THE IMPACT OF NON-DIEGETIC USER INTERFACE DESIGN ON PLAYER EXPERIENCE IN PUZZLE GAMES

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MAY 2024

Declaration of Originality

I, Leong Wan Yi, declare that this research paper entitled “The Impact of Non-Diegetic User Interface Design on Player Experience in Platform Adventure Games” is solely based on my original work except for the citations that have been acknowledged. I hereby declare that this project has not been previously submitted to any other party and will be submitted under the Degree of Bachelor of Science (Honours) Game Development, under the Universiti Tunku Abdul Rahman.

Leong Wan Yi

12 May 2024

Acknowledgment

I would also like to thank Ms Chow Mee Mooi for her guidance and support. Their experience and knowledge have influenced my studies and motivated me to do my best work.

I would also like to thank our friends and family for their unwavering support and encouragement. We have been motivated to overcome challenges and strive for excellence by their belief in us.

Finally, I would like to express my gratitude to everyone who have provided me with feedback and assistance in improving our research. Your insights and suggestions have been invaluable in the refinement of my work.

This research would not have been possible without all those involved and willing to help. Thank you all for your contributions and for believing in my vision.

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List of Terminology

Terminology	Description
2D	Two Dimensional
3D	Three Dimensional
FYP	Final Year Project
GUI	Graphic User Interface
HUD	Heads-Up Display
Linux	Lovable Intellect Not Using XP
macOS	Macintosh Operating System
NPC	Non-Player Character
OS	Operating System
PE	Player Experience
RO	Research Objective
RQ	Research Question
UI	User Interface
USP	Unique Selling Point

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Chapter 1: Introduction and Overview

This report is prepared by the author Leong Wan Yi, 2101503, for the Final Year Project (FYP) with the course code UJMZ 32010. This report will cover the research on the topic "The Impact of Non-Diegetic User Interface Design on Player Experience in Puzzle Games" and the details of the game the author is working on for this course. In this FYP course, the author joined a project team called PolyMasters, which consists of 4 members, as shown in Table 1.

Student Name	Course
Leong Wan Yi	Game Development student
Leong Xue Qian	Game Development student
Ho Keen Mun	Game Design student
Wong Zi Ming	Game Design student

Table 1: Team Members in PolyMasters

The supervisor guiding us throughout this FYP will be Ms. Chow Mee Mooi, Pn. Nik Norazira binti Abdul Aziz and Dr. Ang Kok Yew.

Two game ideas are proposed to the supervisors during the proposal presentation session. The first game idea is a 2.5D puzzle adventure game named Chroma Journey that PolyMasters chose to work on in this FYP. The second game idea is a 3D horror game, Graveyard Manager, in which the player plays as a cemetery caretaker named Ming, facing supernatural disturbances while working there. The player will need to exorcise the restless spirits and survive.

For the chosen game idea, PolyMasters had to refine the game concept to include some ancient Chinese culture. Besides, the game proposal slides for Chroma Journey and Graveyard Manager have been included in Appendix B and Appendix C, respectively.

1.1 Game Introduction

Chroma Journey is a 2.5D platform adventure game where the player will play as a guardian named Chroma, whom the four Auspicious Beasts created. The player is given an enormous task: unveiling the terrible presence of the Four Fiends. Throughout the game, the player has to travel to fascinating landscapes, solve puzzles, and traverse shadowed regions to restore harmony to the world.

1.2 Game Genre

Chroma Journey is a game that contains four types of game genres: adventure, platformer, and a little bit of puzzle. The descriptions for each game genre are shown in Table 2.

Game Genre	Description
Adventure	Chroma Journey combines problem-solving puzzles and exploration of the game environment based on the game story.
Platformer	Chroma Journey is a side-view perspective 3D game, so the player must use the platforming skills throughout the gameplay.
Puzzle	The player must think critically to solve the puzzles and unlock new areas during the gameplay.

Table 2: Game Genres

1.3 Art Style

Figure 1: Limbo's Gameplay Scene

The art style of Chroma Journey is low polygonal graphics and monochromatic art style. Monochromatic art style games mean the developed game will only use one colour with different tones. An excellent example is Limbo, as shown in Figure 1. The game's colour scheme efficiently uses tints, hues, and tones as it switches between lighter, darker, and more or less saturated combinations of the base colour or hue.

1.4 Market Research

Some games can be competitors of Chroma Journey on the market because of their similar art style or gameplay. Table 3 shows the competitor of Chroma Journey.

Figure 2: Screenshot of Limbo's Gameplay Scene

Figure 3: Little Nightmare Gameplay Scene

Game	Description
Limbo	Limbo is a puzzle-platform video game. The monochromatic art style of Limbo brings a creepy, solid mood to the players. Figure 2 shows the screenshot of Limbo's gameplay. It mainly focuses on the crucial part of the gameplay, while the forest background and the outer area are blurred to highlight the essential part of the gameplay. Chroma Journey also plays monotonously and gloomily, but Limbo is already one of the most-played games on the market.
Little Nightmares	Little Nightmares is a third-person action-puzzle adventure game. Its puzzle design perfectly blends with its platforming and horror setting. It brings intense depression and tension to the players as they have no idea what is ahead during the gameplay. The game's publisher stated that Little Nightmares had sold more than 12 million units, indicating the game's success (Allen, 2023).

Table 3: Competitors of Chroma Journey

1.5 Unique Selling Point (USP)

Most popular games usually feature a few USPs that make them unique and apart from other published games. Chroma Journey has a few USPs, as shown in Table 4.

Figure 4: Taotie (饕餮)

Figure 5: Qiongqi (穷奇)

Figure 6: Hundun (混沌)

Figure 7: Taowu (梼杌)

USP	Description
Game Theme	The game's theme will incorporate ancient characters from Chinese mythology, such as Hundun, Qiongqi, Taotie, and Taowu. The appearances of these four Fiends are shown in Figure 4, Figure 5, Figure 6, and Figure 7, and this distinguishes Chroma Journey from other Western or Japanese mythology games.
Unique Level Design	The main puzzles of Chroma Journey will be connected with the features of these Four Fiends. The player must take caution and behave correctly as each Fiend's area will have a different main puzzle.

Table 4: USP

1.6 Game Objective

The game objective of Chroma Journey is for the player to complete the obstacle puzzles while escaping from the Four Fiends during the journey. As a result, the player must think carefully about managing their resources to complete the game level and reach the Four Auspicious Beasts' statue.

1.7 Game Story

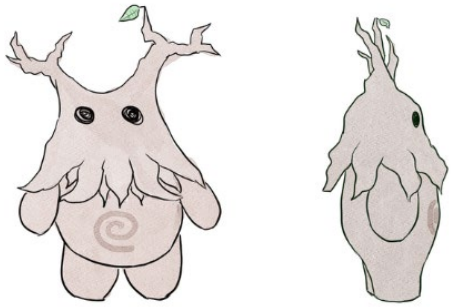


Figure 8: Chroma – Initial Character Sketch

The Four Auspicious Beasts - Azure Dragon, White Tiger, Vermilion Bird, and Black Tortoise, sealed the Four Fiends - Hundun, Qiongqi, Taotie, and Taowu, bringing peace to the world in ancient times. They created Chroma as a guardian for the seal to safeguard the seal. The initial character sketch of Chroma is shown in Figure 8. However, one fateful day, the seals of Azure Dragon were broken, unleashing the four evil beasts in the east. In the face of this crisis, Chroma embarks on a journey to reseal the ancient threats and restore harmony to the world.

Each Fiend has its personality and will react to different stimuli. Table 5 shows the four Fiends' characteristics, which will be used in the level design.

Fiends	Descriptions
Taotie	The greedy devoured all in its path, leaving the deep forests barren of life.

Qiongqi	The thief of sound stole away the voices of creatures in the woods, rendering them speechless.
Hundun	The embodiment of chaos seized the sunlight, plunging the world into perpetual darkness.
Taowu	The stealer of colour drained the vibrant hues from the world.

Table 5: Fiends and Its Characteristics

1.8 Game Mechanics

The four Fiends will be the core game concept with distinctive Characteristics in Chroma Journey. The game mechanics of Chroma Journey is shown in Table 6.

Game Mechanics	**Description**
Player Movement	The player can walk, run, jump, climb, and sneak in the game.
Stamina System	The player's stamina will decrease when running, jumping, or climbing. The player's stamina will increase when idling or walking until it reaches the maximum. If the player rests in the game, the stamina will be restored quicker than when the player walks.
Pick up Items / Interact	The player can pick up interactable game items or interact with the game environment.
Throw light	The player can aim and throw light in the game to attract or disturb the enemies.
Poison System	The player will be poisoned when they reach a certain level in the game. If the poison level

	reaches the maximum, the player will die in the game.
Sound System	The enemies will attracted by the sound made by the player. Thus, the player will need to hide in the grass to reduce the loudness of the sounds.

Table 6: Game Mechanics

1.9 Schedule

Figures 9 and 10 show the schedules of FYP1 and FYP2, respectively. The tasks are listed and categorized into several categories.

No	Task	Group Members	Duration	Weeks						
				1	2	3	4	5	6	7
1	**Brainstorming**									
	Genre research	Everybody	2 weeks							
	Game Ideas	Everybody	2 weeks							
	Game concept	Everybody	2 weeks							
	Proposal preparation	Everybody	1 week							
2	**Designing**									
	Character Sketch	Keen Mun	2 weeks							
	Environment Sketch	Ziming	2 weeks							
	UI layout and design	Keen Mun	2 weeks							
	Level Design	Ziming	5 weeks							
3	**Production (Art)**									
	Modelling	Ziming, Keen Mun	3 weeks							
	Music and Sound effect	Ziming	3 weeks							
	Texturing	Keen Mun	3 weeks							
	Rigging	Keen Mun	2 weeks							
4	**Production (Programming)**									
	Player Movement	Wan Yi	2 weeks							
	Player Camera	Wan Yi	2 weeks							
	Enemy AI	Jane, Wan Yi	5 weeks							
	UI Function	Wan Yi	2 weeks							
	Game physics	Jane, Wan Yi	5 weeks							
5	**Milestone**									
	Progress presentation	Everybody	1 week							
	Bug fixing	Jane, Wan Yi	2 weeks							
	Quality Analysis	Everybody	2 weeks							

Figure 9: The Gantt Chart of FYP1

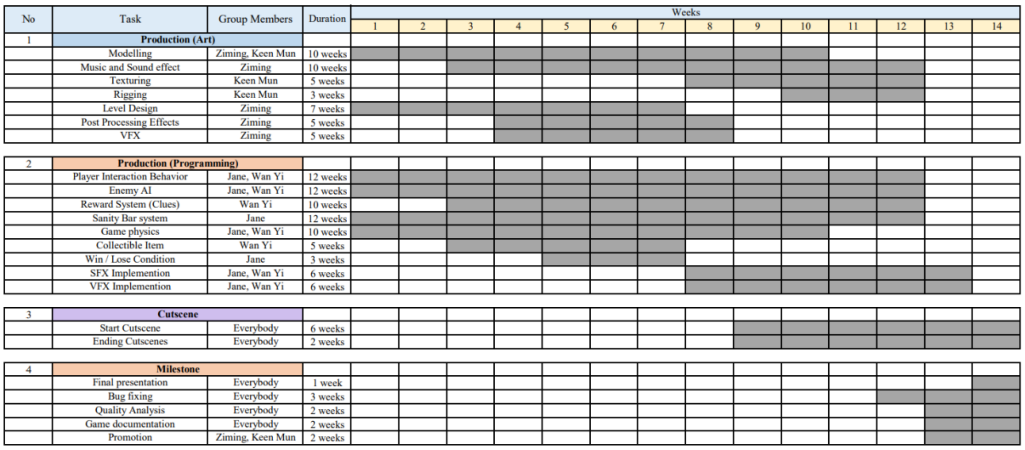


Figure 10: The Gantt Chart of FYP2

1.10 Budget

As the author's project team, PolyMasters plans not to hire any outsourced artists or programmers. The budget will not include the salary part. As a result, the estimated budget will not be over RM 1000.00. The estimated budget of the development period is shown in Table 7.

Category	Item	Quantity	FYP1 (RM)
Hardware	Laptop	4	0.00
	Drawing Tablet	2	0.00
Softwares	Unity 2022.2.1f1	4	0.00
	Visual Studio 2022	2	0.00
	3D Max	2	0.00
	Adobe Photoshop	2	0.00
	Clip Studio	2	0.00
	GitHub	-	0.00
Game Asset	3D Models	-	0.00
	Animation	-	0.00
	Visual Effects	-	0.00
Audio	Background Music	-	0.00
	Sound Effects	-	0.00

Communication	WhatsApp	-	0.00
	Discord	-	0.00
	Trello	-	0.00
Miscellaneous	Printing Fees	4	800.00
	Promotional Material	1	150.00
		TOTAL	950.00

Table 7: Estimated Budget for the Development Period

1.11 Development Resources

The resources used for game development are shown in Table 8.

Development Resources	Description
Unity Game Engine	Unity Game Engine is the game engine used to create the game. The chosen version is Unity 2022.2.1f1.
Visual Studio 2022	Visual Studio is the tool for writing scripts in C# language.
Adobe Photoshop 2020	Adobe Photoshop is the tool for designing game posters.
Adobe Premiere Pro 2020	Adobe Premiere Pro is the tool for editing the game cutscenes and teasers.
3D Max	3D Max is the modeling tool for modeling and animating the game's characters.
Blender	Blender is the modeling tool for modeling the game props.
GitHub Desktop	GitHub is the project collaboration tool used to synchronize the updates across the team.

Google Docs	Google Docs is the tool used to write the game details.
Discord	Discord is the tool used to upload artwork and open meetings.
WhatsApp	WhatsApp is a communication tool that allows team members to communicate efficiently.

Table 8: Software Used in the Development Period

1.12 Project Scopes

Table 9 shows each member's role and tasks, while Table 10 shows each member's research topic. The author, Leong Wan Yi, and Leong Xue Qian will be the game programmers, while Ho Keen Mun and Wong Zi Ming will handle the design part of the developed game.

Member	Role	Tasks
Ho Keen Mun	Lead 3D Artist	• UI arts • Cutscenes • Player and enemy character models and animations
Leong Wan Yi	Game Programmer and Visual Effects Artist	• Player movement and behaviour • UI functions • Visual Effects • Item interaction • Game environmental change functions
Leong Xue Qian	Lead Game Programmer	• Enemy AI functions • Main menu Functions • Game mechanics implementation

Wong Zi Ming	Level Designer and 3D Artist	• Concept arts of the entire game • Levels and game environment designs • Sound effects and background music

Table 9: Project Scopes

Member	Research Topics
Ho Keen Mun	Texturing to Create Realistic Low Poly 3D Models
Leong Wan Yi	The Impact of Non-Diegetic User Interface Design on Player Experience in Platform Adventure Games
Leong Xue Qian	Environmental Fluctuation: Player Awareness and Adaptability in Platform Adventure Game
Wong Zi Ming	Impact of Environment Atmosphere on Player Engagement

Table 10: Research Topic of Each Member

1.13 Summary

Chroma Journey is a 2.5D platform adventure game developed with the Unity Engine. The four-person group named PolyMasters developed the game Chroma Journey to fulfill the criteria of the FYP course.

Chapter 2: Background Study and Literature Review

2.1 Research Topic

This chapter will focus on the research on The Impact of Non-Diegetic User Interface Design on Player Experience in Platform Adventure Games. The author's study aims to study the UI design and implement it into the developed game.

2.2 Introduction

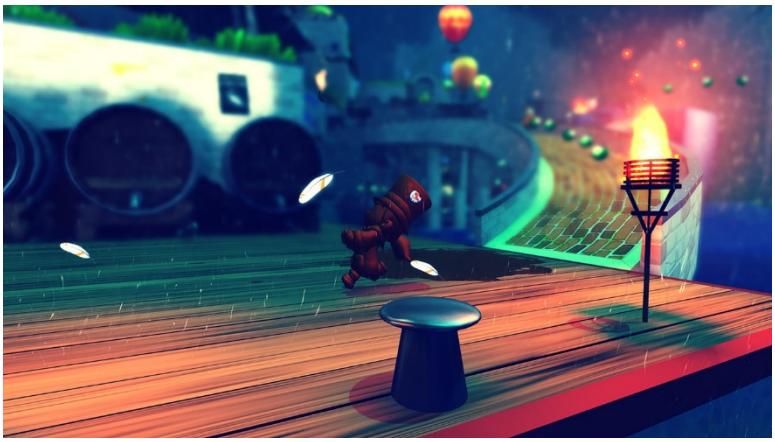


Figure 11: Example of 3D Platform Games – A Hat in Time

Figure 12: Example of 2D Platform Games – Hollow Knight

The term "platformers" or "platform games" is generically used to describe a video game in which the player controls a character that runs and jumps to avoid obstacles and defeat enemies (Minniken. T, 2016, p.2). Platform games are a subgenre of action games. They are also one of the earliest video game genres. Platform games can be 2D

or 3D. Some good examples are A Hat in Time, shown in Figure 11, and Hollow Knight, shown in Figure 12.

Figure 13: Example of Adventure Games – Ori and the Blind Forest

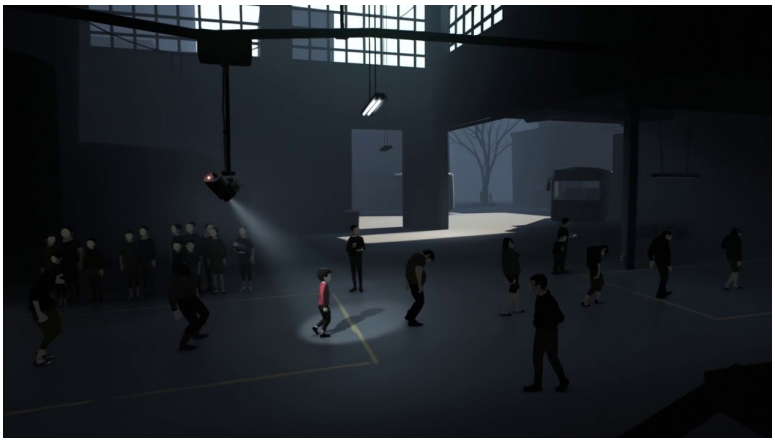


Figure 14: Example of Adventure Games - Inside

An adventure game is any game genre where the player plays as a game character in a story (Adventure Game, 2024). Adventure games focus on puzzle-solving within a narrative framework, generally with few or no action elements (Bronstring, 2018; Vertical Slice Games, n.d.). In adventure games, exploration and the exploration of big worlds are the main activities (Gameranx, 2016). Some good examples of adventure games are Ori and the Blind Forest, shown in Figure 13, and Inside, shown in Figure 14.

As a result, platform adventure games combine the platformers and adventure game genres where the player can control the game character to avoid obstacles, traps, or enemies when exploring the game world.

Different types of UI design are applied in platform adventure games, including non-diegetic UI design. The elements of the game that are only for the player are known as non-diegetic UI elements (F, 2022). Neither the game characters nor the narrative itself acknowledges them. Examples of non-diegetic UI elements will be the main menus, health bars, cooldown timers, etc.

Therefore, this research investigates how the non-diegetic UI design impacts platform adventure game players. The author intends to look into the effects of non-diegetic UI design on player experience. The author will examine the non-diegetic UI design, determine what works best, and apply it in the developed game.

2.3 Problem Statement

UI is a crucial part of the game. It will directly influence the player experience and decrease the playability of the games. With different types of UI design in games, which UI type positively impacts the player experiences, leading the puzzle games to success?

2.4 Research Objectives

Based on the stated problem statement, the main objective of this research is to look into the impact of non-diegetic UI on the player experience in puzzle games. Thus, the research objectives, RO1 and RO2, are listed below.

RO1: To investigate the non-diegetic UI characteristics.

This research will examine non-diegetic UI's different parts and features in puzzle games. At the same time, the author will discuss how non-diegetic UI design is implemented in platform adventure games.

RO2: To examine the influence of non-diegetic UI on player experience.

In this research, the author will evaluate the impact of non-diegetic UI on player experience, which is the player immersion and engagement in puzzle gaming environments. The author will also examine how non-diegetic UI enhances the enjoyment of platform adventure games and the narrative coherence.

2.5 Research Questions

RQ1: How does non-diegetic UI influence player experience in platform adventure games?

This research aims to understand the influence of non-diegetic UI on the overall puzzle gaming experience from the player immersion and engagement levels. The study also explores how the presence or absence of non-diegetic UI elements impacts the players' understanding of the game world and its story.

RQ2: Which non-diegetic UI elements significantly enhance the player experience in platform adventure games?

This research also seeks to identify the specific non-diegetic UI elements perceived by the players as enhancing their overall gaming experience in puzzle games. It will examine player viewpoints to determine the most significant aspects for strengthening enjoyment and satisfaction.

2.6 Literature Review

UI is one of the essential elements of adventure games on the platform, as it allows the games to provide information to the players (Ming, 2022). A well-designed UI will bring a good player experience to the player. The UI design can be divided into multiple categories depending on the game genre. The critical terms for parts of a puzzle game are frequently defined as graphic user interface (GUI), heads-up display (HUD), inventory, dialogue, and health bars.

2.6.1 The Narrative and The Fourth Wall Concepts

The designers can analyze and break down a UI by applying several theories. One of the theories is the diegesis theory. Diegesis focuses on games as stories since it refers to the setting in which the story is placed. In diegesis theory, two core narrative concepts exist, and the fourth wall (Russell, 2011). Narrative refers to the game story. Not every element of a game is included in the story. For instance, the HUD and game menus, while the game's characters are unaware of them. However, this does not mean these UI elements do not support the game's story. For instance, a futuristic game would usually have futuristic-looking GUI components. The fourth wall is a term that describes the invisible wall between diegetic and non-diegetic, either by bringing something from outside the diegetic world or driving something from the diegetic into the non-diegetic (Conway, 2010).

Figure 15: The Four Types of UI Design based on the Narrative and the Fourth Wall Concepts

When creating the UI of adventure games, two questions can be addressed by the Narrative and the Fourth Wall concepts. The first question is "Do the UI components exist in the game story?" while the second question is "Do the UI components exist in the game space?" (Fagerhott, 2009). From these two questions, the UI components in adventure games can be divided into four categories: non-diegetic, diegetic, spatial, and meta, as shown in Figure 15.

2.6.2 Diegetic UI

Figure 16: Gameplay Scene of Dead Space

Based on Figure 11, diegetic UI can be described as the UI elements in the adventure game's storyline and the game world. The diegetic UI elements provide the players with hints and information without taking their attention away from the world's narration. Apart from the player's character, other characters in the game world can also recognize and respond to this information, enhancing the game's immersion. However, it can frequently be problematic for certain UI elements to be visible to the player. An example of diegetic UI can be observed in Dead Space, as shown in the gameplay scene in Figure 16. In Dead Space, instead of providing the health bar overlay on the game screen, the player's health bar is indicated by the high-tech meter on the suit of the player's character. This assumes that player engagement will be increased by incorporating such elements into the game's story.

2.6.3 Non-Diegetic UI

Figure 17: Gameplay Scene of Star Wars Battlefront 2

Figure 18: Gameplay Scene of New Super Mario Bros. U

Non-diegetic UI is the UI element that does not exist in the game's storyline and world space. As these UI elements have been designed to support player gameplay instead of narrative flow, it indicates that characters in the game world are unaware of their existence (Ming, 2022). The non-diegetic UI elements are frequently used to provide the players with statistical information to keep track of the gameplay details, such as the health bars, menu pop-ups, mini maps, etc. An example of non-diegetic UI can be observed in Star Wars Battlefront 2, the gameplay scene of which is shown in Figure 13. The information, such as the players' names, the real-time players' kill stat, and the battle points of the player shown in Figure 17, are not related to the game story or the game space. The second example of non-diegetic UI can be observed in New Super Mario Bros. U, whose gameplay scene is shown in Figure 18. The New Super Mario Bros. U displays the non-diegetic elements on the screen so that the player can track

the score, characters, number of coins and items collected, player's lives, and the level's timer. All these non-diegetic UI elements do not connect with the game's narrative. However, the non-diegetic UI elements might disrupt the player's immersion in the game. Still, they can instantly provide crucial information to the players, especially in first-person shooters and platformer games.

2.6.4 Meta UI

Figure 19: Gameplay Scene of Forza Horizon 3

Figure 20: Gameplay Scene of Don's Starve

Meta UI elements are the UI components that do not fit within the geometry of the game world but still maintain the game's narrative by existing on a two-dimensional (2D) hub plane (Cavalcante Raffaele et al., 2017, p.3). These elements are considered part of the game's story but are not physically located inside the game space. Meta UI elements help convey important information to the player while keeping the narrative intact. An example of Meta UI elements from Forza Horizon 3 is shown in Figure 19, where

raindrops on the game screen represent the rainy day of the current gameplay. Another excellent example from the game Don't Starve is shown in Figure 20. When the player is too hot, a reddish-orange ring will appear on the game screen in the 2D plane, which gives a sign for the player to solve the temperature problem. This meta UI does not break the player's immersion in the game as it uses visual effects instead of showing text that might disrupt the gameplay experience. However, the meta UI elements might block the player's vision depending on their design and placement in the game.

2.6.5 Spatial UI

Figure 21: Gameplay Scene of Assassin's Creed: Syndicate

Figure 22: Gameplay Scene of Splinter Cell Conviction

Based on the narrative and fourth wall concept, spatial UI elements are user interface components integrated into the game world, providing information to the player while maintaining immersion (Cavalcante Raffaele et al., 2017, pp. 2-3). These elements are

designed to be part of the game environment and enhance the player's experience without breaking the narrative flow. The first example of Spatial UI from the game Assassin's Creed: Syndicate is shown in Figure 21. When the player gets near the specific game character, the character is highlighted to show that the player is targeting this character. Another example from Splinter Cell Conviction is shown in Figure 22 where the instruction is shown in the game world to ask the player to save the person. This provides essential information to the player without the need for separate menus or screens, enhancing gameplay flow. However, additional development efforts may be required to implement spatial UI to ensure proper integration and functionality within the game world. Thus, the effectiveness of spatial UI depends on how well they are designed and integrated into the overall gaming experience.

2.6.6 The Similarities and Differences of All Four Types of UI

Table 11 shows the differences between diegetic UI, non-diegetic UI, meta UI, and spatial UI, while Table 12 shows the similarities of all four UI types. Although the representations of these four types of UI are different, they have the common goals of enhancing player experience and adapting to the game's design needs.

The Differences Between The Four Types of UI				
Aspects	**Diegetic**	**Non-Diegetic**	**Meta**	**Spatial**
Definition	Elements integrated into the game's world are visible to players and characters.	Elements outside the game's world, visible only to the player.	Elements that bridge the perceptual gap between player and character can be non-visual.	Elements within the game's spatial dimensions but not its fictional reality.
Integration with Game World	It is fully integrated into the game's fiction.	It is not integrated into the game's fiction.	It is not directly connected to the game's fiction but uses	It is integrated into the game's spatial dimensions but not its fiction.

			innovative means to convey information.	
Purpose	To maintain immersion by making UI elements part of the game world.	To provide essential game-state information without integrating into the game world.	To convey game-state information in a way that mimics natural perception.	To provide environmental and navigational information using the game's spatial context.
Visibility	It is visible to both the game's characters and the player.	It is visible only to the player.	It is designed to be perceived in a way that could be natural for the character.	It is visible to the player but not tied to the game's narrative.
Example	Health level indicated by a character's suit feature	Traditional HUD elements like ammo count	Informative elements are presented visually in the game geometry, such as teammate outlines in Left 4 Dead.	Navigational aids that use the game's 3D geometry without being part of the narrative.

Table 11: The Differences between the Four Types of UI Elements

Similarities	
Enhance Player Experience	All types of UI aim to enhance the player's experience by providing necessary information in a manner that supports gameplay.
Adaptation to Game Design	Each UI type adapts to a game's specific design and narrative needs. Whether providing immersive cues through diegetic elements, clear gameplay information via non-diegetic overlays, enhancing player-avatar connection through meta elements, or guiding player navigation with spatial cues, all UI types are tailored to fit the game's design philosophy and enhance the overall player experience.

Table 12: The Similarities between the Four Types of UI Elements

2.6.7 Player Experience

Denisova et al. (2016, p. 33) emphasize that player experience (PE) refers to the broad range of sensations, thoughts, and feelings that players go through when interacting with digital games. It encompasses aspects such as flow, presence, engagement, immersion, and fun, which describe the multifaceted nature of what individuals undergo while playing games. Wiemeyer et al. (2016) emphasize that PE refers to the individual and personal experience of playing games, describing the qualities of the player-game interactions. It is typically investigated during and after the interaction with games and has gained importance in games research, moving toward a better definition of PE in games. Overall, PE is the thoughts and feelings the player thinks and feels when playing a game.

Many factors can influence PE. One of the factors is the game quality. A game with high game quality brings high playability to the players, while a game with low game quality brings low playability. Every game element inside a game can affect its quality, such as UI, game mechanics, game arts, game flow, etc. Each game element forms a strong bond between each other. This can conclude that every game element is indispensable.

2.7 Game Review

The game chosen for review is Hollow Knight. The reason for selecting Hollow Knight is that it is trendy and has an excellent UI design.

2.7.1 Hollow Knight

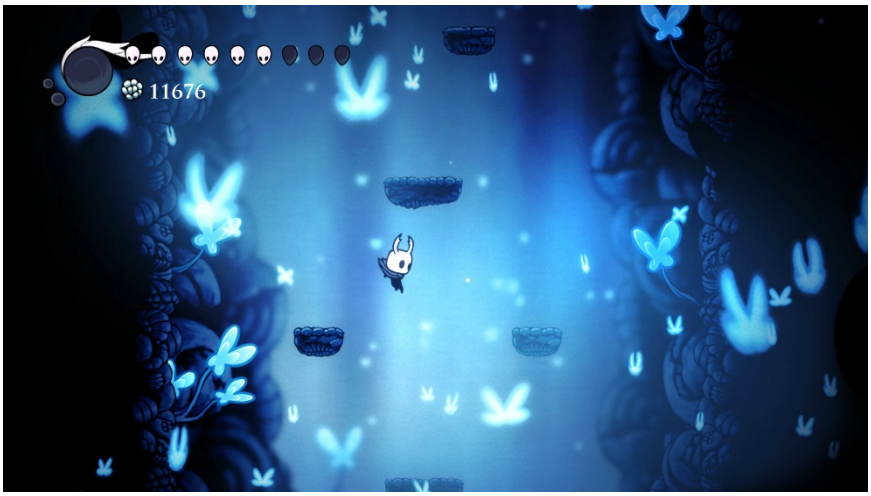


Figure 23: Hollow Knight

Hollow Knight is a hand-drawn Metroidvania action-adventure platformer developed by Team Cherry. It was released on Steam on 24 February 2017 and further released in Linux, macOS, Nintendo Switch, PlayStation 4, and Xbox One (Hollow Knight, n.d.). The player plays as an insectoid warrior, the Knight, exploring Hallownest, a fallen kingdom afflicted by a supernatural disease. The game is set in various underground locations, featuring friendly and hostile insectoid characters and numerous bosses. Players can unlock abilities as they explore, along with pieces of lore and flavour text distributed throughout the kingdom. In Hollow Knight, most UI elements are classified as non-diegetic UI as it does not need much UI from other types.

Figure 24: Hollow Knight – Main Menu

Figure 25: Hollow Knight – Options Menu

Figure 24 shows the main menu of Hollow Knight. The game title is big enough on the game screen. The borderline decoration suits the font and the background graphics perfectly. The designers use the elements of Hollow Knight grass and insect' designs to create suitable border lines for Hollow Knight. The glow and lighting make the game title and buttons evident on the game screen as the designers use the colour contrast theory to make them pop out. Figure 25 shows the game's options menu. Compared to the main menu, the title of the option menu is smaller as it is the sub-panel of the main menu. All the buttons have the same font and same font size to avoid the messiness of UI design and show UI consistency. The arrows will be displayed when the player moves the mouse cursor to the button or uses keys to highlight the button. This is good as it lets the player see which button is highlighted.

Figure 26: Hollow Knight – Dialogue and Name Introduction UI

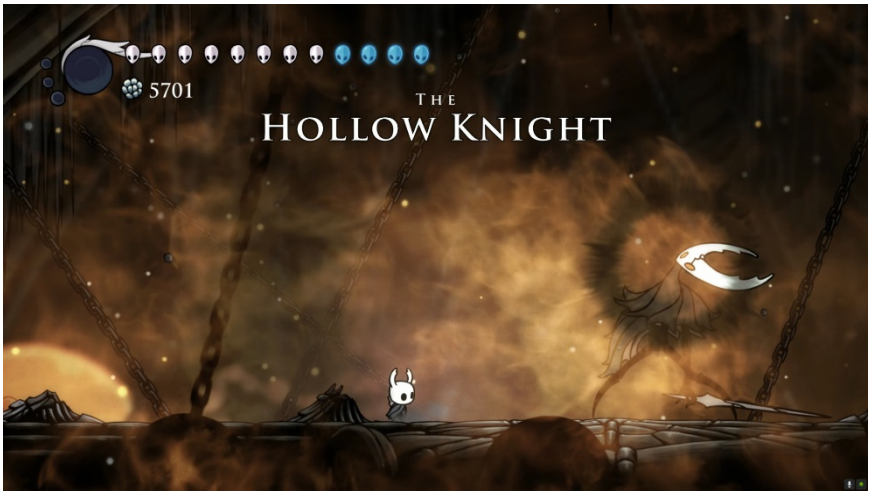


Figure 27: Hollow Knight - Level Introduction and Player Stats

Figure 26 shows the dialogue and introduction of the non-player character's (NPC) name. The dialogue is displayed in the top middle of the game screen as it will not block the vision of the platforms at the bottom. At the same time, the name of the NPC is shown at the bottom left corner to avoid disrupting the player's immersion. Figure 27 shows the level introduction UI in the top middle of the screen and player stats in the top left corner. The level introduction will disappear after a few seconds as it only introduces the level when the player enters the respective level. The big circle represents energy storage, and the tiny skull icons represent the remaining lives. The number of coins the player owns is shown under the player's life stat. By placing the player's stats at the top left corner, the player can receive the player's stat information without disturbing the player's immersion.

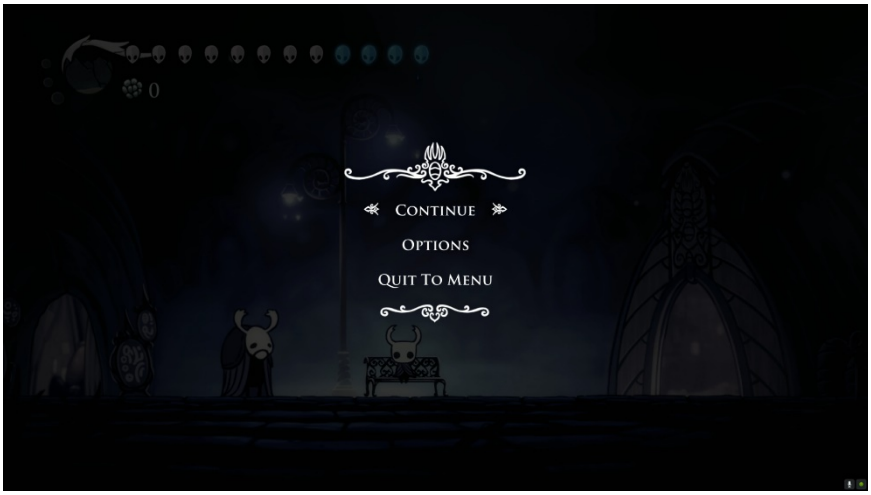


Figure 28: Hollow Knight - In-Game Menu

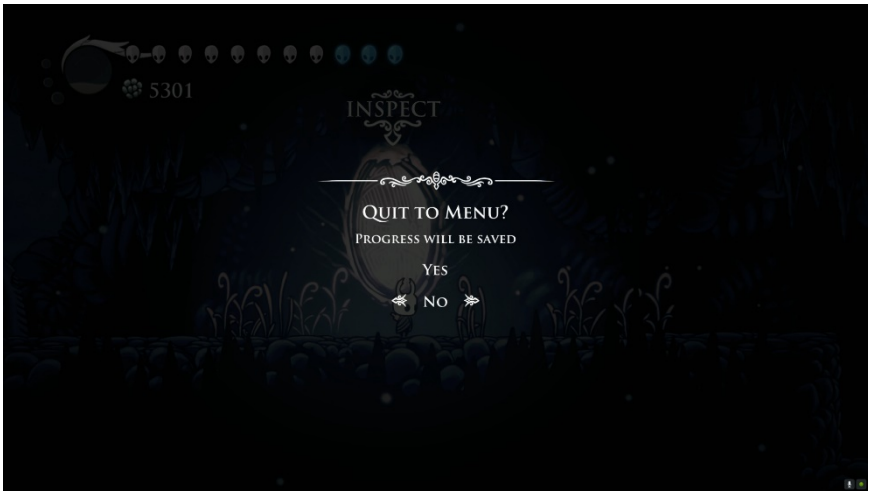


Figure 29: Hollow Knight – Confirmation for Quit to Main Menu

Figure 28 shows the in-game menu of Hollow Knight, which is placed at the center of the game screen. It has a confirmation for quitting the main menu shown in Figure 29 to avoid the player pressing the button accidentally and immediately back to the main menu. It is good to have a confirmation UI part for the player to consider before making the final decision.

Figure 30: Hollow Knight – Inventory

Figure 30 shows the player's inventory in the game. The designer uses borders to draw the rectangle-like panel and place the title near the top middle border. The inventory is mainly separated into three parts, from left to right: the player's equipment, the items, and the details of the items. At the same time, the number of coins earned and the completion percentage are placed at the bottom left and right of the panel, respectively. All the UI elements are arranged neatly in the inventory UI panel. Thus, it does not look messy, although it has a lot of UI elements in one panel.

Figure 31: Hollow Knight - Market

Figure 32: Hollow Knight – Confirmation for Purchasing Chosen Item

Figure 31 shows the market UI of Hollow Knight. It is placed at the half-right of the game screen as it does not want to block the vision of the market entrance. Thus, the player can see the market entrance and know where to exit the market. The market UI is separated into two parts: the selling items and the details of the items. This gives a lot of information to the player as the player can know the item's function and price. After choosing the item to purchase, the confirmation is shown (Figure 32) to ask the player whether the player confirms to spend the coins to buy the selected item.

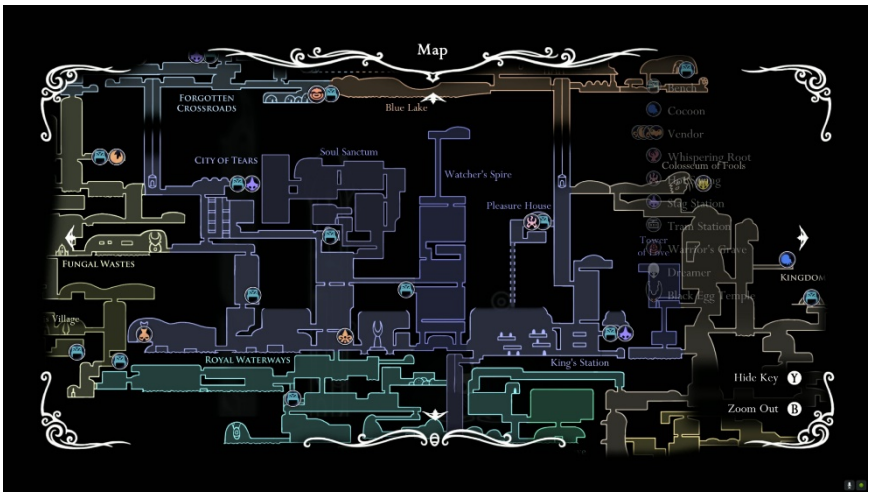


Figure 33: Hollow Knight – Mini Map

In Hollow Knight, the player can purchase the mini-map from the market. After buying the mini-map, the player can open the mini-map by pressing the respective key, and the map will be shown on the game screen, as shown in Figure 33. In this mini-map, the

areas are separated using different colours to let the player know which areas they are located.

Figure 34: Hollow Knight – Guide

When the player reaches the tutorial area in the game, the guide UI will be shown (Figure 34) on the game screen in white colour based to let the player know the key to press and what will happen after pressing the key.

2.8 Review Outcome

Among the four types of UI, non-diegetic UI will be chosen to test the impacts of non-diegetic UI elements on player experience in the developed platform adventure game as the UI elements in this game are primarily non-diegetic, and this will provide enough information for the survey test.

2.9 Summary

The importance of UI in puzzle games is highlighted by the way it delivers essential information and makes players respond quickly. The Fourth Wall and Narrative principles are used to analyse the UI design, which is divided into diegetic, non-diegetic, spatial, and meta components. Diegetic UI components, such as the health indicator in Dead Space, allow game characters to interact with the player, thus enhancing immersion within the game's world and story. Examples of non-diegetic user interface

features are found in New Super Mario Bros. U. and Star Wars Battlefront 2, which provide gameplay information unrelated to the narrative. As shown in Don't Starve in Forza Horizon 3, meta UI elements exist on a 2D hub plane, preserving the story without fitting into the geometry of the game world. Assassin's Creed: Syndicate and Splinter Cell Conviction are examples of how spatial UI integrates into the game environment to provide information without immersion disruption. Understanding these user interface categories helps designers balance the requirement to send important information and player immersion, resulting in a more immersive puzzle gaming experience.

Chapter 3: Chapter 3: Methodology

3.1 Research Methods

This research employs a mixed methods approach to investigate the impact of non-diegetic UI design on the player experience in adventure games. The author uses primary and secondary methods to answer RQ1 and RQ2 comprehensively, as shown in Table 13.

Primary Research Method	**Survey** A set of questionnaires will be set and provided to the participants.
Secondary Research Method	**a. Literature Review** The works of other authors who research the implementation of non-diegetic UI elements are reviewed. **b. Game Review** A few popular puzzle games will be analysed and reviewed based on the non-diegetic UI design.

Table 13: Research Methods Used in the Developed Game

3.2 Participants

The participants in this research will be the players who often play puzzle games. Factors such as gaming experience, age, and familiarity with non-diegetic UI elements will be taken into account for the author to implement them into the game developed by the author's team.

3.3 Sampling Size

The author aims for a sampling size of at least 10 participants from the Discord channel instead of sending emails to students from UTAR (Universiti Tunku Abdul Rahman)

Sungai Long Campus as they might not read the email since there are too many new emails every day. In Discord, it is easy to gather participants on the server.

3.4 Measurement Instrument

The main instrument used in this research is the player survey. This instrument aims to collect the data for answering RQ1 and RQ2, offering a comprehensive understanding of this research topic. At the same time, it provides a good reference for improving the non-diegetic UI elements in the developed game.

3.4.1 Player Surveys

Questionnaires will be set and provided to the participants that relate to RQ1 and RQ2. The questions in the questionnaires are designed to examine the usability, player immersion, and overall satisfaction with the developed game to provide qualitative data into the participants' viewpoints.

The pre-test questionnaire and the post-test questionnaire will be separated into several sections, shown in Table 14 and Table 15, respectively, and the complete sets of questionnaires are available in Appendix B and Appendix C.

Sections	Description
Section 1: Demographic Information	The participants will be asked to fill out their demographic information in this section. The questions in this section are about their age, gender, and experience with platform adventure games.
Section 2: Non-diegetic UI Experience on other Games	The questions in this section are about the placement and the appearance of the non-diegetic UI element in other platform adventure games.
Section 3:	The questions in this section are about the placement and the appearance of the non-diegetic UI element in the tested platform adventure game.

Non-diegetic UI Experience on Tested Game	
Section 4: Impact on Player Experience	In this section, the questions are about the impact of the non-diegetic UI on player experience in the tested puzzle game. It aims to test whether the non-diegetic UI elements affect the player's performance, immersion and feeling.
Section 5: Feedback	In this section, the participants are asked to give feedback on the non-diegetic UI elements and suggestions on improving the non-diegetic UI elements in the tested puzzle game.

Table 14: The Questionnaire Design for Pre-test Section

Sections	Description
Section 1: Non-diegetic UI Experience on Tested Game	After the improvements, the questions in this section are about the placement and appearance of the non-diegetic UI element in the tested platform adventure game.
Section 2: Impact on Player Experience	In this section, the questions are about the impact of the non-diegetic UI on player experience in the tested puzzle game. It aims to test whether the non-diegetic UI elements affect the player's performance, immersion, and feeling.
Section 3: Feedback	In this section, the participants are asked to give feedback on the non-diegetic UI elements and suggestions for improving the UI elements in the tested puzzle game.

Table 15: The Questionnaire Design for Post-test Section

3.5 Research Procedure

The procedure in this research involves a set of well-organized steps to collect data and obtain knowledge on how non-diegetic UI design affects the adventure game player's experience.

Initial UI Implementation

The author will design and implement the non-diegetic UI elements into the developed game at the initial stage based on the existing knowledge and design principles obtained from the literature review and game review.

Initial Gameplay and Feedback (Pre-test Survey)

The participants will play the developed adventure game with the initial UI design. After the gameplay session, the pre-test survey will be given to the participants via Google Forms to collect feedback through observations and discussions. This will identify the problems in the initial UI design and improve the initial UI design at the next stage.

UI Iteration

Based on the feedback collected from the participants at the beginning stage, the author will implement the UI design changes.

Subsequent Gameplayer and Feedback (Post-test Survey)

The second round of gameplay sessions will be conducted after the initial UI design iteration. After the gameplay session, the participants will be given a post-test questionnaire about the player experience and the UI design issues for further improvement.

3.5.1 Research Flow

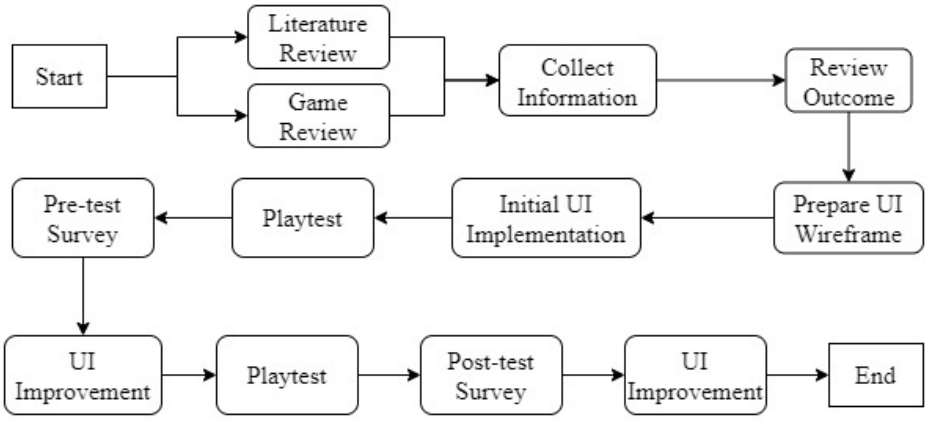


Figure 35: The Flowchart for the Research Flow

Figure 35 shows the research flowchart to examine and implement non-diegetic UI in the developed game. At the beginning of the research, the author collects information about non-diegetic UI through literature reviews and game reviews of popular puzzle games. Once the information has been collected, a review outcome will be concluded based on the information.

The author will prepare the UI wireframes for the developed game and implement the UI based on the wireframes and the collected information. Then, the first playtest session will be ready for the participants. After the first playtest session, a pre-test survey will be conducted to gather participant feedback. The author will improve the UI in the game based on the feedback collected from the pre-test survey. After the first UI improvement, the author will conduct the second playtest session for the participants, and a post-test survey will be performed after the second playtest session. Then, the author will collect feedback from the post-test study and improve the UI of the developed game.

Chapter 4: Functional Specifications

4.1 Introduction

This chapter focuses on the requirements for playing Chroma Journey, including how to control and play the game.

4.2 Game Mechanics

There is one tutorial game level and four game levels. The four-game levels represent the ancient Chinese fiends shown in Table 16. Each level will have different scenes and puzzles to fit the core game mechanics in all four game levels.

Game Levels	Chinese Ancient Fiends
Level 1	Hundun
Level 2	Qiongqi
Level 3	Taotie
Level 4	Taowu

Table 16: Levels and Their respective Chinese Ancient Fiends

4.2.1 Game Controls

The game controls in Chroma Journey are similar to other 3D platformer games, where the player can move around and interact using the keyboard. The controls of the game are shown in Table 11. The player's move speed is different based on the current movement during the gameplay.

Player's Actions	Keyboard Input
Move Forward	W
Move Left	A
Move Right	D
Move Downwards	S

Run	Hold Left Shift
Crouch	C
Jump	Space
Climb	B
Fix Seal	Hold F
Aiming	Hold the Mouse Right Click
Throw	Release Mouse Right Click
Pause Menu	Espace

Table 17: The Game Control Input of Chroma Journey

4.2.2 Stamina System

There is a stamina system for the player to manage the player's control at all game levels during gameplay. A stamina bar will be at the top right corner of the game screen. When there is no stamina left, the player is unable to move. The stamina will be restored or reduced based on the player's current movement.

4.2.3 Interactable Items

Table 18 shows the interactable items available in the game.

Interactable Item	Description
Elemental Stone	The player can collect the elemental stones during the first three levels. The elemental stones will be used at the boss fight level, where the player needs to use the elemental stones to recover the seal stones and repair the broken seal. When the player collects an elemental stone, the game

	screen will pop out the elemental stone icon on the top left of the game screen.
Crates	The player can put the crates in the game levels to use as platforms for the player to jump on to reach the target destinations.
Rocks	The player can throw the rock onto the boss in the boss level to make the boss faint and unable to move within the fainted period.

Table 18: The Interactable Items in Chroma Journey

4.2.4 Tutorial Level

During the tutorial level, guides teach players how to control the character in the game. The tutorial level will not have any puzzle elements as this level only teaches the player how to control their character in the game. At the same time, there will be an additional controls UI panel in the pause menu. This lets the player refer when the player forgets some game controls. The texts of the tutorial guides will be shown at the bottom of the game screen when the player activates the respective area in the tutorial level.

4.2.5 Level 1 (Qiongqi)

The scene at this level is in a forest, where there is only one boss at this level, Qiongqi. The core game mechanic at this level is the sound level system. Different loudness levels will have different attract ranges and affect the enemy's movement speed toward the origin of the sound. The loudness level will be shown in the sound meter UI to let the player decide by looking at the sound meter.

4.2.6 Level 2 (Taotie)

There will only be one boss at this level, the ancient Chinese Fiend, Taotie. The boss will chase the player when the player is in the lake. When the player is on the floating platform on the lake, the boss will try to break the platform to eat the player.

At this level, there will be a poisoning system where there will be fog in this level. The fog is poisoned, and the level of poisoning slowly increases occasionally. The poison level will be shown like the stamina bar, which is placed under the stamina bar. When it reaches the max level, the player loses the game level and needs to replay it. The poison will slow down the player's move speed and increase the stamina usage based on the poison level. Thus, the player must complete this level before the time ends.

4.2.7 Level 3 (Hundun)

There will be a level boss and a few monsters in this level. The scene of this level is in a foggy cave scene. The monsters at this level are sensitive to light sources. A few crystals with a light source will attract the small monsters. With this feature, the player can avoid being caught by the monsters using the throw mechanic to throw light sources to make the respective monster attracted by the light.

4.2.8 Level 4 (Taowu)

This level is the boss level, and the scene at this level is a cave with a bigger space. The broken seal is at this level, and the boss, Taowu, will act to prevent the player from fixing the seal. The player needs to restore the stones that can fix the seal by delivering the sealing energy in the elemental stones. At the same time, the boss will attack the player with its legs.

4.3 Game Structure

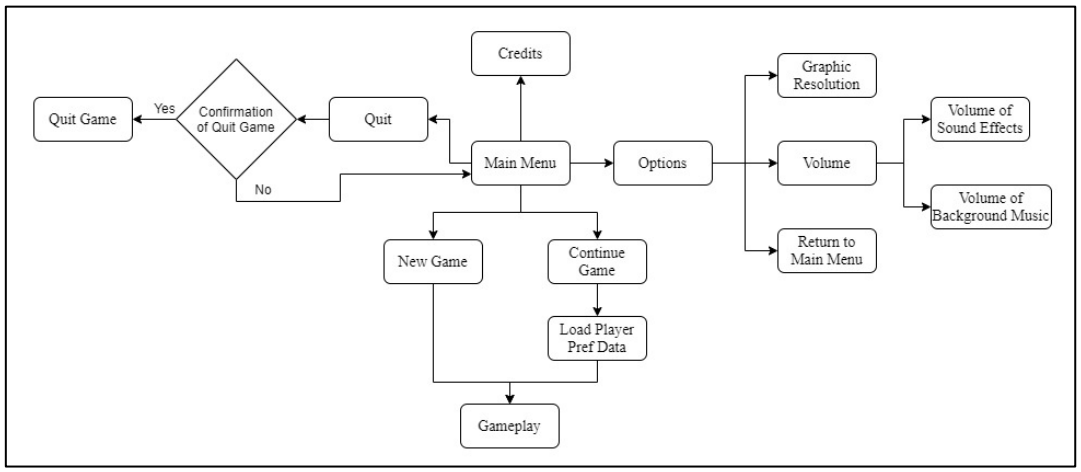


Figure 36: Game Structure of Chroma Journey

Figure 36 shows the game structure of Chroma Journey. When the player opens the game, the game will start from the main menu, which contains the buttons to continue the game, new game, options, credits, and quit the game. The continue game button can only be activated when the player quits the game before finishing the levels. To avoid the player accidentally clicking on the quit game and quitting the game immediately, a confirmation is activated when the player clicks on the quit game button to ask whether the player wants to quit the game. The player can adjust the game's graphic resolution, the background music volume, and the sound effects in the options. The content in the credits is the roles of every member of the author's team.

4.4 System Requirements

Chroma Journey is only available on Windows, and the game's system requirements are shown in Table 19.

	Minimum	Recommended
Operating System (OS)	Windows 7/8/10 (64-bit OS required)	Windows 8/10 (64-bit OS required)
Processor	Intel Core 2 Quad Q6600 @ 2.4 GHz, AMD FX 8120 @ 3.1GHz	Intel i7 920 @ 2.7 GHz, AMD Phenom II 945 @ 3.0 GHz
Memory	4 GB RAM	8 GB RAM
Graphics	NVIDIA GT 630 / 650m, AMD Radeon HD6570 or equivalent	NVIDIA GTX 660, Radeon, R9 – 270
DirectX	Version 9.0c	Version 11
Storage	3 GB available space	3 GB available space
Sound Card	100% DirectX 9.0c compatible sound card	100% DirectX 9.0c compatible sound card

Table 19: Minimum and Recommended System Requirements of the Game

4.5 Summary

In summary, Chapter 4 explains the game control input, the functions in every game level, the tutorial level, the interactable items available in all levels, the game structure, and the game's system requirements.

Chapter 5: Design Specifications

5.1 Introduction

This chapter focuses on the design specifications and implementation of the non-diegetic UI elements in Chroma Journey. A general overview of the entire game also can be found in this chapter.

5.2 Main Menu

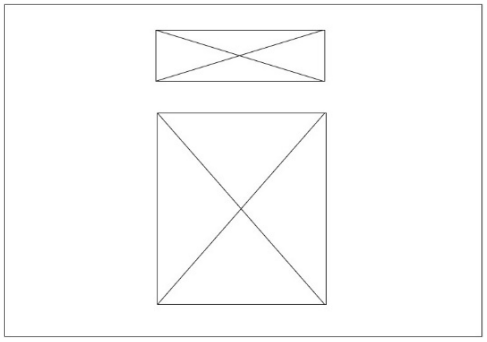


Figure 37: Wireframe of Main Menu

Figure 37 shows the wireframe of the main menu of the game. There will be a video playing in the background of the main menu. The game title will be placed on the top center of the main menu screen, while the buttons in the main menu will be placed at the bottom of the game title. The outcome of the main menu is shown in Figure 38.

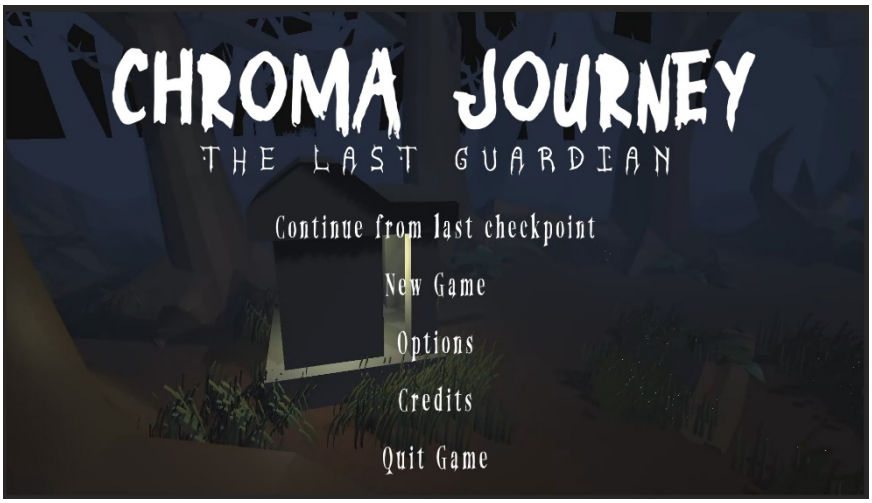


Figure 38: Final Version of Main Menu

5.3 Option Menu

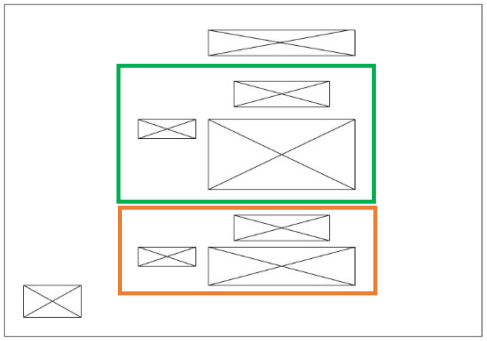


Figure 39: UI Wireframe – Option Menu

Figure 39 shows the options menu wireframe. The option title will be placed at the middle top of the game screen, and the buttons will be placed at the middle center. The game settings will be separated into graphic and volume groups in the green and orange boxes, respectively. The labels of each game setting are placed beside the game settings. The outcome of the options menu is shown in Figure 40.

Figure 40: Final Version of Option Menu

5.4 Credits

Figure 41 shows the credits panel wireframe. No credit title is placed on the game screen, but the subtitles. The subtitles are the art, and the programming is in the middle of the screen. The contents will be categorized into two categories, art and programming, and placed under respective categories. The outcome of the credits panel is shown in Figure 42.

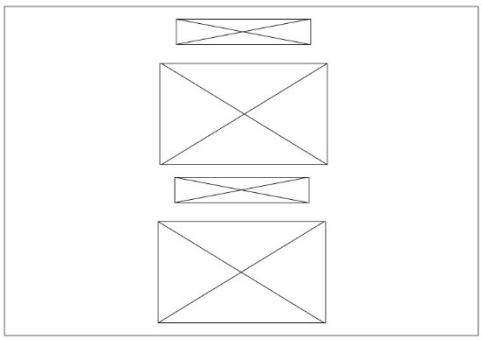


Figure 41: UI Wireframe – Credits Panel

Figure 42: Final Version of Credits Panel

5.5 Poison Bar and Timer

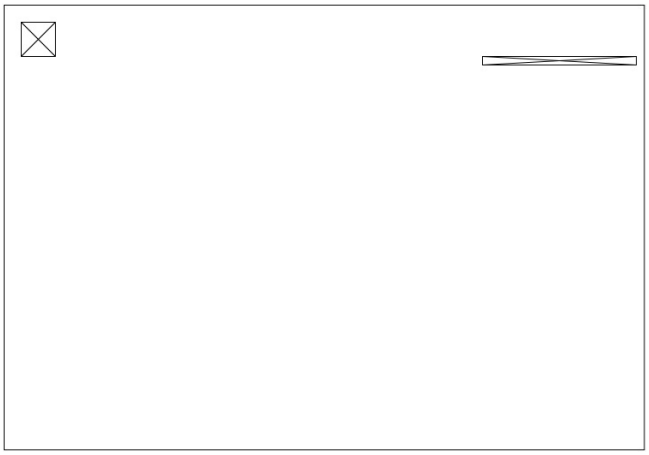


Figure 43: UI Wireframe – Timer and Poison Bar

Figure 44: Final Version of Timer and Poison Bar

Figure 43 shows the wireframe of the poison system's UI elements: the timer and poison bar. The timer will be placed at the top left corner of the game screen, while the poison bar will be placed at the top right corner but below the stamina bar. Figure 43 shows the outcome of the timer and the poison bar.

Initially, the countdown timer in this level is 3 minutes, which means 180 seconds. The timer will only be shown when the time left is 20 seconds, as shown in Table 20. The timer is set to invisible when the game starts due to the player's nervousness and letting the player know that the time will reach the end. If the player cannot finish the level

before the countdown timer ends, the player will lose the game. The same goes for the poison bar; the lesser the time left, the higher the value.

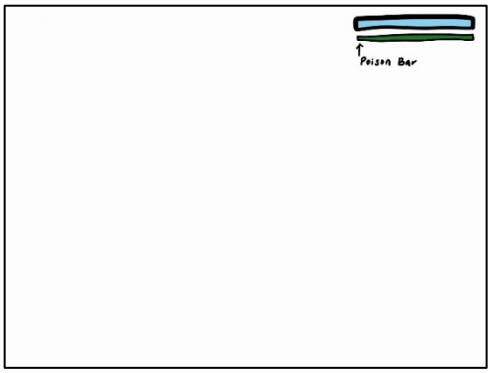
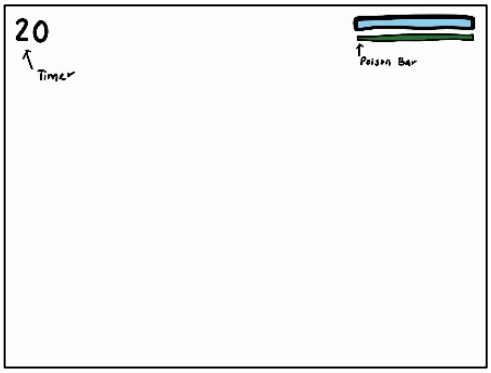
No.	Steps	Sketches
1	The time left is more than 20 seconds.	
2	The time left is 20 seconds or less.	

Table 20: Steps to Timer and Poison Bar Show On the Screen

5.6 Tutorial Guides

The text of the tutorial guides will be shown one by one when the player is in the respective area of the tutorial level, as shown in Table 21. For example, when a new game starts, the player will start from the tutorial level. In the beginning, the player is in the first area, which teaches the player to walk and run. The guide text will be shown at the bottom center of the screen, which teaches the player to press W, A, S, and D to walk and hold the left shift to run.

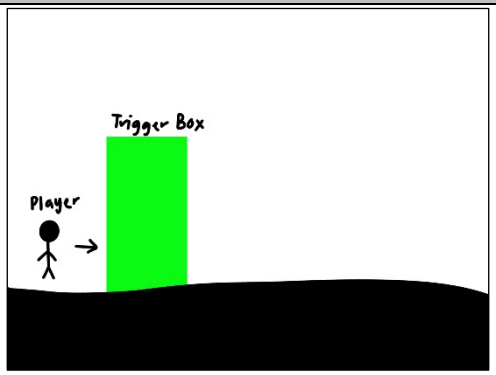
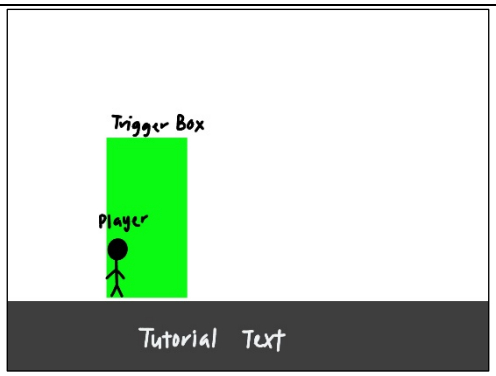
No.	Steps	Sketches
1	Walk to the right.	
2	When entering the trigger area, the tutorial text is shown.	

Table 21: Steps to Make the Tutorial Guides Show On the Screen

5.7 Common In-Game UI

5.7.1 Stamina System UI

The stamina decrease rate and stamina restore rate are shown in Table 22 and Table 23. The stamina will not be decreased or restored when the player is in water and not moving. The stamina bar will be shown on the top right of the game screen to let the player notify the stamina condition.

Player's Stamina Decrease Rate		
Player Movement	**Unit**	**Percentage (%)**
Run	per second	5
Swim	per second	3
Jump	one time	10
Climb	one time	10
Jump and Climb	one time	15

Table 22: The Player's Stamina Decrease Rate in Chroma Journey

Player's Stamina Restore Rate		
Player Movement	**Unit**	**Percentage (%)**
Idle	per second	6
Walk	per second	4

Table 23: The Player’s Stamina Restore Rate in Chroma Journey

The colour of the filling in the stamina bar will be changed based on the percentage of the remaining stamina shown in Table 24. When the player runs out of stamina, the text will pop out which tells the player running out of stamina in Table 25.

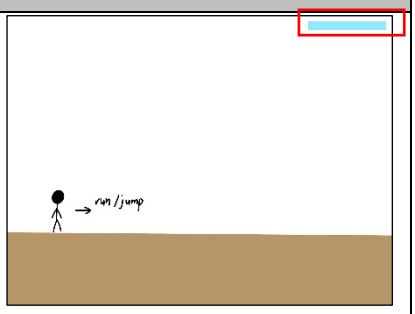
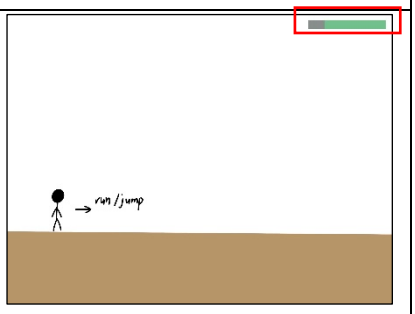
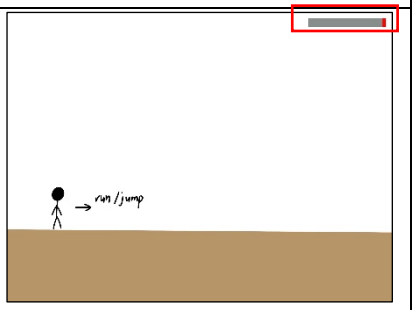
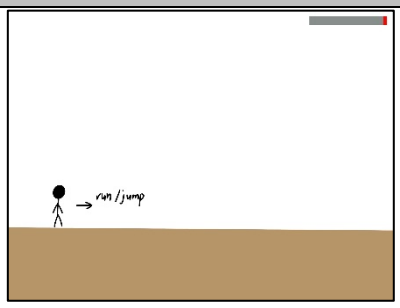
Player's Stamina Status	Colour of the Stamina Bar's Fill	Sketches
When the stamina left more than 80%	Blue	
When the stamina left less than 80% but more than 15%	Green	
When the stamina left less than 15%	Red	

Table 24: The Player's Stamina Bar Colour

No.	Steps	Sketches
1	When the player is going to finish the stamina.	

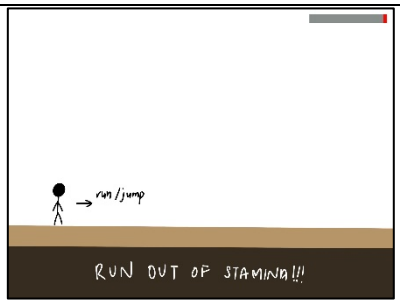
2	When the stamina is used finish, the stamina text is shown at the bottom center of the screen.	

Table 25: Steps to Make the Stamina Text Show On the Screen

5.7.2 Confirmation Panel for Exit Game and Back to Main Menu

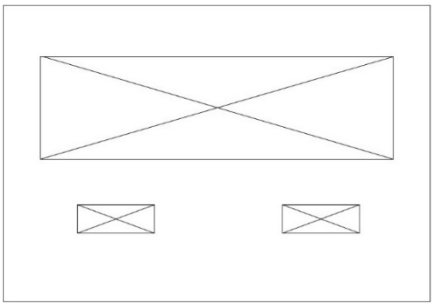


Figure 45: UI Wireframes – Confirmation Panel

Figure 45 shows the confirmation wireframe panel for exit confirmation and back to main menu confirmation. The question will be placed in the middle center of the game screen, and the buttons will be right below the question. Figure 46 and Figure 47 show the exit confirmation panel's outcome and back to the main menu panel's outcome, respectively.

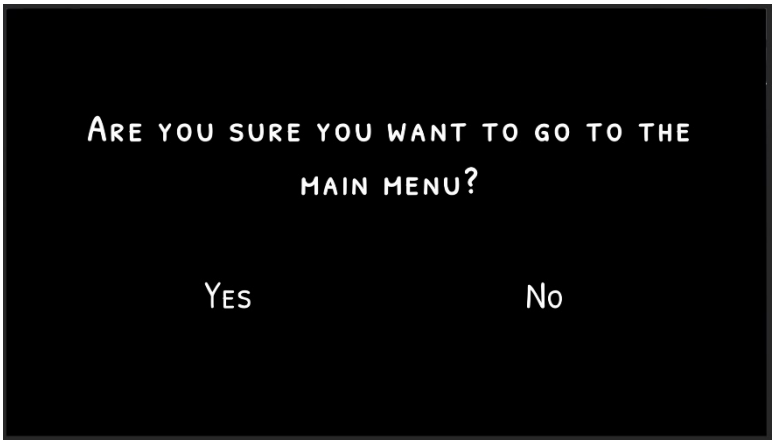


Figure 46: Final Version of Exit Confirmation Panel

Figure 47: Final Version of Back to Main Menu Confirmation Panel

5.7.3 Controls Panel

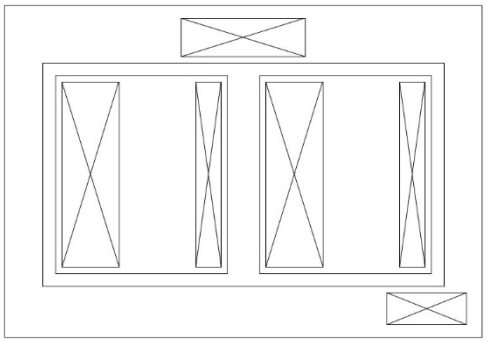


Figure 48: UI Wireframe – Controls Panel

Figure 49: Final Version of Controls Panel

Figure 48 shows the control panel wireframe. All the controls are separated into two rows inserted in the middle of the game screen. A back button will be placed at the bottom right corner of the game screen. The outcome is shown in Figure 49.

5.7.4 Game Over Panel

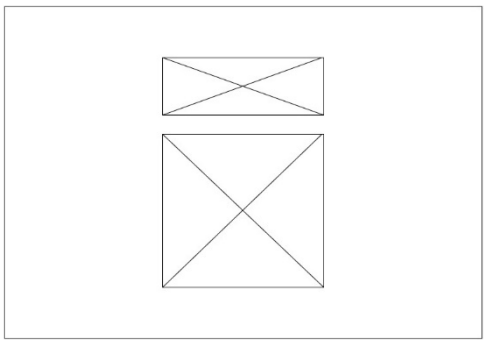


Figure 50: UI Wireframe – Game Over Panel

Figure 51: Final Version of Game Over Panel

Figure 50 shows the game over panel wireframe. The game-over title will be placed in the middle of the game screen, while the buttons will be placed below the game-over title. The outcome of the game over panel is shown in Figure 51.

5.7.5 Pause Panel

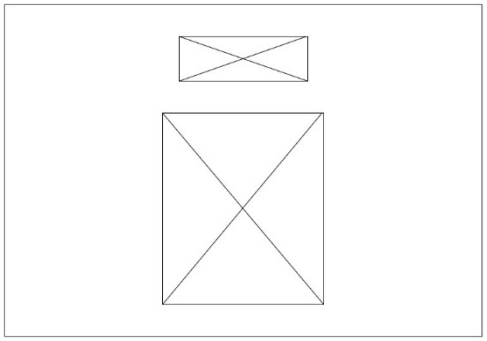


Figure 52: UI Wireframe – Pause Panel

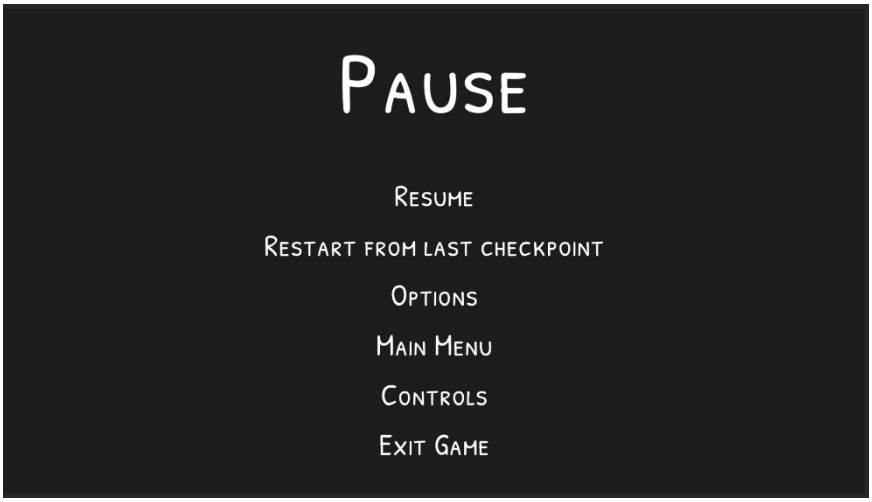


Figure 53: Final Version of Pause Menu

Figure 52 shows the pause menu wireframe. The pause title will be placed in the top middle of the game screen, and the buttons will be placed below the title. The outcome is shown in Figure 53.

5.7.6 Level Introduction

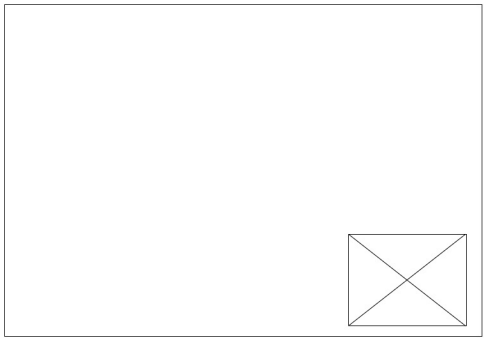


Figure 54: UI Wireframe - Level Introduction

Figure 55: Final Version of Level Introduction

Figure 54 shows the level introduction wireframe. The text will be displayed at the bottom right corner of the game screen. The numbering will follow the sequence of the level. The outcome is shown in Figure 55.

5.7.7 Elemental Balls UI

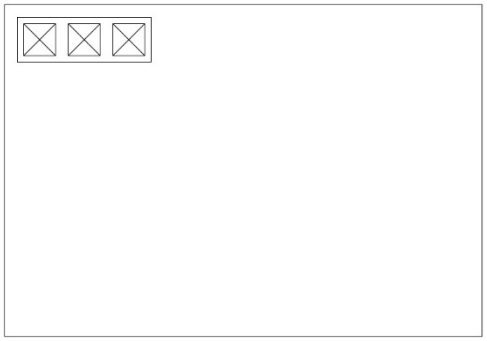


Figure 56: UI Wireframe – Elemental Ball UI

Figure 56 shows the elemental ball wireframe. The images will be placed at the top left corner. It will only appear when the player collects the elemental ball shown in Table 26. The outcome is shown in Figure 57.

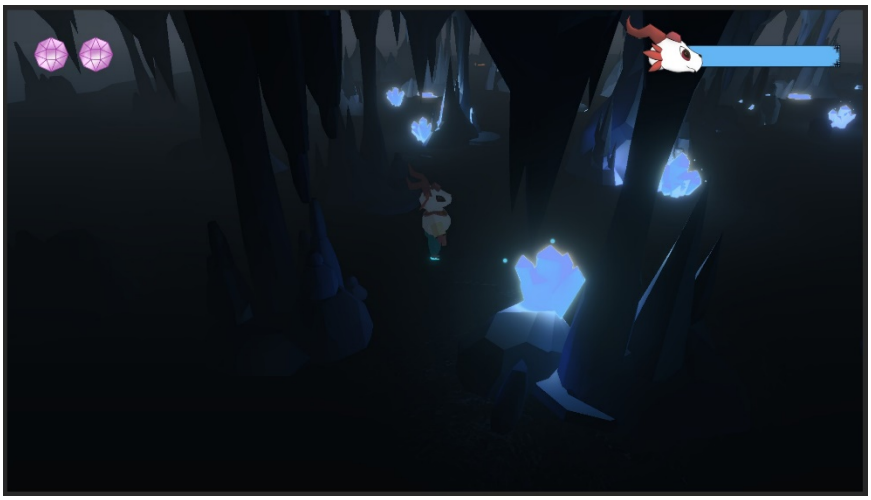
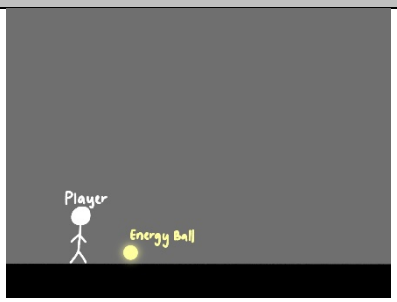


Figure 57: The Final Version of Elemental Ball

No.	Steps	Sketches
1	When the player wants to collect the elemental ball.	

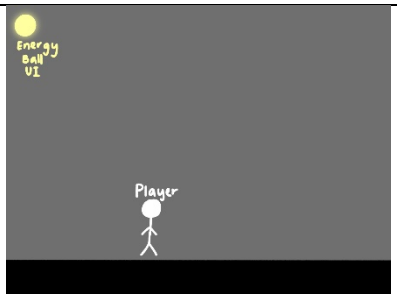
2	The player collected the elemental ball.	

Table 26: Steps to Elemental Ball Images Show On the Screen

5.7.8 Pop-Up Text

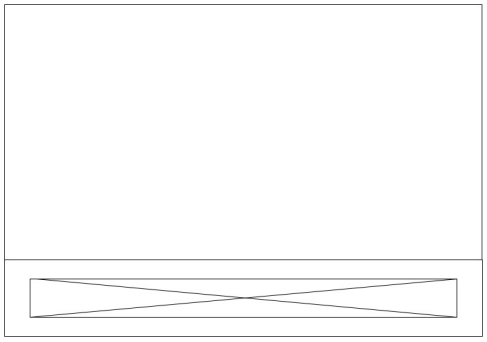


Figure 58: UI Wireframe - Pop-Up Text

Figure 59: Final Version of Pop-Up Text

Figure 58 shows the pop-up text wireframe. Pop-up text is frequently used in the entire game. Figure 59 shows the outcome of our game. The text in the panel will be changed based on the player's situation.

5.8 Test Plans

Test plans are developed to ensure all the non-diegetic UI elements function as expected during the implementation stage.

a. Main Menu

The test plans for the main menu are listed in Table 27.

No.	Test Plans	Expected Results	Implemented
1	The player presses the continue with the last checkpoint button.	The player starts the game at the previously saved checkpoint before quitting.	Yes
2	The player presses the new game button.	The player starts a new game after pressing the new game button.	Yes
3	The player presses the options button.	An options menu panel is shown after pressing the options button.	Yes
4	The player presses the credits button.	A credits panel is shown after pressing the credits button.	Yes
5	The player presses the quit game button.	A quit game confirmation panel is shown when the player presses the quit game button.	Yes

Table 27: Test Plans for Main Menu

b. Options Menu

The test plans for the options menu are listed in Table 28.

No.	Test Plans	Expected Results	Implemented
1	The player chooses low graphic resolution.	The graphics in the game become low resolution.	Yes
2	The player chooses medium graphic resolution.	The graphics in the game become medium resolution.	Yes

3	The player chooses high graphic resolution.	The graphics in the game become high resolution.	Yes
4	The player can adjust the volume sliders.	The volumes become high or low based on the sliders' values.	Yes
5	The player presses the escape key.	The options menu is closed.	Yes

Table 28: Test Plans for Options Menu

c. Credits Menu

The test plan for the credits menu is listed in Table 29.

No.	Test Plans	Expected Results	Implemented
1	The player presses the escape key.	The credits menu is closed	Yes

Table 29: Test Plans for Credits Menu

d. Back to Main Menu Confirmation Panel

The test plans for the back to the main menu confirmation panel are listed in Table 30.

No.	Test Plans	Expected Results	Implemented
1	The player presses the no button.	The back to the main menu confirmation panel is closed.	Yes
2	The player presses the yes button.	The player goes back to the main menu.	Yes

Table 30: Test Plans for Back to Main Menu Confirmation Panel

e. Exit Game Confirmation Panel

The test plans for the exit game confirmation panel are listed in Table 31.

No.	Test Plans	Expected Results	Implemented
1	The player presses the no button.	The exit game confirmation panel is closed.	Yes
2	The player presses the yes button.	The player quits the game.	Yes

Table 31: Test Plans for Exit Game Confirmation Panel

f. Stamina System

The test plans for the stamina system are listed in Table 32.

No.	Test Plans	Expected Results	Implemented
1	The stamina left is more than or equal to 80%.	The stamina bar fill is in blue.	Yes
2	The stamina left is less than 80% but more than 15%.	The stamina bar fill is green.	Yes
3	The stamina left is less than 15%.	The stamina bar fill is in red.	Yes
4	There is no stamina left.	The text tells the player when they run out of stamina when they still want to move.	Yes

Table 32: Test Plans for Stamina System

g. Elemental Ball

The test plan of elemental ball UI is shown in Table 33.

No.	Test Plans	Expected Results	Implemented
1	The player collects the elemental ball.	The image of the elemental ball is shown.	Yes

Table 33: Test Plan for Elemental Ball UI

h. Pause Menu

The test plans of the pause menu are listed in Table 34.

No.	Test Plans	Expected Results	Implemented
1	The player presses the resume button.	The pause menu is closed, and the game resumes.	Yes
2	The player presses the restart from the last checkpoint button.	The pause menu is closed, and the game restarted.	Yes
3	The player presses the options button.	The options menu is opened.	Yes
4	The player presses the main menu button.	The back to the main menu confirmation panel is opened.	Yes
5	The player presses the controls button.	The control panel is opened.	Yes
6	The player presses the exit game button.	The exit game confirmation panel is opened.	Yes

Table 34: Test Plan for Pause Menu

i. Game Over Menu

The test plans for the game over menu are listed in Table 35.

No.	Test Plans	Expected Results	Implemented
1	The player presses the button to restart from the last checkpoint.	The player restarted the level.	Yes
2	The player presses the main menu button.	The back to main menu confirmation panel is opened.	Yes
3	The player presses the exit game button.	The exit game confirmation panel is opened.	Yes

Table 35: Test Plan for Game Over Menu

j. Pop Up Text

The test plans for the pop-up text are listed in Table 36.

No.	Test Plans	Expected Results	Implemented
1	The player enters the trigger box.	The respective text will pop out at the bottom of the game screen	Yes

Table 36: Test Plan for Pop-Up Text

5.9 Summary

Chapter 5 details all the non-diegetic UI elements in Chroma Journey. The test plans are identified and tested during the implementation stage.

Chapter 6: Data Analysis and Discussion

6.1 Introduction

This chapter focuses on the analysis and discussion based on the data collected from the participants via surveys.

6.2 Data Analysis

6.2.1 Data from the Pre-Test Survey

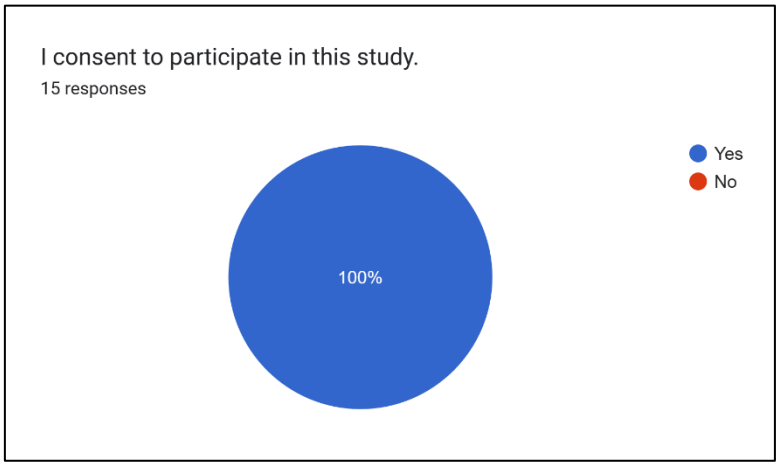


Figure 60: The Percentages of Participants in Study Participation

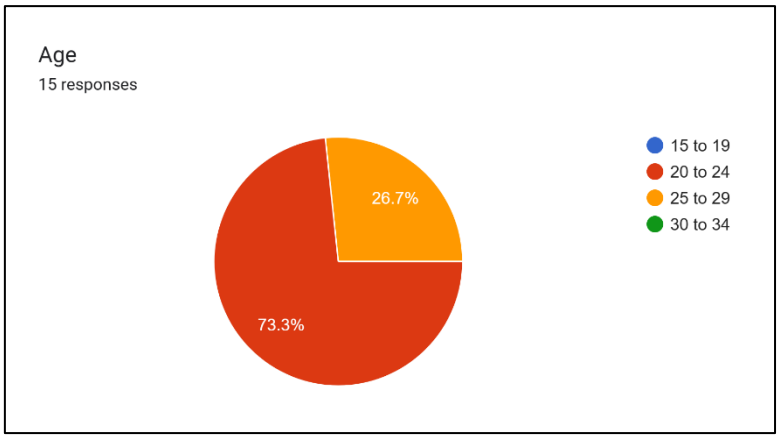


Figure 61: The Percentages of Participants in Age Group

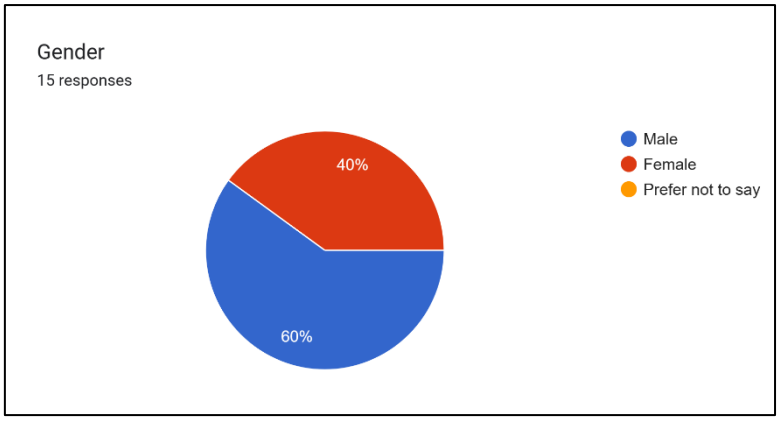


Figure 62: The Percentage of Participants in Gender

There are 15 participants in this study, and all participants consented to participate, as shown in Figure 61. As shown in Figure 61, 73.3% of the participants (11 participants) are categorized in the age group between 20 and 24 years old. In comparison, 26.7% of the participants (4 participants) are categorized in the age group between 25 and 29 years old. As shown in Figure 62, 60% of the participants (9 participants) are Male, while 40% (6 participants) are female.

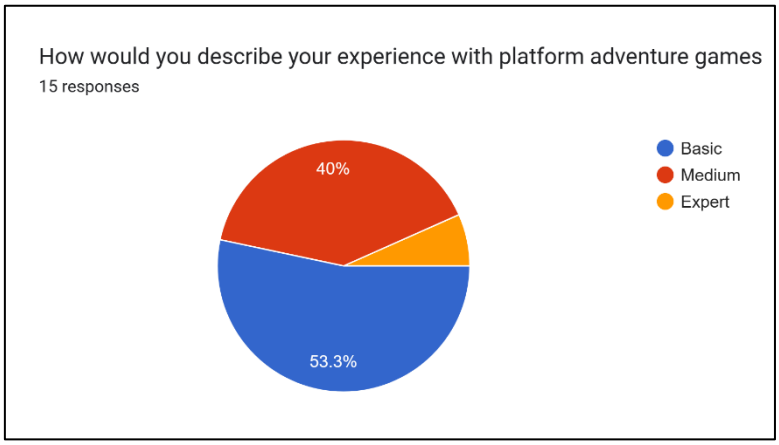


Figure 63: The Percentage of Participants in Platform Adventure Games Experience

As shown in Figure 63, 53.3% of participants (8 participants) have basic experience with platform adventure games, followed by 40% of participants (6 participants) have medium experience with platform adventure games, and 6.7% (1 participant) have expert experience with platform adventure games.

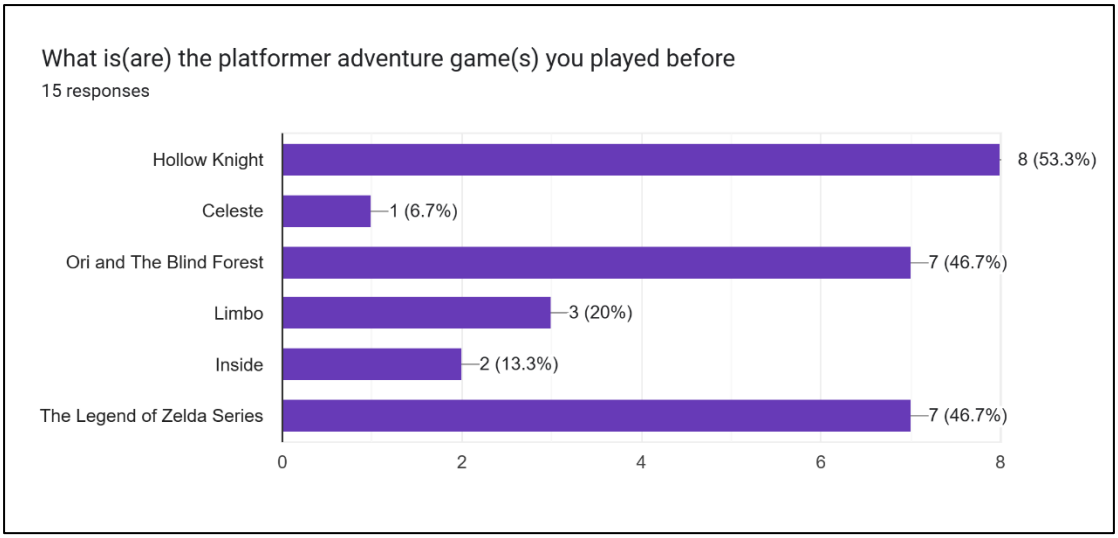


Figure 64: The Percentage of Participants That Which Platformer Adventure Games They Played Before

As shown in Figure 64, 53.3% of participants played Hollow Knight before. Followed by 46.7% of the participants played Ori and The Blind Forest and the Legend of Zelda Series. 20% of the participants played Limbo before. Besides, 13.3% of the participants played Inside before, while only 6.7% played Celeste.

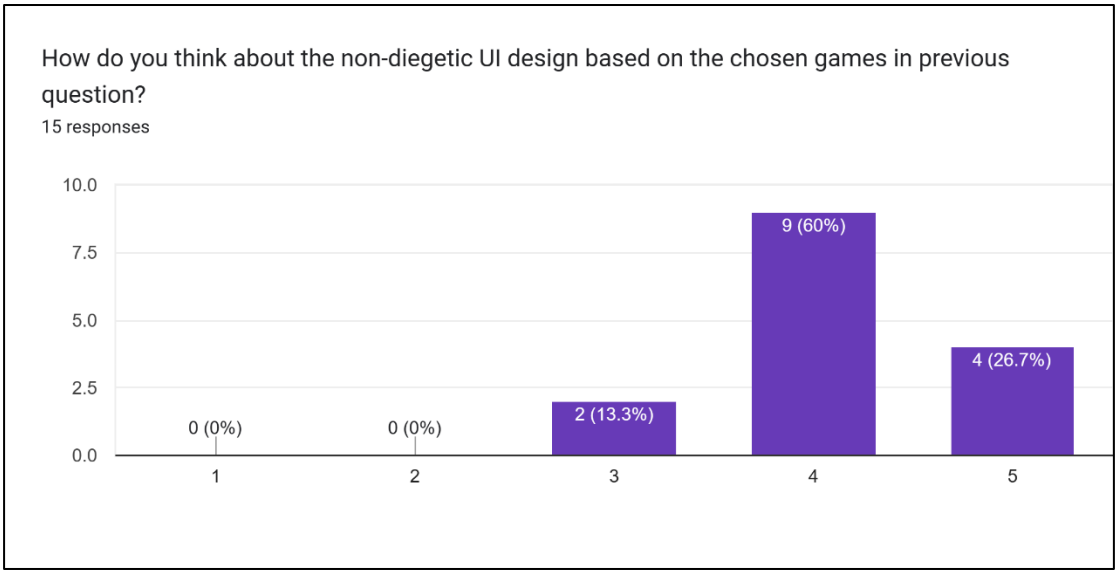


Figure 65: The Percentage of Participants in the Non-Diegetic UI Design of the Chosen Games

The survey question in Figure 65 is a Likert Scale question, starting from very bad (1) to excellent (5). As shown in Figure 65, most of the participants (60%) rated good on the non-diegetic UI design of the chosen platformer adventure games, followed by 26.7%

of the participants rated excellent, while 13.3% rated neutral. No participant was rated bad or very bad for the chosen platformer adventure games.

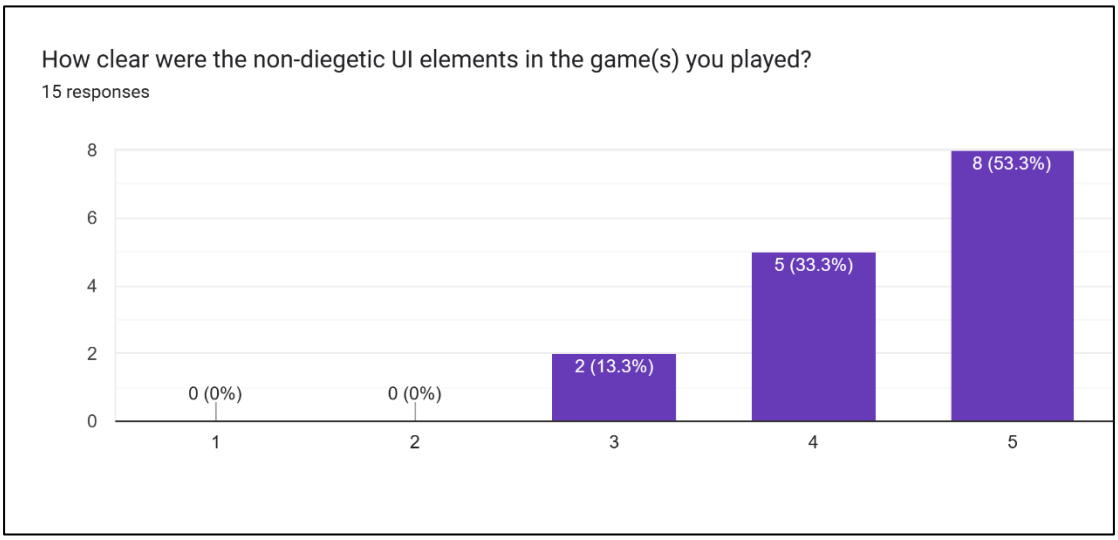


Figure 66: The Percentage of Participants in the Visibility of the Non-Diegetic UI Elements of the Chosen Games

The survey question in Figure 66 is a Likert Scale question, starting from very unclear (1) to very clear (5). As shown in Figure 66, most of the participants (53.3%) rated very clear on the visibility of non-diegetic UI elements of the chosen platformer adventure games, followed by 33.3% of the participants rated clear, while 13.3% rated neutral. No participant was rated unclear or very unclear for the chosen platformer adventure games.

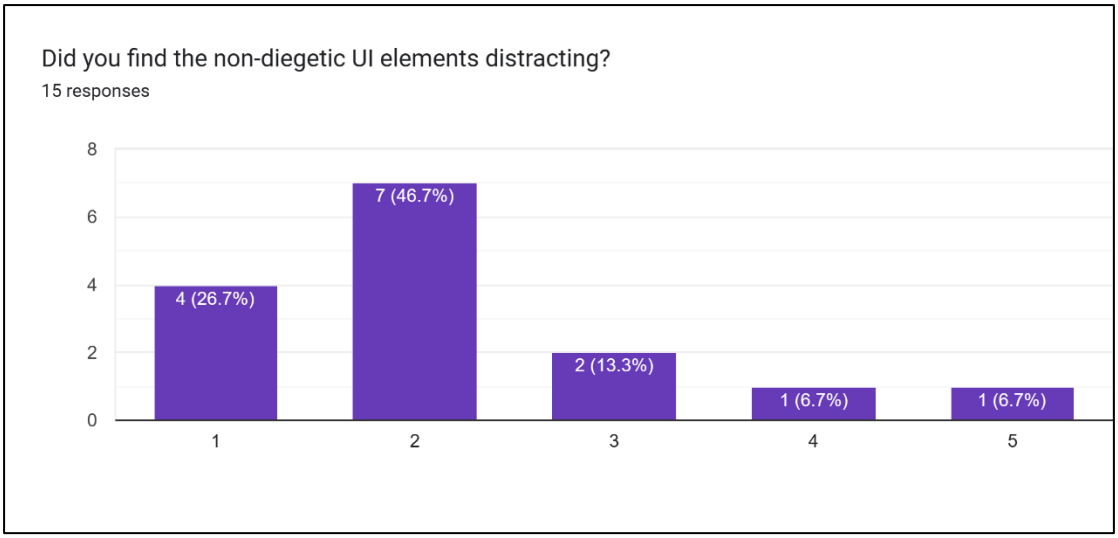


Figure 67: The Percentage of Participants in the Distracting Level of the Non-Diegetic UI

The survey question in Figure 67 is a Likert Scale question, starting from not at all (1) to extremely (5). As shown in Figure 67, most participants (46.7%) rated slightly on the distracting level of non-diegetic UI elements of the chosen platformer adventure games, followed by 26.7% of the participants rated not at all, while 13.3% rated neutral. 6.7% of participants were rated very and extremely each for the distracting level of chosen platformer adventure games.

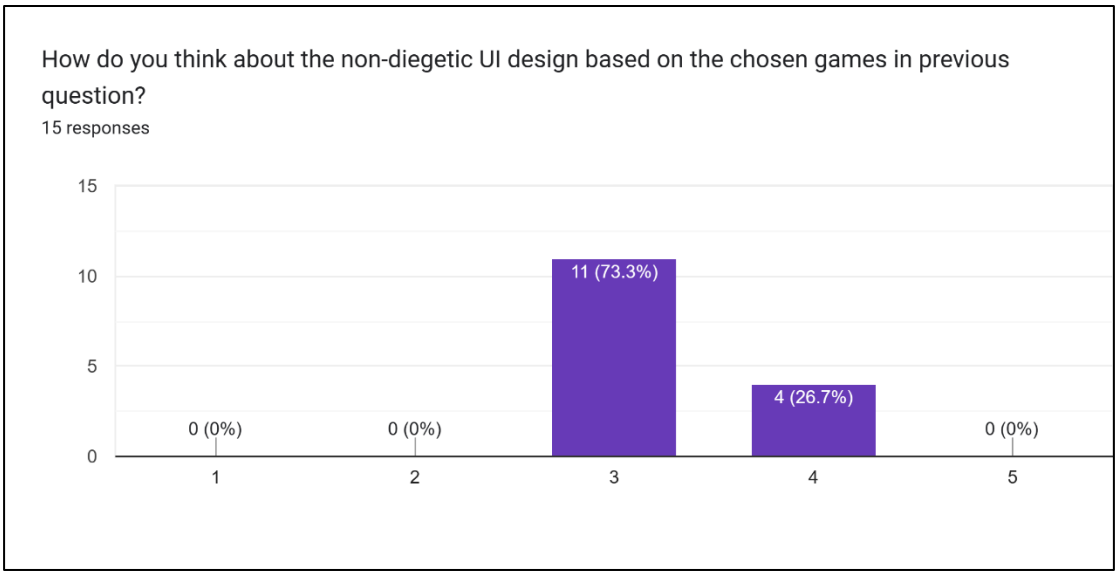


Figure 68: The Percentage of Participants in the Non-Diegetic UI Design of Chroma Journey

The survey question in Figure 68 is a Likert Scale question, starting from very bad (1) to excellent (5). As shown in Figure 68, most participants (73.3%) rated neutral on the non-diegetic UI design of Chroma Journey, followed by 26.7% of the participants rated good. No participant was rated very bad, bad, or excellent for the non-diegetic UI design of Chorma Journey.

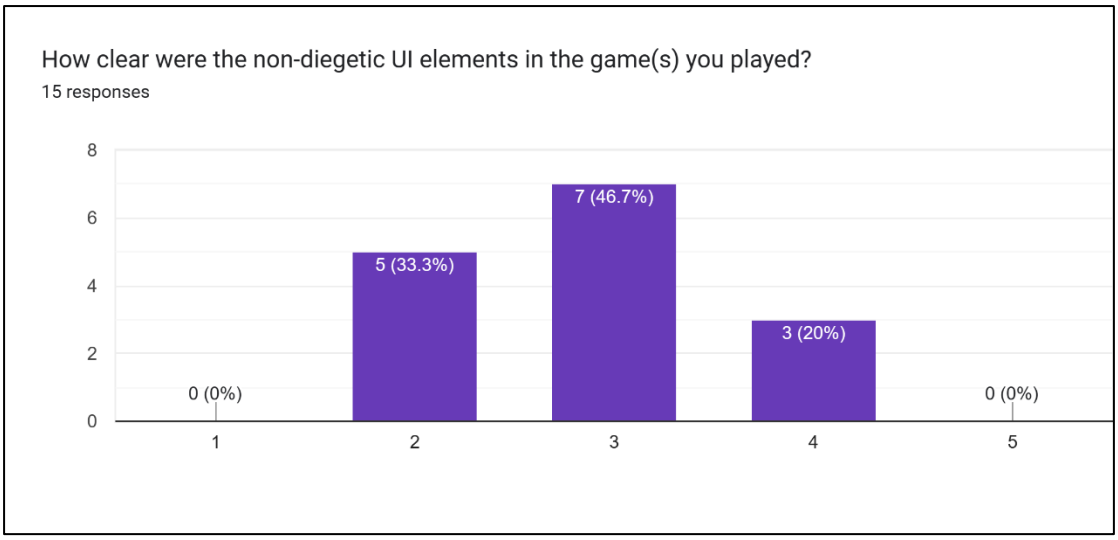


Figure 69: The Percentage of Participants in the Visibility of the Non-Diegetic UI Elements of Chroma Journey

The survey question in Figure 69 is a Likert Scale question, starting from very unclear (1) to very clear (5). As shown in Figure 69, most of the participants (46.7%) rated neutral on the visibility of non-diegetic UI elements of Chroma Journey, followed by 33.3% of the participants rated unclear, while 13.3% rated neutral. No participant was rated very unclear or very clear for Chroma Journey.

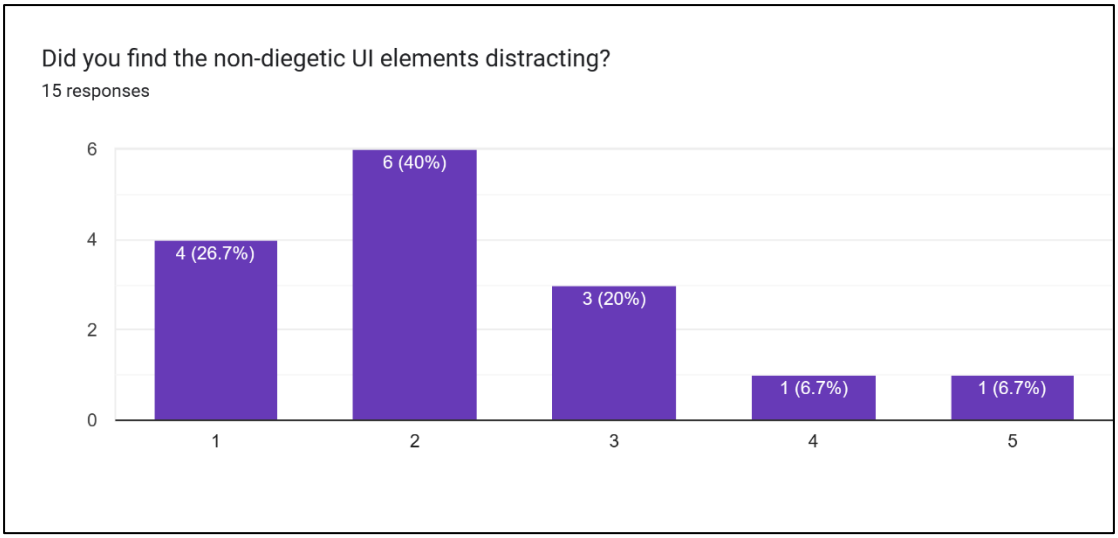


Figure 70: The Percentage of Participants in the Distracting Level of the Non-Diegetic UI

The survey question in Figure 70 is a Likert Scale question, starting from not at all (1) to extremely (5). As shown in Figure 70, most participants (40%) rated slightly on the distracting level of non-diegetic UI elements of Chroma Journey, followed by 26.7% of the participants rated not at all, while 20% rated neutral. 6.7% of participants were rated very and extremely each for the distracting level of Chroma Journey.

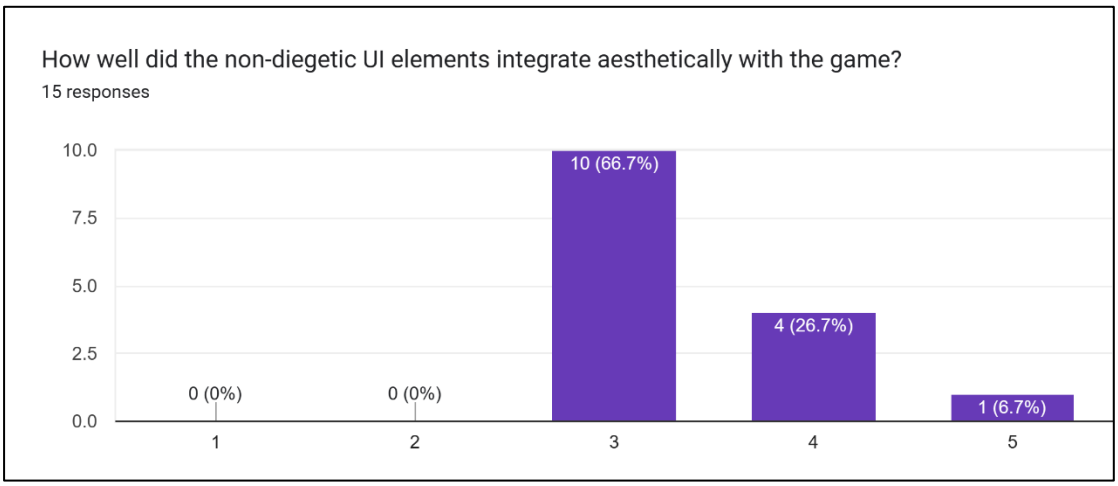


Figure 71: The Percentage of Participants on How Well Did the Non-Diegetic UI Elements Integrate Aesthetically with Chroma Journey

The survey question in Figure 71 is a Likert Scale question, starting from very poorly (1) to extremely (5). As shown in Figure 71, most participants (66.7%) rated neutral,

followed by 26.7% of the participants rated well, while 6.7% rated very well. No participant was rated very poorly or poorly for Chroma Journey.

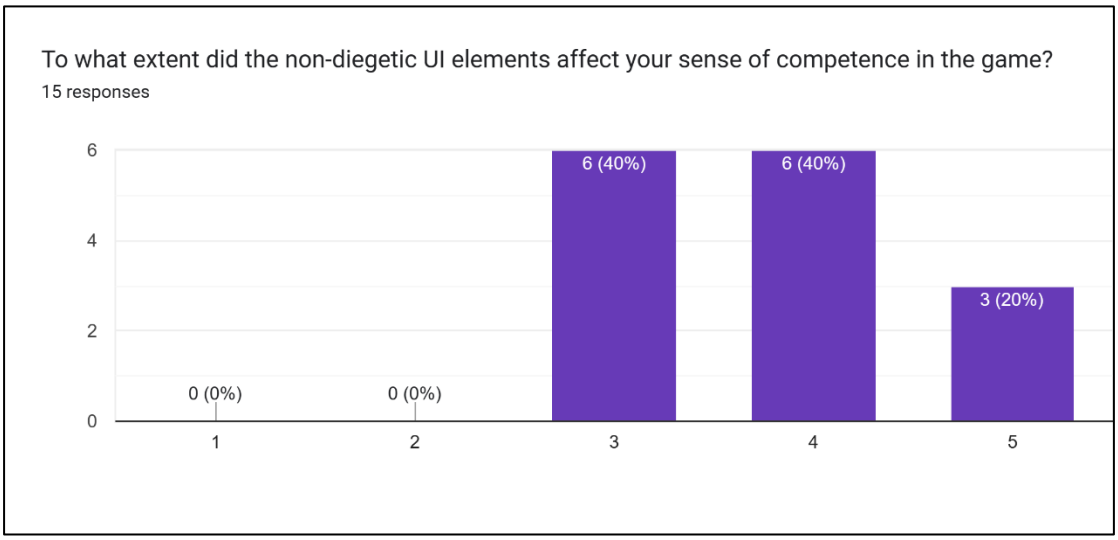


Figure 72: The Percentage of Participants on the Effect of Non-Diegetic UI Elements on Sense of Competence in Chroma Journey

The survey question in Figure 72 is a Likert Scale question, starting from greatly decreased (1) to greatly increased (5). As shown in Figure 72, most participants (40%) rated no impact and somewhat increased respectively, followed by 20% of the participants rated greatly increased. No participant was rated greatly decreased or somewhat decreased for Chroma Journey.

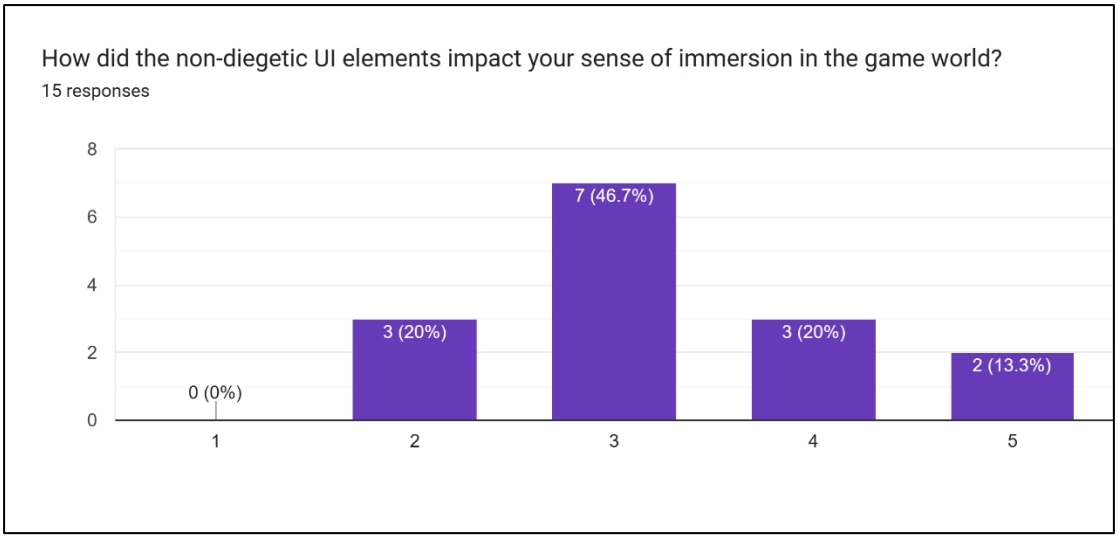


Figure 73: The Percentage of Participants on the Impact of Non-Diegetic UI Elements on the Sense of Immersion in the Game World

The survey question in Figure 73 is a Likert Scale question, starting from greatly decreased (1) to greatly increased (5). As shown in Figure 73, most participants (46.7%) rated no impact, followed by 20% rated somewhat decreased and somewhat increased, while 13.3% rated greatly increased. No participant was rated greatly decreased for Chroma Journey.

Two questions required the participants to give short answers as open-ended feedback on non-diegetic UI. The first question is, "What did you like most about the non-diegetic UI elements in the platform adventure game(s) you played?". The participants commented that the non-diegetic UI elements in the platform adventure games they played gave enough information to the player, were minimalist, and did not distract the player during the gameplay. At the same time, the design of the non-diegetic UI elements suits the games perfectly. The second question asks, "What improvements would you suggest for the non-diegetic UI elements in Chroma Journey?" The participants are given helpful feedback, as shown in Table 37.

No.	Feedback from Participants
1	Make the UI elements smaller.

2	Make it invisible when unused.
3	Only include the UI elements that benefit the player.
4	Keep the UI elements simple and minimalistic.
5	Make the UI elements design more suited to the game.

Table 37: Feedback on Non-Diegetic UI Elements in Chroma Journey

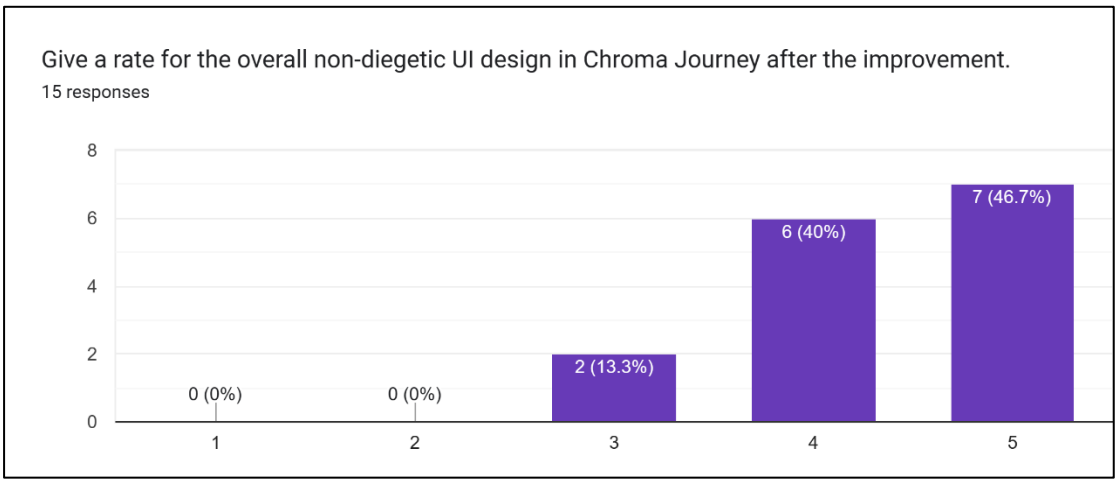


Figure 74: The Percentage of Participants on the Rating for the Overall Non-Diegetic UI Design in Chroma Journey after the Improvement

The survey question in Figure 74 is a Likert Scale question, starting from very bad (1) to excellent (5). As shown in Figure 74, most participants (46.7%) rated excellent, followed by 40% rated good, while 13.3% rated neutral. No participant was rated very bad or bad on the rating for the overall non-diegetic UI design in Chroma Journey after the improvement.

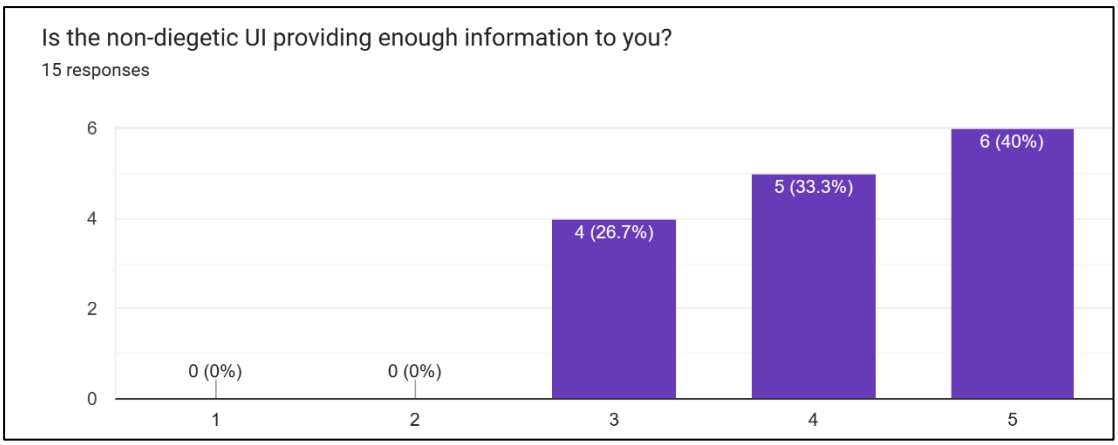


Figure 75: The Percentage of Participants on the Rating of Whether the Non-Diegetic UI Providing Enough Information in Chroma Journey after the Improvement

The survey question in Figure 75 is a Likert Scale question, starting from very bad (1) to excellent (5). As shown in Figure 75, most participants (40%) rated excellent, followed by 33,3% rated good, and 26.7% rated neutral. No participant was rated very bad or bad on whether the non-diegetic UI provided enough information in Chroma Journey after the improvement.

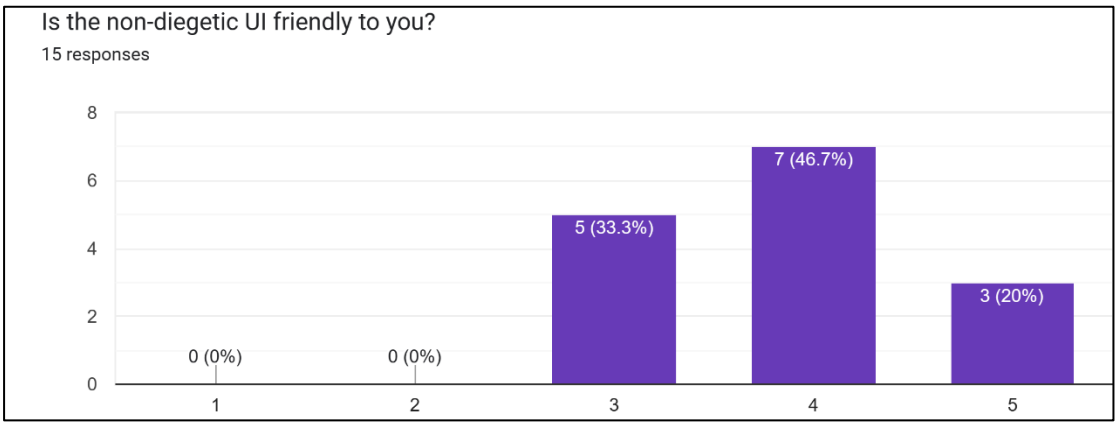


Figure 76: The Percentage of Participants on the Rating of the Friendliness of Non-Diegetic UI in Chroma Journey after the Improvement

The survey question in Figure 76 is a Likert Scale question, starting from very bad (1) to excellent (5). As shown in Figure 76, most participants (46.7%) rated good, followed by 33,3% rated neutral, and 20% rated excellent. After the improvement, no participant was rated very bad or bad on the friendliness of the non-diegetic UI in Chroma Journey.

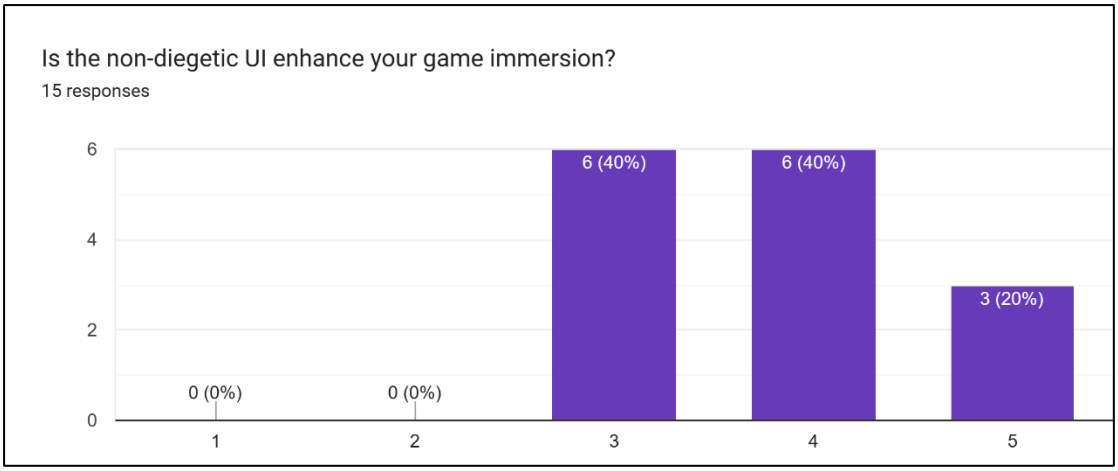


Figure 77: The Percentage of Participants on the Impact of Non-Diegetic UI on Game Immersion

The survey question in Figure 77 is a Likert Scale question, starting from very bad (1) to excellent (5). As shown in Figure 77, neutral and good ratings have the highest percentage of participants (40%) among other ratings, followed by 20% rated excellent. After the improvement, no participant was rated very bad or bad on the impact of non-diegetic UI on game immersion.

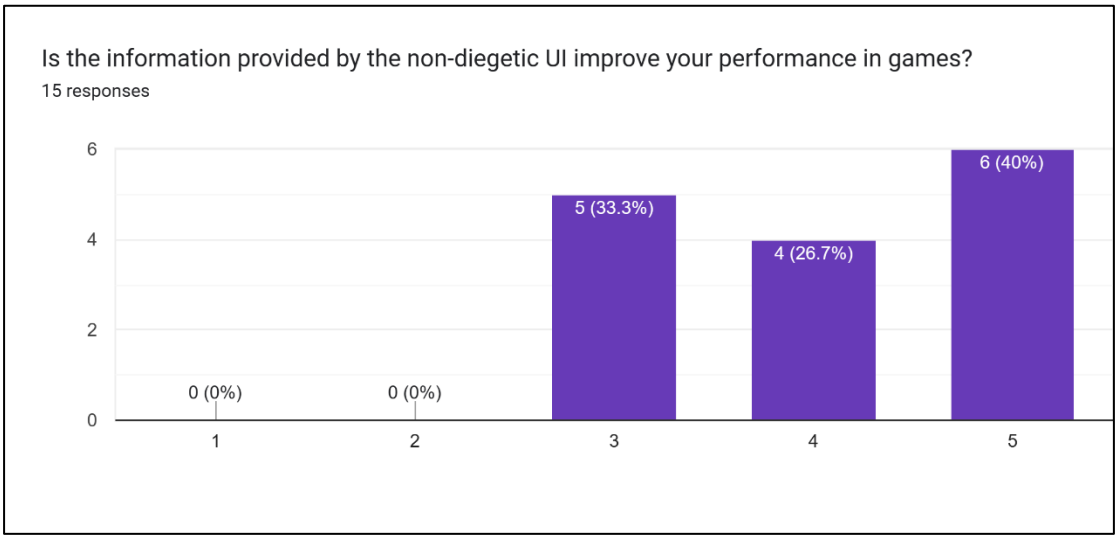


Figure 78: The Percentage of Participants On Whether the Non-Diegetic UI Provides Enough Information to Improve Player Performance in Chroma Journey

The survey question in Figure 78 is a Likert Scale question, starting from very bad (1) to excellent (5). As shown in Figure 78, most participants (40%) rated excellent,

followed by 33,3% rated neutral, and 26.7% rated good. After the improvement, no participant was rated very bad or bad on whether the non-diegetic UI provides enough information to improve player performance in Chroma Journey.

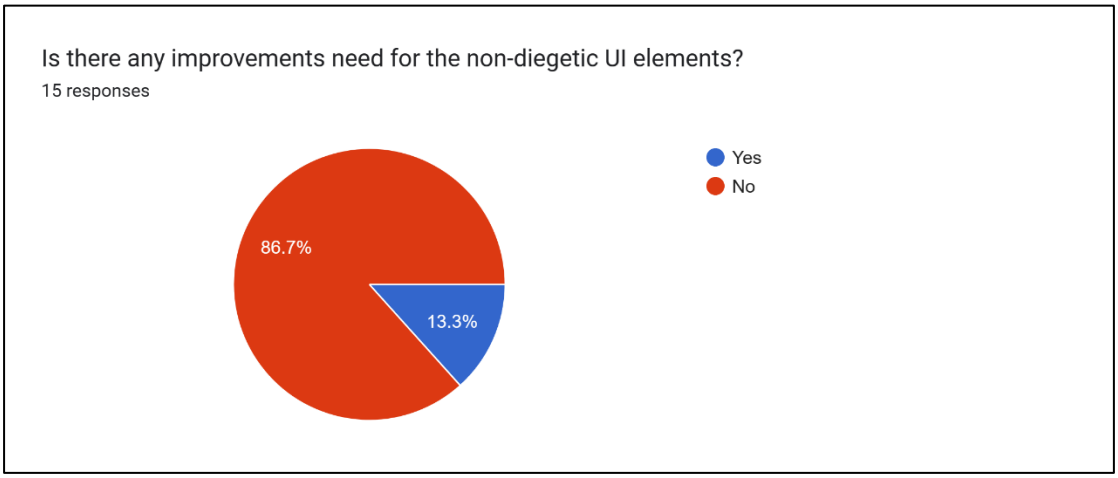


Figure 79: The Percentage of Participants On The Improvements Need for the Non-Diegetic UI Elements in Chroma Journey

As shown in Figure 79, 86.7% of the participants said that no improvement is needed for the non-diegetic UI elements in Chroma Journey, while 13.3% said some improvements are still required when changing the stamina bar fill color.

6.3 Discussion

A good non-diegetic UI design should follow the requirements shown in Table 38.

No.	Requirements to Make a Good Non-Diegetic UI Design
1	Keep the UI design straightforward.
2	The UI design should suit perfectly to the game.
3	Remove every unnecessary UI element in the game to avoid distracting the player.
4	Make the UI elements invisible when unused at the current period.
5	The placement of the UI elements must be correct to ensure the game's playability.

Table 38: The Requirements to Make a Good Non-Diegetic UI Design

6.4 Summary

The results of the surveys are analysed and discussed in Chapter 6. The overall feedback from the participants is gathered and arranged as requirements to make an excellent non-diegetic UI design.

Chapter 7: Future Work and Conclusion

7.1 Conclusion

The author faced numerous difficulties and challenges during the development process of the game Chroma Journey. The first was the busy schedule. Throughout the game production process, each team member of PolyMasters is responsible for more than one subject. Each member has a problem with the time arrangement, as they have too many assignments in the current semester. Besides, the project has only been given 21 weeks to build a complete game demo and a thesis simultaneously. Third, each member's skill is insufficient to develop a game that meets expectations.

7.2 Future Works

There are still a lot of improvements needed for the developed game. First, there are still some minor bugs in the game. PolyMasters should fix the bugs to ensure the game is smooth. Second, more guides must be added to the game to guide the players and show them what they can do. Lastly, more visual cues and sound cues should be added to the game to improve its playability.

Chapter 8: Reference

Adventure game. (2023, January 31). https://www.computerhope.com/jargon/a/adventure-game.htm

Bowers, M. (2019, September 17). *Level Up: A Guide to Game UI (with Infographic)*. Toptal Design Blog. https://www.toptal.com/designers/gui/game-ui

Minkkinen, T. (2016). Basics of Platform Games. https://www.theseus.fi/bitstream/handle/10024/119612/Thesis%20-%20Toni%20Minkkinen.pdf?sequence=

F, J. (2022, March 30). What are your UI choices - Juliann F - Medium. *Medium*. https://medium.com/@gfruity/what-are-your-ui-choices-834ea7d937c

Ming, D. T. H. (2022, January 6). UI and UX Design in Video Games - David Tan Hao Ming - Medium. *Medium*. https://davidtanhaoming.medium.com/ui-and-ux-design-plays-an-important-role-in-video-games-e03f557b380

Mora-Cantallops, M. (2018). Transhistorical Perspective of the Puzzle Video Game Genre. https://doi.org/10.1145/3235765.3235768

Cavalcante Raffaele, R., José Andrade Carvalho, B., & G. M. Silva, F. (2017). Evaluation of Immersive User Interfaces in Virtual Reality First Person Games, 123–126. http://hdl.handle.net/10400.6/7474

Denisova, A., Nordin, A. I., & Cairns, P. (2016). The Convergence of Player Experience Questionnaires, 33–37. https://doi.org/10.1145/2967934.2968095

Adventure game. (2024, May 6). https://www.computerhope.com/jargon/a/adventure-game.htm

Bronstring, M. (2018, October 30). What are adventure games? *Adventure Gamers*. https://adventuregamers.com/articles/view/17547

Gameranx. (2016, February 3). *What is an Action/Adventure Game?* https://gameranx.com/features/id/3350/article/what-is-an-action-adventure-game/

Hollow Knight. (n.d.). Hollow Knight. https://www.hollowknight.com/

Vertical Slice Games. (n.d.). *VSG*. VSG. https://verticalslicegames.com/genre/adventure/

Appendix A: Project Paper Consutlation Logbook

Appendix A

Project Paper Consultation Logbook	
Project Title	Chroma Journey
Student Name	LEONG WAN YI
Student ID	2101503
Year/Semester	Year 3 Semester 3
Supervisor	Ms. Chow Mee Mooi

WEEK 01	
Comments: **2 / 11 / 2023** Briefing Session I attended the briefing session of Final Year Project 1 (FYP 1) about the things we need to take caution when doing our FYP. Miss Chow did tell us that it is not necessary to have one research topic for each game idea if the research topic is related to both game ideas. The supervisors also mentioned that ChatGPT is just a tool to guide us when we have some problems during game development, we should not fully depend on the AI tool. Forming Group Formed a group with Jane (GV), Keen Mun (GS), and Zi Ming (GS) named PolyMasters.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 (5) Poor Satisfactory Good	**Date:** 22/12/2023

WEEK 02	
Comments: **7 / 11 / 2023** Group Discussion Keen Mun, Zi Ming, Jane, and I had a group discussion on campus about the game ideas. After the discussion, we decided to propose an adventure game and a horror game. **8 / 11 / 2023** Consultation Our group was having a consultation with Miss Nik and Mr. Simon and proposed our rough game ideas. Mr. Simon said the horror game idea has high potential as it is a Chinese cultural theme-based horror game, and it has strong unique points. He also said that the first game idea is not unique as there are a lot of games in the market that are quite like the first game idea. Comments • Suggest having different endings for the horror game idea. • Add mood board and concept board into the game proposal slides. • Do more research on different death bodies, the meaning of death in Chinese culture, and the things that the Chinese will do when someone died • Doing low-poly horror games will affect the game immersion and the player experience. Thus, high poly is the best choice in horror games. • The game title can include both Chinese and English words, but the Chinese words can be much bigger than the English words. We can research how the designers design horror movie posters.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 (5) Poor Satisfactory Good	**Date:** 22/12/2023

WEEK 03	
Comments: **15 / 11 / 2023** Proposal Presentation Our group proposed our two game ideas to the supervisors during the proposal presentation. Comments from supervisors during the presentation • If our game is a 3D game, the concept art should also be in 3D. • To make sure the horror game has higher playability, it should have different ghosts with different visions. Each type of ghost can have different exorcisms and lead to different endings. • For the Chroma Journey game idea, the supervisors expect us to have different kinds of animals in the game and the player can collect animal pieces in the puzzle game to form the animal and help them to collect the color seeds. • The game size should not be too big. **16 / 11 / 2023** Consultation after a talk We chose the first game idea, Chroma Journey for the project development. Ms. Chow and Dr Lim have given some advice to Jane and me: • We can do something related to the 12 zodiacs, which means that we can make the animals as the 12 zodiacs. • It is not necessary to have one level for each zodiac as it will be a heavy project. Thus, we can split to 3 or 4 in a level. • Based on the clues provided, and the zodiac's characteristics find the zodiacs out and complete the level. • Then when the player completes all the levels, the zodiac circle forms and lights up. **17 / 11 / 2023** Thesis Briefing We have a thesis briefing session on Friday with Ms Chow to brief us: • What should be included in each chapter of the thesis • How to choose a proper thesis topic Consultation I showed my research topic (Comparative Analysis of UI Types in Adventure Games) to Ms. Chow, and she said my topic was too wide and I might not have enough time to finish it. Thus, she advised me	**Supervisor signature:** 

to narrow down my topic to one or two types instead of all UI types. I can explain all four UI types in the literature review but not means that I need to examine all four UI types in my research.	
Progress (please circle the feedback) 1 2 3 4 [5] Poor Satisfactory Good	**Date:** 22/12/2023

WEEK 04	
Comments: **21/ 11 / 2023** <u>Thesis Consultation</u> I proposed the modified research topic to our supervisor, Ms. Chow, which is "The Impact of Non-Diegetic UI Design on Player Experience in Adventure Games". Ms. Chow said that hypotheses are not needed for the research. Thus, I send her my research questions and research objectives to her through WhatsApp. She said I could start writing Chapter 1 of the FYP report which is the expansion of the research proposal, and Chapter 2 will focus on my research area. **22 / 11 / 2023** <u>Project Consultation</u> Our group has created a Game Design document to show our game concept. However, there are no visuals in the GDD that can explain the game concept better. Thus, our supervisors said that we should have a game flow, concept arts, and level design sketches to show the game concept in a better way so that everyone able to understand clearly how the game works.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 [5] Poor Satisfactory Good	**Date:** 22/12/2023

WEEK 05	
Comments: **29/ 11 / 2023** Project Consultation Our group had shown a block-out level to the supervisors during project consultation. The supervisor requested to have at least dummy assets in the level design. Our group should also have part of the level with built-in mechanics by next week. **01 / 12 / 2023** Thesis Consultation Comments from thesis supervisor: • The report should not use first-person pronouns (I, We, etc.) and replace them with 'the author'. • Add more descriptions of the subtopic before the table contents. • Instead of saying 'as shown below', do mention the table or the figure. • Add figures for the elements that need greater explanation.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 (5) Poor Satisfactory Good	**Date:** 22/12/2024

WEEK 06	
Comments: **06/ 12 / 2023** Project Consultation Our group did not show much progress on our project, as the supervisors asked us to speed up our working speed to show at least a tutorial and one level of the game. **08 / 12 / 2023** Thesis Consultation Comments from thesis supervisor: • Add more introductions before entering the main content of each part of the report. • The wording in the report has to be formal. • For the project scope, we have to brief a bit on the project before	**Supervisor signature:**

we talk about the respective roles. • Bold the description words (Table x.xx or Figure x.xx) to see them clearer. • Do not write "Table 1.2 and 1.3", has to be "Table 1.2 and Table 1.3".	
Progress (please circle the feedback) 1 2 3 4 [5] Poor Satisfactory Good	**Date:** 22/12/2023

WEEK 07	
Comments: **13/ 12 / 2023** <u>Project Consultation</u> Comments from supervisors: • Add footstep sounds to increase the player experience. • Take caution on the darkness of our game as the projector might not be able to support the ambient of our game. • The pig should be facing the wall instead of facing the camera. • Add more obstacles and puzzles in level 1.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 [4] 5 Poor Satisfactory Good	**Date:** 22/12/2023

WEEK 08	
Comments: **18/ 12 / 2023** <u>Game Alpha Presentation</u> Our group presented our game alpha during the presentation in the morning. We had shown our presentation slides and game alpha demo which included the main menu, tutorial level, and level of the game. Comments from supervisors: • Improve the level design as there are not many game mechanics in the game and it will decrease the playability of the game.	**Supervisor signature:**

• The main character of the game needs to be improved as the character seems like a bad character in the game.	
Progress (please circle the feedback) 1 2 3 4 [5] Poor Satisfactory Good	**Date:** 22/12/2023

WEEK 09	
Comments: **01/ 02 / 2023** <u>Project Consultation</u> Comments from supervisors: • Our progress is too slow, and we should meet up to have a discussion to finalise our game-level design. •	**Supervisor signature:**
Progress (please circle the feedback) 1 2 [3] 4 5 Poor Satisfactory Good	**Date:** 8/5/2024

WEEK 10	
Comments: **08/ 02 / 2023** <u>Project Consultation</u> We have optimised our game design in the game design document. At the same time, all the game mechanics are clarified in detail in the document. Comments from supervisors: • The supervisors want us to show in our game and not just in the game design document. • All the levels must remain in the game but can be scaled down.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 [4] 5 Poor Satisfactory Good	**Date:** 8/5/2024

WEEK 11

Comments: **15/ 02 / 2023** Project Consultation Comments from supervisors: • Put more visuals instead of showing the game design document. • Want to see the game flow.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 [3] 4 5 Poor Satisfactory Good	**Date:** 8/5/2024

WEEK 12	
Comments: **22/ 02 / 2023** Project Consultation Comments from supervisors: • Suggest adding a cutscene after the player presses the new game button in the main menu. This is to let the player understand the game. • The game title needs to be enhanced and beautified because it is a bit flat. • Good progress but still need to add more details into the game. • For lake level, the lake should not be flat all the time and should have some waves to make it more realistic. • Add flickering to the crystal props. • The platforms at the lake level should have a floating behaviour. • The props in the game environment should have a meaning on why putting the props in the level.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 [5] Poor Satisfactory Good	**Date:** 8/5/2024

WEEK 13	
Comments: **29/ 02 / 2023** Project Consultation Comments from supervisors:	**Supervisor signature:**

WEEK 20	
Comments: **18/ 04 / 2023** Project Consultation • Add more details to the game. • Combine the work before showing the game. • The numbering of the levels needs to be corrected. • Suggest adding restoration of each level. (environment changes)	**Supervisor signature:** 
Progress (please circle the feedback) 1 2 [3] 4 5 Poor Satisfactory Good	**Date:** 8/5/2024

WEEK 21	
Comments: **25/ 04 / 2023** Project Consultation • Add cheat codes to show the game faster during the game beta presentation. • Sound effects are not suitable for the game. • Poster still can be improved. • Need improvement on our game to make sure it can be played properly and can be presented to the public. • A design is a form of communication, a form of expression. So, make sure it has forms and objectives.	**Supervisor signature:** 
Progress (please circle the feedback) 1 2 3 [4] 5 Poor Satisfactory Good	**Date:** 8/5/2024

WEEK 22	
Comments: **02/ 05 / 2023** Project Consultation • Add environment restorations in the ending cutscene. • Sound effects need to be enhanced.	**Supervisor signature:** 

• The boxes in level 3 should have different sizes based on their mass to look more logical.	
Progress (please circle the feedback) 1 2 [3] 4 5 Poor Satisfactory Good	**Date:** 8/5/2024

WEEK 23	
Comments: **06/ 05 / 2023** <u>Game Beta Presentation</u> Feedback from the guests: • There are some bugs in the game. • Not enough guides to let the player know what to do. • At the lake level, can add a dead zone at the borders to let the player fall and die. • Add more visual cues and sound cues. • The stamina bar in the last level should also be grayscale as the whole level is in grayscale.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 [4] 5 Poor Satisfactory Good	**Date:** 8/5/2024

• Improve and show the supervisors more things in the game.	
Progress (please circle the feedback) 1 2 [3] 4 5 Poor Satisfactory Good	**Date:** 8/5/2024

WEEK 14	
Comments: **07/ 03 / 2023** No consultation for this week.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 [3] 4 5 Poor Satisfactory Good	**Date:** 8/5/2024

WEEK 15	
Comments: **14/ 03 / 2023** <u>Project Consultation</u> Comments from supervisors: • No defence mechanisms for the player. • The fog in the cave level should be moving.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 [3] 4 5 Poor Satisfactory Good	**Date:** 8/5/2024

WEEK 16	
Comments: **21/ 03 / 2023** <u>Project Consultation</u> Comments from supervisors: • Add some glowing to the character to make it obvious because the character is quite dull in the environment.	**Supervisor signature:**

Progress (please circle the feedback) 1 2 [3] 4 5 Poor Satisfactory Good	**Date:** 8/5/2024

WEEK 17	
Comments: **28/ 02 / 2023** No consultation for this week.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 [3] 4 5 Poor Satisfactory Good	**Date:** 8/5/2024

WEEK 18	
Comments: **04/ 04 / 2023** <u>Project Consultation</u> • Add fade in and fade out effect when transit to the next scene to let it seems smoother. • Continue to work on the game.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 [3] 4 5 Poor Satisfactory Good	**Date:** 8/5/2024

WEEK 19	
Comments: **11/ 04 / 2023** No consultation for this week.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 [3] 4 5 Poor Satisfactory Good	**Date:** 8/5/2024

Appendix B: First Game Idea Proposal Presentation Slides (Chroma Journey)

TEAM MEMBERS

HO KEEN MUN	2100171	GS
WONG ZI MING	2003878	GS
LEONG WAN YI	2101503	GV
LEONG XUE QIAN	2001345	GV


CHROMA JOURNEY
GAME TITLE


GAME GENRE
3D TOP DOWN, HORROR, ADVENTURE
ART STYLE
3D LOW-POLY, FLAT COLOR, MONOCHROMATIC
CHROMA JOURNEY | POLYMASTERS

GAME INTRODUCTION

A little spirit called **Chroma** who is the only spirit in the **black forest** takes on his journey to find the **seed of color** to recover the **colorful world**.

Along the adventure, Chroma is required to communicate or seek help with the **animals** to solve the **puzzle** that is blocking his way to the **destination**.

CHROMA JOURNEY | POLYMASTERS

GAME MECHANIC

CHROMA JOURNEY | POLYMASTERS

COLOR GUIDANCE

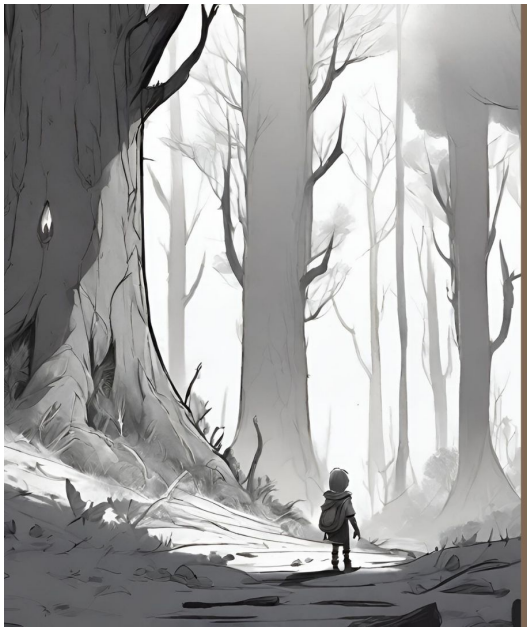
Color is the main direction clue for players in the game.

UNKNOWN CREATURES

Avoid being caught by the **monster** in the forest.

STAY IN THE LIGHT

Stay in the **light** to **maintain and recover stamina** to reduce the appearance of the monster.



GAME STORY

One day, the ancient colour tree began to wither, and the entire **forest began to lose its colour**.

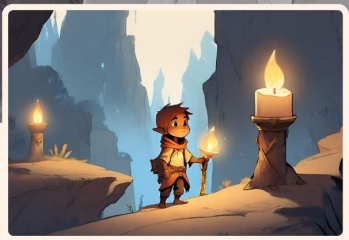
Chroma was sent on a journey by the ancestors to **search for colour seeds** in order to save the woodland, which was losing its colour. Throughout the adventure, Chromia slowly **discovers the secret or truth** behind the fading, leading him to...

CHROMA JOURNEY | POLYMASTERS

UNIQUE SELLING POINTS

ANIMAL RELATED PUZZLE

The help from animal puzzle stands out as a unique gameplay from a normal puzzle game.

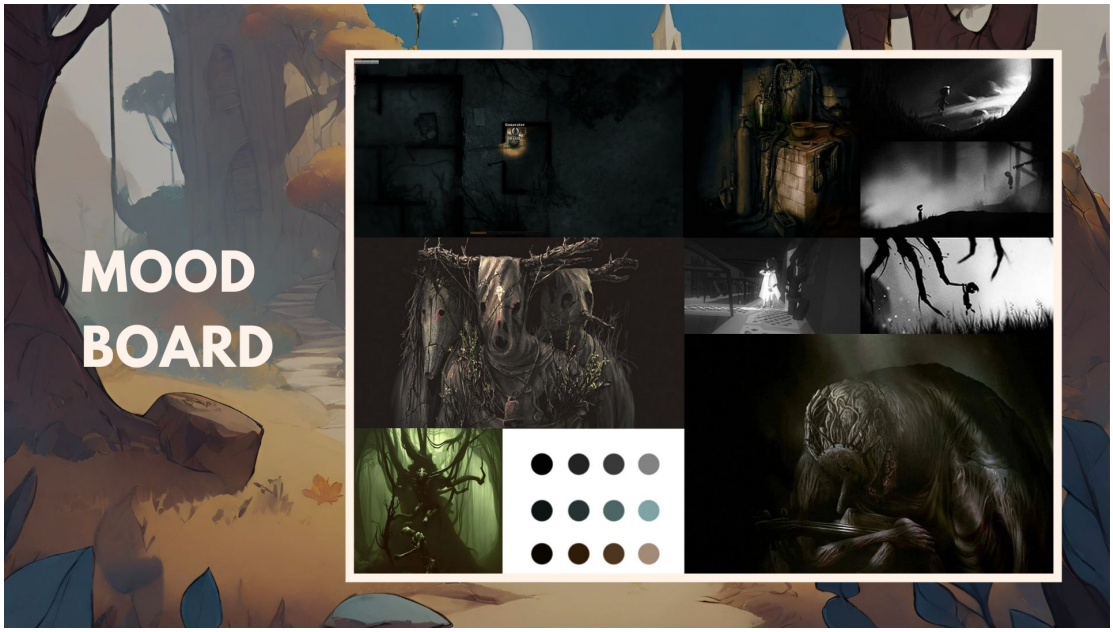


LIGHT SOURCES MECHANIC

Light sources in the environment keep players safe and create a creative thinking playtime of **how players plan to use their light sources.**

CHROMA JOURNEY | POLYMASTERS

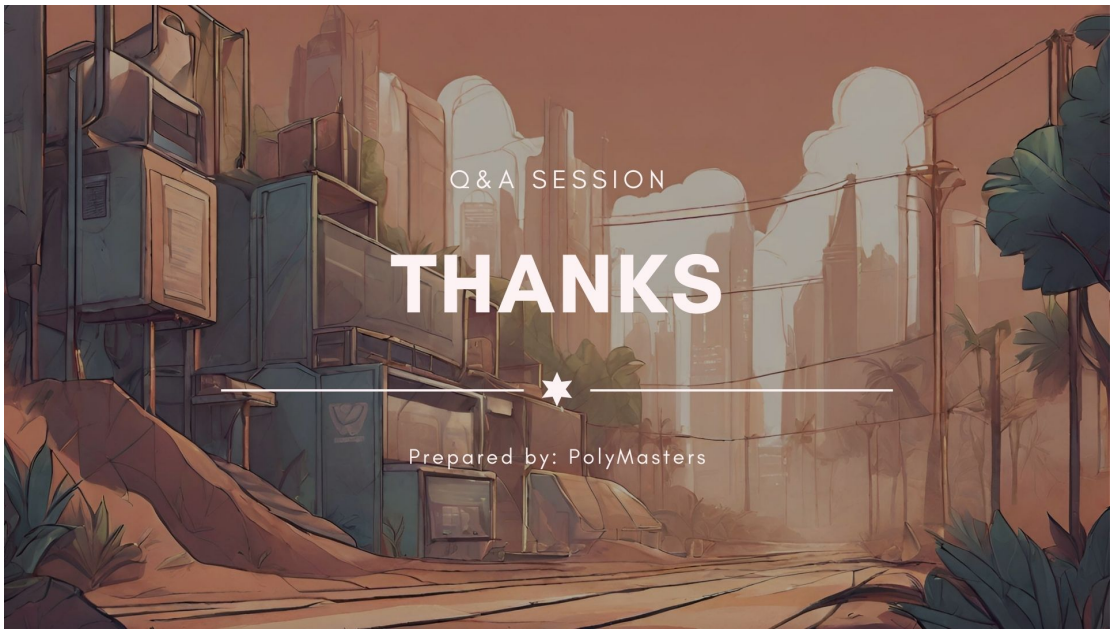

TARGET MARKET
12 - 30 YEARS
PUZZLE GAMER
TARGET PLATFORM
PC PLATFORM


MOOD BOARD

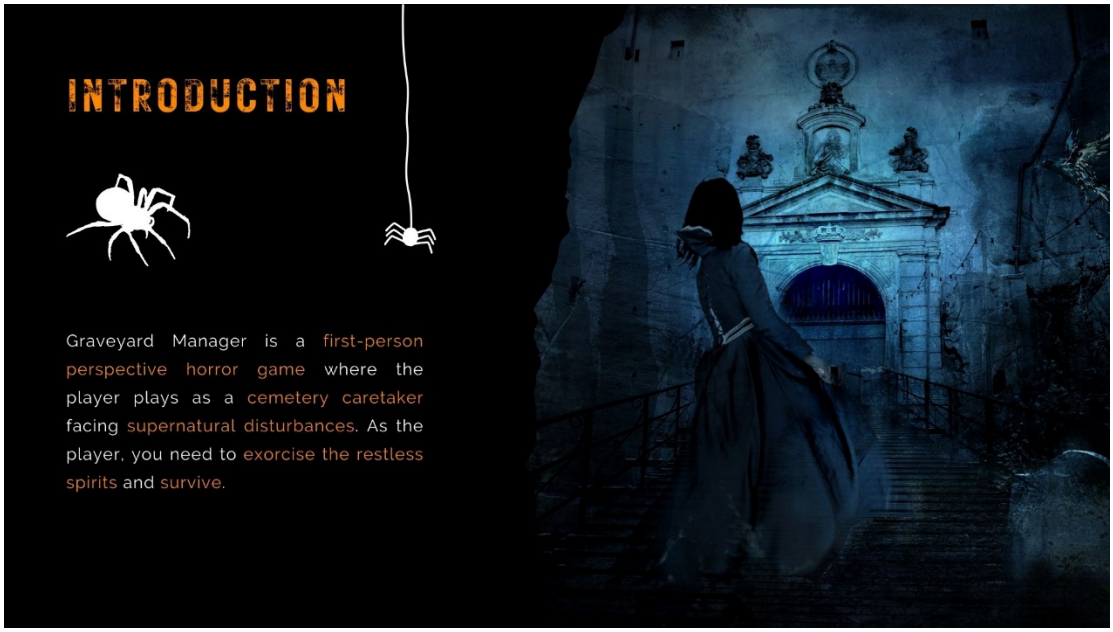

CHARACTER SKETCH


REFERENCE
DARKWOOD
ONE
UPON
LIGHT

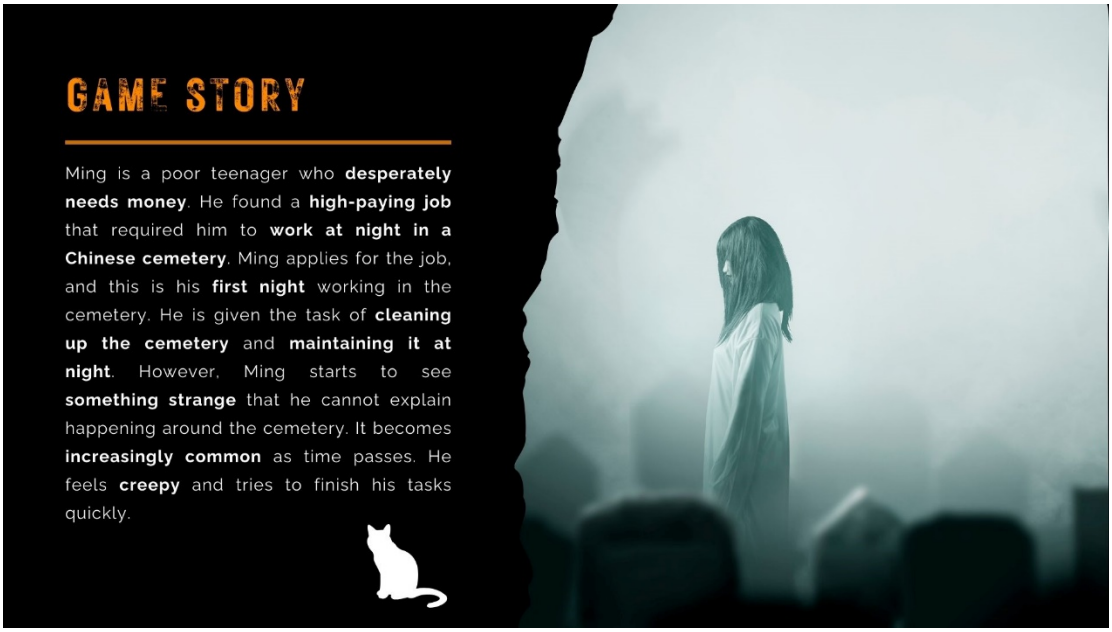
Appendix C: Second Game Idea Proposal Presentation Slides (Graveyard Manager)




GRAVEYARD
MANAGER


INTRODUCTION
Graveyard Manager is a first-person perspective horror game where the player plays as a cemetery caretaker facing supernatural disturbances. As the player, you need to exorcise the restless spirits and survive.


GAME GENRE
Horror
ART STYLE
High Poly 3D
Dark


GAME STORY
Ming is a poor teenager who **desperately needs money**. He found a **high-paying job** that required him to **work at night in a Chinese cemetery**. Ming applies for the job, and this is his **first night** working in the cemetery. He is given the task of **cleaning up the cemetery** and **maintaining it at night**. However, Ming starts to see **something strange** that he cannot explain happening around the cemetery. It becomes **increasingly common** as time passes. He feels **creepy** and tries to finish his tasks quickly.

GAME CONCEPT

Game Goal

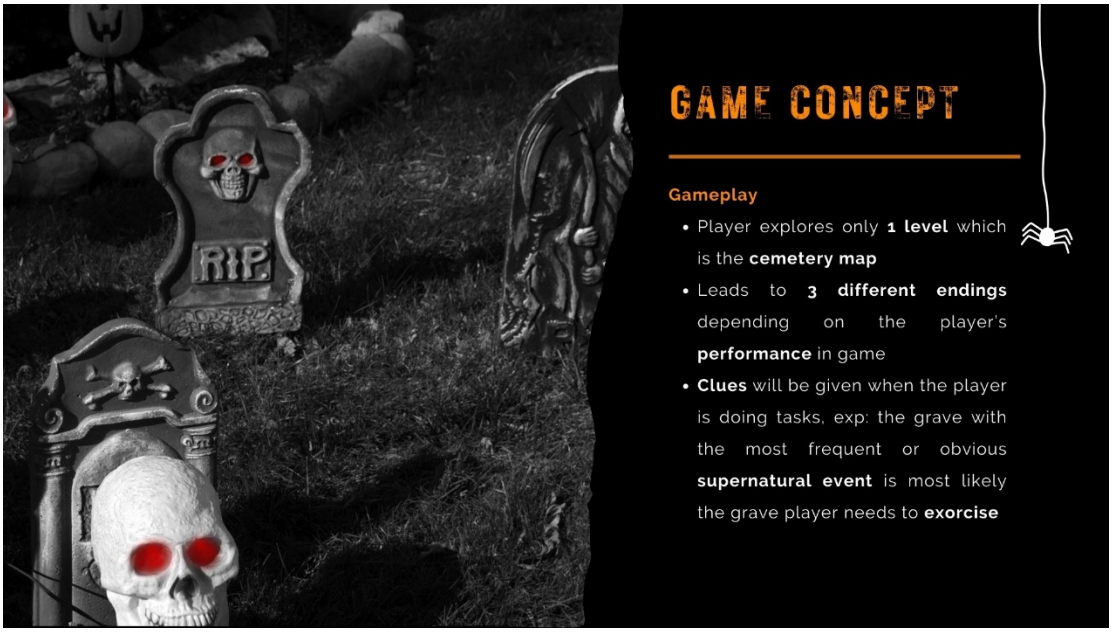
- Find and **exorcise** the right grave

Game Objective

- **Complete all the given tasks** in the game as a cemetery worker, such as swiping floor, cutting grass.
- **Avoid sanity bar to be empty**

Camera Perspective

- First-person perspective



GAME CONCEPT

Gameplay

- Player explores only **1 level** which is the **cemetery map**
- Leads to **3 different endings** depending on the player's **performance** in game
- **Clues** will be given when the player is doing tasks, exp: the grave with the most frequent or obvious **supernatural event** is most likely the grave player needs to **exorcise**


GAME CONCEPT
Gameplay
• The player will have a **sanity bar** slowly decreasing
• **Pray** in shrines using **incense stick** to restore sanity
• Incense stick is **limited** (means **time is limited**)
• Endings will be told via cutscene


ENDINGS
ONE: Survive the night
• The player exorcises the **correct grave**
TWO: Fail to survive
• The player exorcises the **wrong grave**
THREE: Possessed
• The player's **sanity bar** is **empty**

UNIQUE SELLING POINTS

- Horror game with **Chinese cemetery theme** is not usual in the market
- Promote **Chinese culture about death**
- Able to see the **ghost appearance in Taoism** (religion)

TARGET MARKET

18-25 years old computer user

Horror game fans

TARGET PLATFORM

PC platform

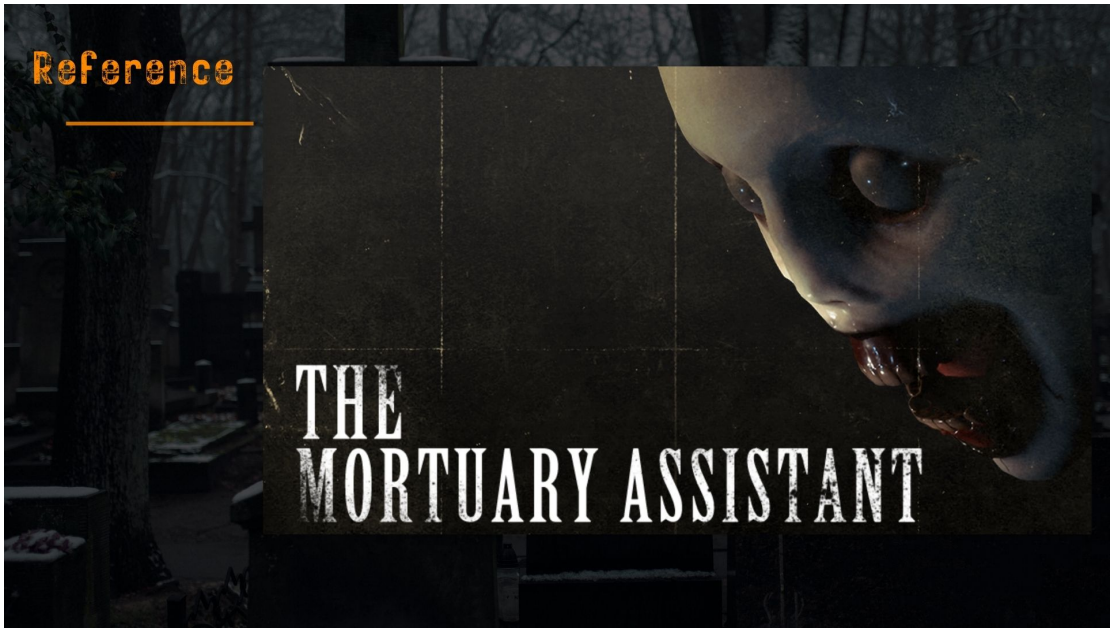
SKETCH

Ghost in game

CONCEPT ART

Cemetery

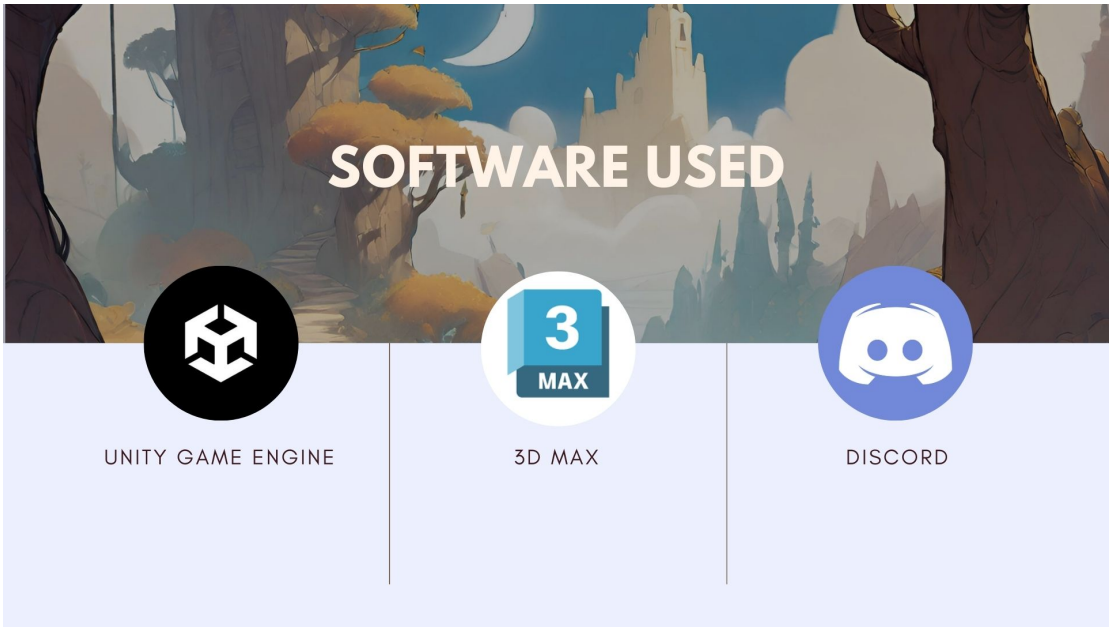

MOOD BOARD
Horror
Creepy
Cold

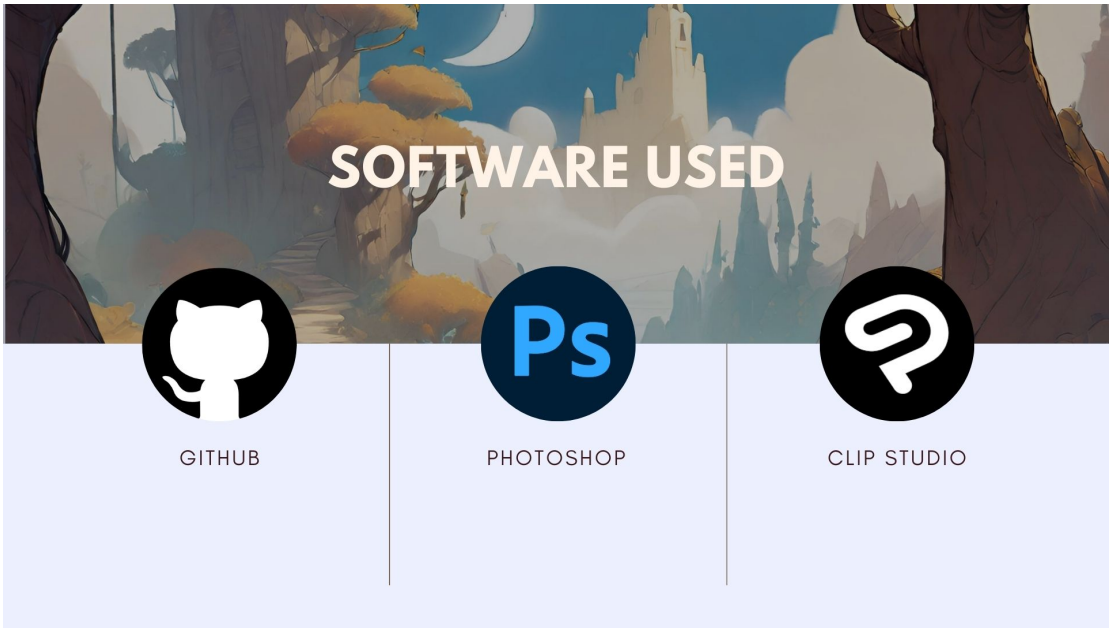

Reference
THE
MORTUARY ASSISTANT

GENERAL

HARDWARE AND SOFTWARE REQUIREMENTS

Specifications	Figure
Operating System	Windows 7 & Above
Processor	Intel Core2 Duo E8400, 3.0GHz or AMD Athlon 64 X2 6000+, 3.0GHz or higher
Memory	4GB RAM
Graphics	GeForce 9600 GT or AMD HD 3870 512MB or higher
Storage	10 GB available space


SOFTWARE USED
UNITY GAME ENGINE
3D MAX
DISCORD


SOFTWARE USED
GITHUB
PHOTOSHOP
CLIP STUDIO

BUDGET AND RESOURCES

(x 4 person)

Description	Cost (RM/person)	Total Cost (RM)
Printing Thesis	70	280
Promotional Material	100 (per group)	100
Miscellaneous	100	400

INDIVIDUAL SCOPE

Group Member	Scope
Ho Keen Mun	3D Modelling Artist, UI Designer
Wong Zi Ming	Level Designer, Game Designer, Sound Engineer
Leong Xue Qian	Programmer (Mechanics & AI)
Leong Wan Yi	Programmer (UI & Character)

GANTT CHART

FYP 1

No	Task	Group Members	Duration	Weeks						
				1	2	3	4	5	6	7
1	**Brainstorming**									
	Genre research	Everybody	2 weeks							
	Game Ideas	Everybody	2 weeks							
	Game concept	Everybody	2 weeks							
	Proposal preparation	Everybody	1 week							
2	**Designing**									
	Character Sketch	Keen Mun	2 weeks							
	Environment Sketch	Ziming	2 weeks							
	UI layout and design	Keen Mun	2 weeks							
	Level Design	Ziming	5 weeks							
3	**Production (Art)**									
	Modelling	Ziming, Keen Mun	3 weeks							
	Music and Sound effect	Ziming	3 weeks							
	Texturing	Keen Mun	3 weeks							
	Rigging	Keen Mun	2 weeks							
4	**Production (Programming)**									
	Player Movement	Wan Yi	2 weeks							
	Player Camera	Wan Yi	2 weeks							
	Enemy AI	Jane, Wan Yi	5 weeks							
	UI Function	Wan Yi	2 weeks							
	Game physics	Jane, Wan Yi	5 weeks							
5	**Milestone**									
	Progress presentation	Everybody	1 week							
	Bug fixing	Jane, Wan Yi	2 weeks							
	Quality Analysis	Everybody	2 weeks							

GANTT CHART (FYP 2)

No	Task	Group Members	Duration	Weeks													
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	**Production (Art)**																
	Modelling	Ziming, Keen Mun	10 weeks														
	Music and Sound effect	Ziming	10 weeks														
	Texturing	Keen Mun	5 weeks														
	Rigging	Keen Mun	3 weeks														
	Level Design	Ziming	7 weeks														
	Post Processing Effects	Ziming	5 weeks														
	VFX	Ziming	5 weeks														
2	**Production (Programming)**																
	Player Interaction Behavior	Jane, Wan Yi	12 weeks														
	Enemy AI	Jane, Wan Yi	12 weeks														
	Reward System (Clues)	Wan Yi	10 weeks														
	Sanity Bar system	Jane	12 weeks														
	Game physics	Jane, Wan Yi	10 weeks														
	Collectible Item	Wan Yi	5 weeks														
	Win / Lose Condition	Jane	3 weeks														
	SFX Implemention	Jane, Wan Yi	6 weeks														
	VFX Implemention	Jane, Wan Yi	6 weeks														
3	**Cutscene**																
	Start Cutscene	Everybody	6 weeks														
	Ending Cutscenes	Everybody	2 weeks														
4	**Milestone**																
	Final presentation	Everybody	1 week														
	Bug fixing	Everybody	3 weeks														
	Quality Analysis	Everybody	2 weeks														
	Game documentation	Everybody	2 weeks														
	Promotion	Ziming, Keen Mun	2 weeks														

RESEARCH TOPICS

Chroma Journey

HO KEEN MUN

Impact of 3D animation in horror games

WONG ZI MING

Color effects on level design

LEONG WAN YI

Comparative analysis of UI types in horror games

LEONG XUE QIAN

Dynamic Level of Detial (LOD) Systems for Chinese Horror Game Environments: Improving Performance without Sacrificing Quality

RESEARCH TOPICS

Graveyard Manager

HO KEEN MUN

Impact of 3D animation in horror games

WONG ZI MING

Light effects on level design

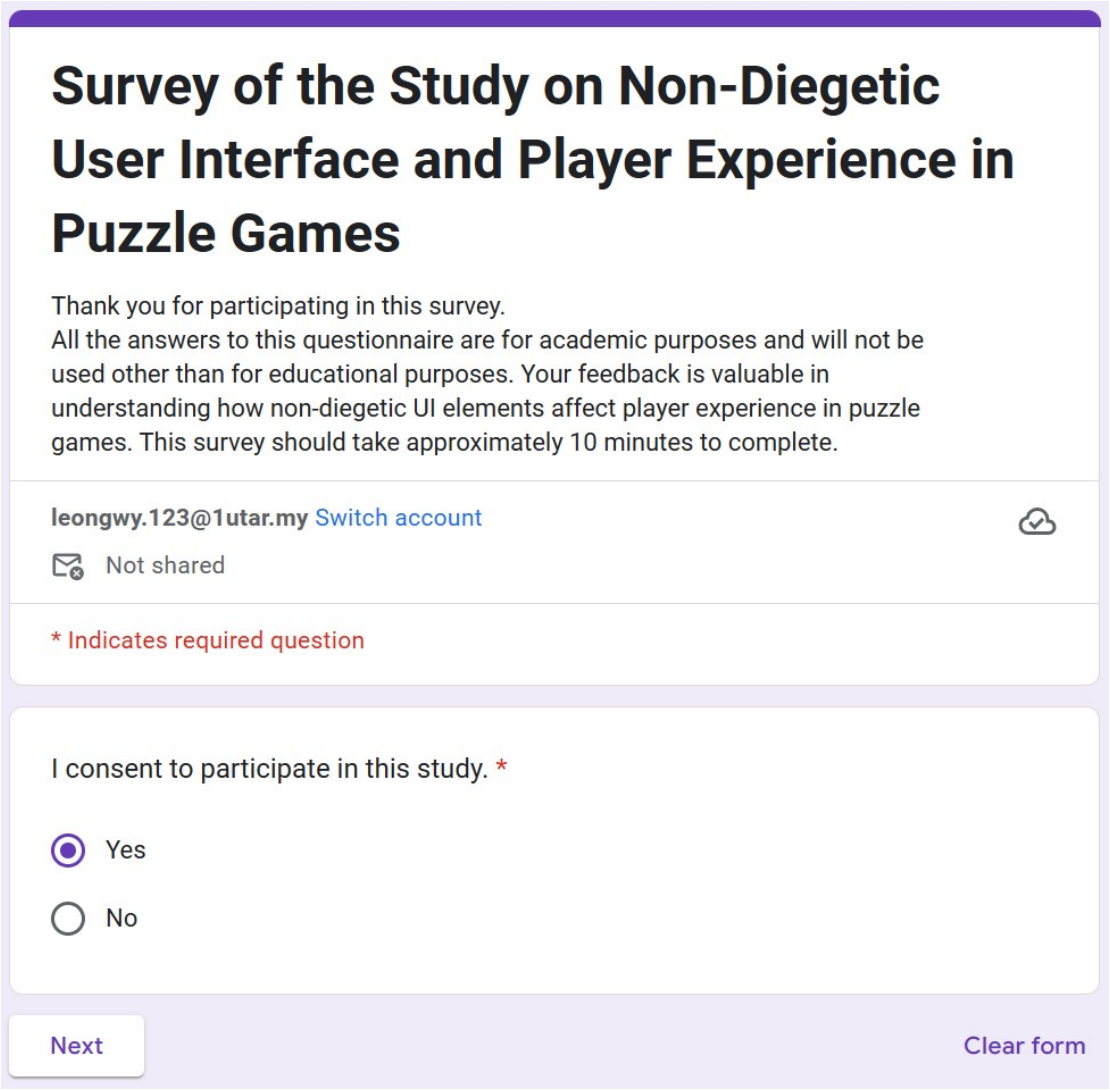
LEONG WAN YI

Comparative analysis of UI types in horror games

LEONG XUE QIAN

Dynamic Level of Detial (LOD) Systems for Chinese Horror Game Environments: Improving Performance without Sacrificing Quality

Appendix D: Survey (Pre-Test)



Survey of the Study on Non-Diegetic User Interface and Player Experience in Puzzle Games

Thank you for participating in this survey.
All the answers to this questionnaire are for academic purposes and will not be used other than for educational purposes. Your feedback is valuable in understanding how non-diegetic UI elements affect player experience in puzzle games. This survey should take approximately 10 minutes to complete.

leongwy.123@1utar.my Switch account

Not shared

* Indicates required question

I consent to participate in this study. *

- (●) Yes
- ( ) No

Next Clear form

Section 1: Demographic Information

Choose only one answer for each question

Age *

- ◯ 15 to 19
- ◯ 20 to 24
- ◯ 25 to 29
- ◯ 30 to 34

Gender *

- ◯ Male
- ◯ Female
- ◯ Prefer not to say
- ◯ Other: _____

How would you describe your experience with platform adventure games *

- ◯ Basic
- ◯ Medium
- ◯ Expert

Non-Diegetic UI Experience on Other Games

Non-diegetic UI is the UI element shown on the game screen but not involved in the narrative world. Examples of non-diegetic UI are the health bar, heads-up display, ammo status, game point display, etc.

What is(are) the platformer adventure game(s) you played before *

- [x] Hollow Knight
- [ ] Celeste
- [x] Ori and The Blind Forest
- [ ] Limbo
- [ ] Inside
- [ ] The Legend of Zelda Series
- [ ] Other: _____

How do you think about the non-diegetic UI design based on the chosen games in previous question? *

1 = Very Bad
2 = Bad
3 = Neutral
4 = Good
5 = Excellent

	1	2	3	4	5	
Very Bad	○	○	○	◉	○	Excellent

How clear were the non-diegetic UI elements in the game(s) you played? *

1 = Very Unclear
2 = Unclear
3 = Neutral
4 = Clear
5 = Very Clear

	1	2	3	4	5	
Very Unclear	○	○	○	○	◉	Very Clear

Did you find the non-diegetic UI elements distracting? *

1 = Not At All
2 = Slightly
3 = Moderately
4 = Very
5 = Extremely

	1	2	3	4	5	
Not At All	○	◉	○	○	○	Extremely

Non-Diegetic UI Experience on Chroma Journey

The questions are repeated from previous section for my developed game, Chroma Journey

How do you think about the non-diegetic UI design based on the chosen games in previous question? *

1 = Very Bad
2 = Bad
3 = Neutral
4 = Good
5 = Excellent

	1	2	3	4	5	
Very Bad	○	○	○	◉	○	Excellent

How clear were the non-diegetic UI elements in the game(s) you played? *

1 = Very Unclear
2 = Unclear
3 = Neutral
4 = Clear
5 = Very Clear

	1	2	3	4	5	
Very Unclear	○	○	◉	○	○	Very Clear

Did you find the non-diegetic UI elements distracting? *

1 = Not At All
2 = Slightly
3 = Moderately
4 = Very
5 = Extremely

	1	2	3	4	5	
Not At All	◉	○	○	○	○	Extremely

How well did the non-diegetic UI elements integrate aesthetically with the game? *

1 = Very Poorly
2 = Poorly
3 = Neutral
4 = Well
5 = Very Well

	1	2	3	4	5	
Very Poorly	○	○	◉	○	○	Very Well

Impact on Player Experience

To what extent did the non-diegetic UI elements affect your sense of competence in the game? *

1 = Greatly decreased
2 = Somewhat decreased
3 = No impact
4 = Somewhat increased
5 = Greatly increased

	1	2	3	4	5	
Greatly decreased	○	○	◉	○	○	Greatly increased

How did the non-diegetic UI elements impact your sense of immersion in the game world? *

1 = Greatly decreased
2 = Somewhat decreased
3 = No impact
4 = Somewhat increased
5 = Greatly increased

	1	2	3	4	5	
Greatly decreased	○	○	○	◉	○	Greatly increased

Open-Ended Feedback

What did you like most about the non-diegetic UI elements in the platform adventure game(s) you played? *

Your answer

What improvements would you suggest for the non-diegetic UI elements in puzzle games? *

Your answer

Thank you for your time and feedback! Your answers are invaluable to my study on improving non-diegetic UI in Chroma Journey.

Appendix E: Survey (Post-Test)

Survey of the Study on Non-Diegetic User Interface and Player Experience in Puzzle Games (Post-Test)

leongwy.123@1utar.my Switch account

Not shared

* Indicates required question

Non-Diegetic UI Experience

Non-diegetic UI is the UI element shown on the game screen but not involved in the narrative world. Examples of non-diegetic UI are the health bar, heads-up display, ammo status, game point display, etc.

Likert Scale
1 = Very Bad
2 = Bad
3 = Neutral
4 = Good
5 = Excellent

Give a rate for the overall non-diegetic UI design in Chroma Journey after the improvement. *

	1	2	3	4	5	
Very Bad	○	○	○	○	○	Excellent

Is the non-diegetic UI providing enough information to you? *

	1	2	3	4	5	
Very Bad	○	○	○	○	○	Excellent

Is the non-diegetic UI friendly to you? *

	1	2	3	4	5	
Very Bad	○	○	○	○	○	Excellent

Open-Ended Feedback

Is there any improvements need for the non-diegetic UI elements? *

- ○ Yes
- ◉ No

If yes, please give your feedback.

Feedback: *

Your answer

Thank you for your time and feedback! Your answers are invaluable to my study on improving non-diegetic UI in Chroma Journey.

Appendix F: Final Project Title Form

Fill in the information below as detailed as you can after confirming project title.

Project Type:

☑ **Product Based Project**

☐ **Research Based Project**

(tick the appropriate box)

Student ID	Student Name	Email & Contact no
2101503	Leong Wan Yi	leongwy1103@gmail.com +6017-891 4905
2001345	Leong Xue Qian	qianxue.jane@gmail.com +601136618226
2100171	Ho Keen Mun	robert2@gmail.com +6016-229 8270
2003878	Wong Zi Ming	zimingwong2@gmail.com +601151284354

Supervisor: Ms. Chow Mee Mooi

Project Title:

Chroma Journey: The Last Guardian

Project description:

Chroma Journey is a 2.5D platform adventure game where the player will play as a guardian named Chroma, whom the four Auspicious Beasts created. The player is given an enormous task: unveiling the terrible presence of the Four Fiends. Throughout the game, the player has to travel to fascinating landscapes, solve puzzles, and traverse shadowed regions to restore harmony to the world.

Student Name	Individual Project Scopes
Ho Keen Mun	• UI arts • Cutscenes • Player and enemy character models and animations
Leong Wan Yi	• Player movement and behaviour • UI functions • Visual Effects • Item interaction • Game environmental change functions
Leong Xue Qian	• Enemy AI functions • Main menu Functions • Game mechanics implementation
Wong Zi Ming	• Concept arts of the entire game • Levels and game environment designs • Sound effects and background music