recognise most of the affordance on the UI panel.

Having presented the screenshots of scenes to the participants, they can match most of the scenes right. However, different voices were found in one picture.



Figure 4.1: scene of town

Figure 4.1 shows a part of the town where the player can visit the market, restaurant, and bank through this scene. The three buildings are located at the top-left, top-right, and bottom-right corners, respectively. There are seven parents who did not recognise these three buildings correctly, and even though some of the parents who gave the correct match were not certain about their answers. The most common mistake among these seven parents is that they would think the top-left building to be a restaurant instead of a market because, as non-English speakers, they do not understand the meaning of the word "market" written on the board above the building. Although the players could learn the location of the scenes during playing, the learning process may contain avoidable mistakes since the player needs to enter a building and exit it after realising he has got to the wrong place. One effective solution I could figure out is to modify the assets and label the scene's name in Chinese on the asset sprite. However, having myself lack the experience in drawing pixel arts, changing the sprite may destroy the harmony in the picture and makes it look strange in the scene. Therefore, with all in consideration, I finally decided to add a sign for each building that allows the player to interact with and shows the name of the building, as shown in Figure 4.2. This newly added feature was proved to be able to reduce confusion.



Figure 4.2: scene of town with signs

4.3.2 Results from Second Interview

After the one-week demo play, the 24 volunteers were asked to join the second online interview to share their experience of playing the game. It can be concluded from the result from the interviews that most of the participants spent around one hour on playing the game. One participant quit playing at very beginning and the reason given by that participant is that "I really can not handle computer so I could hardly continue playing this game." 7 out of 24 participants achieved the final goal in the game, and the virtual day in the game they spend for achieving that goal are: 45, 53, 44, 44, 41, 36, 40, respectively. The average for that amount is calculated to be 43.

During the interview, the participants were asked following questions:

Question: To what extend do you think this game would benefit your child learning financial management and what financial management skill do you think your child could learn from this game?

All of the volunteer agree that children could learn more or less from this game. The most popular financial management skill that the children can learn from this game suggested by the participants is that they think this game would be successful on teaching the children that making money takes a lot of effort. Another skill comes close second the participants believe the children can benefit from this game is planning the budget. Some parents also mentioned this game could encourage the children to save their money in the bank account and making profit.

Question: Which part of interaction in this game do you think bring you difficulties when you were playing the game?

Answer: Six participants suggest they are not familiar with using computers and the way of controlling the character to move and the short-cuts involving pressing keys on the keyboard confused them while they were playing. They suggest to change the interaction approach to mouse moving and click only so that it would be friendly to people who do not use computer very often.

Some participants also mentioned the inconvenience of UI text reminder for the interaction, suggesting the size of the text could be bigger.

Question: What feature in this game do you think can be improved and what new feature do you think can be added to the game? **Answer:** The answers to this question show a significant difference between individuals, the participants have shown vast creativity on this question. The most frequently mentioned improvement is adding a map system. Some participants say they usually lose direction while playing the game, especially in the farm scene, what they see on the screen is just farmlands, and they can not locate themselves in their minds. This is a very practical suggestion as this reflects that the player may have a different perspective from the game developer. I am familiar with the scene and the location of buildings because I drew the scene myself. However, the player did not involve in this process, and thus they should be given help to get familiar with the game's environment.

4.3. RESULTS AND ANALYSIS

Another constructive opinion is that the game could add more interactable elements. For example, a participant mentioned that the game could provide a more convenient method for watering, the participant advised that it could be better if the character could water all six fields in one farmland at once so that the player does not need to run to every field.

Other useful suggested improvements are:

- The game could add a weather system, where in the rainy days the player does not need to water the plants.
- A mobile version could be developed so that the players can play this on their phones or tablets.
- The game could add different background musics in different scenes.
- the game could use a book-keeping system that records the incomes and outgoings.
- The game could add stock and funds system to teach the player investment. The game could add a tag on the objects that can be interact with. The character could have faster move speed so that the player could spend less time on walking to another location on the map.

Question: (This question only asked the seven participants who finished the final goal.) What do you think is the best strategy to reach the final goal?

Answer: All of the seven participants suggest that their strategies to be keeping taking part in the daily quiz in the bank, planning the budget, and saving the rest of money into the saving account to earn interest.

Results and feedback from the second interview suggest the game is adequate for educating high-junior-school students in financial management knowledge; however, at the meanwhile, some imperfections exist in the game. During the interview, I found that the participants were trying to be too kind and polite, they tended to give more positive evaluation and encouragement even if they indeed got frustrated when they were playing. I felt like most of the participants were afraid of spoiling the result of the experiment and trying to blame some confusion caused by the game while they were playing on themselves. For example, one participant kept praising the game and suggested that there was no need for improvement; he admitted that he only unlocked one extra farmland and blamed it on that he did not have much game playing experience. Although the first interview shows that most of the players do not play games very often, which may affect the assessment of the game development, some valuable feedback was gained from the second interview. This feedback gives a direction for future improvements.

Chapter 5

Project Reflection and Future Work

Starting with me stirred curiosity in an HCI tutorial, I motivated to develop a serious game that can educate high-junior-school students financial management skills. Through research, I found that serious games may have significant potential on education and multiple studies suggests that there is a need in educating juveniles about finance. Therefore, I had developed a 2-D pixel style game based on relevant game designing, education, finance and HCI theories on the Unity engine. Through a recent discussion on the "Chocolate covered broccoli" criticism on the serious games, I decided to design my game to be educational but also bring player fun and enjoyment.

Spending untold hours on learning and developing the game on the Unity engine, I have gain invaluable experience on game designing, coding with C#, and using Unity engine. Such experience would definitely contribute to my career pursuit. Moreover, applying HCI theories on the UI and UX design allow me to gain experience on coping with users. I had a chance to not only understand the user on a higher dimension, but also to practice applying the theories in the field. I would describe the development process to be challenging to me since this is the first time I develop a game with a complex game-play system in an unfamiliar game engine and I had to learn new coding techniques and the function in the Unity engine. However, the product, as a mini-serious game, is satisfiable and proved adequate to achieve its educational aims. The game allows the player to act as a farm owner, who aims chasing the title "the Happiest Farm Owner" in the town. To win this title, the player needs to achieve two small goals, requiring the player to earn money from growing plants, answering everyday quiz, and increasing bank savings. Some HCI theories were applied in the UI panel and UX designs and these designs achieved some extent successful through reviewing the feedback from the experiment. The game system could be improved by adding features such as a map system, and more convenient operating methods such as allowing the player to water several fields at once. More concentration could be put on the UI design, to optimise the player's experience.

Finally, the participants of the experiment were not the audience that this game is designed to, and overall the participants lack the experience of playing video games. These factors may

produce an effect on the results gained from the experiment. Although, the experiment observed most of the junior-high-school students parents who volunteered to take part in this experiment have a negative attitude towards games and most of them do not know the educational potential of serious games. However, these parents shows an open attitude on allowing their children trying to play serious games in the future. The participants also suggest the product of the game could be adequate to educate junior-high-school students about financial management skills and provided valuable advise on future improvements. The experiment for the game's next iteration should consider to invite junior-high-school students so that the results can be more objective from the audience.

Appendix A

Appendix A: English translation for the help documents:

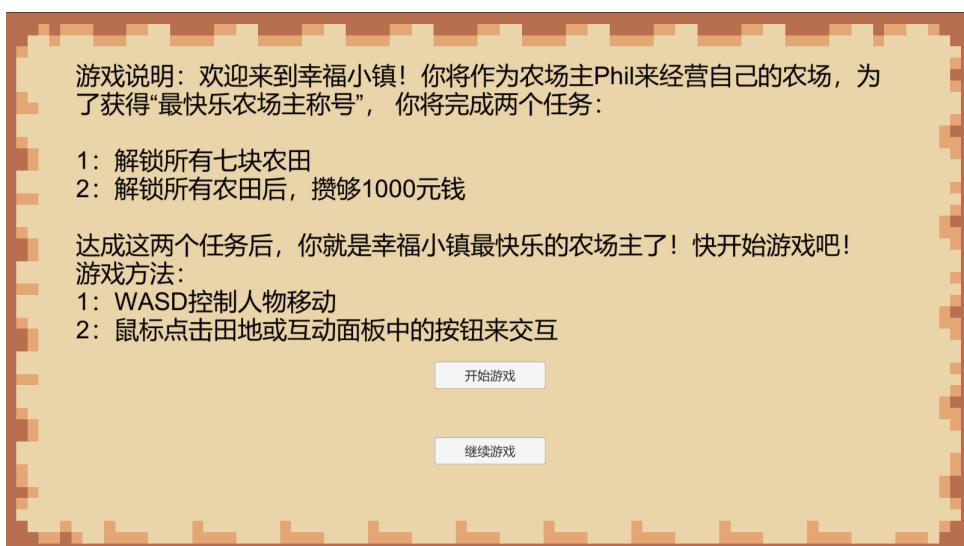


Figure A.1: Help documentation on the game start menu

Translation:

Guidance: Welcome to the Happy valley! you will act as a farm owner, Phil, running your farm. In order to win the "Happiest Farm Owner" title, you shall achieve two goals:

- 1: Unlock all seven farmlands.
- 2: After unlocking all farmlands, earn 1000 Yuan money you your account.

After achieved these two goals, you will be the happiest farm owner! Let's start!

How to play:

- 1: WASD controls the character to move.

- 2: Click the buttons or fields on the farmlands to interact.

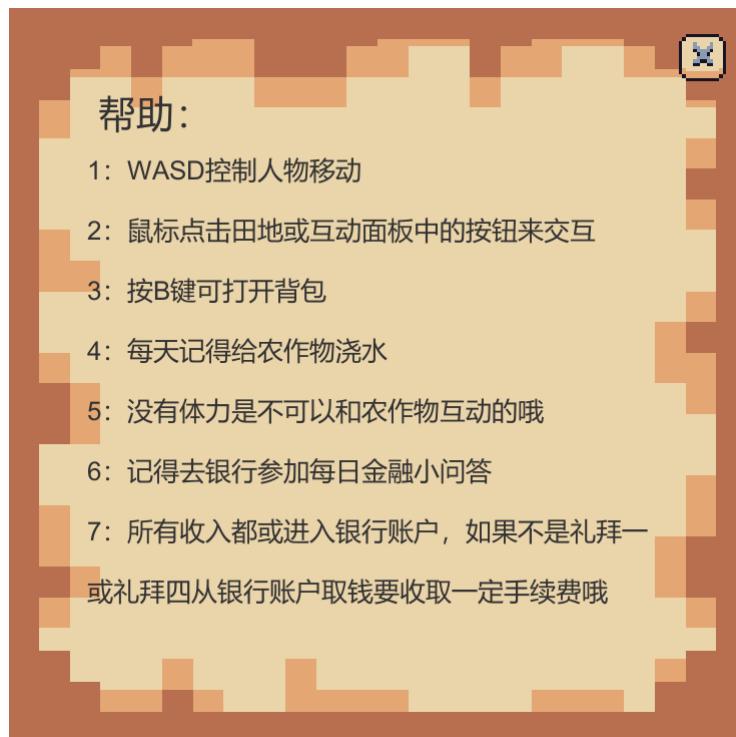


Figure A.2: In-game help documentation

- 1: WASD controls the character to move.
- 2: Click the buttons or fields on the farmlands to interact.
- 3: Press "B" to open inventory.
- 4: Remember to water your plants.
- 5: You can not interact with the plants if you have no energy.
- 6: Remember to take the every quiz in the bank.
- 7: All of your income will go to you saving account in the bank. Withdraw made on days expect from Monday or Thursday will charge a service fee.

Appendix B

Appendix B: Ethic Forms for The Experiment:

B.1 CHN-Consent Form

同意书-家长

《一个帮助小孩子培养理财技巧的严肃游戏》

项目大纲:

这是一个英国布里斯托大学计算机系大三的学生的毕业设计项目。项目的主旨是设计一款严肃游戏来帮助儿童培养理财技巧。项目的原型开发基于心理学，教育学和经济学的相关知识。但是游戏的用户交互和玩法设计还需要初中年龄小孩子和其家长提出评价，来进行真实的检验。

关于“严肃游戏”:

严肃游戏的设计主要目的并不是用来娱乐。一款好的严肃游戏可以作为一个强有力的工具使人得到培训，治疗恐惧症，适应新环境，传递信息，尤其是教育。对于青少年教育类严肃游戏来说，使用者会逐步地通过游戏化的训练或者模拟来学习一种技能或知识。和传统意义上的游戏来比，严肃游戏使得用户在学习的体验中更有参与感。

更多关于严肃游戏的材料:

<https://zh.wikipedia.org/wiki/%E4%B8%A5%E8%82%83%E6%B8%B8%E6%88%8F>
<https://baike.baidu.com/item/%E4%B8%A5%E8%82%83%E6%B8%B8%E6%88%8E>

为什么我被邀请参加调查?

本调查中的严肃游戏针对于初中年龄的孩童，来帮助他们培养理财技巧和习惯。因此，您，作为有初中年龄孩童的家长，被邀请参加调查。

我必须要参加吗？ 不，参加是自愿的，不是必须的。

我可以在任何时间退出吗？

当然可以。您可以在任何时间退出调查或采访。如果您感觉到任何不安或不适，您可以无理由立即停止并退出本次调查。

我需要做什么？

首先您将被一起邀请参加一个线上采访。采访中，您将会被教如何去玩这款游戏，您可能会被问到一些一些用户交互设计方面的问题。采访过后，您将会被要求在一周内玩这款游戏（什么时间玩，玩多久将取决于您自己的时间安排）。最后，您将会再次被邀请参加视频采访，来分享您的体验和对于游戏的评价。

我将会有哪些数据被收集？

在整个过程中，视频采访不会录音录像，但是您对于游戏和设计的有趣的评价或建议将会被我记录下来。在您玩游戏的期间，一些数据将会被保存，例如您一共花费了多少时间来玩这款游戏。另外，一些游戏数据将会被记下来，例如您在游戏中一共解锁了多少块农田。这些数据会和您的个人信息分开储存，并且只有我能看到这份文件。

这些数据将会被用来干什么？

被记录下来的您对于游戏的评价将会在我的学术报告中加以分析。我可能会匿名地，完全引

用，或者复述您的评价，来展现本游戏得到的评价。

收集到的游戏数据将会在我的学术报告中匿名地展示并加以分析，来展示我收集到了什么样的数据。

我的数据会被怎么使用？

您的参与的机密性将会被保证。 您的研究数据将只会对被监督研究是否正确进行的研究人员和国家性的组织开放。 您的研究数据将会是匿名的。这意味着这些数据将会对应一个数字编码而不是您的个人信息， 所有关于您身份的信息将会被抹去。因此本次研究中，从任何文件或报告中识别您的名字将是不可能的。最后， 您的数据将会被“开源”。 这意味着他将被在线存储并用来向公开使用。

什么是“开源”？

开源意味着实验数据将会被免费的， 向任何对本次研究感兴趣的人或想对本次实验数据进行分析的人开放。因此我们无法保证这些数据将被怎样使用。但是所有的数据在公开之前将会被匿名，所以从研究数据中得到您的身份信息将是不可能的。

参加的风险或缺点？

一个缺点可能是参加研究可能会耗费您一定的时间。我尽力用我学到的知识将游戏设计好，并且尽量确保他没有任何不适合孩子接触的地方。您的参与将会为本游戏的设计和本次研究提供重要帮助！

本次研究被谁监督？

本项目和研究被英国布里斯托大学 Management's Ethics Committee 所监管。

请回答下列问题：

是 否

您是否：

- | | | |
|----------------------|--------------------------|--------------------------|
| ● 对于此次研究得到了充足的信息？ | <input type="checkbox"/> | <input type="checkbox"/> |
| ● 有机会去问调查人任何问题？ | <input type="checkbox"/> | <input type="checkbox"/> |
| ● 对于您的所有疑问得到满意的答复？ | <input type="checkbox"/> | <input type="checkbox"/> |
| ● 有足够的信息来决定是否参加本次调查？ | <input type="checkbox"/> | <input type="checkbox"/> |

您是否了解：

您可以在调查结束之后要求删除和您有关的任何数据

- | | | |
|-------------|--------------------------|--------------------------|
| ● 在任何时候？ | <input type="checkbox"/> | <input type="checkbox"/> |
| ● 不用给出任何理由？ | <input type="checkbox"/> | <input type="checkbox"/> |

您是否了解：

您可以在调查结束之后要求删除和您有关的任何数据

- 本次调查中收集的数据和反馈将在本次实验结束之后匿名的被开源?

您是否允许调查人:

- 在学术报告中引用您的评价或数据?

- 我在此郑重同意参与本次调查
- 我了解本次研究之后数据将会被开源。我知道这意味着匿名的信息将被向公众开放并且有可能会被与本实验无关的目的使用，而且这些信息将不会暴露我的身份信息

参与人签名: _____ 时间: _____

姓名拼音 (先名后姓, 全部大写): _____

B.2 ENG-Consent Form

Serious Game: A game to help children develop money management skills. - Consent Form

Project outline:

This is an individual project for a Computer Science BsC student in University of Bristol. The aim of the project is to design a serious game for junior-high aged children to help them develop money management skills. The prototype of this game is developed based on relevant psychology, education, and financial knowledge. However, the game needs to be examined in the real world with parents who have junior- high aged children, sharing their feedbacks on both UI design and the system design of the game.

About Serious Games:

Also known as applied games, is designed for a primary purpose other than pure entertainment. A serious game can be a powerful tool to provide the opportunities of skill training, treatment of phobia, adaptation to the environment, adherence to the message and especially on education. For the youth educational serious games, the user will learn specific subjects gradually through gamified exercise and simulations. Compared with traditional teaching methods, serious games make players more engaged and gain more fun while learning.

Further reading about serious game:

https://en.wikipedia.org/wiki/Serious_game#Youth_education

<https://grendelgames.com/what-are-serious-games/>

Why I have been invited to participate?

The serious game in this project is developed aimed to teach junior-high age children to develop money management habits. Therefore, parents who has junior-high age children or older will be invited to take part.

Do I have to take part? No, participation is voluntary.

Can I withdraw at any time?

Yes. You can withdraw at any time during the interviewing. If you feel unsafe or uncomfortable, you can immediately call a stop and withdraw the participation without giving a reason.

What do I have to do?

Firstly, you will be asked to join an online interview. During the interview, you will be introduced to the game, and some questions related to the User Interface will be asked. After the interview, you will be asked to play the game occasionally for a week (depends on your own time arrangement). Finally, you will be invited to an online interview again, to share any feedback on the gameplay or the design of game system.

What data will be gathered during my participation?

During the interview, the interview will not be recorded, however, when you are criticising on the game design or giving any interesting comment on the game, the sentence you say will be noted down. During the game play, you will be asked to record some gameplay statistics, for example how long did you spend on the game in the week. Moreover, some gameplay data will be gathered, such as how many farmlands you have unlocked in the game. These data will be stored separately from the identity information, and can be accessed only by me.

How will the findings be used?

The transcripts of your interview will be analysed in my academic thesis report. My thesis will include direct or paraphrased but anonymous quotes to indicate what feedbacks I have received.

The gathered gameplay and statistic data will be listed and analysed in my academic thesis report anonymously to show what data I have gathered.

What will happen to my data next?

Your involvement in the study will remain confidential. This information will only be available to research staff and national bodies which monitor whether research studies are conducted properly. Your study data will be anonymised. This means that it will be given an identification number and any identifying information about you will be removed. Therefore, it will not be possible to identify you by name from any aspect of documentation or reporting for this research study. At the end of the study your data will be made “Open Access”. This means that it will be stored in an online database so that it is publically available.

What is open access?

Open access means that data are made available, free of charge, to anyone interested in the research, or who wishes to conduct their own analysis of the data. We will therefore have no control over how these data are used. However, all data will be anonymised before it is made available and therefore there will be no way to identify you from the research data.

Disadvantages/risk of taking part?

One disadvantage to you is that the interview and gameplay will take you some time. I have tried to make a well-designed game based on the knowledge I have learnt, and try to make sure there will be nothing inappropriate to children. Your participation will significantly help the design of the game and this research.

Who has reviewed the study?

This project has been reviewed by the University of Bristol School of Management’s Ethics Committee.

Please answer the following questions to the best of your knowledge

Yes No

HAVE YOU:

- | | | |
|---|--------------------------|--------------------------|
| ● Been given sufficient information explaining about the study? | <input type="checkbox"/> | <input type="checkbox"/> |
| ● Had an opportunity to ask questions and discuss this study? | <input type="checkbox"/> | <input type="checkbox"/> |
| ● Received satisfactory answers to all questions you asked? | <input type="checkbox"/> | <input type="checkbox"/> |
| ● Received enough information about the study for you to make a decision about your participation? | <input type="checkbox"/> | <input type="checkbox"/> |

DO YOU UNDERSTAND:

That you are free to withdraw your participation and data even after giving consent

- | | | |
|---------------------------------------|--------------------------|--------------------------|
| ● At any time? | <input type="checkbox"/> | <input type="checkbox"/> |
| ● Without having to give a reason? | <input type="checkbox"/> | <input type="checkbox"/> |

DO YOU UNDERSTAND:

- | | | |
|---|--------------------------|--------------------------|
| ● That data collected in this survey will be ‘open accessed’ but anonymous after the research? | <input type="checkbox"/> | <input type="checkbox"/> |
|---|--------------------------|--------------------------|

DO YOU CONSENT THE RESEARCHER:

- | | | |
|--|--------------------------|--------------------------|
| ● Citing quotations of your in-game data or feedback sentences in the academic report generated by this research? | <input type="checkbox"/> | <input type="checkbox"/> |
|--|--------------------------|--------------------------|

- | |
|---|
| <ul style="list-style-type: none">● I hereby fully and freely consent to my participation in this study● I understand that after the study the data will be made “open data”. I understand that this means the anonymised data will be publicly available and may be used for purposes not related to this study, and it will not be possible to identify me from these data |
|---|

B.3 CHN-Partcipate Information Sheet

《一个帮助小孩子培养理财技巧的严肃游戏》

项目介绍：

您好！我是一名来自英国布里斯托大学的计算机科学大三在读学生，作为毕业项目，我设计了一款“严肃游戏”。为了测评和分析我的设计的优缺点，我想邀请您来参加我的调查。

严肃游戏：理论上讲，严肃游戏是一类游戏，但是它不仅可以给人们带来游戏的娱乐性，更可以让人们学到一些知识，或者锻炼一些技能。我设计的这款严肃游戏的主旨，就是为了帮助初中年龄的小朋友去学习如何培养理财的观念。

为了收集游戏的反馈和真实的数据，我需要一些志愿者来试玩这款游戏。然而因为初中年龄的孩童法律和规定里被定义为“脆弱人群”，所以我很难直接找孩子们来进行试玩和采访。所以，作为有初中年龄段孩子的家长，您被邀请来加入本次调查。

我需要做什么：

首先，您会被邀请参加一个视频采访，我会教您这个游戏怎么玩，您可以提出一些对于游戏的评价，例如画面，玩法和设计方面的评价。我的视频采访不会录音或者录像，但是我可能会把您的评价记下来，并在我的报告里加以分析。所有的反馈都将被匿名的，安全的保存，他们将被存放在一个 OneDrive 账户里面，由 University of Bristol 的学生账户密码来保护。

然后，您可以在一周的时间里随意的玩这款游戏，在什么时间玩，玩多久您决定。我会记录下一些在游戏里面的数据，例如您在游戏中解锁了多少块农田，这些数据只会被用于统计和分析。游戏里没有对错，您可以做任何您认为对的事情。

最后，您会被再次邀请参加视频采访，您可以分享玩过游戏后的体验。像第一次采访一样，我可能会记下您分享的体验，但是我会保证您的反馈的机密性。

如果您对本次调查任一环节感觉到不安全或者不舒服，您可以无理由地随时退出本次调查。

我的数据会被怎么使用？

您的参与的机密性将会被保证。您的研究数据将只会对被监督研究是否正确进行的研究人员和国家性的组织开放。您的研究数据将会是匿名的。这意味着这些数据将会对应一个数字编码而不是您的个人信息，所有关于您身份的信息将会被抹去。因此本次研究中，从任何文件或报告中识别您的名字将是不可能的。最后，您的数据将会被“开源”。这意味着他将被在线存储并用来向公开使用。

什么是“开源”？

开源意味着实验数据将会被免费的，向任何对本次研究感兴趣的人或想对本次实验数据进行分析的人开放。因此我们无法保证这些数据将被怎样使用。但是所有的数据在公开之前

将会被匿名，所以从研究数据中得到您的身份信息将是不可能的。

谢谢参加我的研究！

B.4 ENG-Partcipate Information Sheet

Serious Game: A game to help children develop money

management skills. - Participate Information Sheet

Introduction of study:

Hello! I am a 3rd-year Computer Science BsC student in the University in Bristol, in the UK, and I have designed a ‘serious game’ as my graduation project. In order to evaluate how well is the game, I would like to invite you to join a study.

To help you understand what is a ‘serious game’: technically, a serious game is a game, but it will not merely give people entertainment, but also allow them to learn knowledge or practice a skill. In my case, I have developed a serious game to help junior-high aged children to learn money management skills.

In order to gather feedbacks and real data, some volunteers needed to be invited to play this game. However, as the law and regulations define junior-high aged children as ‘vulnerable people’, it is considerably difficult for me to actually invite children to take part in the gameplay and interview. Therefore, as a parent who has a junior-high aged child(ren), you are invited to join this survey.

What do I need to do:

First, you will be asked to join an online interview, you will be taught how to play this game and be asked some feedbacks. You can give any comments on the graphics, gameplay, or design. The online meeting will not be recorded but I may note down the feedbacks you give. That note will be used to support to evaluate my game in my report. All of your feedbacks will be kept confidential and anonymous, they will be kept in OneDrive account protected by University of Bristol student account password.

Then, after the interview, you will be asked to play this game for roughly a week. You can play it whenever you like, feel free to arrange your time! I may record some data such as how many farmlands you unlock in the game, but those are just for statistics and analysis. There are no right or wrong in the game, you can do whatever you like in the game.

Finally, you will be asked to join an interview again to share further comments or experience on the game. Like before, I may take notes of your comments but will keep them confidential.

If you feel unsafe or uncomfortable with any procedure in the survey, you can withdraw without giving any reason at any time.

What will happen to my data?

Your involvement in the study will remain confidential. This information will only be available to research staff and national bodies which monitor whether research studies are

conducted properly. Your study data will be anonymised. This means that it will be given an identification number and any identifying information about you will be removed. Therefore, it will not be possible to identify you by name from any aspect of documentation or reporting for this research study. At the end of the study your data will be made “Open Access”. This means that it will be stored in an online database so that it is publically available.

What is open access?

Open access means that data are made available, free of charge, to anyone interested in the research, or who wishes to conduct their own analysis of the data. We will therefore have no control over how these data are used. However, all data will be anonymised before it is made available and therefore there will be no way to identify you from the research data.

Thank you for your participation in my study!

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