Wu: A Cultural Export Game with Dynamic Difficulty

By

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Abstract

This report discusses the design and development of *Wu*, a 2D action game intended to serve as a means for exporting Chinese popular culture to Western players. Developed with the Unity engine, the game features a dynamic difficulty system that monitors player behavior and automatically modifies the content to better match the observed level of skill. Feedback from playtesting confirmed that the dynamic difficulty adjustment significantly increased the probability of completing the game, and that most players acquired a better understanding of the Wuxia genre on which the game is based.

Acknowledgments

Contents

1. Introduction

This report describes research on cultural export in a dynamic difficulty game, *Wu*. It provides information about the design process, story, core gameplay, development technique and experience goals of the project.

Our game has two main purposes, Chinese culture export and dynamic difficulty adjustment. We hope our game will allow Western players to learn aspects of Chinese culture that we want to spread, and dynamic difficulty adjustment will enable our game to be played by more people, thus increasing the breadth of cultural export.

The aspect of culture we want to spread is Wuxia, a popular story genre unique to China. The stories are usually set in ancient China, and involve supernatural martial arts combined with chivalry, based on two important concepts, *wu* and *xia.*

The Background section describes our inspirations and preliminary work. The Design section talks about our goals and motivations, and how we developed the gameplay of our project. It also discusses the design of the DDA system.

The Culture Export section introduces the Wuxia-inspired story, setting and characters in our game, and describes some story highlights. The Art section covers the development of art assets, and the Evaluation section explains the methods and results of user testing.

2. Background

2.1. Inspiration

Wuxia is an extremely popular entertainment genre in China, comparable to *Star Wars* in the United States and samurai in Japan. Wuxia stories are told in Chinese novels, movies, comic books and video games.

Figure 1. Combat scene from *The Tale of Wuxia*. Source: URL.

Figure 1 is a screen capture from *The Tale of Wuxia* (Heluo Studio, 2016). This game creates a complete Wuxia world, with a high degree of freedom and abundant skills. The mental abilities and martial arts skills chosen by players create entirely different combat experiences, providing high motivation to explore the game world, collecting more skills that increase the depth of play strategy.

Figure 2. Skill menu from *The Scroll Of Taiwu.* Source: [URL](URL).

Figure 2 is a screen capture from *The Scroll of Taiwu* (ConchShip Games, 2018), one of the most popular Wuxia games in recent years. It was developed by an independent three-member team, and has sold more than 1 million copies on Steam. The success of *The Scroll of Taiwu* proves the potential of Wuxia-based gaming in Western countries. [1]

The Scroll Of Taiwu is a Roguelike game offering a selection of over 500 skills, each with a complete background description.

2.2. Project practice

When we came up with the idea for creating this project, we decided to make a similar game to verify the feasibility of the concept.

Figure 3. Combat from *Ruthless Iron Hand.* Source: Screen capture.

Figure 3 is a screen capture from *Ruthless Iron Hand*, the Wuxia-inspired game

we created as a proof-of-concept for this project. It was presented at a recent

MassDIGI competiton, and earned a positive evaluation from judges.

2.3. Art assistance

At the beginning of this project, our biggest challenge was the lack of art

resources. Neither of us are good at creating game art. Fortunately, WPI graduate

student Shano Liang offered to help us, and created a variety of high-quality art

assets. In addition, we succeeded in mastering the technique of converting animated

3D models to 2D pixel art (see Section 6.3 below), which saved us a lot of time.

3. Design

3.1. Overview

Roguelikes are a time-honored genre of gaming. The reason we chose to develop a Roguelike game is that it fits the *Wuxia* genre very well. In a typical Wuxia story, there are a wide variety of mental abilities and martial arts skills, similar to the skill-based nature of Roguelike games. Roguelike games also have high replayability, which encourages players to experience a wide variety of different skills and learn the backstories behind them.

3.2. Motivation and goal

As a country with thousands of years of history, China still has great room for improvement in culture export. Compared with Japanese culture, Chinese culture is far from being popular in Europe and America.

For a long time, China has been in a relatively weak position in the field of cultural export, as they have not been focused on this field. In recent years, with the continuous improvement of Chinese comprehensive national strength, the scope and channels of Chinese foreign cultural communication are also expanding. At present, many countries and regions in the world have established inter-governmental cultural cooperation relations with China, and the output volume of the Chinese cultural industry has also been significantly increased. We hope to use our game to spread some Chinese cultural content.

The word Wuxia can be separated into two syllables, *wu* and *xia*. *Wu* stands for power in Chinese, and is represented in Wuxia stories by the use of supernatural martial arts. *Xia* is a spiritual concept, and is represented by the mental abilities and virtuous qualities embodied in Wuxia stories.

The purpose of our game is to spread the concepts of *wu* and *xia* to Western players, and maintain interest in these Wuxia themes throughout our game.

3.3. Core gameplay and experience goal

This section describes the core gameplay of *Wu* and the experience we want to create for players.

3.3.1. Combat

Combat is the most important part of *Wu.* We want players to enjoy exciting combat through a wide variety of fighting styles and choices. We used the game *Wizard of Legend* (Contingent99, 2018) as an inspiration for our combat design. [2]
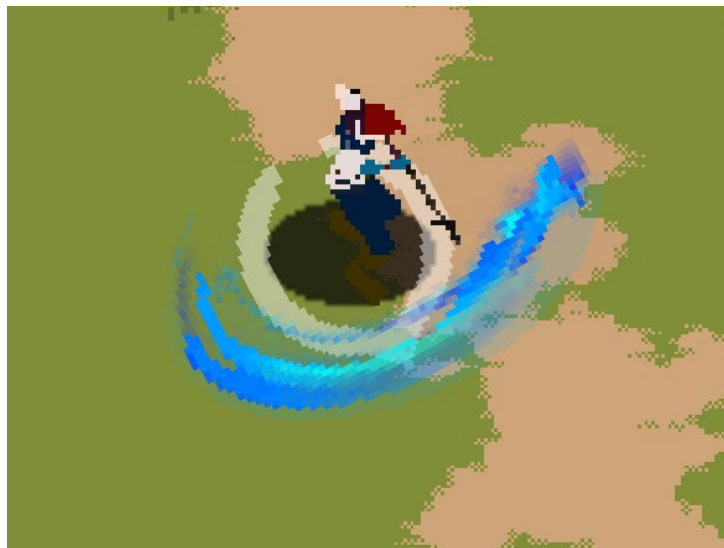
Figure 4. Three-combo attack from *Wu.* Source: Screen capture.

3.3.2. Combo basic attack

Attack skill are active. They must be initiated by the player. There are two major attack methods: a three-combo attack, and martial skill attacks. The three-combo method, shown in Figure 4, provides a way to optimize the attack speed and damage inflicted on enemies.

The third hit of a combo attack can cause additional effects, depending on which weapons are used.

3.3.3. Martial skill attacks

Martial skill attacks are also active. In *Wu*, players can choose from three martial skill attacks with different styles and features.

7

Figure 5. Spear skills: Stab storm and spear shock. Source: Screen capture.

Spear skill attacks combine high damage with a wide attack range, but also involve high stiffness. "Stiffness" is the period in which a player cannot perform any action after using a skill attack. Figure 5 shows a spear attack being used in the game.

Sword skill attacks combine medium damage and attack range with very low stiffness. Sword attacks tend to be very rapid, allowing the player to remain mobile while fighting to avoid enemy damage.

Blade skill attacks combine high damage, large attack range, and low stiffness. These attacks are powerful, and can knock enemies off their feet, forcing them to move.

3.3.4. Internal skills

Internal skills are passive attributes, and do not need to be initiated by the player. They usually enhance the player's stats, and some produce special combat effects. Different combinations of attack and internal skills can create a variety of combat styles.

3.3.5. Skill collection

Skill collection motivates players to keep playing. *Wu* contains dozens of martial and internal skills for players to collect, and different collections of skills can produce very different game experiences. However, skills are acquired randomly, and a player can only bring four martial skills into effect at the same time. Some martial skills can be reinforced to gain extra effects.

3.4. Level design

3.4.1. Overview

Like most Roguelikes, *Wu* is a level-clearance game. When the player enters a new level, all enemies must be defeated in order to enter the next level.

The enemies in each level are randomly generated, using our dynamic difficulty adjustment (DDA) system to modify the number and distribution of enemies according to the player's stats and skills.

3.4.2. Event levels

Some levels are event levels, with no enemies or fighting. They are used to advance the story, provide rewards or cause mischief to the player.

3.4.3. Special levels

Special levels involve one-of-a-kind combat experiences, such as an encounter with a boss enemy, or a fight that leads to a specific story event.

3.5. Terrain design

3.5.1. Overview

There are special terrain elements that can affect the way a player navigates or fights in the game, generating unique gameplay. Most of these elements are traps.

Figure 6. Spike trap in *Wu*. Source: Screen capture.

3.5.2. Traps

Some areas of the ground and walls are covered with spikes, as shown in Figure 6. Touching spiked terrain can cause damage to both the player and enemies. Due to the players' ability to dislodge enemies while fighting, the presence of spikes creates opportunities for players to quickly destroy opponents.

3.6. Enemy design

3.6.1. Overview

There are four basic types of enemy in our game, each of which is designed to test the player's mastery of a particular ability. Each enemy type has different strengths and weaknesses.

Figure 7. Wolf enemies in *Wu.* Source: Screen capture.

3.6.2. Enemy types

Wolf. The wolf, shown in Figure 7, is a fairly weak enemy. Individual wolves do not inflict much damage, but they move very quickly, and often appear in packs. Their high speed and numbers make them difficult to escape. The player's best option is to defeat them as quickly as possible.

Wolves test the player's mastery of attack strategies.

Figure 8. A tiger enemy in *Wu*. Source: Screen capture.

Tiger. The tiger is a large, aggressive enemy that inflicts high damage (Figure 8). Tigers are difficult to fight in most situations, but they are not invulnerable. When a tiger launches an attack, it defenses are momentarily weakened, which gives an alert player the opportunity to counter-attack.

Tigers test a player's timing and agility.

Figure 9. An archer enemy in *Wu.* Source: Screen capture.

Archer. Archers are dangerous enemies (Figure 9). They can't take much damage, but they can inflict a lot. Archers take aim as soon as the player enters their attack range, and after a short delay, fire an arrow at the player's position. The arrow flies so fast that the player is likely to be hit.

Players can avoid arrows by starting a roll maneuver after the archer fires.

This enemy is a test of the player's mastery of the roll maneuver.

Figure 10. A Blade enemy in *Wu.* Source: Screen capture.

Blade. Blade, shown in Figure 10, is a medium-speed enemy that will approach the player and attempt to attack. Blade is protected by a powerful shield that must be broken before the player can inflict any damage.

4. Dynamic difficulty adjustment

4.1. Motivation

According to Game Flow Channel theory, players experience the best immersion when they are balanced boredom and anxiety. [3] However, Roguelike games combine randomness and complexity with the danger of permadeath. These attributes involve high anxiety and learning cost. [4] Fans of Roguelike games enjoy these challenges, but other players are likely to become frustrated and give up because of the difficulty of advancement.

Some Roguelike games include features to mitigate the effects of permadeath. *Lost Castle* (HunterStudio, 2016) allows players to restore some skills or equipment for their next round of play. But it still requires the accumulation of many skills and equipment to win, which leads to a repetitive game experience.

In order to guarantee the passibility of levels, we decided to implement a dynamic difficulty adjustment system in our game to accommodate different levels of player skill. People who just want to experience the story don't have to replay the game again and again, but plenty of challenge is available for those who love the Roguelike experience.

4.2. Design strategy

Manually designing different levels of difficulty cannot fully take into account the ability and experience of all players. [4] The system we created for *Wu* uses the player's current stats and equipment to automatically generate levels that are likely to be winnable if they play reasonably well. At the beginning of each level, our system calculates a current player factor (CPF) to assess their prior experience, stats, skills and resources. It then calculates a current level factor (CLF) to estimate the difficulty of the level. Finally, the system dynamically adjusts the CLF to better match the CPF.

4.3. Implementation

To calculate the CPF, the system reads the following data:

1. Player's max health and current health

2. Player's attack value

3. Player's Qi value

4. Player's skill point level and distribution

5. Number of previously passed levels

To calculate the CLF, the system examines the parameters of the level being entered to determine:

1. Its order in the sequence of levels

2. The number and type of enemies to be deployed
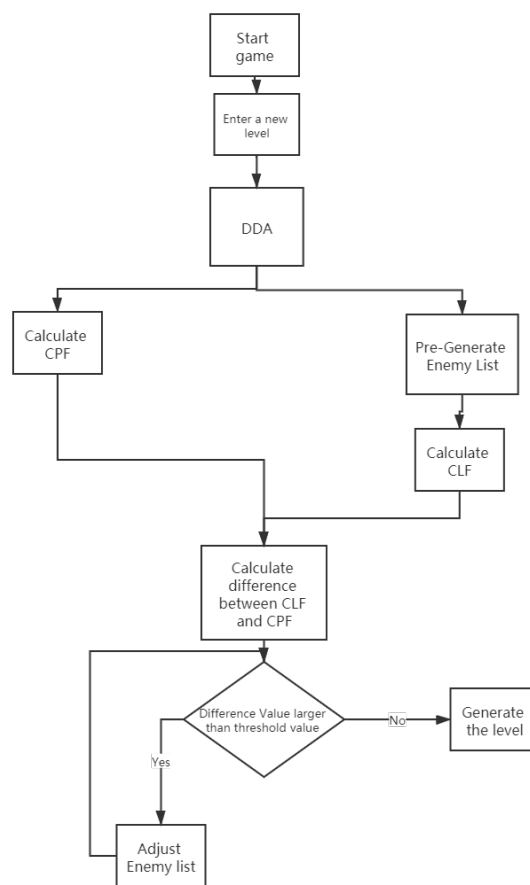
2. The strength of each enemy

Figure 11. The workflow of *Wu.*

The operational workflow of *Wu's* dynamic difficulty system is illustrated by the diagram in Figure 11.

5. Cultural export

5.1. Motivation

Wuxia is a complex genre, similar in scope and diversity to Western superhero universes. Our game could not possibly include much of the vast lore of Wuxia. In order to present the basic core of Wuxia, we split it into two parts: *Wu* and *Xia*. [6]

Wu means power in Chinese. In the Wuxia genre, *wu* refers to all parts of the story that are related to power, such as combat, weapons and so on. The moves and weapons in our game are based on those commonly found in the martial arts genre. In particular, our combat animations attempt to recreate the moves seen in movies and TV shows with martial arts themes (see Section 6).

In Chinese, *xia* refers to a noble quality similar to the Western idea of chivalry, with suggestions of unique spiritual qualities. The earliest definition of *xia* spirit can be traced back to the Han dynasty. Chivalrous spirit in China has a long history, and has eveolved over time.

The origin of Wuxia novels can be traced back to the *San Xia Wu Yi* of the Qing dynasty. From this novel, Wuxia gradually became an entertainment genre familiar to everyone. We chose the *xia* spirit represented in *San Xia Wu Yi* and integrated it into the story of our game. [7]

5.2. Goal

Our game includes two stories in which we incorporate the classic x*ia* spirit. In every story there is a character who teaches the PC about x*ia*. Our goal is to make players who experience the game understand and admire the x*ia* spirit. We also hope that playing our game will make players interested in the genre of Wuxia.

5.3. Setting

The game is a set in China around the year C.E. 960 - C.E. 1644, during the period of the ancient Ming dynasty. It is a fantasy world in which the strength of a person's *wu* represents their social status.

5.4. Overview

In *Wu*, the player begins as a character seeking the power of *wu* and wealth in the Meteorite Valley. There are opportunities to learn a variety of skills, but these adventures come with great peril. The player also encounters a variety of people and events, and learns about *xia* and *wu* from them. [8]

Here is a summary of important terms:

Nei Li: Magic power, like the mana of a wizard.

Wu: A magical power that offers extraordinary abilities, such as enhanced strength, *nei li* and enhanced perception. *Wu* has two categories, internal skill, and martial skill.

Internal skill: The source of *nei li*, which enhances a character's basic abilities. Represented by the passive attributes in our game.

Martial skill: Represented by the active skills in our game. Good martial skills can enhance the power of Internal skills.

School: A faction in the world of *Wu.*

5.5. Game world setting

There are several large schools in the world of *Wu*: Wudang, Shaolin, Tangmen, Qingchen, Huangshan, Black Dragon Gang, Sky Chaser and Wanma Gang. They are called the Eight Schools. Since they have a large sphere of influence, they control trade in several provinces. Alongside the government, they are the largest organizations in the world. [9]

Our game takes place in the Meteorite Valley, a vast crater created by the fall of a massive meteorite. The meteorite caused mysterious changes to the local ecological landscape. Dangerous and strange animals haunt in Valley.

Fifty years ago, an isolated group of people found a powerful treasure in the Meteorite Valley. Since then, more rare treasures were found, and the valley became a place for people to pursue their dreams. Lawless criminals, skilled craftsmen and chivalrous warriors from all corners of the country come to seek fame and fortune.

5.6. Characters

Blue Sparrow: A woman from Tangmen, about twenty years old. A well-traveled chivalrous woman.

Wu Yan: One of the top-ten masters in the world. Nobody knows where he learned his Wu.

5.7. Quests

Our game has two different story quests that can be completed to earn rewards. Each story features a different aspect of *xia* spirit that we want to convey to the player. [10]

5.7.1. Blue Sparrow quest

In the Blue Sparrow quest, players meet an unnamed woman and learn her purpose and *xia* spirit by helping her.

In the initial scene, the player discovers that the woman is weak, and wonders why she would dare to enter the dangerous Valley.

In the next scene, after helping her, the player learns that her name is Blue Sparrow, and her purpose is to help a group of sick villagers find medicine. The PC wonders why she's putting herself in harm's way for people she doesn't know. The Blue Sparrow tells the player that sacrifice to others is an aspect of *xia* spirit. This is one kind of *xia* found in the Wuxia novel *San Xia Wu Yi*.

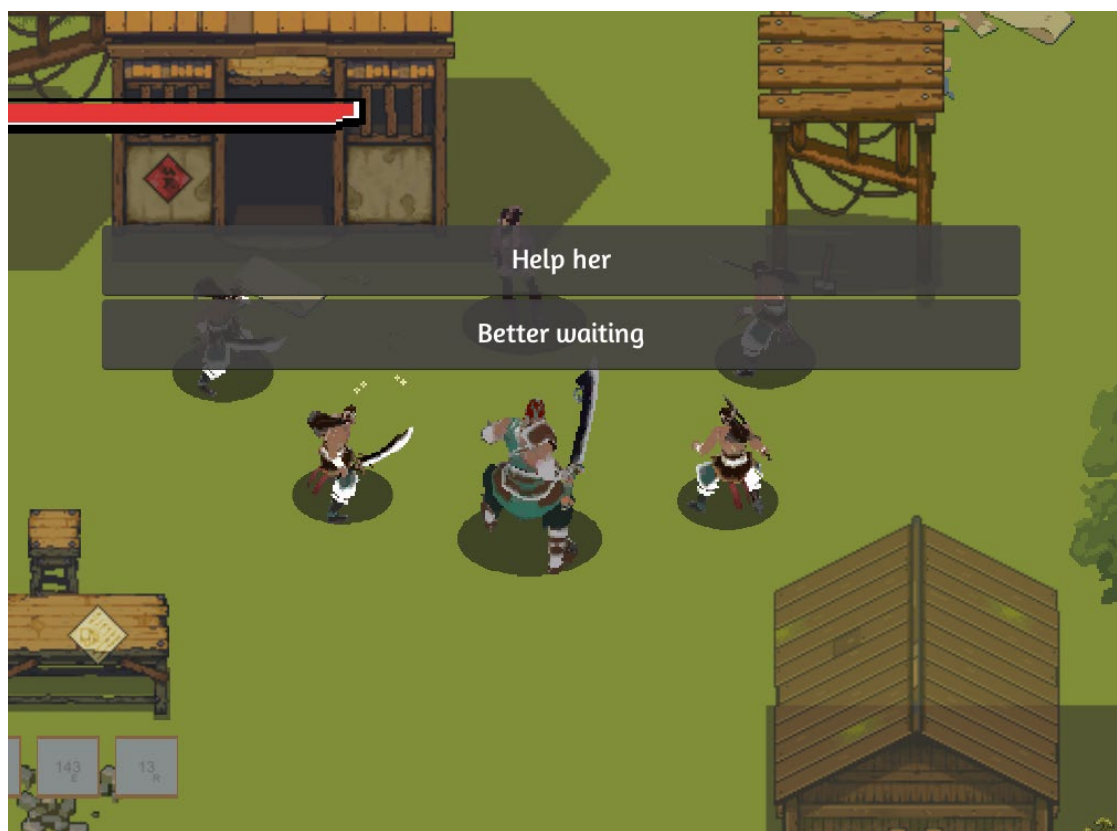Figure 12. Choice presentation in Blue Sparrow quest of *Wu*. Source: Screen capture.

Figure 12 shows a player making a choice during the Blue Sparrow quest.

Figures 13 & 14: Cutscenes from Wu Yan quest. Source: Screen capture.

5.7.2. Wu Yan quest

In the Wu Yan quest (illustrated in Figures 13 and 14), the player meets a powerful knight, and discovers his purpose and *xia* spirit in the stories the player encounters.

In the initial scene, Wu Yan displays his great power by helping the PC escape from danger. In the second scene, the player encounters three people who are being mobbed. Whether the player decides to help them or not, Wu Yan reappears and helps fight off the mobsters. After Wu Yan leaves, the three rescued people tell the PC about Wu Yan's creed.

In the final scene, the player encounters Wu Yan again and learns that his purpose for entering the Valley is to hunt down a man who committed a village massacre. After the execution of the wicked, Wu Yan explains his *xia* spirit to the player.

The Wu Yan quest reveals that punishing evil and doing as much good as possible are also aspects of *xia* spirit, both mentioned in the *San Xia Wu Yi*.

6. Visual art

6.1. Overview

Our game is a Roguelike action game. On the one hand, we need to show the martial arts part of the genre. On the other hand, we need to provide the game with a variety of skills. Both of these required us to produce a large number of art materials, but neither of us had a foundation in art skills. This section describes how we determined the art style of our game, and solved various problems.

6.2. Art style

After some consideration, we decided that pixel art was the best art style for our game. First of all, there are lots of pixel-style Roguelike games in the market, such as *Dead Cells* and *Wizard of Legend*, which means the pixel style would be readily accepted by players. Secondly, the pixel style does not have very complicated colors, which would make it easy for us to modify and iterate the art assets.

6.2. Asset creation

A Roguelike action game requires many skills, which require a large number of art assets for different types of moves. We didn't have the ability to create all of the animations needed for each move. Solving this problem became our first challenge.

Our initial thought was to use spine animation to create the art assets. Spine animation would only require us to draw the limbs of the characters, and then use tools to create the movements we needed.

We used spine animation to generate our first generation of animation assets. But spine-based animation is a 2D planar effect, more suitable for use in cross-board games. Because we were using the overlook Angle mode, the spine animation material looked so weird in our game that we had to drop the idea.

The game *Dead Cells* inspired us. After reading the *Dead Cells* production report written by art developer Thomas Vasseur, we came up with a way to make rigged animation with 3D models and convert it into 2D animation. [11]

In the report provided by Vasseur, he mentioned that in the development process of *Dead Cells*, almost all the art materials of characters and enemies were converted from 3D models. Through special rendering methods, *Dead Cells* achieved very attractive art effects.
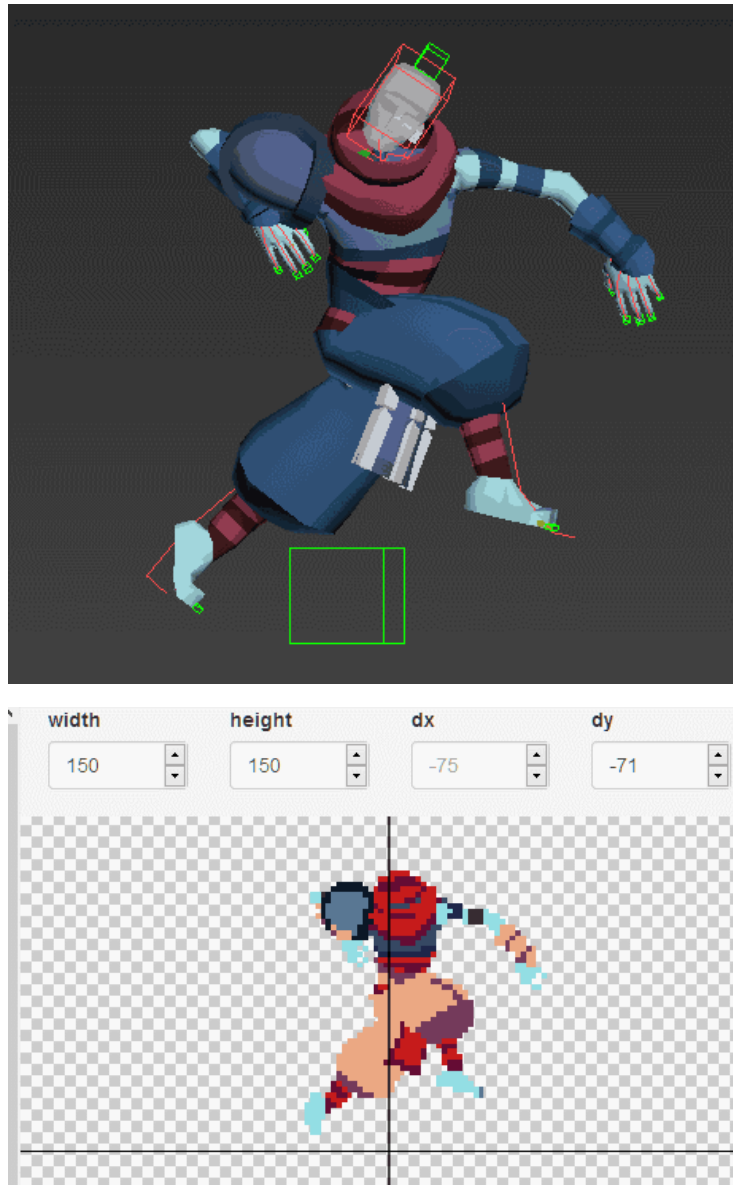
Figure 15. Dead Cells' 3D to 2D conversion tool. Source: URL.

Figure 15 shows the convert tool Motion Twin used. There are many

advantages to this approach

First, the 3D models to be converted do not require particularly high accuracy, and are fairly easy for beginners to make. Second, only a single 3D model is needed to produce 2D animations in eight directions of motion through rig animation, which can greatly improve the production efficiency.

We soon began experimenting with this method of making art assets.

6.3. 3D to 2D conversion

We found a tool in the Unity store, PixelArtPipeline, which can convert 3D models into 2D animation. After a simple test, we found that the conversion quality of this tool was very good, and the resulting pixel animation is very satisfactory for recreating the 3D model's color and shape.
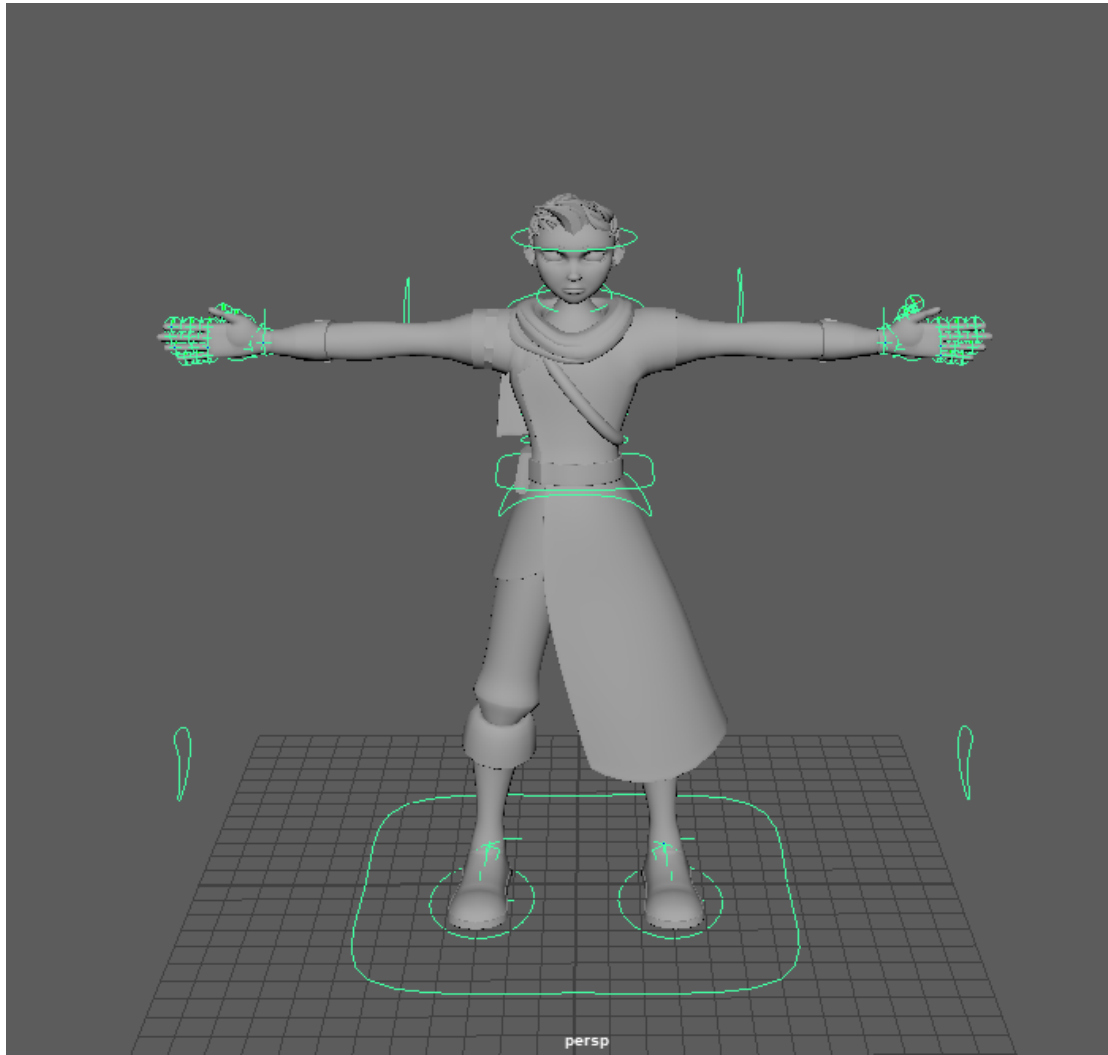
Figure 16. Model of protagonist. Source: Screen capture.

Figure 16 is the 3D model of our game's protagonist, produced in Maya. We colored and rigged the model to ensure that the model could act according to our requirements.

We designed a variety of weapons for the main character, based on the types of weapons commonly found in Wuxia stories.
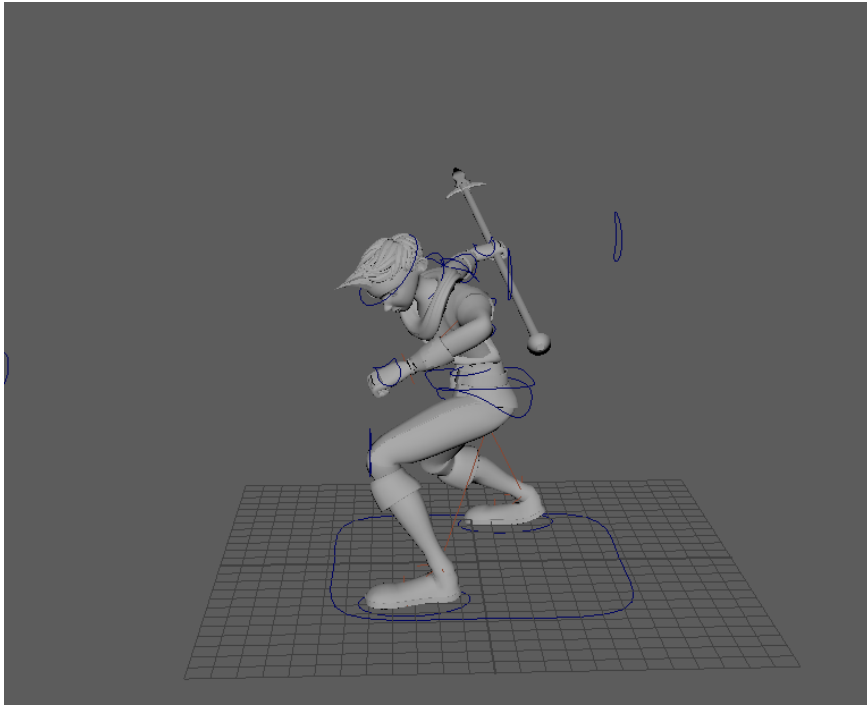
Figure 17. Protagonist with spear. Source: Maya screen capture.
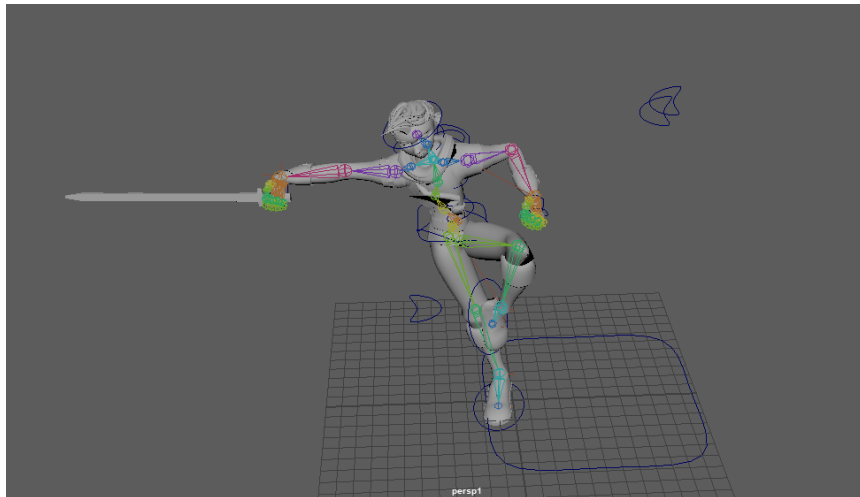

Figure 18. Protagonist with sword. Source: Maya screen capture.

Figure 17 and 18 are Maya views of the protagonist model, shown using different types of weapons.
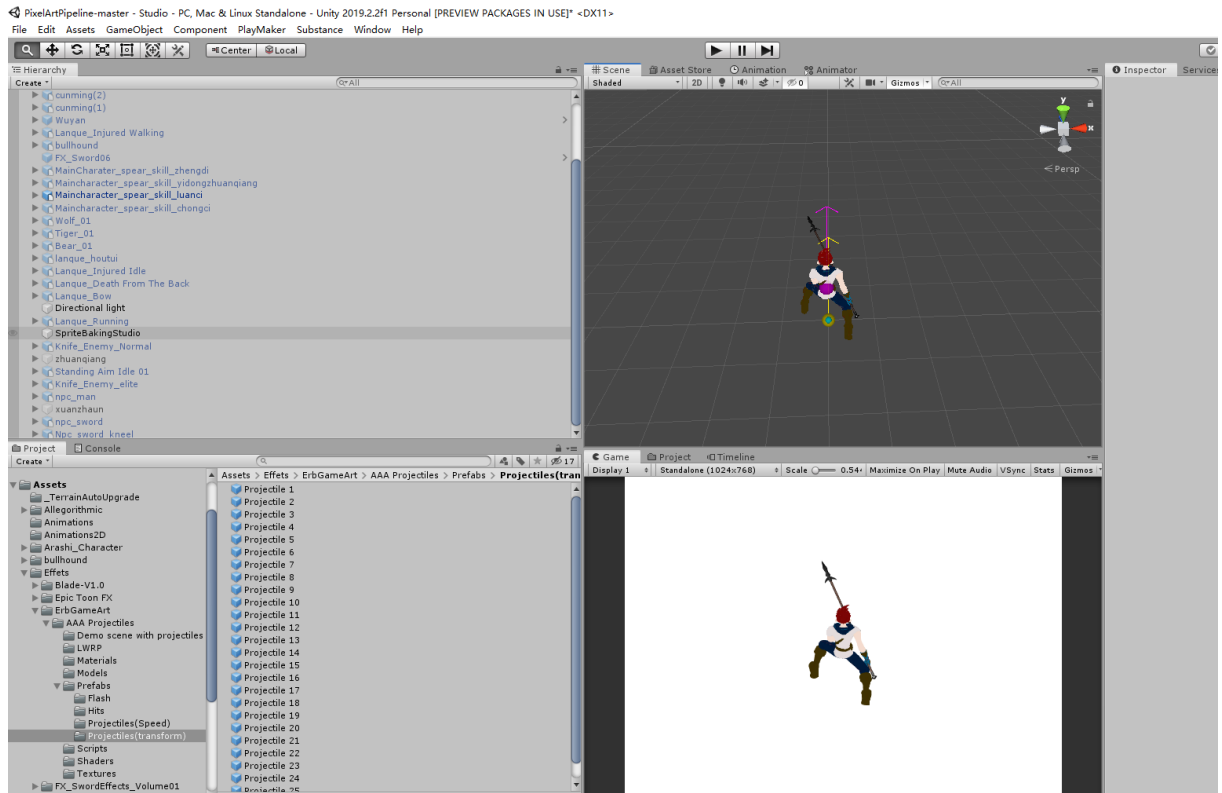
Figure 19. Interface of Unity's PixelArtPipeline. Source: Unity screen capture.

After we created and animated the 3D model, we loaded it into Unity and

converted it to 2D animation using PixelArtPipeline, as shown in Figure 19.

Figure 20. 2D animation frames created from 3D model. Source: Screen captures.

The resulting 2D animation frames are shown in Figure 20

After making the main character and proving that this method worked, we made various enemy and NPC models and converted them to 2D animation. All of the character animations in our game were created using this method.

6.4. Environmental art

Our quests take place in forest scenes. The art assets for the environment can be divided into two categories, decorations and tiles.

Figures 21 & 22. Samples of Shano Liang's environmental art. Source: Photoshop screen capture.

6.4.1. Decorations

For the decorations in the scene, we obtained help from WPI graduate student Shano Liang, who helped us generate pixel art assets. Figures 21 and 22 display examples of her work.

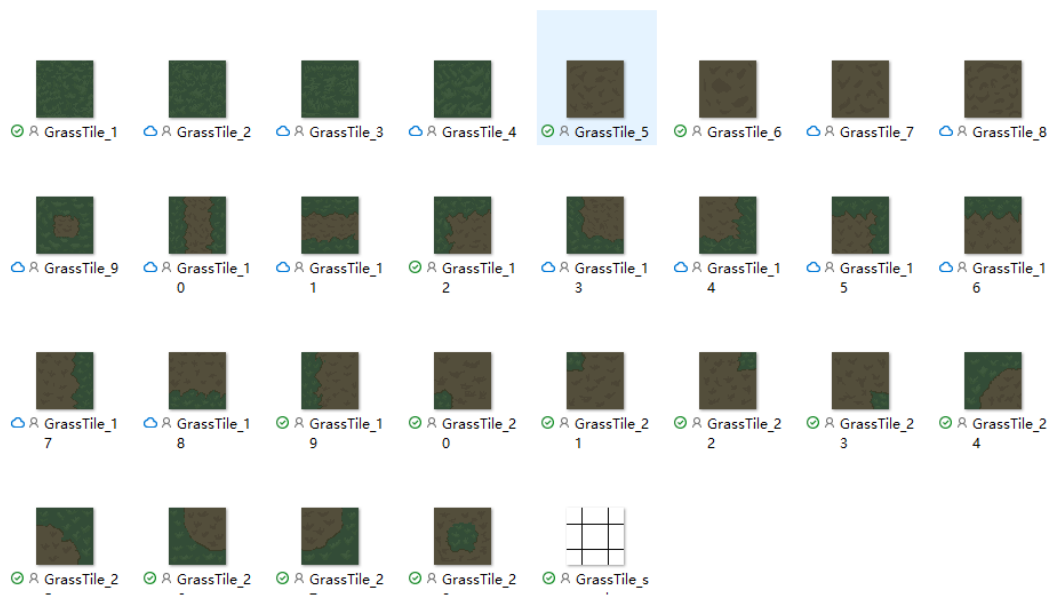Figure 23. Tile maps for our game. Source: AESprite screen capture.

6.4.2. Tiling

We decided to use a tilemap to make the ground for our game, which means we just needed some pre-made ground tiles. *Wu* is a Roguelike game, which requires a lot of map scenes. Using tiles to create our randomly generated maps saved us a lot of time.

7. Evaluation

7.1. Test approach and objectives

Our testing had two major objectives. The first was to determine if the DDA system helped player pass levels with an appropriate level of difficulty. The second objective is determining if players could understand the intention of our stories, and if this had stimulated their interest in Wuxia.

7.2. Test methodology

An A/B test strategy was used to evaluate the DDA system. We prepared two levels with two different stories. The Blue Sparrow quest was called the A test, and the Wu Yan quest was called the B test. They have the same level number, and the length of each story is also similar. The difference is, the B tests had the DDA system active, but the difficulty of the A tests were based only on the number of levels passed.

After playing, each tester was asked tocomplete a survey to determine their subjective experience. We also recorded the duration of the play session and the number of passed levels as objective evaluation parameters.

Our surveys were completed by 39 testers, all students from WPI.

7.3. Test questions and results

7.3.1. Question 1.

How much do you know about Wuxia?

39 responses

	#	%
Never heard about it	30	76.9
Know something about it	4	10.3
Relatively familiar with it	2	5.1
Very familiar with it	3	7.7

7.3.2. Question 2.

Have you ever play non-turn-based Roguelike games, such as Wizard of Legend, DeadCell?

39 responses
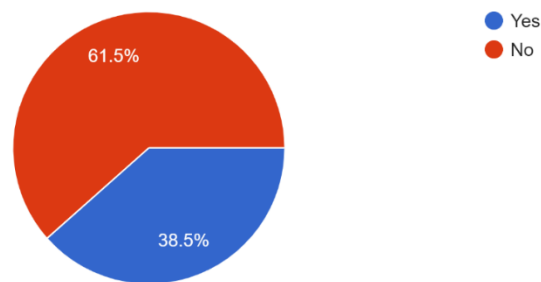
	#	%
Yes	24	61.5
No	15	37.5

7.3.3. Question 3.

How many Roguelike games have you played before?
39 responses
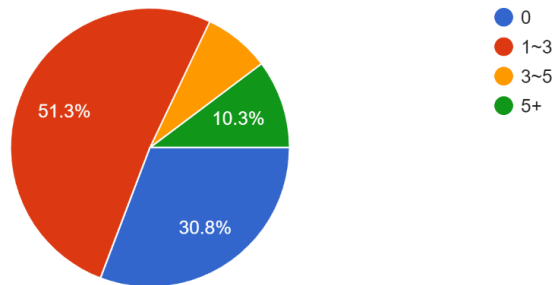
	#	%
0	12	30.8
1-3	20	51.3
3-5	3	7.7
5+	4	10.3

7.3.4. Question 4.

Do you often choose to play roguelike games?
39 responses

	#	%
Yes	30	76.9
No	9	23.1
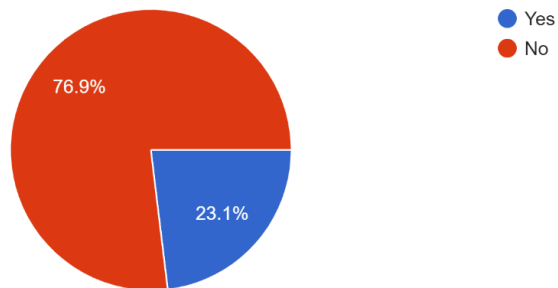
7.3.5. Question 5.

What's the Xia spirit you think in Blue Sparrow story?

39 responses
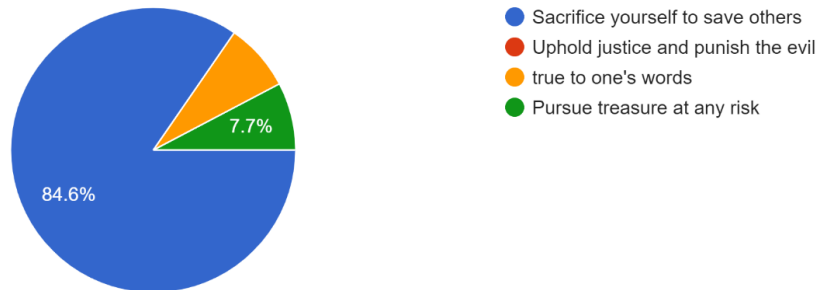
	#	%
Sacrifice yourself to save others	33	86.4
Uphold justice and punish evil	0	0
True to one's words	3	7.7
Pursue treasure at any risk	3	7.7

7.3.6. Question 6.

What's the Xia spirit you think in Wu Yan story?
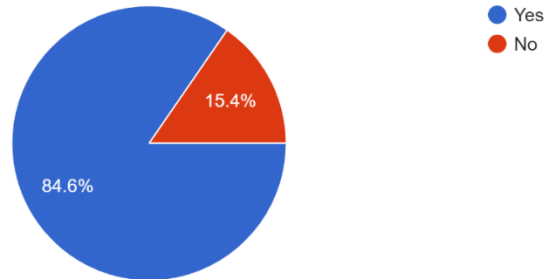
39 responses
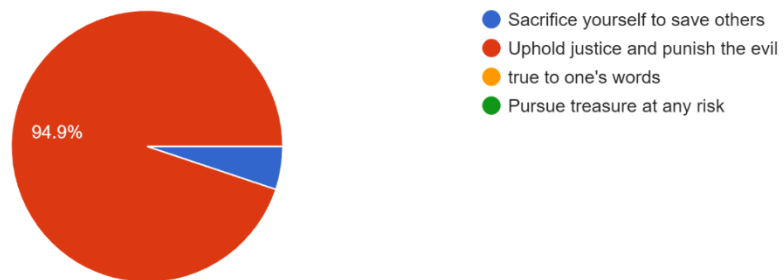
	#	%
Sacrifice yourself to save others	2	5.1
Uphold justice and punish evil	37	94.9
True to one's words	0	0
Pursue treasure at any risk	0	0

7.3.7. Question 7.

Will you try to watch some films with "Wuxia" tag in the future? （e.g Reign of
Assassins，Crouching Tiger, Hidden Dragon）

39 responses

● Yes
● No

15.4%

84.6%

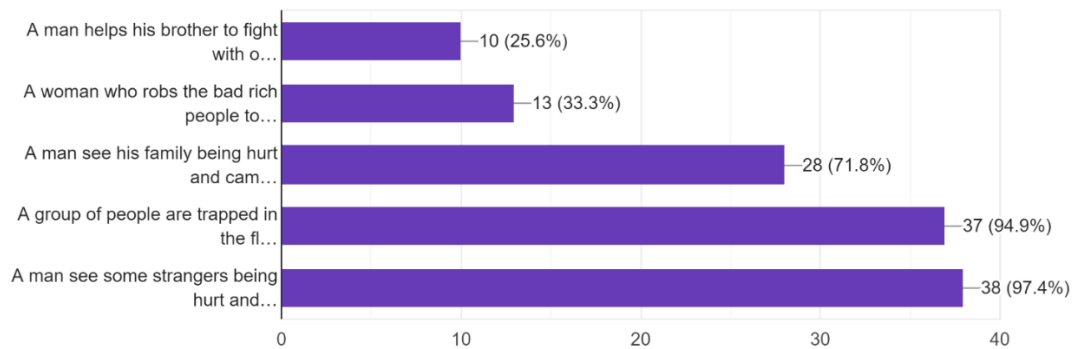|	#	%
Yes	33	84.6
No	6	15.4

7.3.8. Question 8.

Which of the following people's behavior do you think is Xia spirit.(Multiple choices)

39 responses

	#	%
A man helps his brother	10	25.6
A woman robs bad rich people	13	33.3
A man sees family being hurt	28	71.8
A group of people trapped	37	94.9
A man sees strangers hurt	38	97.4

40

7.3.9. Question 9.

The difficulty of operating the character in the Blue Sparrow test.
39 responses
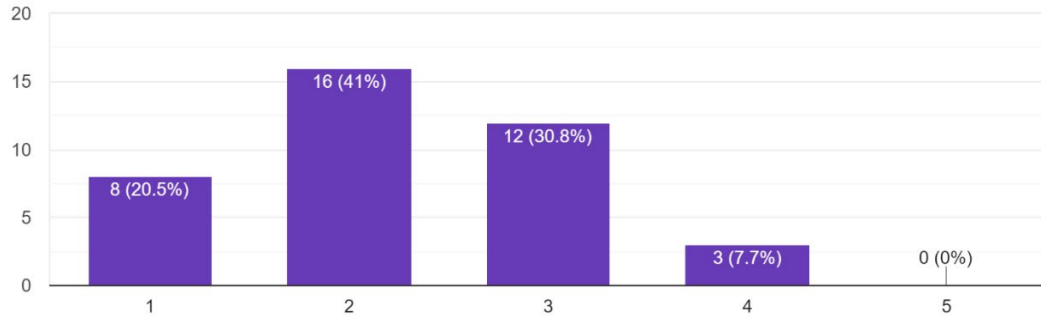
	#	%
1 (Very easy)	8	20.5
2 (Easy)	16	41
3 (Normal)	12	30.8
4 (Hard)	3	7.7
5 (Very hard)	0	0

7.3.10. Question 10.

The difficulty of combat with normal Enemies in the Blue Sparrow test.
39 responses
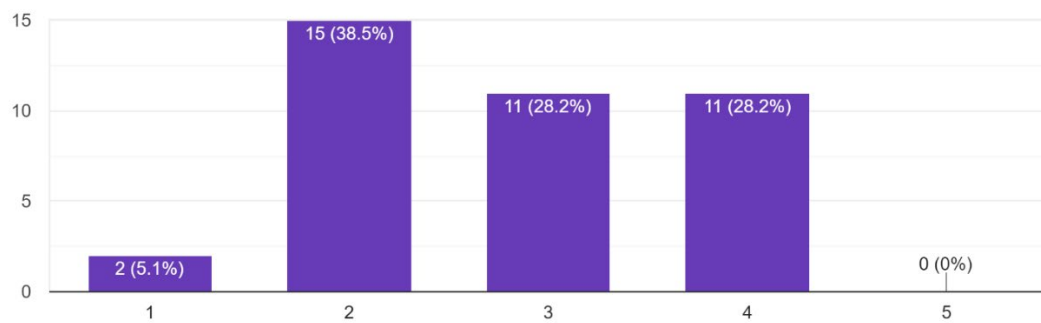
	#	%
1 (Very easy)	2	5.1
2 (Easy)	15	38.5
3 (Normal)	11	28.2
4 (Hard)	11	28.2
5 (Very hard)	0	0

7.3.11. Question 11.

Did you feel the difficulty adjustment during playing in the Blue Sparrow test?

39 responses

	#	%
Yes	20	51.3
No	14	36.9
Maybe	5	12.8

7.3.12. Question 12.

What do you think about the number of the enemy in the Blue Sparrow test?
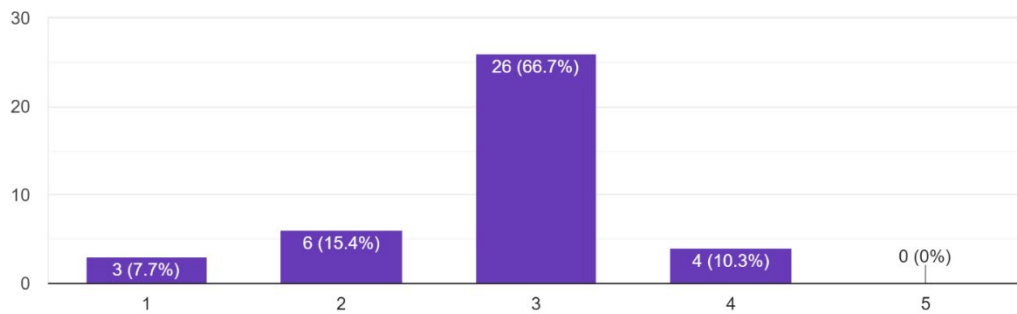
39 responses

	#	%
1 (Very easy)	3	7.7
2 (Easy)	6	15.4
3 (Normal)	26	66.7
4 (Hard)	4	10.3
5 (Very hard)	0	0

7.3.13. Question 13.

The difficulty of operating the character in the Wu Yan test.
39 responses
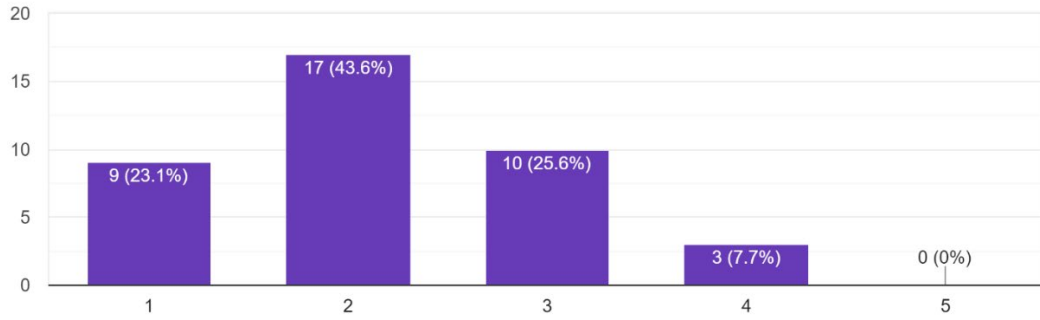
	#	%
1 (Very easy)	9	23.1
2 (Easy)	17	43.6
3 (Normal)	10	25.6
4 (Hard)	3	7.7
5 (Very hard)	0	0

7.3.14. Question 14.

The difficulty of combat with normal Enemies in the Wu Yan test.
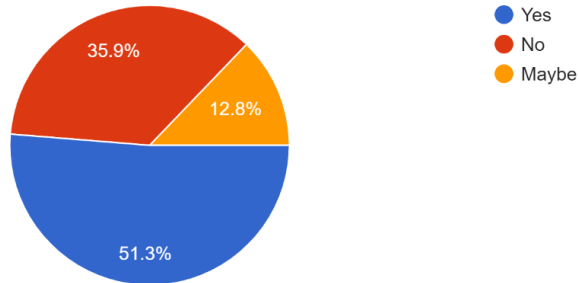39 responses
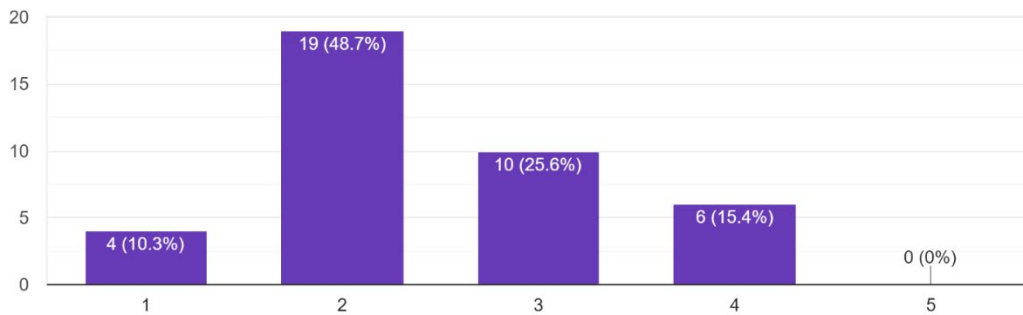
	#	%
1 (Very easy)	4	10.3
2 (Easy)	19	48.7
3 (Normal)	10	25.6
4 (Hard)	6	15.4
5 (Very hard)	0	0

43

7.3.15. Question 15.

Did you feel the difficulty adjustment during playing in the Wu Yan test?
39 responses
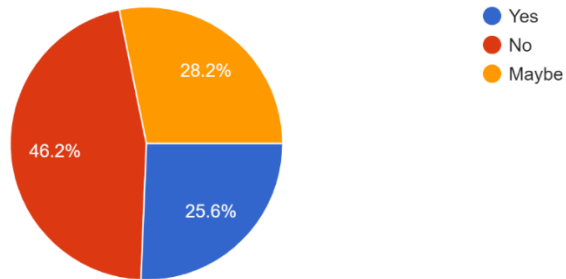
	#	%
Yes	10	25.6
No	18	46.2
Maybe	11	28.2

7.3.16. Question 16.

What do you think about the number of the enemy in the Wu Yan test?
39 responses
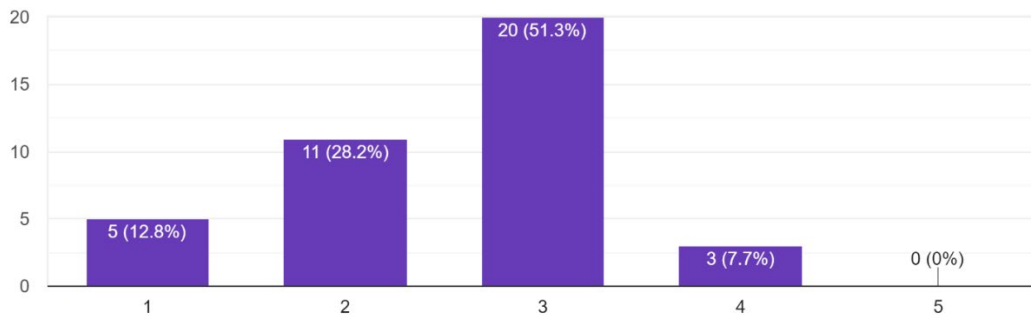
	#	%
1 (Very easy)	5	12.8
2 (Easy)	11	28.2
3 (Normal)	20	51.3
4 (Hard)	3	7.7
5 (Very hard)	0	0

7.4. Result analysis

7.4.1. Player background

Questions 1 - 4 examined the testers' background knowledge about Roguelike games and Wuxia. 76.9% of our testers had never heard of Wuxia. 61.5% of our testers never played any non-turn-based Roguelike game, and 76.9% didn't often choose to play Roguelike games. From these answers, we concluded that Wuxia and Roguelike games are niche entertainment categories. Most of our players had no contact or knoweldge of them.

7.4.2. Dynamic difficulty experience

Questions 9 - 16 tested the tester's experience about the difficulty of *Wu*. We examined the experience of the DDA in five aspects: the number of enemies, the subjective sense of the difficulty, the subjective sense of the difficulty adjustment, the level passing rate and the level passing time.

About the number of enemies, 66.7% of our testers in the A test and 51.3% of our testers in the B test thought the number of enemies was suitable. Only 7.7% thought the number of enemies in the B test was too high. The A testers appeared to think that the number of enemies was a little too small.

About the subjective feeling of the difficulty, 59% of B testers found it easier than average, compared to 43.6% in the A test. 25.6% of our testers think the B test

is in average difficulty, 28.2% in the A test. 15.4% of our testers think the difficulty of the B test is harder than the average, and 28.2% in the A test.

About the subjective feeling of the difficulty adjustment, 51.3% of our testers thought they could feel the difficulty adjustment in the A test, and 25.6% in the B test. 36.9% of our testers thought they didn't feel the difficulty adjustment in the A test, and 46.2% in the B test. 12.8% of our testers weren't sure if they could feel the difficulty adjustment in the A test, and 28.2% in the B test.

About the level passing rate, among our 39 testers, 13 testers passed the A test, so the passing rate was 33.3%. 24 testers passed the B test, so the passing rate was 61.5%.

About the level passing time, the average game time of A test was 5 min 25s and 5 min 3s in the B test. The Average Passing time in the A test was 7 min 28s, and 5 min 20s in the B test.

From these results, we can draw the following preliminary conclusions. The DDA system reduced the difficulty of the game, and therefore achieved part of the purpose of our design, by successfully improving the player's passing rate and passing time. However, the current DDA system fails to balance the difficulty for those players who want a more challenging game.

The DDA system seems to hide itself well. Only 25.6% of our testers could feel the difficulty adjustment. However, the passing rate shows that the subjective

difficulty did change for different players. We believe that the reason why more people felt the difficulty adjustment in the A test was that we control the difficulty at a steady level in the B test, while the difficulty in the A test was ever-increasing.

7.4.3. Culture export

Question 1 tested the tester's knowledge about Wuxia. The results were as expected, and consistent with our prior research. 76.9% of our testers said they had never heard of Wuxia, and our testers included five Chinese students. It is safe to say that Americans have little or no knowledge of Wuxia. This also proves the necessity of cultural output of Wuxia.

Qusetion 5 tested whether the participants understood the *xia* spirit that we conveyed in the quest of the Blue Sparrow, that *xia* involves sacrifice to save others. 85% of our testers chose the correct answer, which means that most players understood the *xia* spirit of that quest.

Question 6 tests whether the player can understood the *xia* spirit of the Wu Yan quest, that is, the importance of preaching good and punishing evil. 95% of our players chose the correct answer, which means that almost all players learned and understand the *xia* spirit of the quest.

Question 7 is about the interest the players have in Wuxia after playing our game. We asked players if they would be interested in trying out more Wuxia works

in the future, such as watching films and reading novels. In the questionnaire, we added a photo from a Wuxia movie to make it easier for the tester to understand. To our surprise, 85% of our testers said they would try it in the future. As the testers only experienced the game for half an hour, and we were able to convey only a limited amount information, we believe we succeeded to some extent in spreading awareness and interest in Wuxia.

Question 8 was a test of whether the player really understood what we were suggesting about *xia* spirit, or just our story. We listed five situations that were completely different from the plot of the game, and asked the testers to choose which of them represented *xia* spirit. If a tester chose the right answer, it suggested that they understood the meaning of the *xia* spirit we were trying to convey. After the test, more than 90% of our testers made the right choice, which suggests that we succeeded in communicating the *xia* spirit.

8. Conclusion

Based on our test result analysis, we believe that we achieved our primary goal. The DDA system we created successfully increased the passing rate of the players, especially since most of our testers didn't have much Roguelike experience. However, the DDA system still needs to be improved. It failed to offer an equally interesting game experience for highly skilled players. We need to adjust the system parameters for a better adjustment.

In terms of cultural export, I think we did a fairly good job. Most of the players seemed to understand what we were trying to communicate, and our game successfully increased some players' interest in Wuxia. We want to add more in the future, because Wuxia is a broad genre with much greater richness to offer.

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Appendix A: IRB Purpose of Study & Study Protocol

Project: *Wu*: A Cultural Export Game with Dynamic Difficulty

Purpose of study

To obtain playtest feedback in order to locate/address operational bugs, and to identify opportunities for design improvement.

Study protocol

Participants are provided a computer on which to play the sample game. Investigator observes participants during play, answering questions and providing guidance as needed. Afterward, participants are asked to fill out a short survey to characterize their subjective experience.

Opening briefing for testers

"Hello, and thank you for volunteering to test our game. Before we begin, could you please read and sign this Informed Consent form? [Tester signs IC form.] Thank you. During your test session, the game will be recording a variety of metrics about your play activity. When your session is complete, we will ask you to complete a brief survey about your play experience. At no point during your play session, or in the survey after, will any sort of personal and/or identifying information about you be recorded. Please begin playing when you feel ready."

Appendix B: IRB Informed Consent Form

Informed Consent Agreement for Participation in a WPI Research Study

Investigator: Brian Moriarty, IMGD Professor of Practice

Contact Information: bmoriarty@wpi.edu, 508 831-5638

Title of Research Study: *Wu*: **A Cultural Export Game with Dynamic Difficulty**

Sponsor: WPI

Introduction: You are being asked to participate in a research study. Before you agree, however, you must be fully informed about the purpose of the study, the procedures to be followed, and any benefits, risks or discomfort that you may experience as a result of your participation. This form presents information about the study so that you may make a fully informed decision regarding your participation.

Purpose of the study: The purpose of this study is to obtain feedback on the MQP project in order to facilitate design improvements and find/address operational bugs.

Procedures to be followed: You will be asked to play a brief game lasting less than ten minutes. Instrumentation in the game software will anonymously record your activity during play. After completing the game, you will be asked to complete a brief, anonymous survey describing your subjective experience.

Risks to study participants: There are no foreseeable risks associated with this research study.

Benefits to research participants and others: You will have an opportunity to enjoy and comment on a new game under active development. Your feedback will help improve the game experience for future players.

Record keeping and confidentiality: Records of your participation in this study will be held confidential so far as permitted by law. However, the study investigators and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of the data will not identify you.

Compensation or treatment in the event of injury: There is no foreseeable risk of injury associated with this research study. Nevertheless, you do not give up any of your legal rights by signing this statement.

For more information about this research or about the rights of research participants, or in case of research-related injury, contact the Investigator listed at the top of this form. You may also contact the IRB Chair (Professor Kent Rissmiller, Tel. 508-831-5019, Email: kjr@wpi.edu) and the University Compliance Officer (Jon Bartelson, Tel. 508-831-5725, Email: jonb@wpi.edu).

Your participation in this research is voluntary. Your refusal to participate will not result in any penalty to you or any loss of benefits to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit.

By signing below, you acknowledge that you have been informed about and consent to be a participant in the study described above. Make sure that your questions are answered to your satisfaction before signing. You are entitled to retain a copy of this consent agreement.

_____   Date: _____

Study Participant Signature

_____

Study Participant Name (Please print)

_____   Date: _____

Signature of Person who explained this study