THE EFFECT OF PUZZLE DESIGN ON PLAYER'S EXPERIENCE

TAN WEI YON

BACHELOR OF SCIENCE (HONS)

GAME DEVELOPMENT (GV)

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FACULTY OF CREATIVE INDUSTRIES (FCI)

UNIVERSITI TUNKU ABDUL RAHMAN (UTAR)

Declarations

I, Tan Wei Yon, declare that this research paper entitled “The Effect of Puzzle Design on Player’s Experience” 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 (Hons) Game Development, under the Universiti Tunku Abdul Rahman.

Signature of Author

Acknowledgement

I'd like to express my deepest thanks to my research supervisor, Ms Chow Mee Mooi for her continuous patience to provide guidance and feedbacks along the progress of writing this research paper. My research writing would not be that smooth without your kind advice and suggestions given.

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Finally, I would like to thank the help of the participants that spends their time to playtest our game and provide feedbacks of improvements for our game.

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List of Terminology

Terminology	Description
AI	Artificial Intelligence
UI	User Interface
COVID-19	Coronavirus Disease 2019
P1	Player 1
P2	Player 2

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Chapter 1: Introduction and Overview

To fulfill the graduation requirements, Medic team is formed to pass the FYP Project with course code UJMZ 32010. Medic team has 3 members which each of them will responsible on design, arts, and programming respectively. Two game ideas are presented on the game proposal session, which the details are included in Appendix A. The idea one with the game title Twin's Elude is being selected to further develop.

1.1 Game Introduction

Twin's Elude is an action-adventure game where two players are required to collaborate to complete the level. The game will be top-down view which two players can see each other's screen. The action of one player can be observed by another player while playing.

Twin's Elude follows the similar concept from A Way Out which requires two players to collaborate. Due to the various project limitations listed in Section 1.10, the game is suggested to be developed under 2D environment.

1.2 Unique Selling Point

a) Exactly two players are required to play the game.

b) Two players play collaboratively to solve the puzzle along their adventures.

1.3 Game Objective

a) Both players need to stay alive.

b) Both players need to escape the monster dungeon world.

c) Both players need to work collaboratively to pass the levels.

1.4 Game Story

Long times ago, the human's world was dominated by a twin of cruel demons. They had brought many pains to the human. After hundred years later, the human managed to defeat the demons and a peaceful world began again. Due to these historical reasons, the twins are viewed as taboo in the human world.

The main characters are a twin pair that were born in a small village. The twin pair was abandoned by the village and they were thrown into the sacrificial well. However, the villagers do not notice that there is a monster dungeon world deep inside the well.

The twin pair managed to stay survive from the drop and realized their current bad situation. The twin pair must work together and find the way to escape from the dungeon.

1.5 Game Mechanics

The overview of the game mechanics is listed in Table 1.5.1 below:

Mechanics	Description
Cloaking / Hiding	The players can use some items in the game to hide from the enemies.
Inventory	Each player will have individual inventory that shows the item hold by the players.
Item Usage / Durability	Some items have the usage limit. The items get destroyed if reaches the usage limit.

Pick Up / Drop / Use / Interact	Both players can pick up, drop, use and interact with game objects.
Dodge	Both players can invade the enemy's attack from dodging.
Pull	Both players can pull certain objects.
Shared Health	Both players share the same health.
Collaboration elements in puzzle	The puzzle always requires some forms of collaborations between the two players.

Table 1.5.1: Brief overview on game mechanics

1.6 Schedule

The schedule is planned in gantt chart and shown in the Figure 1.6.1 below:

Figure 1.6.1: Gantt chart

The red block marks the important deadline. The red block in the W7 column indicates the alpha release, while the red block in the W21 column indicates the beta release of the game. In the alpha release, the game is expected to show the complete level 1 gameplay, including AI enemies, puzzles, item interaction, player behavior, and boss fights. In the beta release, the game will be well polished, and completed with all mechanics.

1.7 Budget

The project budget is calculated and shown in Table 1.7.1 below:

EXPENSES	**RM**
Electrical Expenses	600
Water Expenses	200
Internet Data Plan	400
TOTAL (RM)	**1200**
SOFTWARE & HARDWARE	
Computer Laptops	FOC
Unity Game Engine	FOC
Photoshop / GIMP	FOC
TOTAL (RM)	**FOC**
MISCELLANEOUS	
Hardcopy Printing	800
Others	500
TOTAL (RM)	**1300**
GRANT TOTAL (RM)	**2500**

Table 1.7.1: Estimated budget for the development time

1.8 Development Resources

The development resources used along the development process is listed down in Table 1.8.1 below:

Development Resources	Description

Unity Game Engine	The engine is the primary tool used to create and build the game. The chosen version is Unity 2019.4.13f1.
Visual Studio Community 2017	The tool is used to organize and write scripts.
Github Desktop	The tool is used to save, track and synchronize changes across the team.
Google Sheet /Google Docs	The tools are used to document the important info and game details.
Google Drive	The tool is used to transfer large files or build files among the team. It is also the backup tool to serialize the version among the team
Discord / Whatsapp	The tools are used to communicate smoothly among the team members.
Photoshop CC 2019 / GIMP	The tools are used to create the 2D art assets of the game.

Table 1.8.1: Development resources

1.9 Project Scopes

Each member is responsible for different roles respectively. The overview of the assigned tasks is distributed as Table 1.9.1 below:

Team Member	Role	Tasks
Koh Wan Yee	Artist	- Concept Art Sketches - Game Environment - Sprite Sheets for main character, boss and enemies

		- UI Arts - Cutscene storyboard - 2D Animation
Elias	Designer	- Level design - Game mechanics - Narrative - Character / AI behavior design - Input control design - Dialogue
Tan Wei Yon	Programmer	- Characters & AI - Mechanics implementation - Maps implementation - Inventory - Item interactions - Puzzle function - Network synchronization - UI function

Table 1.9.1: Project scopes

1.10 Project Limitations

The overview of project limitations is listed in Table 1.10.1 below:

Limitation	Description
Time Constraints	Both the game project and the research report are required to

	complete within 6 months of development time. The first milestone (alpha) will be reached after less than 4 weeks of development time. The second milestone (beta) will be reached after less than 14 weeks of development time.
Skill Constraints	The team members are unequipped with 3D skillsets. Thus, the team members' skillsets limit the possibility space of the proposed game.
Heavy Workloads	Each team member takes additional two to three subjects per semester besides the FYP Project. Other assignments from other subjects are required to be tackled individually by every team member during the game development time. This creates huge pressure among the team members to make progression on the game.

Table 1.10.1: Project limitations

1.11 Summary

In summary, Twin's Elude is a 2D action-adventure game that requires two players to collaborate in order to escape from the monster dungeon. The game project is developed by Medic team which consists of 3 members. The purpose of the game project is to fulfil the requirements of FYP Project subject.

2.0 Chapter 2: Background Studies and Literature Review

2.1 Introduction

This chapter focuses on the research relevant to the game project that is created by the author. The research title is the effect of puzzle design on player's experience.

2.2 Problem Statement

There are four problem statements for the research as listed below.

a. What are the elements of good puzzle design?

This research aims to find out the elements of good puzzle design that make the game better in general.

b. What are the elements of bad puzzle design?

This research aims to find out the elements of bad puzzle design, so that the author can avoid implementing these elements into the game.

c. What are the tips or suggestions to design puzzle?

This research aims to gather several tips or suggestions from other experienced puzzle designers. The tips or suggestions from other should act as the guideline for the author and his teammates when lacking ideas.

d. How to determine if the puzzle is suitable for the game?

This research also aims to determine a way to verify whether a puzzle is suitable for a specific game.

2.3 Significance of Research

The significance of the research is to explore the puzzle design concepts and understand its effect on the player gameplay experience. The research is important to guide the author on the puzzle design process of the game.

2.4 Definition of Puzzle

Scott Kim defined a puzzle is a problem that is fun to solve and has a right answer (TED, 2009, 01:50-01:57). However, Schell (2008, p. 209) defined a puzzle as a game with a dominant strategy. A dominant strategy is when choices are offered to a player, but one of them is clearly better than the rest (Schell, 2008, p. 180). The definitions from Schell are used in this research.

2.5 Literature Review

Schell (2008, pp. 211-212) mentioned one of the puzzle design principle is to make the goal easily understood. When the players look at a puzzle, they should able to guess easily the goal of the puzzle. The players quickly lose interest if they are not sure what they supposed to do. Therefore, a good puzzle has a clear goal, while a bad puzzle makes players confuse what to do.

Besides, Schell (2008, pp. 212-213) mentioned that a good puzzle design is easy to get started. When a puzzle is presented to the player, the player should be able to visualize what their first few steps would be (Schell, 2008, p. 213). According to Schell, when designing a puzzle, the game needs to make sure players know how to start solving the puzzle, either by explaining it, or make it more obvious.

According to Bates (2004, p. 130), a good puzzle is the puzzle that is appropriate to the environment. A good puzzle fits naturally into the story and gives the player the opportunity to learn more about the people, the setting, and the world they are exploring (Bates, 2004, p. 130).

Bates (2004, p. 128) discussed a few elements that make a bad puzzle. One of the bad puzzles is arbitrary puzzle. The effects of the events are not related to its cause. The events seem happen only just because the designer of the puzzle thinks that it is the right timing for the events to happen. This usually happens when the designer wishes to prevent the player from leaving a specific area in the game before solving all the puzzles. This forces the players to be trapped until they solve all the puzzles there, without providing any logical explanation on how solving the puzzles leads to the ability to proceed the level.

Bates (2004, p. 128) also mentioned that one of the bad puzzles is designer puzzle. The designer puzzle is the puzzle that makes sense to the puzzle designer only, but not necessarily other people. From the point of view of Bates, the best way to avoid designing bad designer puzzle is let the people test it out. If the puzzle designer finds that he requires to explain why or how the puzzles work more than twice, the puzzles should be considered to abandon or simplify.

Luban (2002) mentioned that assistance providence is important for the players as a lot of players will lose interest and quit the game when a puzzle is impossible to break. Luban (2002) suggested to include help mechanisms, such as provide clues to the players if the software detects that the players are unable to break the puzzle. When the players spend more than several minutes in front of the puzzle, and walk away without solving it, the players behaviour pattern is detected, and clues are added to the scene to help the players (Luban, 2002).

According to A. Einhorn (2015), good puzzle design gives a player the moment of satisfaction when the solution that he thinks hard works. A. Einhorn used four steps to determine whether a puzzle can bring the satisfaction to the players. The first step is to make sure the player understands the objective clearly. The problem in the puzzle should be communicated to the player first. The second step is to let the player discovers the pieces of the puzzle needed to solve it. The

third step is the player notices the association between the components and works out a solution in their head. The key point is that the players can read the puzzles and reason it inside their head, and they are not forced to solve the puzzle with simple trial and error methods only. The fourth step is that the player implements the solution that he comes out and solves the puzzle. Therefore, a good puzzle design has 4 complete steps mentioned above, while the puzzle is bad when any step is missing.

Bates (2004, pp. 133-134) suggested that the designer needs to develop player empathy in the process of designing a puzzle. The player empathy is the ability to view the game from the perspective of a player. When the designer puts himself in the player's shoes, the designer can foresee what the player might think and act in certain situation. This helps the designer to provide a better game experience to the players. Therefore, player empathy is one of the ways to determine whether a puzzle is suitable for a specific game.

Bates (2004, p. 134) also stated an ideal puzzle should amplify the theme of the game. The actions that the player take must always be logical for his game characters' setting.

2.6 Summary

The research is about the puzzle design in games. The research is conducted to explore the puzzle design concepts and understand its effect on the player gameplay experience. This research aims to provide a guidance for the puzzle design in the author's game project.

3.0 Chapter 3: Methodology

3.1 Introduction

This chapter focuses on the methodology of the research. COVID-19 pandemic had put more challenges on data collection process, due to difficulty created when reaching the participants. Therefore, the research methods for the proposed game are shown in Table 3.1.1 below:

Primary Research Method	**a. Survey** A set of questionnaires is administered to the selected participants as shown in Appendix B.
Secondary Research Method	**a. Literature Review** The works from other researchers are reviewed.

Table 3.1.1: Research methods for the proposed game

3.2 Sampling method

The sampling method used is convenient sampling method. Convenient sampling method is a non-probability method which the most accessible participants are selected.

This sampling method helps to reach out participants easily and speedy, especially when the participants are hard to reach out physically during COVID-19 pandemic.

3.3 Measurement Instrument

After the participants play the proposed game during game session, the participants are provided with a survey form to collect the necessary data.

3.4 Activity Flow

The research activity is conducted as shown in Table 3.4.1 below.

Activity Flow	Description
Literature Review	Obtain the relevant results from other researchers' work.
Game Session	The participants play the proposed game. The author stays together with the participants to ensure the game runs smoothly on the participants' side.
Feedback Session	The participants' feedback is collected after game session.

Table 3.4.1: Activity flow of the research

3.5 Limitations

There are several limitations that constrained the process of research as shown in Table 3.5.1 below:

Limitations	Description
Limited Server's Capacity	The server used to connect the players together has very limited capacity. This limitation will restrict the number of participants to take the survey at the same time.
Network Issues	The research may be affected by the poor connectivity of the players, which may cause uncontrollable network issues during the research activities.

Table 3.5.1: The limitations of research process

3.6 Summary

The sampling method used is convenient sampling method, where the participants are formed from the people surrounding the author. The data is collected via a set of designed questions from the participants after they played the game.

Chapter 4: Functional Specification

4.1 Introduction

This chapter focuses on the functional specification of Twin's Elude game. All functional requirements are discussed in this chapter.

4.2 Game Control Input

The player uses the keyboard input to control his character in the game. The available control inputs are listed out in the Table 4.2.1 below.

Control Input	Key
Move Up	W
Move Down	S
Move Left	A
Move Right	D
Dodge	Space
Interact / Pick Up Item	K
Drop Item	L
Use Item	J
Notify Signal	Tab
Quit Game	Escape

Table 4.2.1: The game control input of Twin's Elude game

4.3 Players

Two players are needed to play this game. The first player is denoted as P1, while the second player is denoted as P2. The Table 4.3.1 below shows the differences between P1 and P2.

Differences	P1	P2
(a) Gameplay screen	Left	Right
(b) Able to pick up bricks (refer section 4.4)	Yes	No
(c) Able to pass through small holes (refer section 4.4)	No	Yes

Table 4.3.1: Differences between P1 and P2

4.4 Game Items

a. Overview of Game Items

There are some game items that are introduced in level 1 and level 2 respectively. The Table 4.4.1 shows the introduced items in level 1, while the Table 4.4.2 shows the introduced items in level 2.

Level 1 Items	Descriptions
Boss Scene Key	Used to unlock the boss fight doors. This key only exists in boss fight scene.
Brick	Used to block the players. Pickable by P1 only.
Cloth	Used to hide from enemy.
Door	Can be locked or unlocked based on certain circumstances.
Fruit	Used to heal the players' health.
Hint Object	Interact to display the hint in the form of text or image.
Knife	Used to attack the enemy.
Normal Scene Key	Used to unlock the doors.
Sacred Tree	Interact to drop down fruit.

Small Hole	Interact to pass through blocked area. Interactable by P2 only.
Spike Trap	A trap that can damage players' health once touched.
Stepping Blocks	Used as components of certain puzzles.
Stone	Used to attack the enemy.
Switch	Interact to open the door.
Treasure Box	Treasure box may contain keys. Interact to open the box.
Wooden Box	Wooden box may contain random items. Attack or dodge to destroy the wooden box.
Light Orbs	Emits light sources up to four directions (top, bot, left, and right).
Light Absorber	Receive two light sources and blend the colour together.
Mirror	Reflect any light source that hits the mirror. Interact to rotate the mirror.

Table 4.4.1: The description of introduced game items in level 1

Level 2 Items	Descriptions
Gem	Receive the colour of light source and output the light with the gem's own colour.
Fire Arrow Trap	A trap that shoots the fire arrow every fixed amount of time interval.
Fire Arrow	Always move forward. Player is damaged once hits by the fire arrow.

Machine Controller	Interact to rotate the three-rotator machine object.
Three-Rotator Machine	A machine that can be rotated.

Table 4.4.2: The description of introduced game items in level 2

b. Pick and Drop Items

There are plenty of game items that can be picked up and dropped by the players. Table 4.4.3 below shows the list of pickable and droppable items.

Items	Pickable (Y / N)	Droppable (Y / N)	Player (P1 / P2)
Stone	Y	Y	Both
Fruit	Y	Y	Both
Knife	Y	Y	Both
Cloth	Y	Y	Both
Normal Scene Key	Y	**N**	Both
Boss Scene Key	Y	Y	Both
Gem	Y	Y	Both
Brick	Y	Y	P1

Table 4.4.3: The list of pickable and droppable items

c. Interact Items

There are plenty of game items that can be interacted by the players. Table 4.4.4 below shows the list of interactable items.

Interactable Items	Players (P1 / P2)
Hint Object	Both

Sacred Tree	Both
Small Hole	P2
Switch	Both
Treasure Box	Both
Mirror	Both

Table 4.4.4: The list of interactable items

c. Puzzle Related Items

Some items are included as parts of the puzzles in the Twin's Elude game. The Table 4.4.5 below shows the related item lists for each puzzle in the game.

Puzzles	Related Item Lists
Stepping Puzzle	- Hint Object - Stepping Block - Door
Light Mirror Puzzle	- Hint Object - Light Orbs - Light Absorber - Mirror - Gem - Door
Pixel Drawing Puzzle	- Hint Object - Stepping Block - Door
Three Rotator Puzzle	- Hint Object

	- Stepping Block - Door - Switch - Machine Controller - Three-Rotator Machine

Table 4.4.5: Related item lists for each puzzle

4.5 Puzzles

There are many different types of puzzles introduced in level 1 and level 2 respectively. Table 4.5.1 below shows the puzzles introduced in level 1, while Table 4.5.2 lists out the puzzles introduced in level 2.

No.	Puzzles' Name (Level 1)	Description
1	Stepping Puzzle	Step on correct blocks for 3 times consecutively to solve the puzzle.
2	(8 x 8) Pixel Drawing Puzzle	Draw the exact same pattern as shown in the image of hint object on the 64 (8 x 8) stepping blocks to solve the puzzle.
3	Simple Light Mirror Puzzle	Rotate the mirror to reflect the lights from light orbs to the light absorber. The puzzle is simplified to teach the players on the usages of light orbs, light absorber and mirror only.

Table 4.5.1: The list of puzzles in level 1

No.	Puzzles' Name (Level 2)	Description
1	Full Light Mirror Puzzle	Similar as Simple Light Mirror Puzzle, except that the puzzle introduces concept

		of light blending between colours. Gem object is introduced to the players.
2	(10 x 10) Pixel Drawing Puzzle	Draw the exact same pattern as shown in the image of hint object on the 100 (10 x 10) stepping blocks to solve the puzzle.
3	Three Rotator Puzzle	Rotate three-rotator machine with three machine controllers until match the correct angle to solve the puzzle.

Table 4.5.2: The list of puzzles in level 2

4.6 Summary

Chapter 4 explained the game control input, items, and puzzles used in Twin's Elude game. The items that are related to puzzles are identified, and the puzzles that are introduced in both level 1 and level 2 are explained in this chapter.

Chapter 5: System Design Specification and Implementation

5.1 Introduction

This chapter focuses on the system design specification and implementation of the puzzles. All puzzle designs are explained and implemented in the Twin's Elude game.

5.2 Gameplay Screen

There are two types of gameplay screens that may appear in Twin's Elude game. Different gameplay screens are used at different locations. Table 5.2.1 shows the available types of gameplay screens.

Gameplay Screen	Description	Location
Split Screen	The player screen is splitted vertically into half. P1's view is on the left side, while P2's view is on the right side of the screen.	Normal Level
Merge Screen	Both players use one single merged screen to view the game.	Boss Fight Level

Table 5.2.1: The available types of gameplay screens

5.3 Hint Object

Hint object is used to display the hint in the form of text or image. Table 5.3.1 shows the available types of hint.

Types of Hint	Description
Text-based Hint	The hint is displayed in the form of text.
Image-based Hint	The hint is displayed in the form of sprite.

Table 5.3.1: The available types of hint

a. Open & Close Hint

To open the hints from the hint objects, players need to follow the steps shown in Table 5.3.2 below.

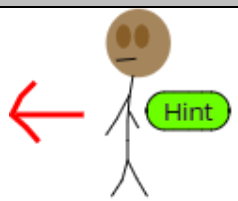
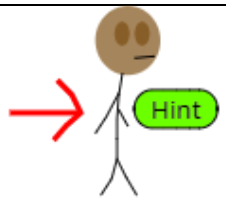
No.	Steps	Sketches
1	Stand near the hint object.	
2	Face towards the hint object.	
3	Press interact key to display the hint.	
4	Press any key to close the hint.	

Table 5.3.2: Steps to open or close the hints

5.4 Small Hole

Small hole can be interacted by P2 to pass through blocked area. Small hole is found in the walls. Figure 5.4.1 below shows the sketches of small hole.

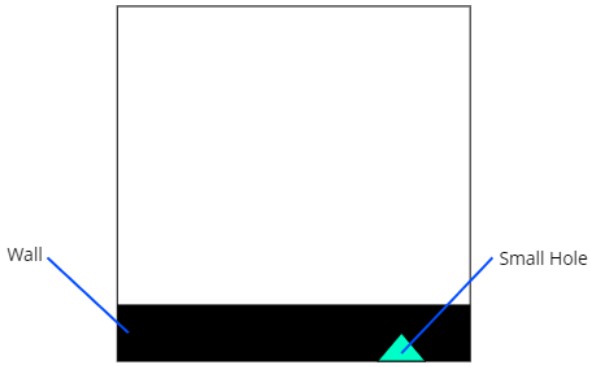
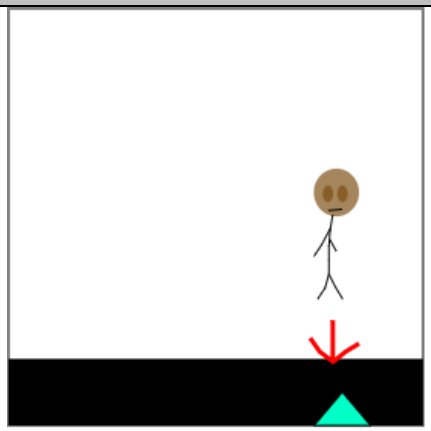


Figure 5.4.1: The sketches of small hole

a. Pass Through Small Hole

To pass through small hole, players need to follow the steps shown in Table 5.4.2 below.

No	Steps	Sketches
1	Stand near and face to the small hole.	

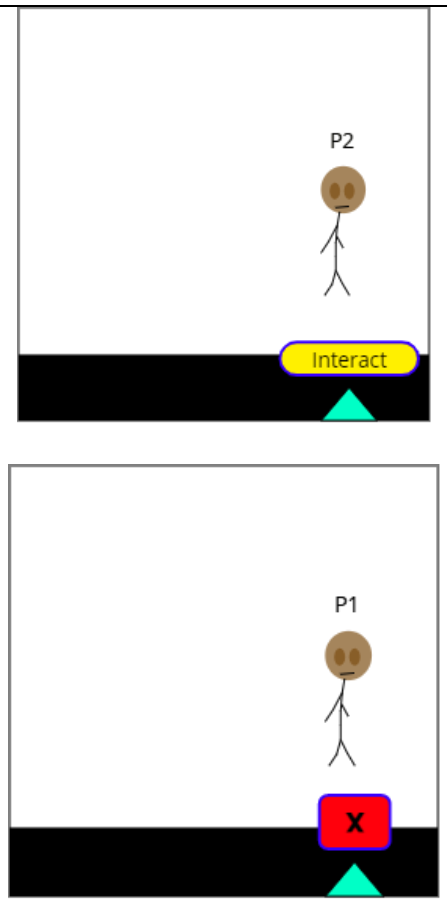
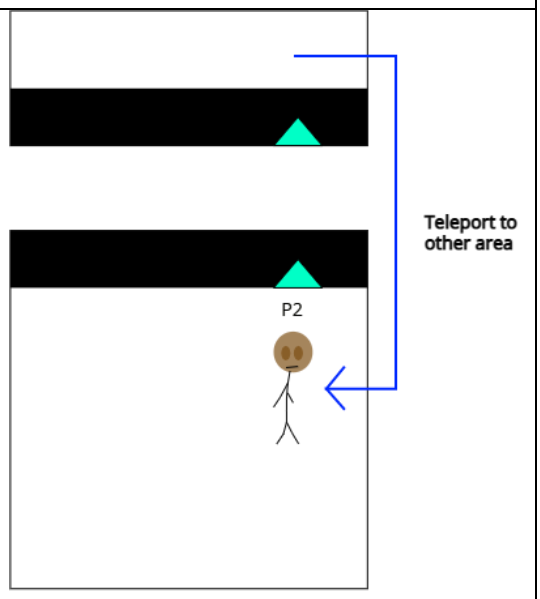
2	UI will be displayed out. Based on the UI, players know whether they can interact with small hole or not.	
3	Press down the interact key once. P2 is teleported to the other area.	

Table 5.4.2: Steps to pass through small hole

5.5 Brick

Brick is used to block the players and can be picked up by P1 only. To pick up or drop brick, P1 needs to follow the steps in Table 5.5.1 below.

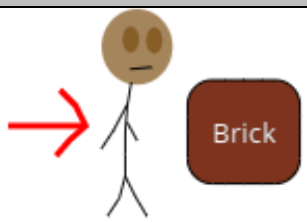
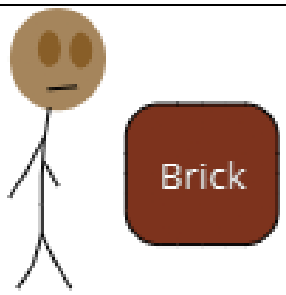
No.	Steps	Sketches
1	Stand near and face to the brick object.	
2	Press down the pickup key. The brick is picked by P1.	
3	Press down the drop key to put it in front of P1.	

Table 5.5.1: Steps to pick up or drop brick

5.6 Stepping Puzzle

Stepping puzzle is introduced in level 1 (refer to Chapter 4 Section 4.5). The components used in the puzzle are listed in Table 5.6.1 below.

Components	Description
Hint Object	Text-based hint. Displayed text hint is: “3 Matching Sequences Are Required”.
Stepping Blocks	The blocks that can be stepped on by players.

Puzzle Door	The door is opened only after the puzzle is solved.
Previous Door	The door that connects to previous level area.

Table 5.6.1: Components of stepping puzzle

Figure 5.6.2 shows the sketches of the components of stepping puzzle in level 1, while Figure 5.6.3 shows the actual implementations in Twin's Elude game.

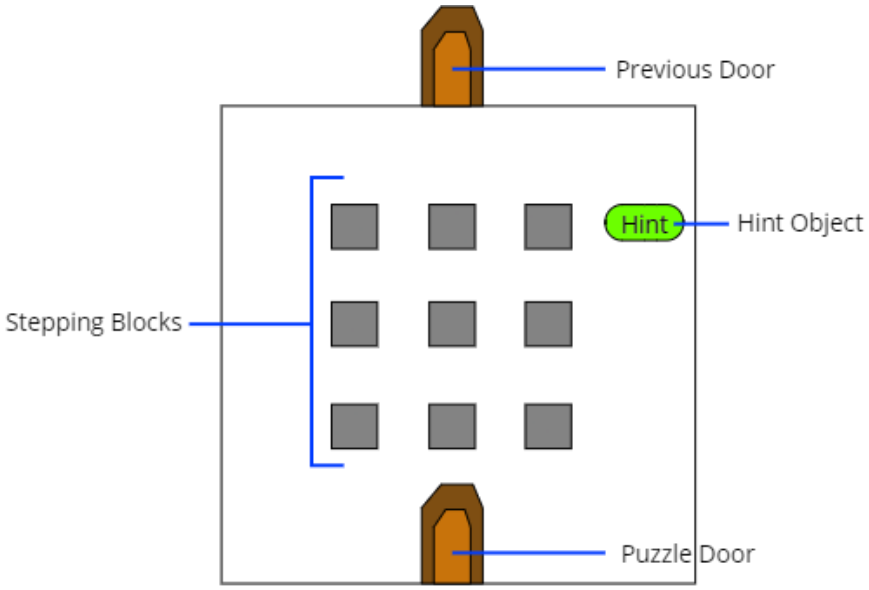
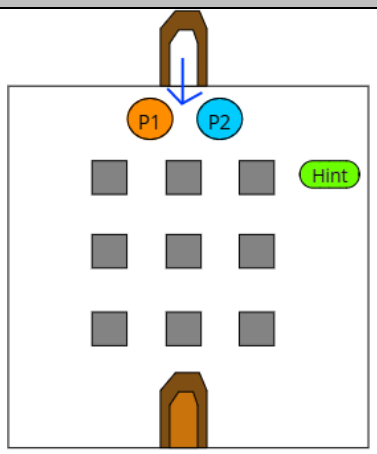
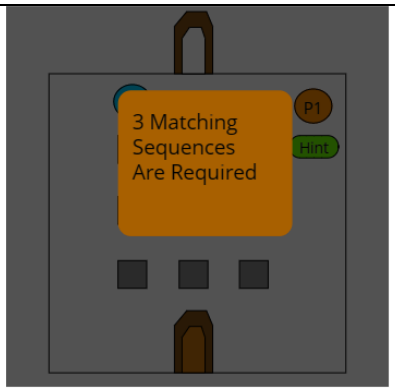


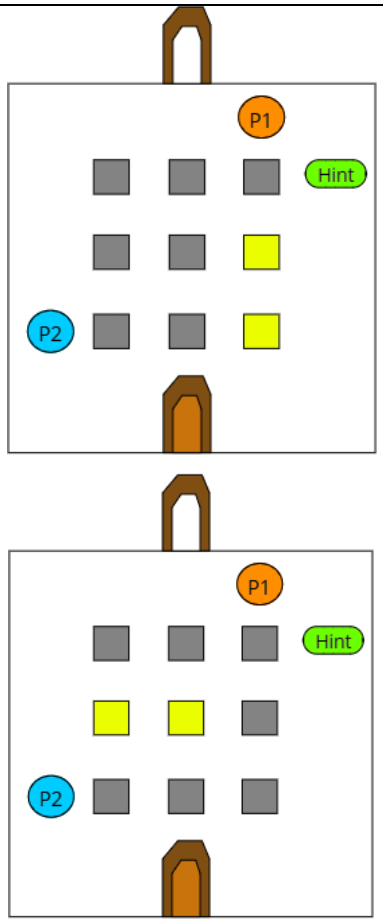
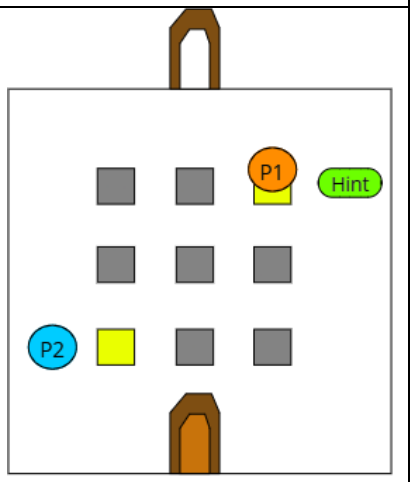
Figure 5.6.2: The sketches of placement of stepping puzzle in level 1

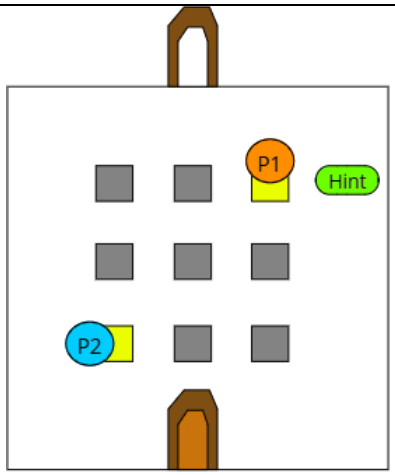
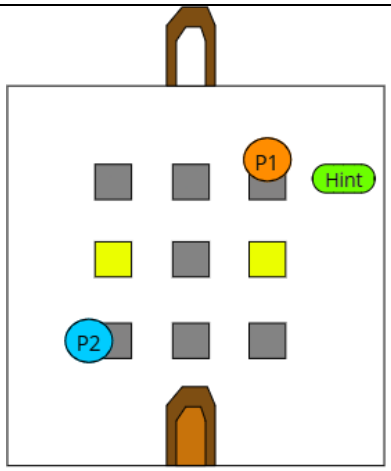
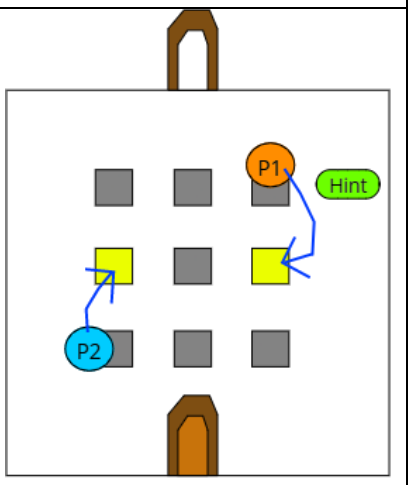
Figure 5.6.3: The actual implementations of stepping puzzle in level 1

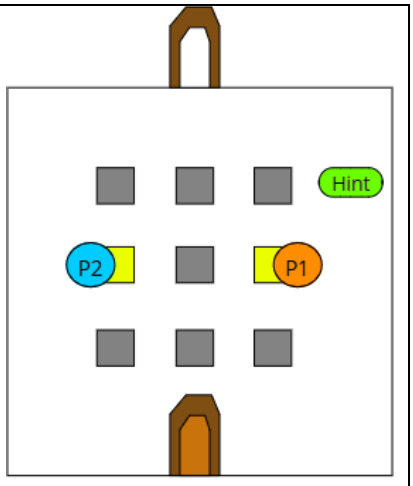
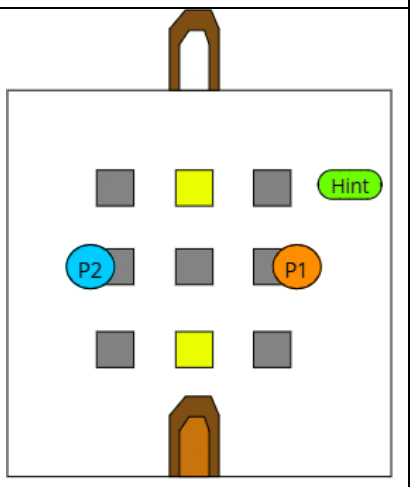
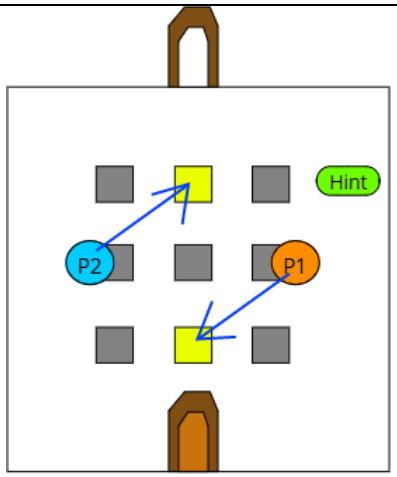
a. Puzzle Design

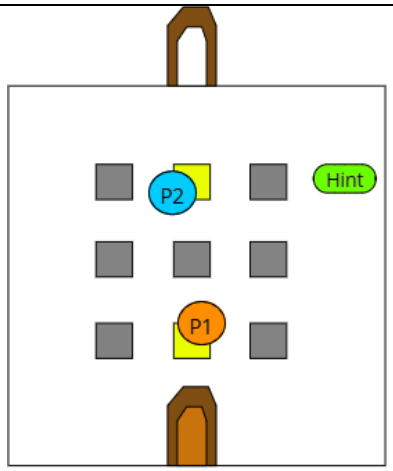
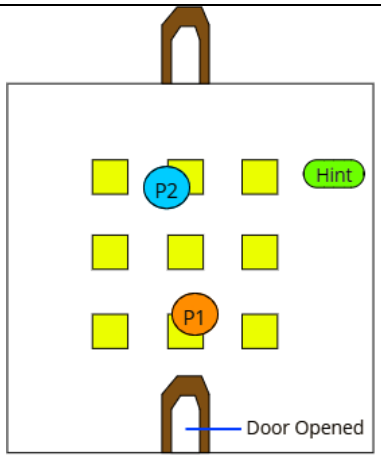
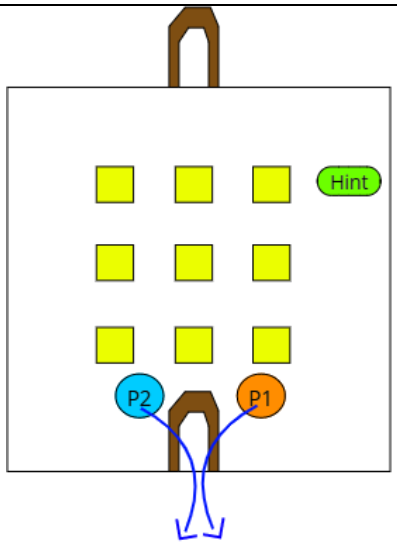
To solve the stepping puzzle, players have to step on the correct stepping blocks for 3 consecutive times. Table 5.6.4 shows the demonstration of step-by-step process to solve the puzzle.

No.	Steps	Sketches
1	Players enter the puzzle area from previous door.	
2	Players interact with hint object to understand what to do to solve the puzzle.	

3	Two stepping blocks are lighted up randomly every 10 seconds.	
4	Lighted blocks stop changing automatically after one of the player steps on any lighted block.	

5	Both players step on the lighted stepping blocks. The correct sound is played to provide positive feedback to the players.	 Success Time = 1
6	Two stepping blocks are lighted up randomly.	
7	Players move to the new lighted up blocks without touching other unlighted blocks.	

8	Both players step on the lighted stepping blocks for 2 consecutive times. The correct sound is played to provide positive feedback to the players.	 Success Time = 2
9	Two stepping blocks are lighted up randomly again.	
10	Both players move to the new lighted up blocks without touching other unlighted blocks again.	

11	Both players step on the lighted stepping blocks for 3 consecutive times.	 Success Time = 3
12	When success time reaches 3, the puzzle is solved. All stepping blocks are lighted up and the puzzle door is opened.	
13	Players are able to proceed to the next area.	

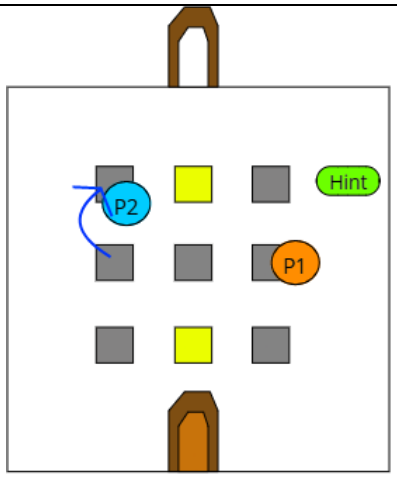
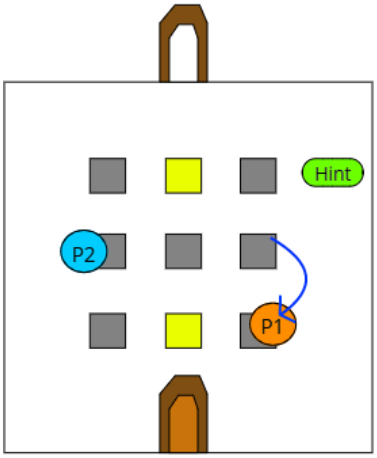
14	However, before success time reaches 3, if one of the players steps on any unlighted block, the success time is reset to zero. This means that players have to step on the lighted blocks correctly for 3 consecutive times again to solve the puzzle.	  Success Time = 0

Table 5.6.4: step-by-step process to solve the stepping puzzle

5.7 Pixel Drawing Puzzle

Pixel drawing puzzle can be found in level 1 and level 2. Table 5.7.1 lists the pixel drawing puzzles that are found in each level.

Level	Puzzle Name
1	8 x 8 Pixel Drawing Puzzle
2	10 x 10 Pixel Drawing Puzzle

Table 5.7.1: Pixel drawing puzzles found in each level

Pixel drawing puzzle is made up of some components. Table 5.7.2 below lists out the components used in pixel drawing puzzle.

Components	Descriptions
Hint Object	Image-based hint. Displayed image is the pattern that players need to match.
Stepping Blocks	The blocks that can be coloured by players.
Puzzle Door	The door is opened only after the puzzle is solved.
Previous Door	The door that connects to previous level area.

Table 5.7.2: The components used in pixel drawing puzzle

Figure 5.7.3 shows the sketches of the components of pixel drawing puzzle, while Figure 5.7.4a and Figure 5.7.4b show the actual implementations in level 1 and level 2 respectively.

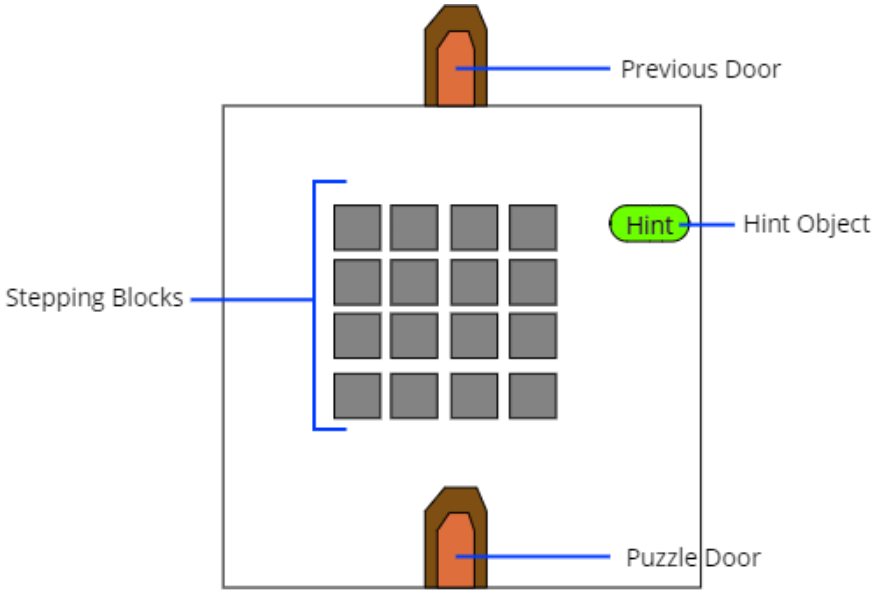


Figure 5.7.3: The sketches of placement of pixel drawing puzzle

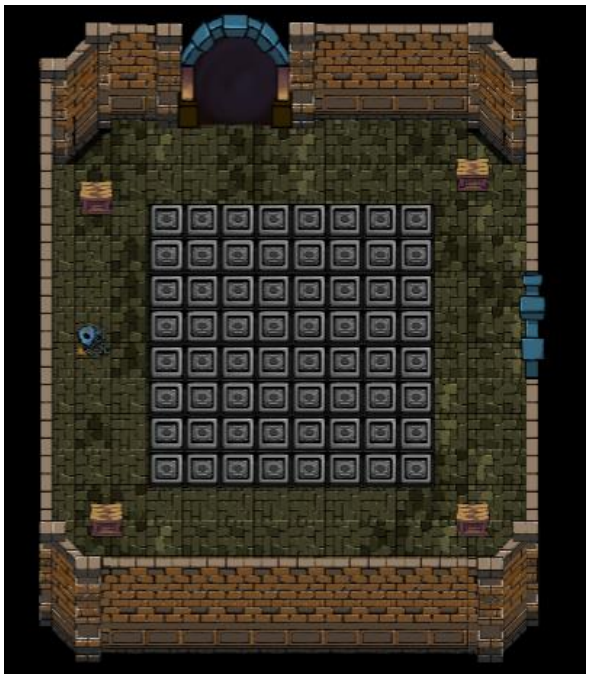


Figure 5.7.4a: The actual implementation of pixel drawing puzzle in level 1

Figure 5.7.4b: The actual implementation of pixel drawing puzzle in level 2

a. Drawing Colour

Each player uses different colour to draw on the stepping blocks. Table 5.7.5 shows the design sketches of drawing colour for each player. Table 5.7.6a and Table 5.7.6b show the actual drawing colour of the puzzle for each player.

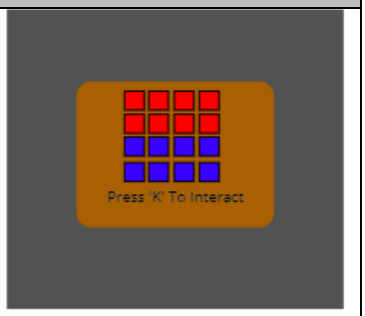
Players (P1 / P2)	Drawing Colour	Hint Image
P1	Dark Green	
P2	Yellow	

Table 5.7.5: The design sketches of drawing colour for each player

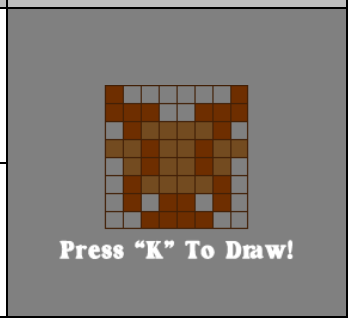
Players (P1 / P2)	Drawing Colour	Hint Image
P1	Dark red	
P2	Light red	

Table 5.7.6a: The drawing colour of 8x8 pixel drawing puzzle

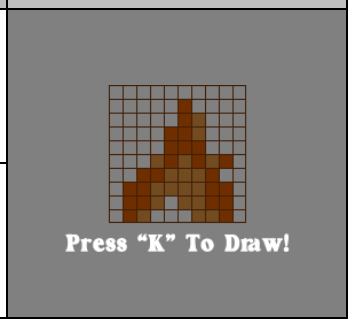
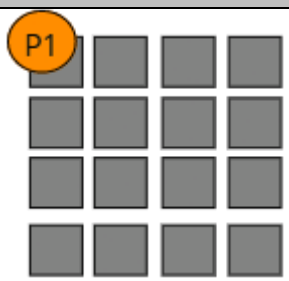
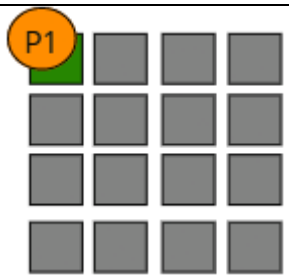
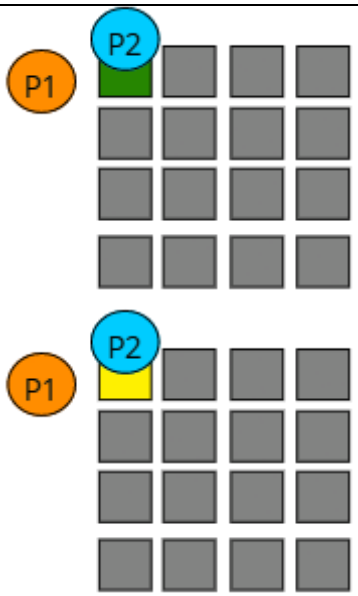
Players (P1 / P2)	Drawing Colour	Hint Image
P1	Dark brown	
P2	Light brown	

Table 5.7.6b: The drawing colour of 10x10 pixel drawing puzzle

The drawing colour is not necessarily same as the colour displayed in hint image. This is because the key to solve the puzzle is matching the pattern displayed in hint image, instead of matching the colour (refer to Section 5.7.c).

b. Place and Erase Colour

To place or erase colour on stepping blocks, players need to follow the steps in Table 5.7.7 below.

No.	Steps	Sketches
1	Step on the stepping block.	
2	Press down interact key once. The stepped block will change to the drawing colour of the player only if the block's colour is not the player's drawing colour.	
	That also means that other player can override the coloured blocks with his drawing colour too by pressing the interact key.	

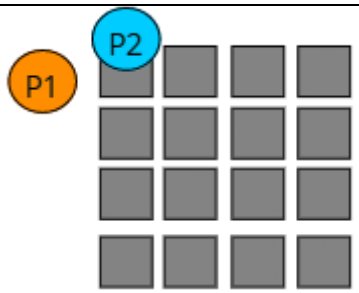
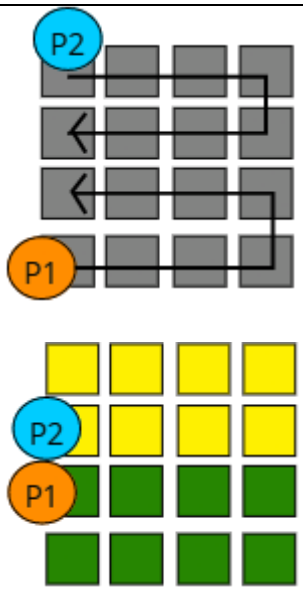
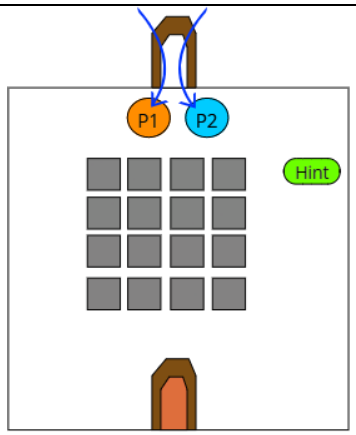
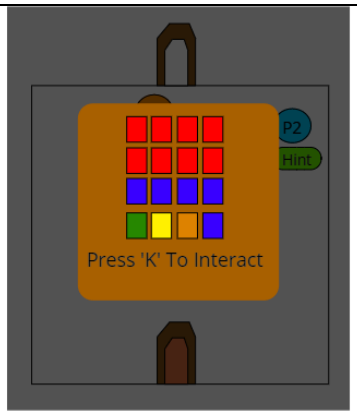
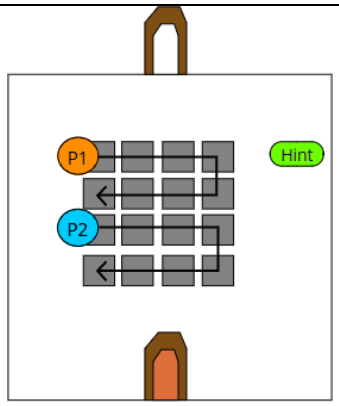
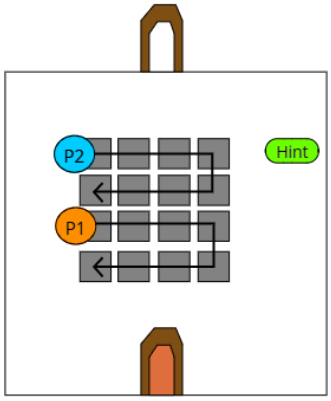
3	Press down interact key once again. The colour of stepped block will be erased only if the block's colour matches with the player's drawing colour.	
4	Optionally, long press the interact key while stepping on the blocks to place or erase colour faster.	

Table 5.7.7: Steps to place or erase colour on stepping block

c. Puzzle Solving

To solve the pixel drawing puzzle, players need to place colour on the stepping blocks until it matches with the patterns displayed in hint image provided. Table 5.7.8 shows the step-by-step process to solve the puzzle.

No	Steps	Sketches

1	Players enter the puzzle area.	
2	Players open the hint and understand how to solve the puzzle.	
3	Players place colour on the blocks to match the patterns displayed in hint image.	 

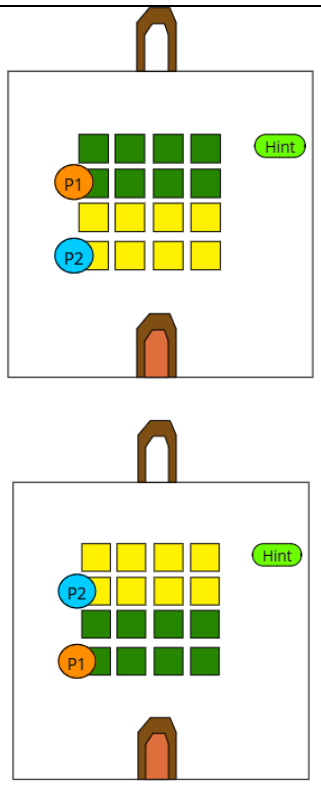
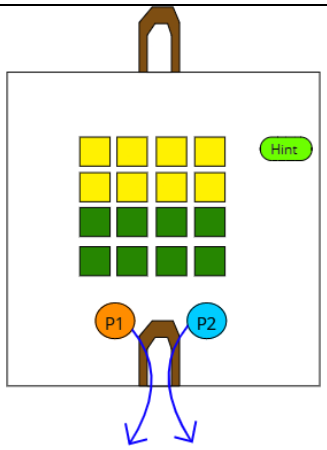
4	The puzzle is solved as long as the pattern is matched.	
5	The puzzle door is opened. The puzzle freezes as players cannot longer interact with any stepping block anymore.	

Table 5.7.8: Step-by-step process to solve pixel drawing puzzle

5.8 Light Mirror Puzzle

Light mirror puzzle can be found in both level 1 and level 2. Table 5.8.1 lists the light mirror puzzles that are found in each level.

Level	Puzzle Name
1	Simple Light Mirror Puzzle

2	Full Light Mirror Puzzle

Table 5.8.1: Light mirror puzzles found in each level

The components used in simple light mirror puzzle and full light mirror puzzle are slightly different. Table 5.8.2 and Table 5.8.3 list out the components used in light mirror puzzles in level 1 and level 2 respectively.

Components	Description
Hint Object	Text-based hint.
Light Orb	Act as the light source.
Mirror	Reflect light.
Light Absorber	Receive the light to open the puzzle door.
Small Hole	Used to pass through blocked area.
Bricks	Used to blocks the players.
Switch	Interact to open the switch door.
Previous Door	The door that connects to previous level area.
Switch Door	The door is opened by the switch only.
Puzzle Door	The door is opened only after the puzzle is solved.

Table 5.8.2: Components used in light mirror puzzle in level 1

Components	Description
Hint Object	Text-based hint.
Light Orb	Act as the light source.
Mirror	Reflect light.

Gem	Receive the colour of light source and output the light with the gem's own colour.
Light Absorber	Receive the light to open the puzzle door.
Fire Arrow Trap	A trap that shoots the fire arrow every fixed amount of time interval.
Previous Door	The door that connects to previous level area.
Block Door	The door can be opened by the switch or stepping block.
Puzzle Door	The door is opened after the puzzle is solved.

Table 5.8.3: Components used in light mirror puzzle in level 2

Figure 5.8.4a and Figure 5.8.4b show the sketches of the components of light mirror puzzles in level 1 and level 2, while Figure 5.8.5a and Figure 5.8.5b show the actual implementations of light mirror puzzles in level 1 and level 2 respectively.

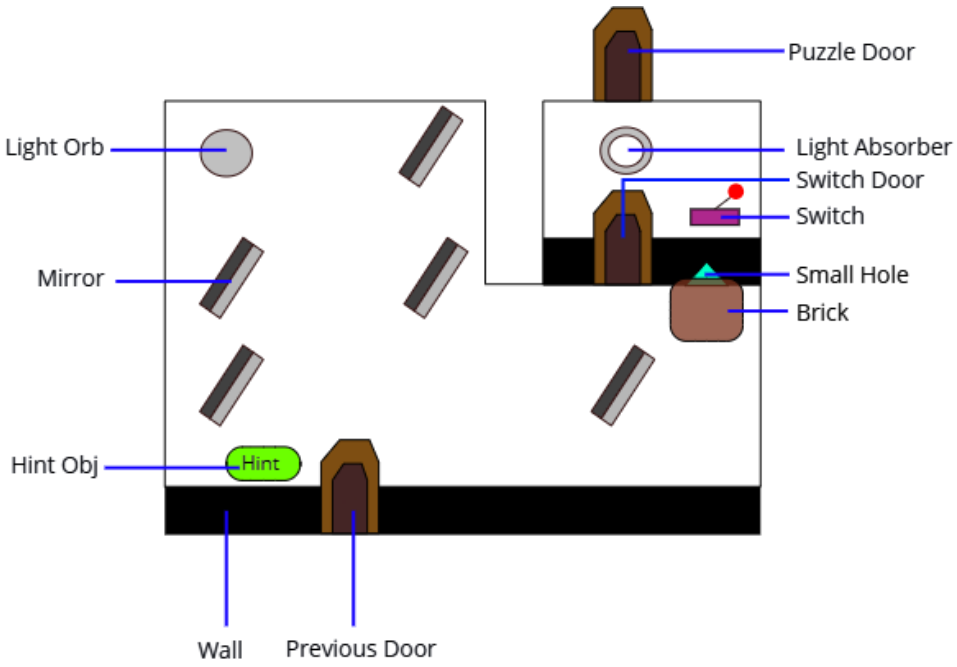


Figure 5.8.4a: The sketches of placement of light mirror puzzle in level 1

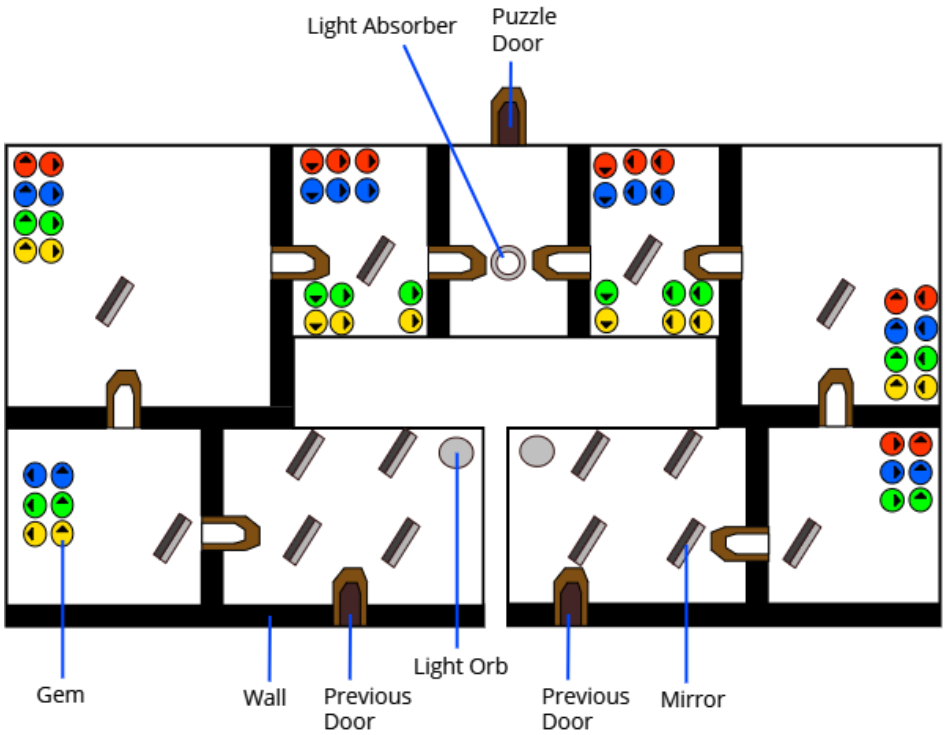


Figure 5.8.4b: The sketches of placement of light mirror puzzle in level 2

Figure 5.8.5a: the actual implementation of light mirror puzzle in level 1

Figure 5.8.5b: the actual implementation of light mirror puzzle in level 2

a. Light Orb

Light orbs will emit light to one of the directions from up, down, left and right. Figure 5.8.6 below shows the sketches of emission of light source from light orb.

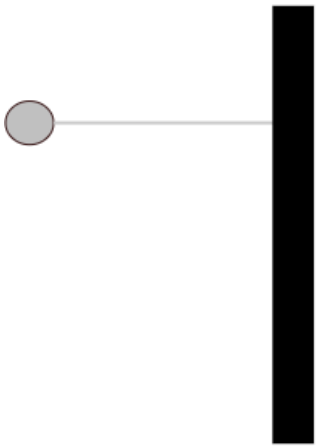


Figure 5.8.6: The sketches of emission of light source from light orb

b. Mirror

Mirror has two sides, which are front and back. Figure 5.8.7 shows the design of structure of mirror in the game.

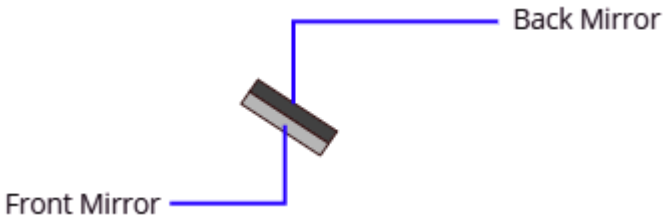


Figure 5.8.7: The design of structure of mirror

Mirror can be interacted to rotate the mirror in 90 degree clockwise. To rotate the mirror, players need to follow the steps shown in Table 5.8.8 below.

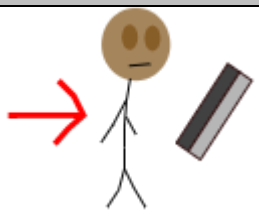
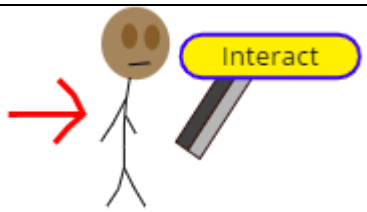
No.	Steps	Sketches
1	Stand near and face to the mirror.	
2	UI displayed will show that mirror is interactable by the players.	
3	Press down the interact key once. The mirror is rotated 90 degree clockwise.	

Table 5.8.8: The steps to rotate the mirror

Mirror will reflect light only when the light hits the front mirror. Table 5.8.9 shows the outcome of light reflection with all possible mirror's rotation.

Situation	Description	Outcomes

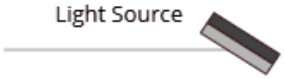
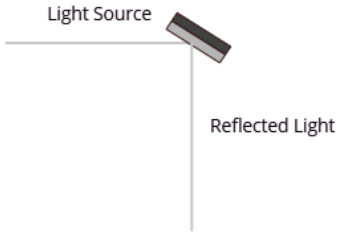
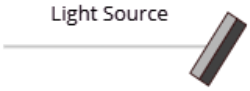
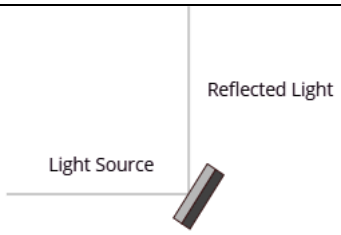
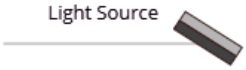
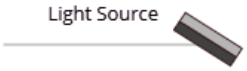
	The light hits the back mirror. The mirror will not reflect light.	
	The light hits the front mirror. The mirror will reflect light.	
	The light hits the front mirror. The mirror will reflect light.	
	The light hits the back mirror. The mirror will not reflect light.	

Table 5.8.9: Outcome of light reflection with all possible mirror's rotation

c. Light Absorber

Light absorber receives one or two light sources and blend their colour together. If light absorber only receives one light source, the blended colour is always same as the light source's colour. Table 5.8.10 lists out all the possible light colour while Table 5.8.11 lists out all the possible combination of blended colour for light absorber.

Light Colour
Neutral
Red
Green
Blue

Yellow
Orange
Purple
Cyan
Yellowish Green
Yellowish Blue

Table 5.8.10: All possible light colour

Colour A	Colour B	Blended Colour
Red	Green	Yellow
Red	Blue	Purple
Red	Yellow	Orange
Green	Blue	Cyan
Green	Yellow	Yellowish Green
Blue	Yellow	Yellowish Blue
Colour A	-	Colour A
-	Colour B	Colour B

Table 5.8.11: All possible combination of blended colour for light absorber

d. Gem

Gem has its own colour and output direction. Table 5.8.12 shows all the possible colour that the gem may have, while Table 5.8.13 lists out all the possible output direction.

Gem Colour

Red
Blue
Green
Yellow

Table 5.8.12: All possible gem colour

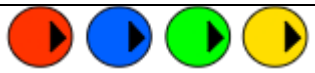
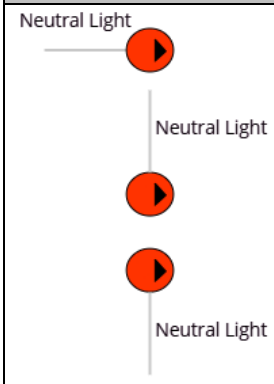
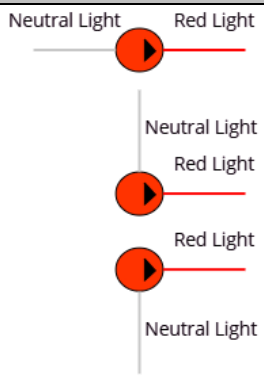
Gem Output Direction	Sketches
Left	
Right	
Top	
Bottom	

Table 5.8.13: All possible output direction of gem

Gem will only output the light with the gem's own colour if the gem is hit by the light source with neutral colour or the gem's own colour. Table 5.8.14 lists out the gem's behaviour in different situation.

Situation	Description	Outcomes
	The gem receives neutral colour from left, top or bottom direction. The gem will output light with its own	

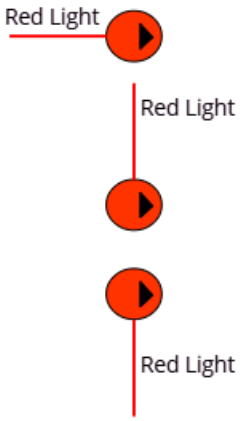
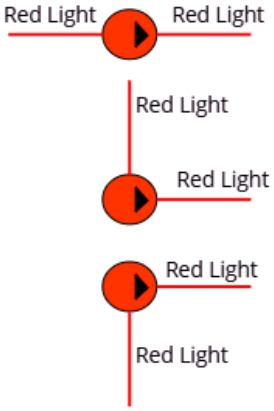
	colour in output direction.	
	The gem receives its own colour from left, top or bottom direction. The gem will output light with its own colour in output direction.	
	The gem does not receive neutral colour or its own colour. The gem will not output any light.	
	The gem will not output any light if the light source's direction is same as the output direction.	

Table 5.8.14: The gem's behaviour in different situation

Gem can be picked up and dropped by both players. To pick up or drop the gem, players need to follow the steps shown in Table 5.8.15 below.

No.	Steps	Sketches

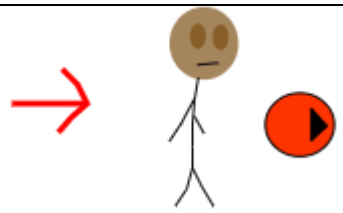
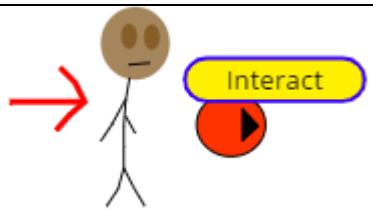
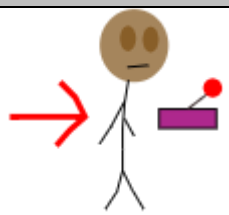
1	Stand near and face to the gem.	
2	UI displayed will show that gem is interactable by the players.	
3	Press down the pickup key once. The gem is picked up by the players	
4	Press down the drop key to drop the gem on player's foot.	

Table 5.8.15: Steps to pick up or drop the gem

e. Switch

Switch can be interacted to open the door. Table 5.8.16 below lists out the steps to open the door via switch.

No.	Steps	Sketches
1	Stand near and face to the switch.	

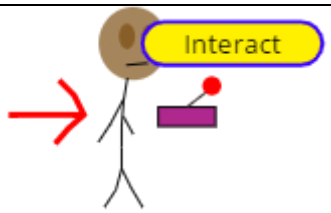
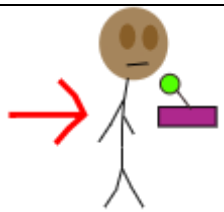
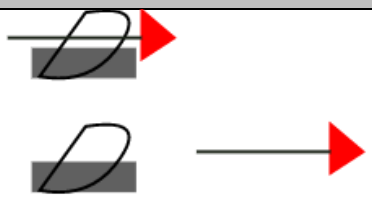
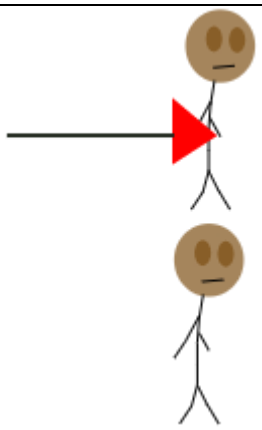
2	UI displayed shows the switch can be interacted by players.	
3	Press down the interact key to open the door via the switch.	

Table 5.8.16: Steps to open the door via switch

f. Fire Arrow Trap

Fire arrow trap is a trap that shoots the fire arrow every fixed amount of time interval. Table 5.8.17 explains the behaviour of fire arrow trap.

Behaviour	Sketches
Fire arrow trap shoots fire arrow every fixed amount of time interval.	
Fire arrow will damage players and disappear after hitting players.	

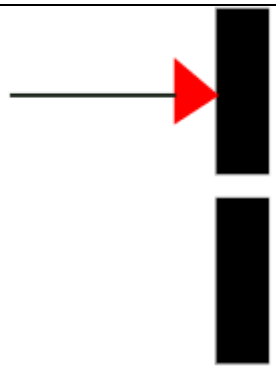
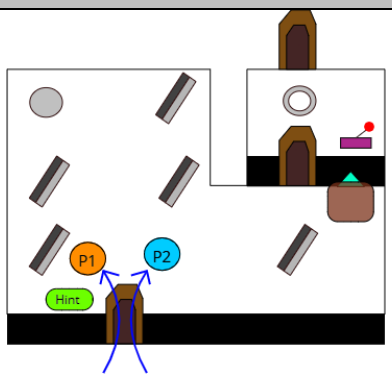
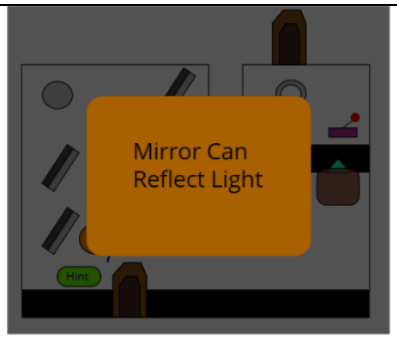
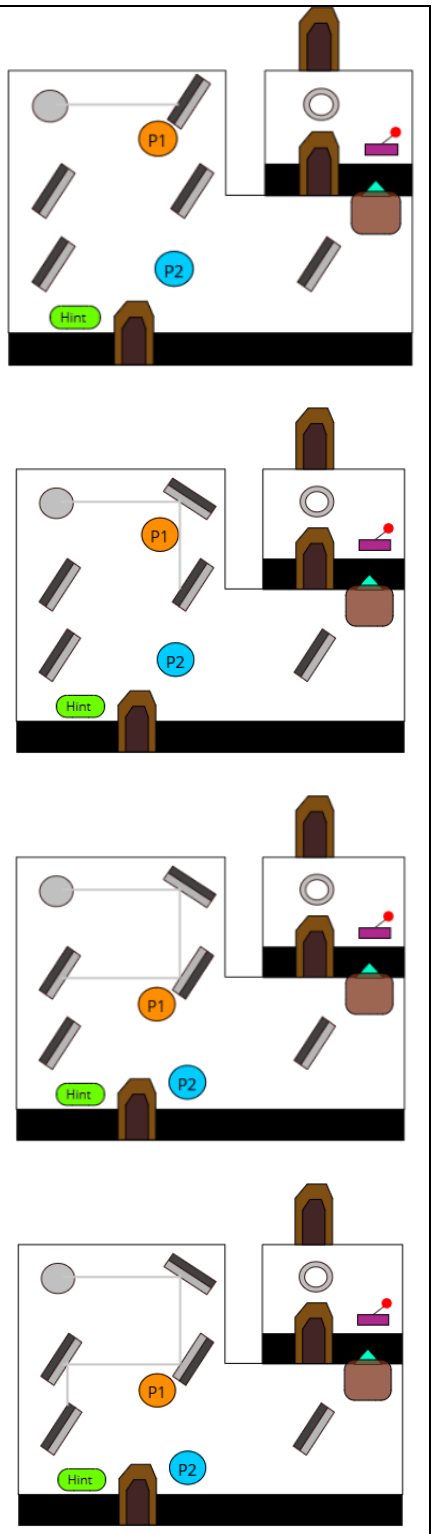
Fire arrow will also disappear when hitting wall.	

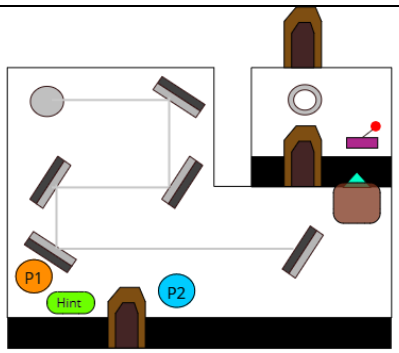
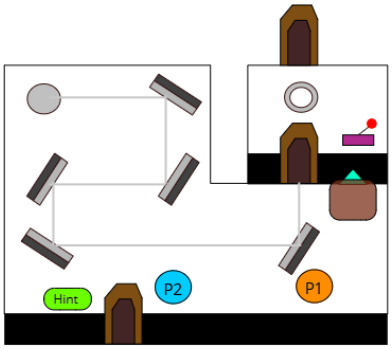
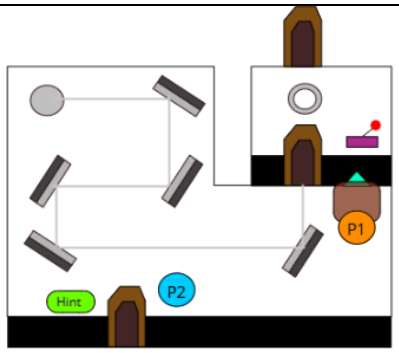
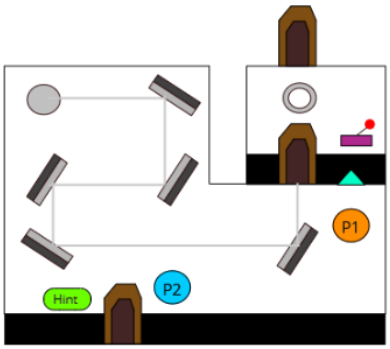
Table 5.8.17: The behaviour of fire arrow trap

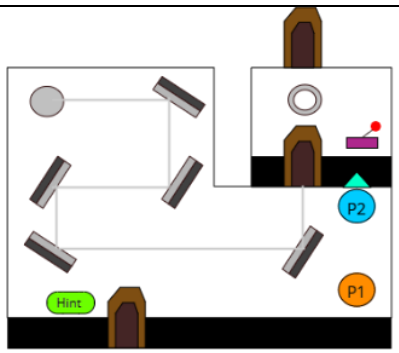
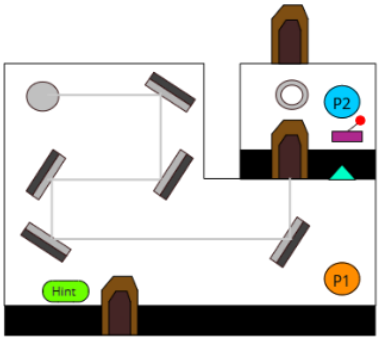
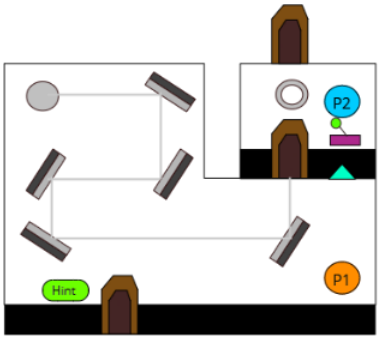
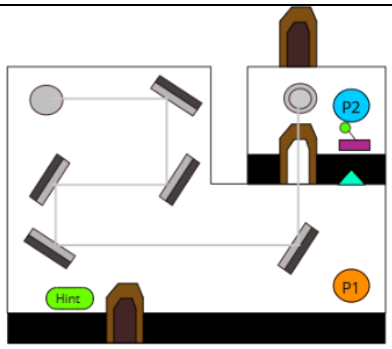
g. Level 1 Puzzle Solving

To solve the light mirror puzzle in level 1, players need to figure out a way to let the neutral light hitting the light absorber. Table 5.8.18 lists out the step-by-step process to solve the puzzle.

No.	Steps	Sketches
1	Players enter the puzzle room from previous door.	
2	Players open the hint to understand how to solve the puzzle.	

3	Players rotate the mirror until the lights are reflected on each mirror.	

		 
4	Lights are blocked by the switch door. P1 needs to pick up the brick, so that P2 can pass through the small hole to open the switch door via the switch.	 

		  
5	Neutral light hits the light absorber. The blended colour is neutral colour.	

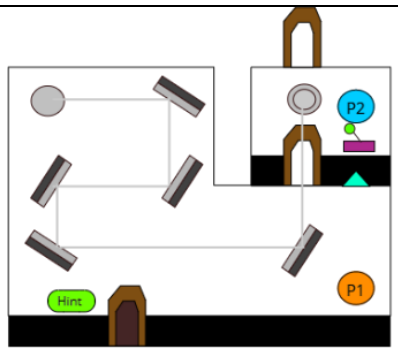
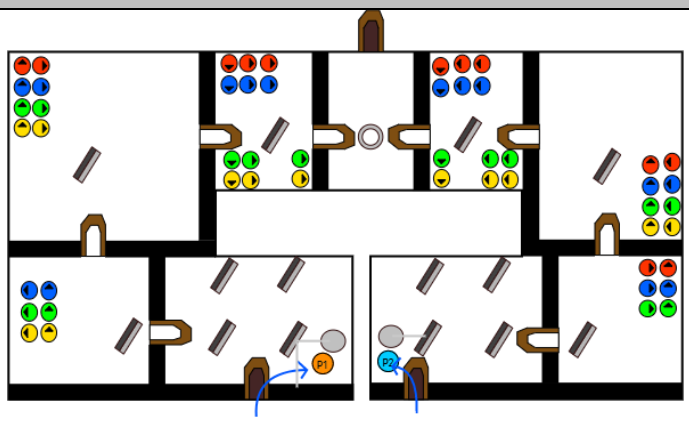
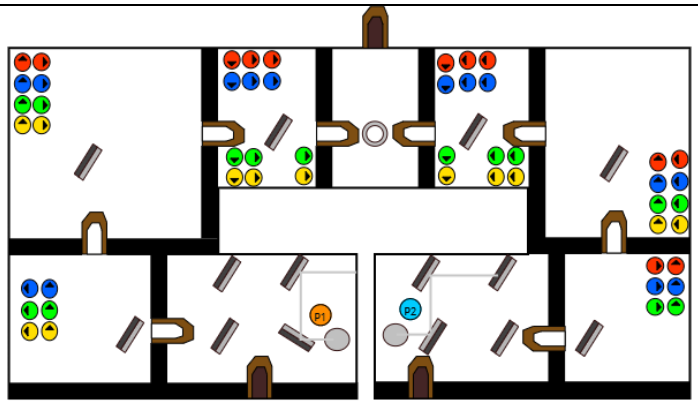
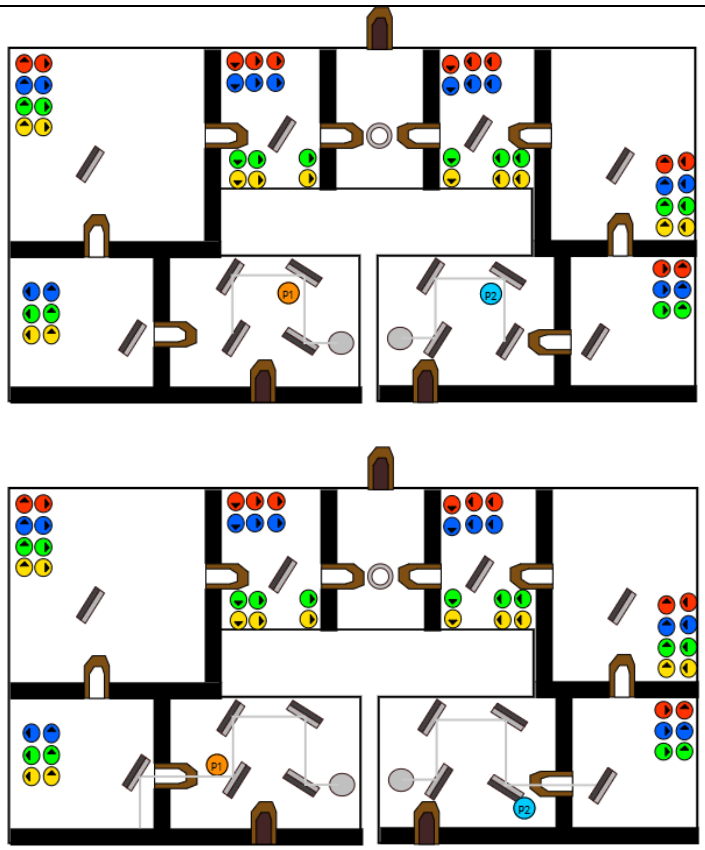
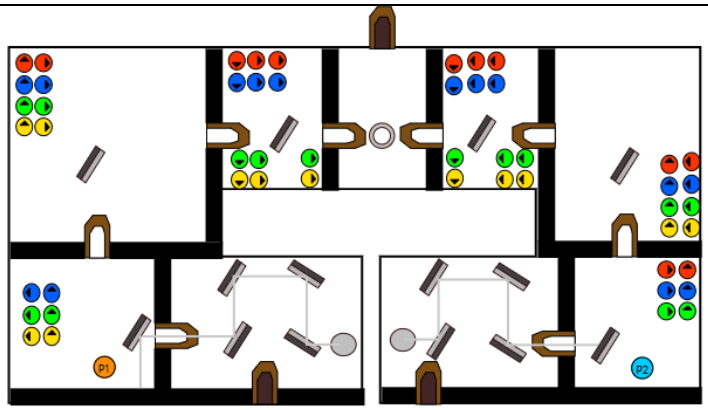
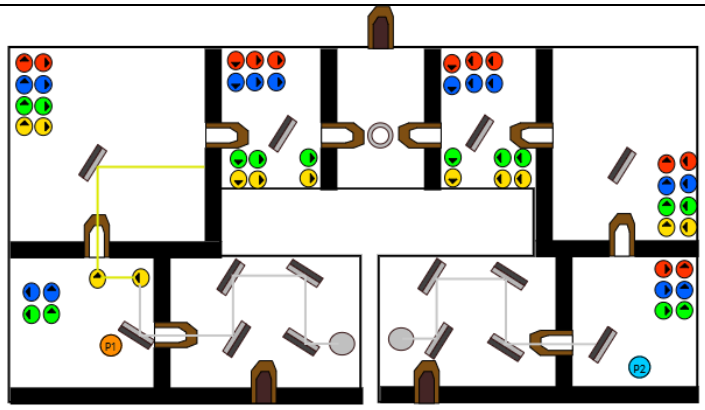
6	Puzzle solved and the puzzle door is opened.	

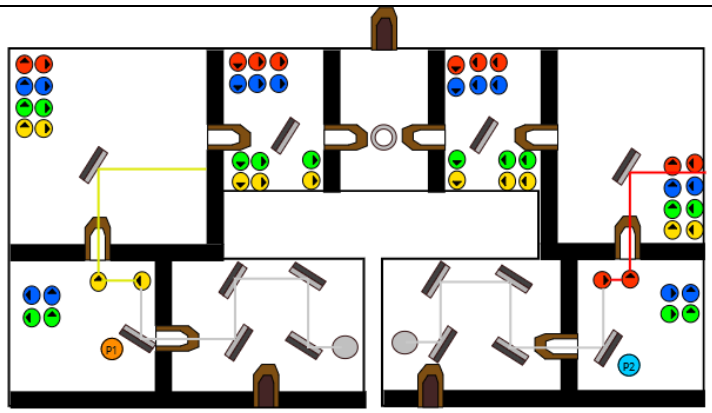
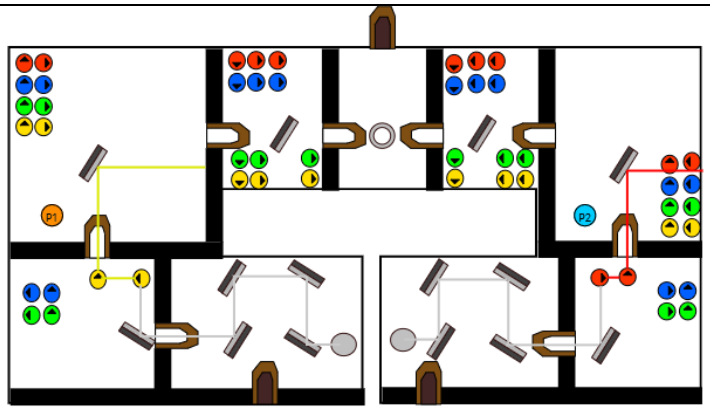
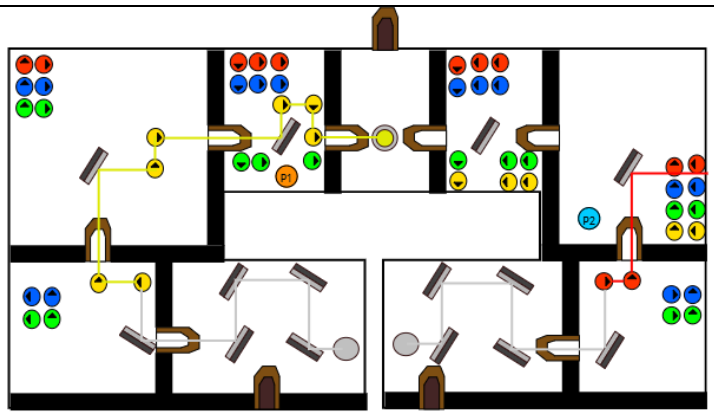
Table 5.8.18: Step-by-step process to solve light mirror puzzle in level 1

h. Level 2 Puzzle Solving

To solve the light mirror puzzle in level 2, players need to figure out a way to let light absorber become orange colour. Table 5.8.19 lists out the step-by-step process to solve the puzzle.

No.	Steps	Sketches
1	Players enter the puzzle room from previous door.	
2	Players rotate the mirrors in order to reflect the light to the next room.	

		
3	Players enter the next room. Red and yellow colour are required to merge into orange colour.	
4	The player on the left side has to adjust the position of yellow gems and mirrors.	

5	The player on the right side has to adjust the position of red gems and mirrors.	
6	Players enter the next room.	
7	The player on the left side has to arrange the mirror and gems until the yellow reflected light hits the light absorber.	

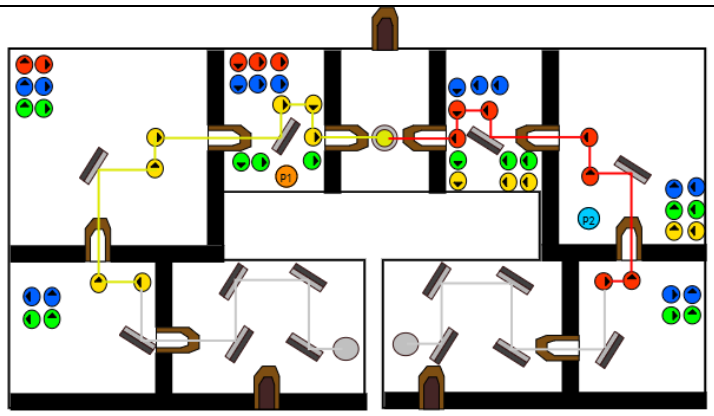
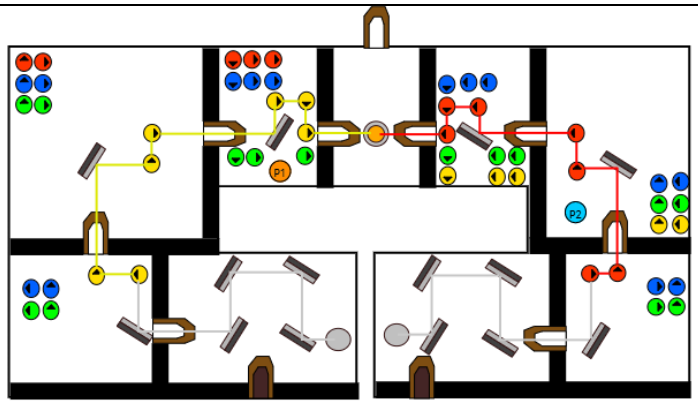
8	The player on the right side also arranges the mirror and gems until the red reflected light hits the light absorber as well.	
9	The light absorber changes to orange colour and, the puzzle door is opened.	

Table 5.8.19: Step-by-step process to solve the puzzle.

5.9 Three Rotator Puzzle

Three rotator puzzle is introduced in level 2. The components used in the puzzle are listed in Table 5.9.1. below.

Components	Description
Hint Object	Text-based hint. Displayed hint is “Match the patterns to proceed”.
Stepping Block	The blocks that can be stepped to open the small door.
Switch	Interact to open the small door.

Three-Rotator Machine	A machine that can be rotated.
Machine Controller	Interact to rotate the three-rotator machine object.
Small Door	The door is opened by the stepping block or switch.
Puzzle Door	The door is opened after the puzzle is solved.

Table 5.9.1: Components of three rotator puzzle

Figure 5.9.2 shows the sketches of the components of three rotator puzzle in level 1, while Figure 5.9.3 shows the actual implementations in Twin's Elude game.

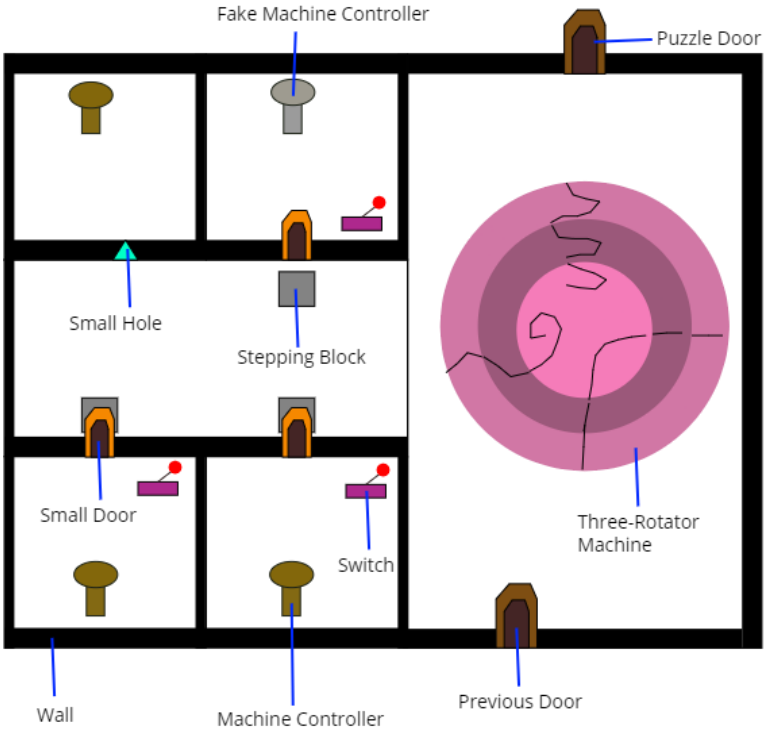
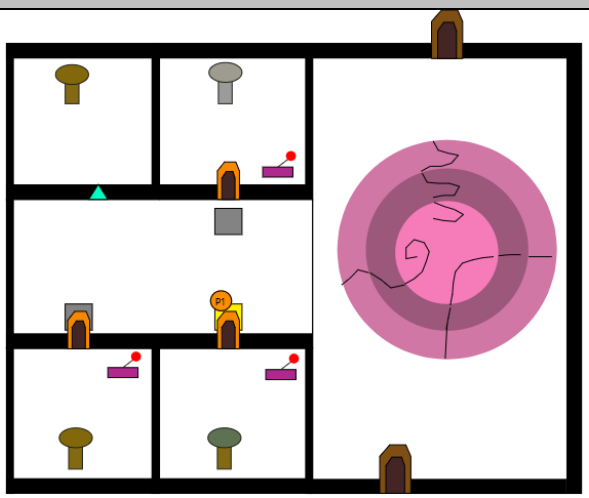


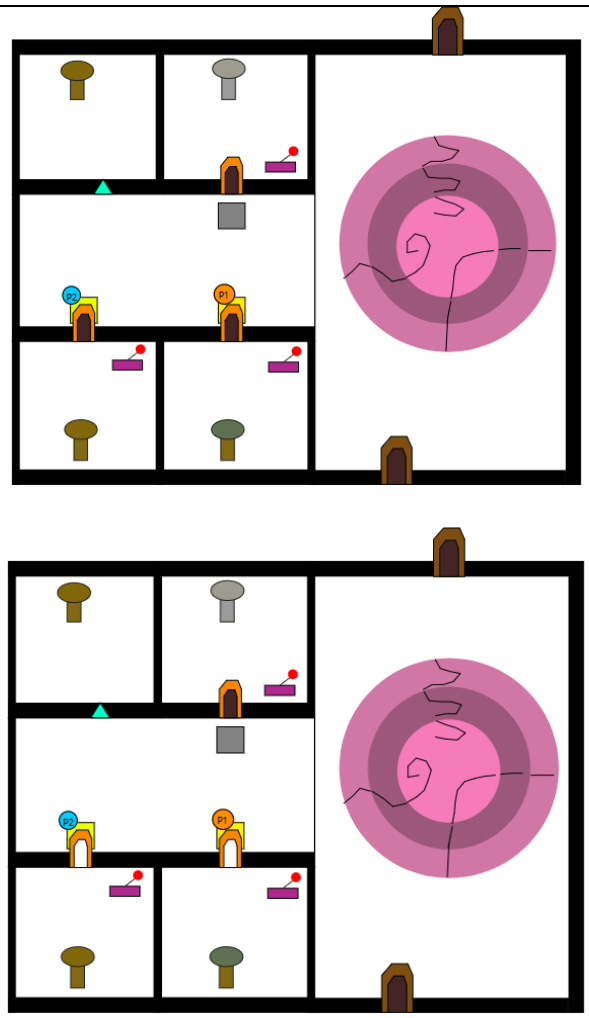
Figure 5.9.2: The sketches of placement of three rotator puzzle in level 1

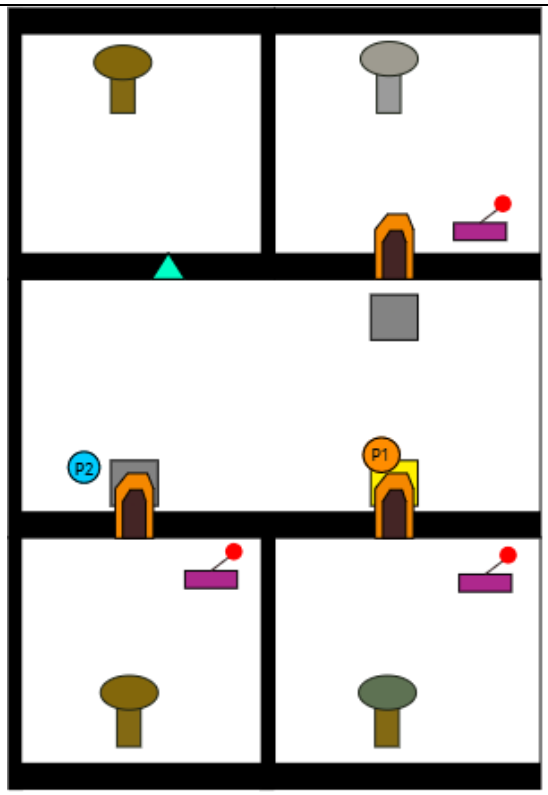
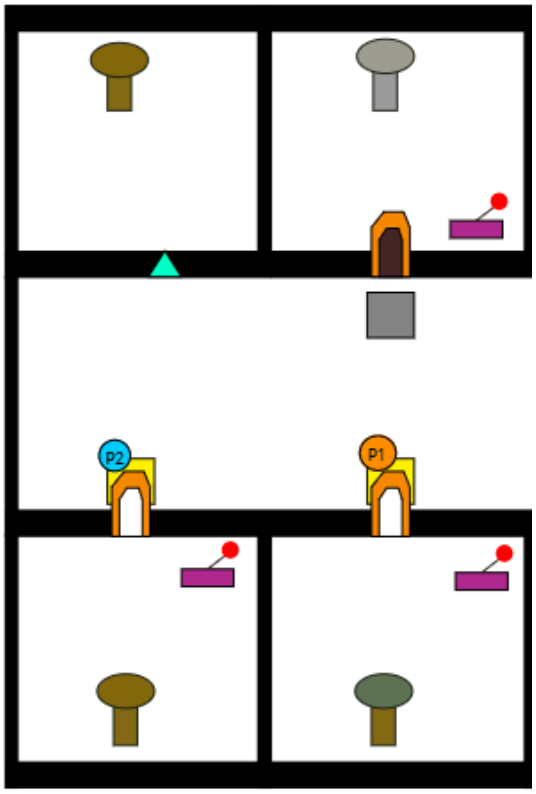
Figure 5.9.3: The actual implementations of three rotator puzzle in level 1

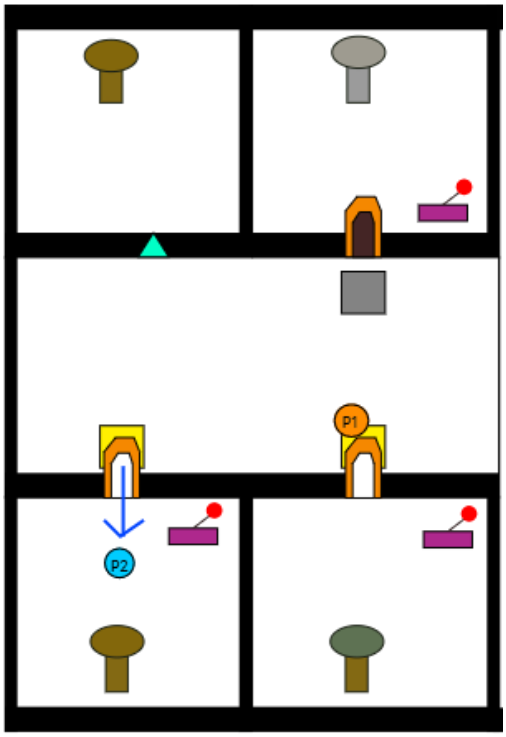
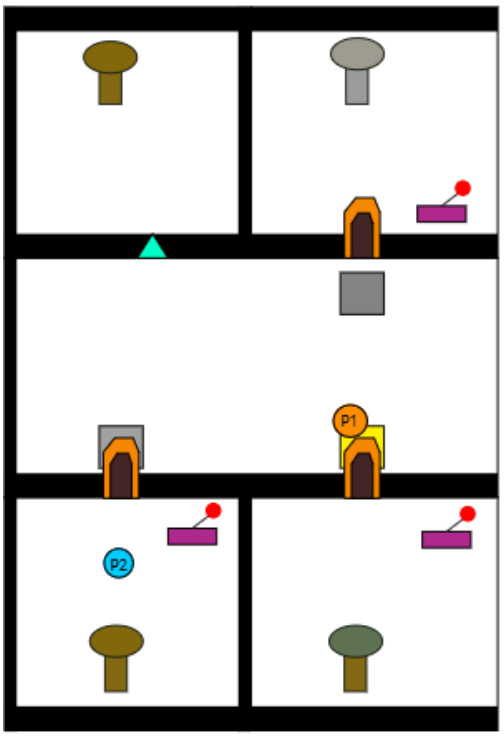
a. Enter and Exit Small Door

To enter and exit the small doors, players need to follow the steps shown in Table 5.9.4 below.

No.	Steps	Sketches
1	Both players need to step on two separate stepping blocks to open the respective small doors. Stepping blocks will change to yellow colour when being stepped.	

2	The door closes when only one player steps on the stepping block.	
3	To enter the small door, player needs to roll to get inside the small door before the door is closed.	

		 
4	To exit the small door, player needs to interact with the switch	

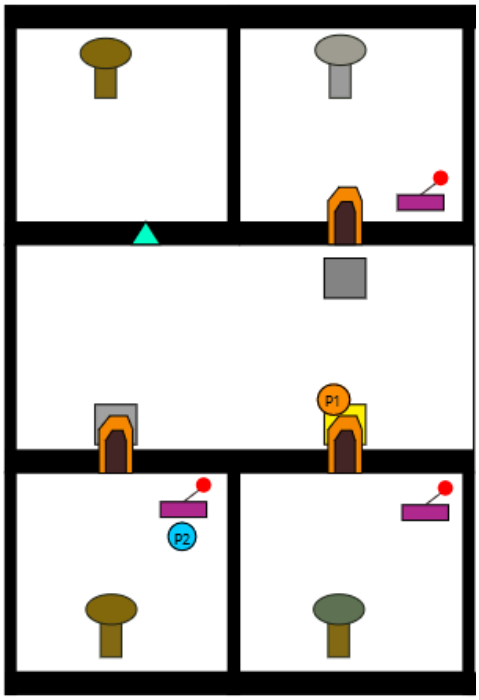
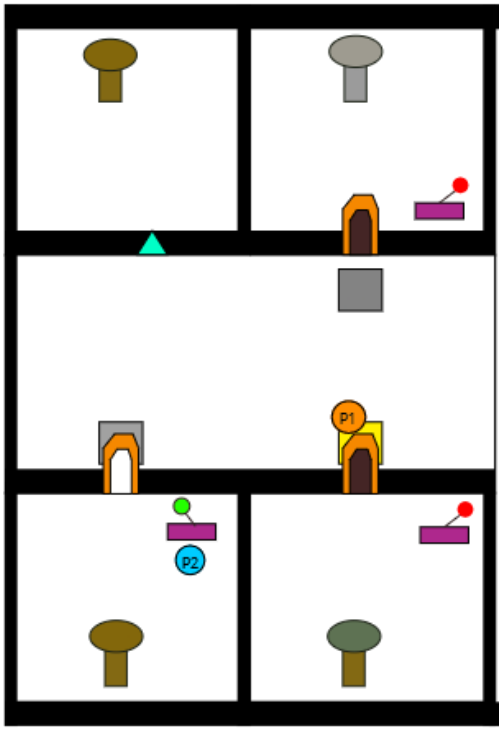
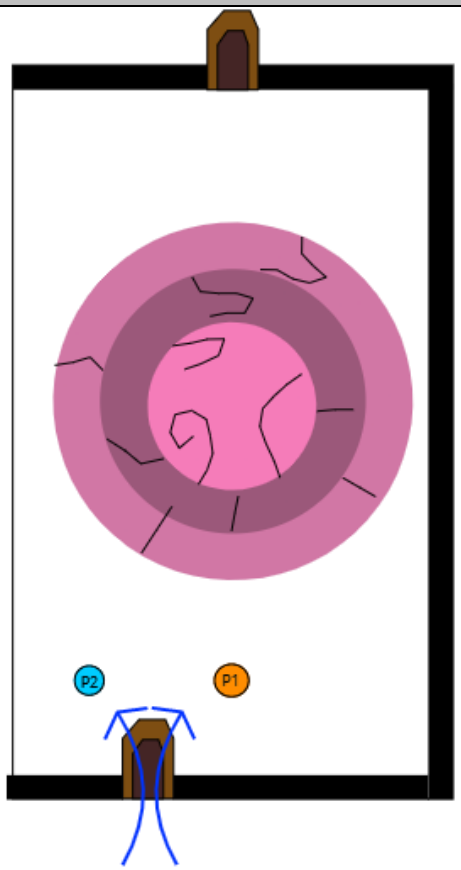
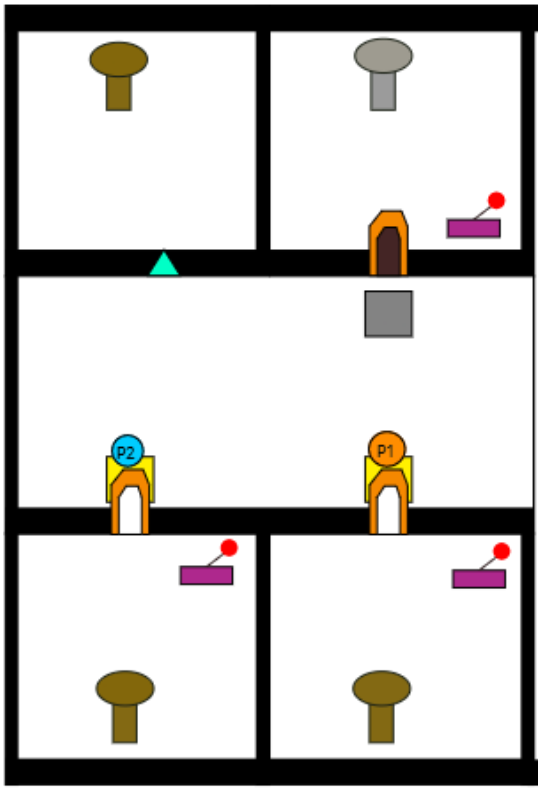
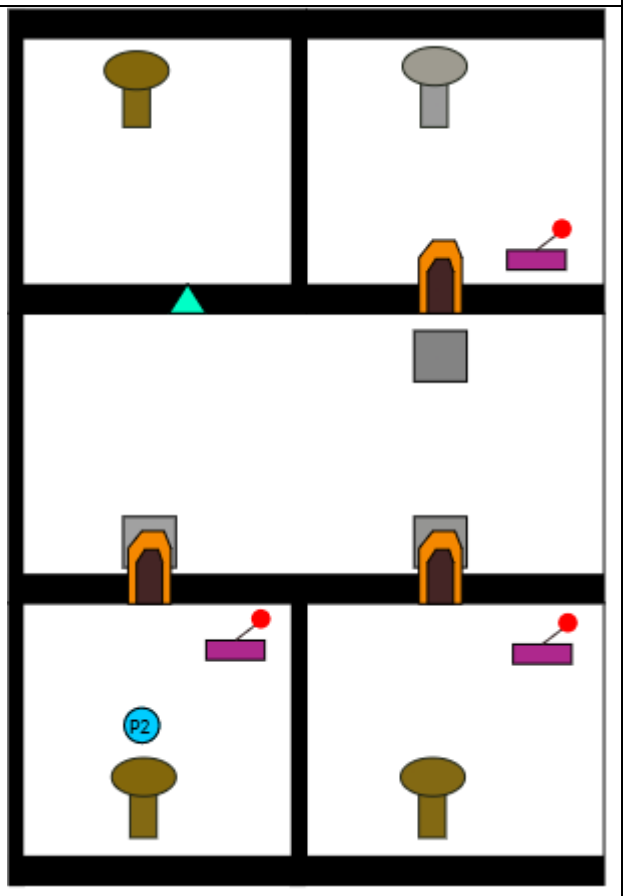
	to open the closed small door.	 

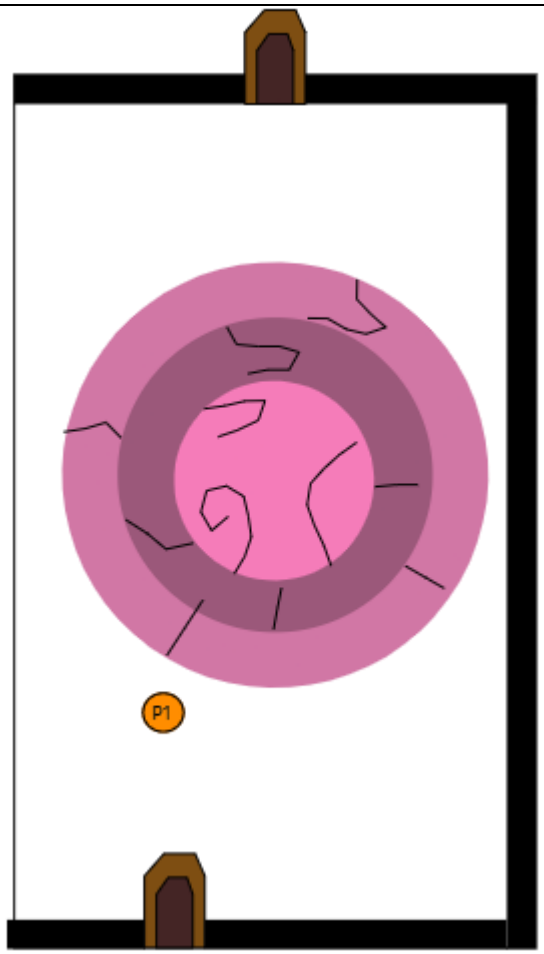
Table 5.9.4: Steps to enter or exit small door.

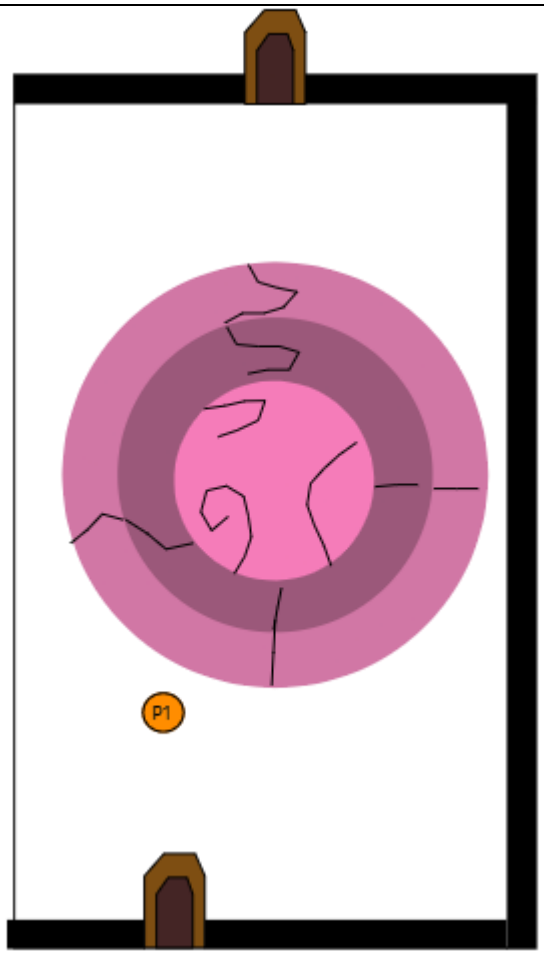
b. Puzzle Solving

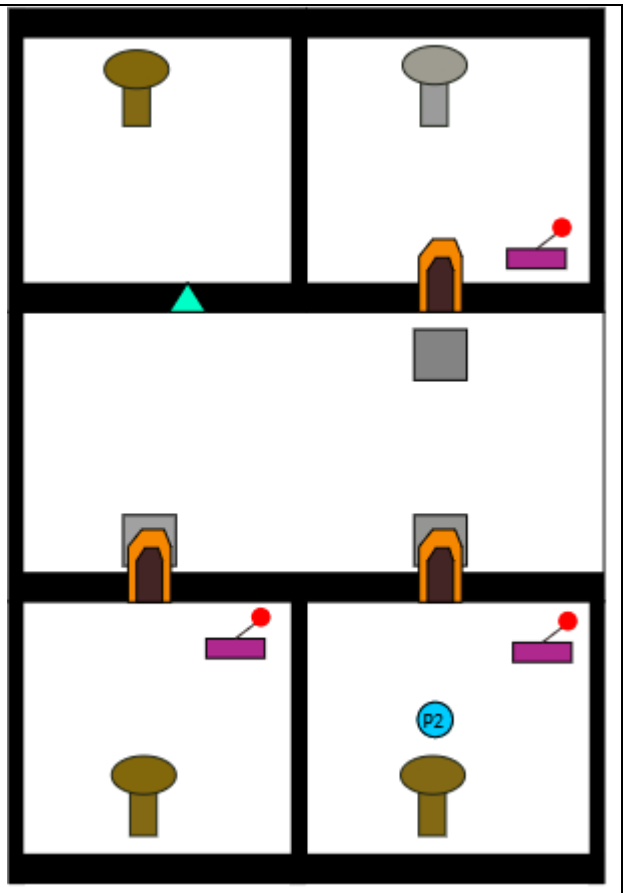
To solve the three-rotator puzzle, players need to rotate the three-rotator machine until all the patterns are matched. Table 5.9.5 shows the step-by-step process to solve the puzzle.

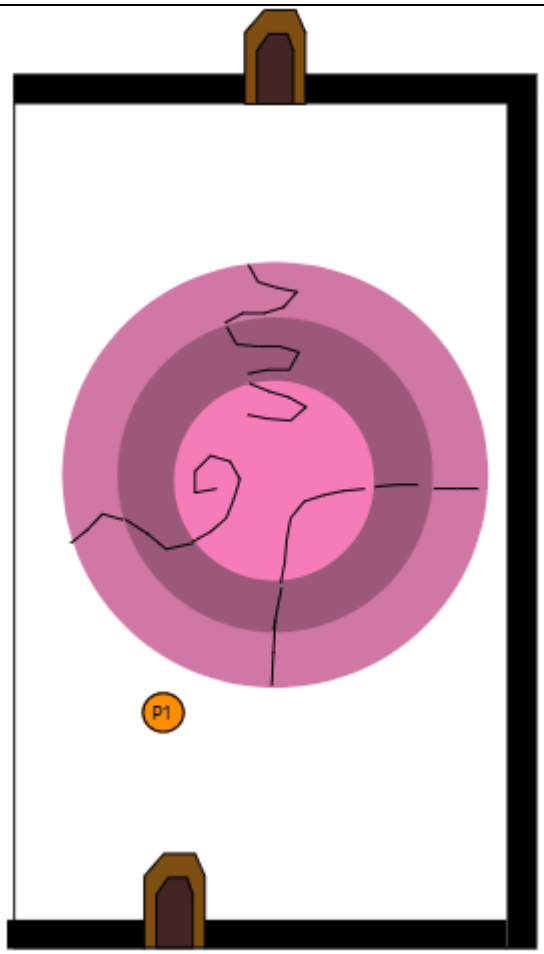
No.	Steps	Sketches
1	Players enter the puzzle room from previous door.	

2	Players step on the stepping blocks to open the door.	
3	One of the players enters inside the small door and interact with the machine controller, while another player stands beside the machine to provide views.	

		 P1

		 P1

4	Repeat the process until all the patterns are matched in the three-rotator machine.	

		 P1

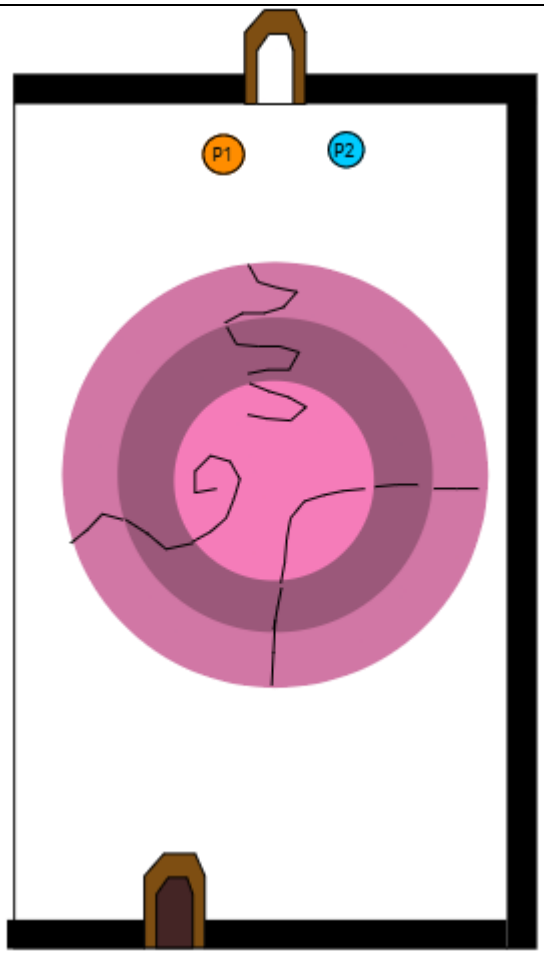
5	When the patterns are matched, the puzzle door is opened.	

Table 5.9.5: Step-by-step process to solve the three-rotator puzzle

5.10 Test Plans

Test plans are developed to make sure each puzzle functions as expected during the implementation stage. The group of people that test and provide feedbacks are from development team members, supervisors, friends and family members.

a. Stepping Puzzle

The test plans for stepping puzzle are listed out in Table 5.10.1 below.

No.	Test Plans	Expected Results	Implemented
1	Two players step on the lighted blocks.	Two random blocks are lighted, and a	Yes

		correct sound is played.	
2	Either one of the players steps on the unlighted block.	Two random blocks are lighted, and a wrong sound is played.	Yes
3	None of the players steps on any block.	Two random blocks are lighted every 10 seconds.	Yes
4	Two players step on the lighted blocks for three consecutive times.	All blocks are lighted, and the puzzle door is opened.	Yes

Table 5.10.1: Test plans for stepping puzzle

b. Pixel Drawing Puzzles

The test plans for pixel drawing puzzles are listed out in Table 5.10.2 below.

No.	Test Plans	Expected Results	Implemented
1	The player presses down interact key down once when the current stepped blocks have default colour.	The colour of stepped blocks changes to the player's own colour.	Yes
2	The player presses down interact key down once when the colour of current stepped blocks is the player's own colour.	The colour of stepped blocks changes to the default colour.	Yes
3	The player presses down interact key down once when the colour of current	The colour of stepped blocks	Yes

	stepped blocks is another player's colour.	replaces with the player's own colour.	
4	The player walks on multiple blocks while pressing the interact key.	The stepped blocks are toggled as described in test plans 1, 2 and 3.	Yes
5	The colour of stepping blocks matches the patterns in the hint image.	The stepping blocks freeze and the puzzle door is opened.	Yes

Table 5.10.2: Test plans for pixel drawing puzzles

c. Simple Light Mirror Puzzle

The test plans for simple light mirror puzzle are listed out in Table 5.10.3 below.

No.	Test Plans	Expected Results	Implemented
1	Press down the interact key once while standing near and facing to the mirror.	The mirror is rotated for 90 degree clockwise.	Yes
2	The source light hits the front mirror.	The light will be reflected.	Yes
3	The source light hits the back mirror.	The light will not be reflected.	Yes
4	Players interact with the brick object.	Only P1 can pick up the brick object.	Yes
5	Players interact with small hole.	Only P2 can pass through the small hole.	Yes

6	Players interact with the switch.	The switch door will be opened.	Yes
7	The light hits the wall.	The light source will not penetrate through wall.	Yes
8	The light hits the brick object.	The light source will not penetrate through brick object.	Yes
9	The light absorber receives one source of light.	The colour of light absorber changes to the source light's colour. The puzzle door is opened.	Yes

Table 5.10.3: Test plans for simple light mirror puzzle

d. Full Light Mirror Puzzle

The test plans for full light mirror puzzle are listed out in Table 5.10.4 below.

No.	Test Plans	Expected Results	Implemented
1	Press down the interact key once while standing near and facing to the mirror.	The mirror is rotated for 90 degree clockwise.	Yes
2	The source light hits the front mirror.	The light will be reflected.	Yes
3	The source light hits the back mirror.	The light will not be reflected.	Yes
4	The light hits the wall.	The light source will not penetrate through wall.	Yes

5	The light source hits gem in different situations.	The gem behaves as described in Table 5.8.14.	Yes

Table 5.10.4: Test plans for full light mirror puzzle

e. Three-Rotator Puzzle

The test plans for three-rotator puzzle are listed out in Table 5.10.5 below.

No.	Test Plans	Expected Results	Implemented
1	Two players step on the stepping blocks.	The two small doors in front of the stepping blocks are opened.	Yes
2	Either one player steps on the stepping block only.	All small doors are closed.	Yes
3	Interact with the machine controllers.	The three-rotator machine will rotate.	Yes
4	The patterns of the three-rotator machine are matched.	The puzzle door is opened.	Yes

Table 5.10.5: Test plans for three-rotator puzzle

5.11 Summary

Chapter 5 explains the details of gameplay screens, puzzle-related game items, puzzle components and puzzle designs in Twin's Elude game. The test plan is 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 participants.

6.2 Data Analysis

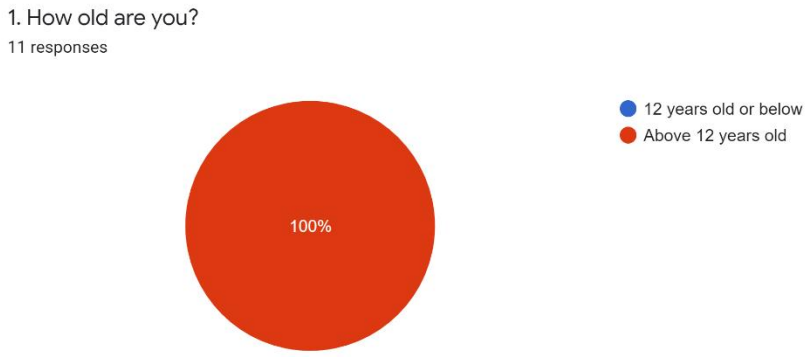


Figure 6.2.1: The percentages of participants in different age groups

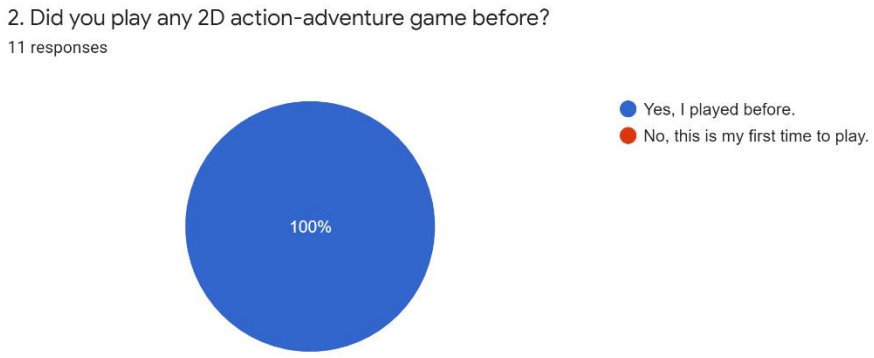


Figure 6.2.2: The percentages of participants that play 2D action-adventure game before

As shown in Figure 6.2.1 and Figure 6.2.2 above, all participants are categorized in the age group of above 12 years old and had prior experience of playing 2D action-adventure game before.

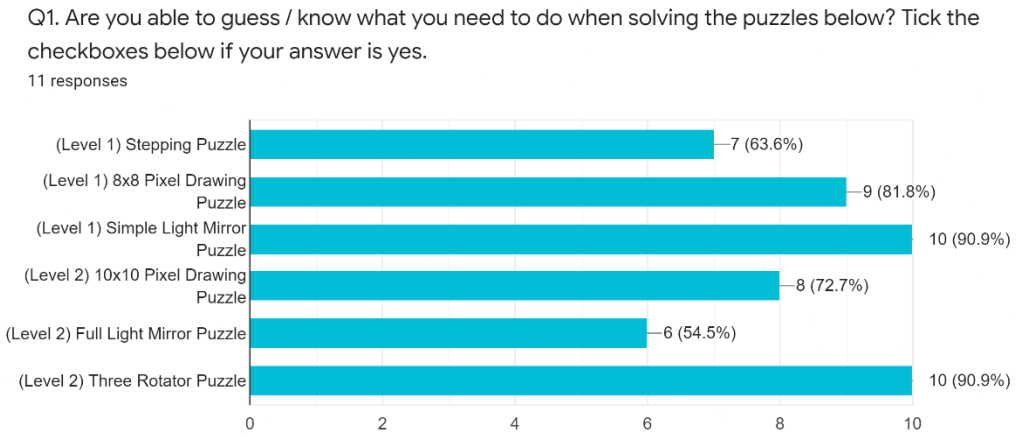


Figure 6.2.3: The percentages of participants that know what to do when solving each puzzle

As shown in Figure 6.2.3, 63.6% of the participants know what to do when solving the stepping puzzle in level 1, while 36.4% of the participants do not know what to do when solving the stepping puzzle in level 1.

81.8% of the participants know what to do when solving the 8x8 pixel drawing puzzle, while 18.2% of the participants do not know what to do when solving the 8x8 pixel drawing puzzle.

90.9% of the participants know what to do when solving the simple light mirror puzzle, while 9.1% of the participants do not know what to do when solving the simple light mirror puzzle.

72.7% of the participants know what to do when solving the 10x10 pixel drawing puzzle, while 27.3% of the participants do not know what to do when solving the 10x10 pixel drawing puzzle.

Only 54.5% of the participants know what to do when solving the full light mirror puzzle, while 45.5% of the participants do not know what to do when solving the full light mirror puzzle.

10 out of 11 participants know what to do when solving the three-rotator puzzle, while only 1 participant does not know what to do when solving the three-rotator puzzle.

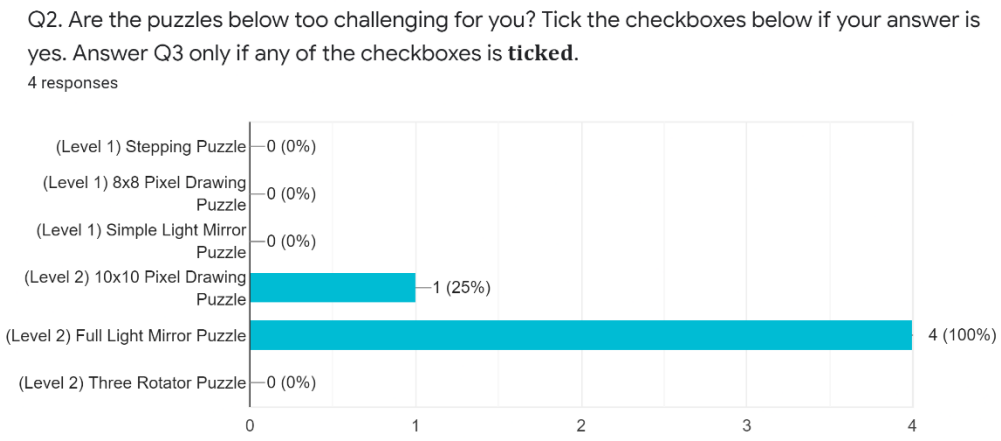


Figure 6.2.4: The percentages of participants that feel too challenging for each puzzle

As shown in Figure 6.2.4, all participants do not feel that the stepping puzzle, 8x8 pixel drawing puzzle, and simple light mirror puzzle are too challenging.

1 out of 11 participant feels that the 10x10 pixel drawing puzzle is too challenging to solve. 4 out of 11 participants feel that full light mirror puzzle is too challenging to solve.

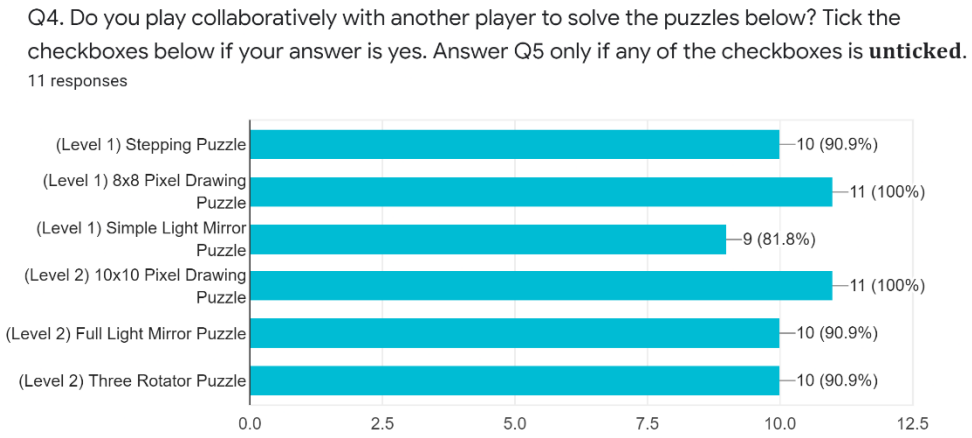


Figure 6.2.5: The percentages of participants play collaboratively with another player to solve each puzzle

More than 80% of the participants play collaboratively with another player to solve each puzzle.

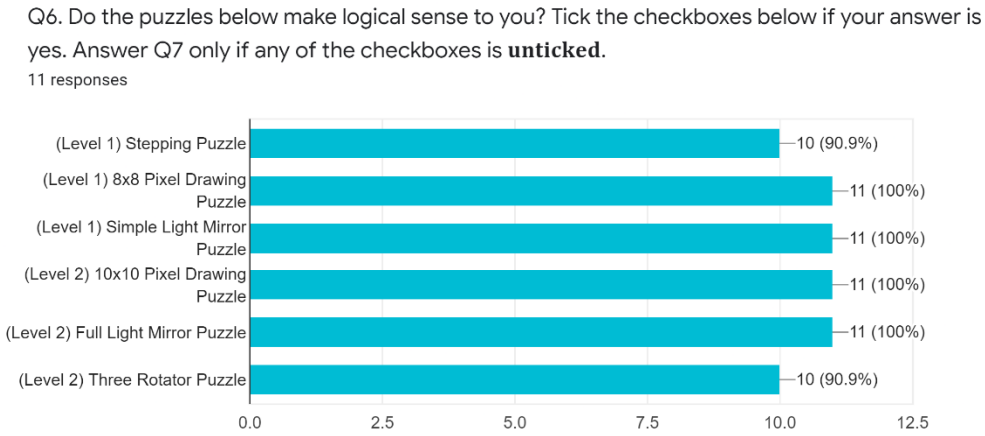


Figure 6.2.6: The percentages of participants feel that each puzzle makes logical sense

More than 90% of the participants feel that each puzzle makes logical sense.

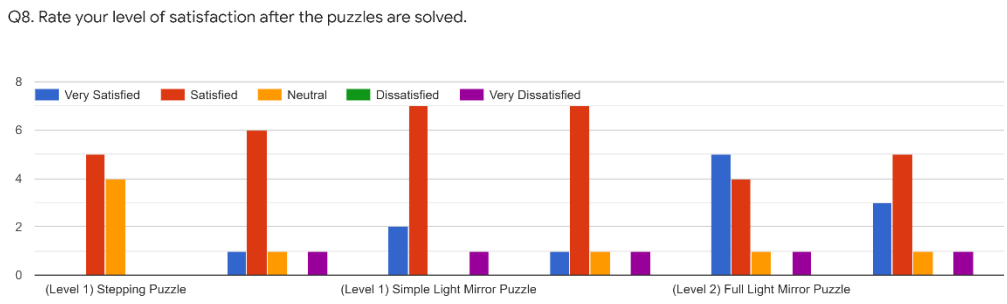


Figure 6.2.7: The percentages of participants on different level of satisfaction after the puzzle are solved

As shown in Figure 6.2.7, 5 out of 11 participants feel satisfied after solving the stepping puzzle. 4 out of 11 participants feel normal after solving the stepping puzzle. 2 participants choose to not answer this question.

After solving the 8x8 pixel drawing puzzle, 1 out of 11 participants feel very satisfied, 6 out of 11 participants feel satisfied, 1 out of 11 participants feel normal, 1 out of 11 participants feel very dissatisfied, and 2 participants choose to not answer this question.

After solving the simple light mirror puzzle, 2 out of 11 participants feel very satisfied, 7 out of 11 participants feel satisfied, 1 out of 11 participants feel dissatisfied, and 1 participant chooses to not answer this question.

After solving the 10x10 pixel drawing puzzle, 1 out of 11 participants feel very satisfied, 7 out of 11 participants feel satisfied, 1 out of 11 participants feel normal, 1 out of 11 participant feels very dissatisfied, and 1 participant choose to not answer the question.

After solving the full light mirror puzzle, 5 out of 11 participants feel very satisfied, 4 out of 11 participants feel satisfied, 1 out of 11 participants feels normal, and 1 participant feels dissatisfied.

After solving the three-rotator puzzle, 3 out of 11 participants feel very satisfied, 5 out of 11 participants feel satisfied, 1 out of 11 participants feels normal, 1 out of 11 participants feels dissatisfied, and 1 participant chooses to not answer this question.

6.3 Discussion

According to Schell (2008), a good puzzle has a clear goal, while a bad puzzle makes players confuse what to do. Around half of the participants cannot guess what they need to do when solving the full light mirror puzzle. This indirectly causes the participants to feel too challenging to solve the puzzle, as they could not understand the goal of the puzzle.

According to A.Einhorn (2015), good puzzle design gives a player the moment of satisfaction when the solution that he thinks hard works. Most of the participants feel satisfied after playing the puzzle.

According to Luban (2002), a lot of players will lose interest when a puzzle is impossible to break. The hint is provided in each puzzle to provide clues for the players to solve the puzzle.

6.4 Summary

The result of survey is analysed and discussed in Chapter 6. The next chapter explains the challenges or obstacles that Medic team met along the development process. The future enhancement of Twin’s Elude and research direction are mentioned as well.

Chapter 7: Conclusion

Along the development process, the author had encountered many obstacles and challenges. One of the challenges is heavy schedule. Each of the team members of Twin's Elude project has 1 to 3 subjects to be handled individually along the game development. Each member needs to manage his own time wisely. The second challenge is time constraints. The project is given only around 5 months of development time to make a complete game and research report at the same times. The third challenge is immature working pipeline at early stage. The work distributed between each member is not balanced. The challenge is solved by having the discussions among team members and re-adjust the workflow.

There are still rooms of improvements that can be made in Twin's Elude game. One of the future enhancements is to add save points in the game. When players die in the game, players need to respawn at the start point of the level again. The save points can let players respawn at the latest checkpoints and save players' time. Secondly, add support for animation-based hints. Animation can give players more clearly visual clues as compared to texts only. Thirdly, support more than 2 players to connect to the game at the same times. Currently, the game only supports exactly two players to connect to the game within one single version build. Adding this support can make more pairs of players to play the game at the same time under the same version build.

The future research direction can be the study of the effect of complexity of puzzle on the player's experience.

References

Bates, B. (2004). *Game Design* (2nd ed.). Cengage Learning PTR.

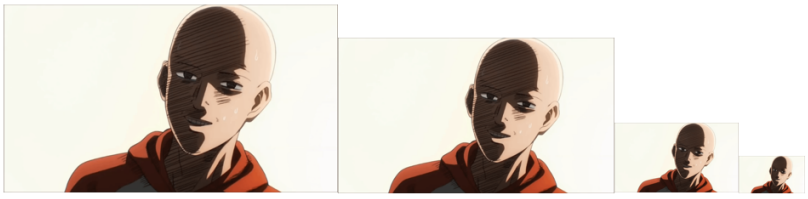
Einhorn, A. (2015, May 28). *Four-step puzzle design*. Gamasutra. https://www.gamasutra.com/blogs/AsherEinhorn/20150528/244577/Fourstep_puzzle_design.php

Luban, P. (2002, December 6). *Designing and Integrating Puzzles in Action-Adventure Games*. Gamasutra. https://www.gamasutra.com/view/feature/131326/designing_and_integrating_puzzles_.php?print=1

Schell, J. (2008). *The Art of Game Design: A Book of Lenses* (1st ed.). CRC Press.

TED. (2009, December 4). *Talks Scott Kim takes apart the art of puzzles* [Video]. YouTube. https://www.youtube.com/watch?v=EHxR9kBVVV4

Appendix A: Proposal Presentation Slides



FYP Games Proposal

Name	ID	Course / Year
Koh Wan Yee	1803185	GS / Y3S2
Muhamad Elias Bin Mohd Alif Leong	1705608	GS / Y3S2
Tan Wei Yon	1600825	GV / Y3S2

Game 1: Twin's Elude

Story

- Living in a world where's twin is taboo because ex-demon rulers were a twin pairs.
- Two twin forsaken by their village and were thrown into sacrificial well.
- Villagers doesn't know there's a monster dungeon inside the well, they don't even care what's available underneath as long as they can sacrifice the twin.
- Twin managed to survive the drop, after waking up, they saw a dungeon door in front of them.
- Now, the twin must work do whatever it takes to survive and escape the dungeon to fight their destiny.

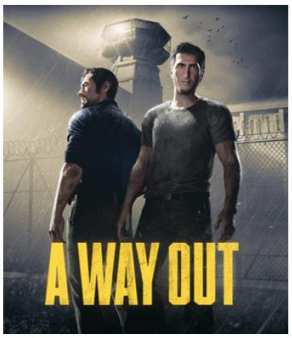
Game Info

- **Genre: Action-Adventure**
- **Target Audience: 12++**
- **Graphic: 2D Top-Down View**
- **Target Platform: PC**
- **Control Device: Keyboard**

Unique Selling Point

- 2D version of compulsory to play two-players with split-screen.
- Must work together to solve puzzles even though they can move to seperate locations.
- Screen transition change from split screen to one screen while playing. (Exp: Will change to one screen only when fighting boss)

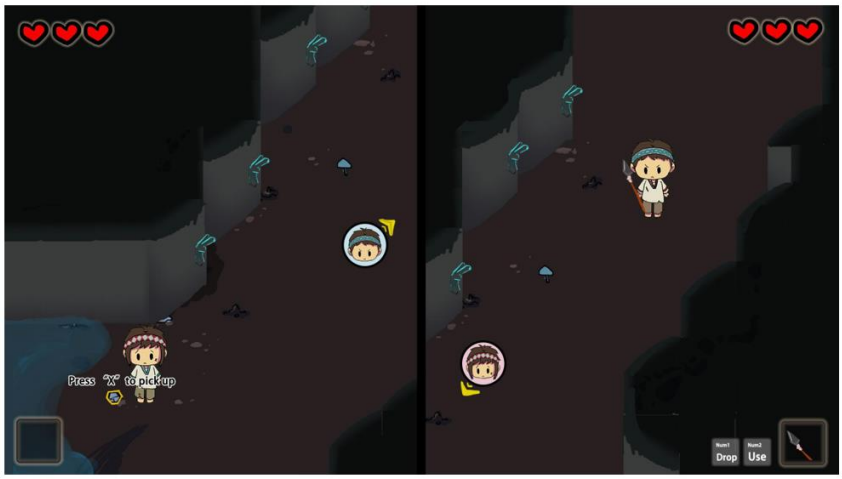
Inspirations



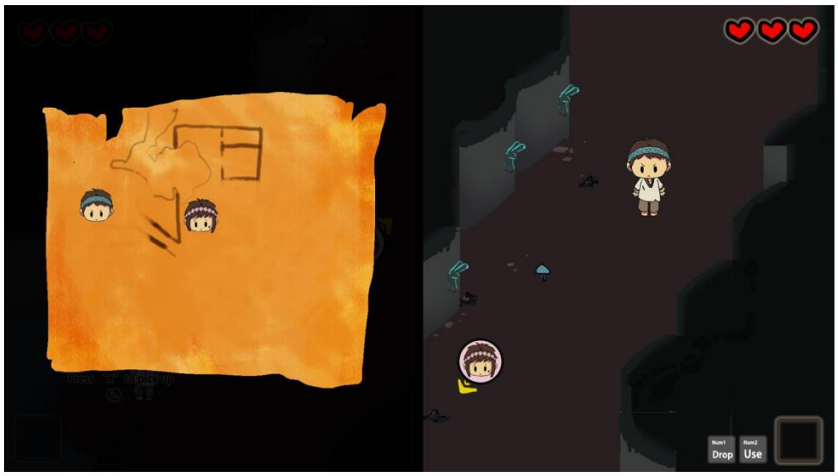
Character Design

- Twin's taboo - Madagascar Zulu's
- Clothing Reference

Split Screen + Pick Up + Character Location

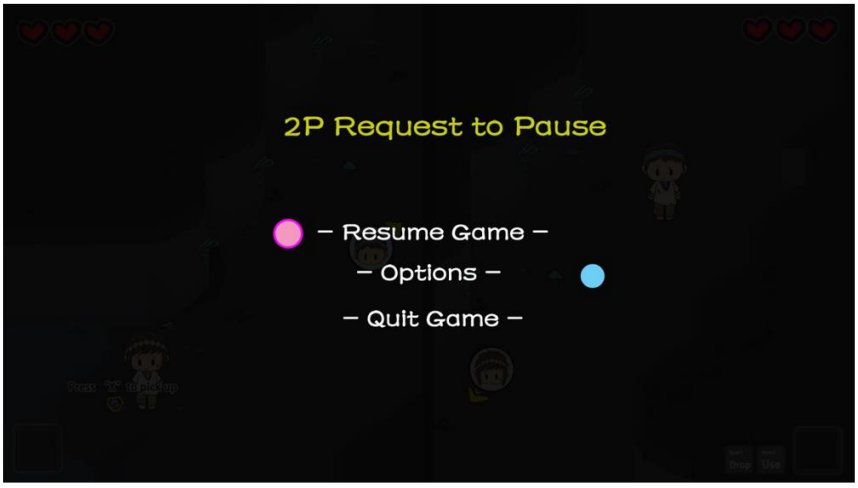


Map (When only one player opening it)

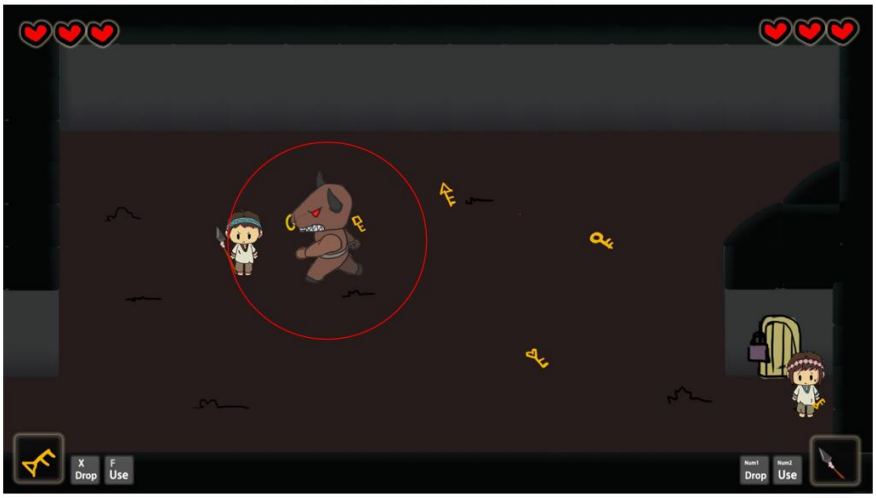


Map (When two player opening it)

Pause Scene



Boss Scene



Game Networking

- Photon Plugin in Unity engine.
- Client-server architecture
- Why using Photon?
  - Save tons of development times.
  - No need to deal with low-level socket programming.

Potentially To Be Added

- Both characters will have different functions, can do different things with each of them.
- Controller support.

Game 2: Trance Authorized

Story

- Player play as Hypnotherapist that helps people to forget about their trauma.
- One day, “Cody” mother fell ill and he needed a lot of money.
- While looking for a way to obtain more money, he saw a big research company recruiting huge numbers of people to retrieve an artifact at their destroyed facility.
- “Cody” decided to take on the job and went to retrieve the artifact with numbers of people.
- However, they didn’t know that the place was infested with monsters and terrorist.
- Without the option to turn back, “Cody” must press forward to get the artifact to get the fund to save his mother.

Game Info

- **Genre: Action-Adventure**
- **Target Audience: 12++**
- **Graphic: 2D Top-Down View**
- **Target Platform: PC**
- **Control Device: Keyboard**

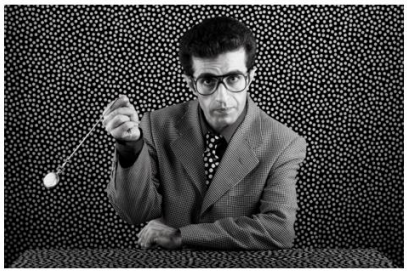
Unique Selling Point

- Hypnotize the enemies as the core gameplay.
- The skills and possibilities of the character depend on the other AIs instead of the main character itself.

Inspirations

Character Design

- Smart/formal clothing

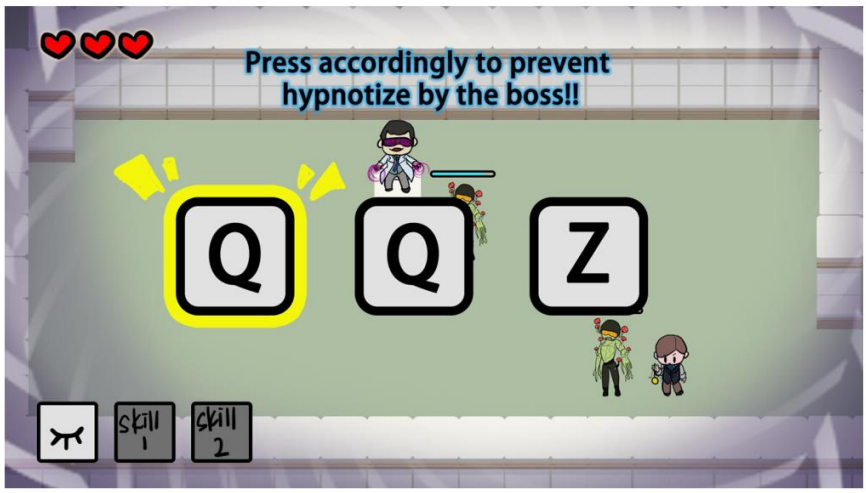


Hypnosis State(Player Detect Radius)

Hypnosis State

Boss Fight

Boss QTE



Potentially To Be Added

- More functions to the main characters.
- Controller support.

Miscellaneous

Project Scope

1st Game: Twin's Elude

- Minimum Levels: 3 - 5
- Minimum Boss Fights: 1 - 2
- At least functional online 2D multiplayer experience.
- Suitable sound effect/ BGM used.
- Overall visual looks integrated and suitable for the theme.
- Functional Bugs Tolerant: < 5% - 10%.

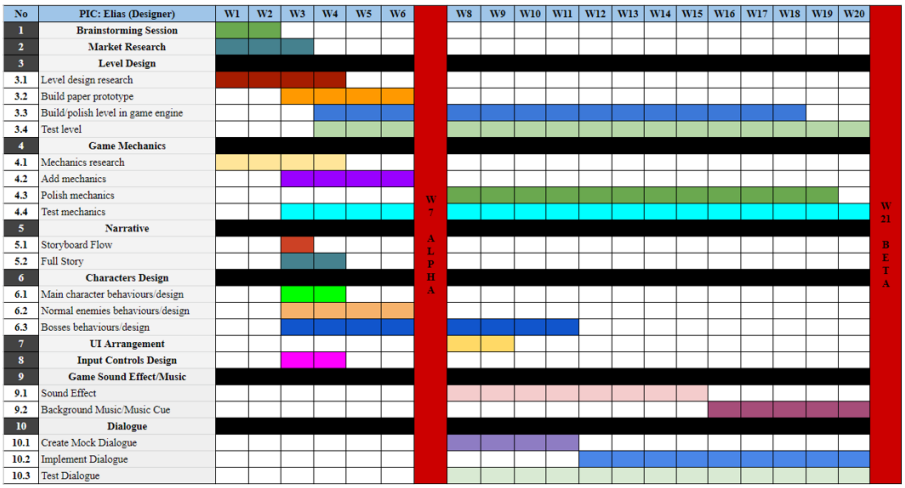
2nd Game: Trance Authorized:

- Minimum Levels: 3 - 5
- Minimum Boss Fights: 1 - 3
- Smooth transition between main character and the controlled AI.
- Suitable sound effect/ BGM used.
- Overall visual looks integrated and suitable for the theme.
- Functional Bugs Tolerant: < 5%

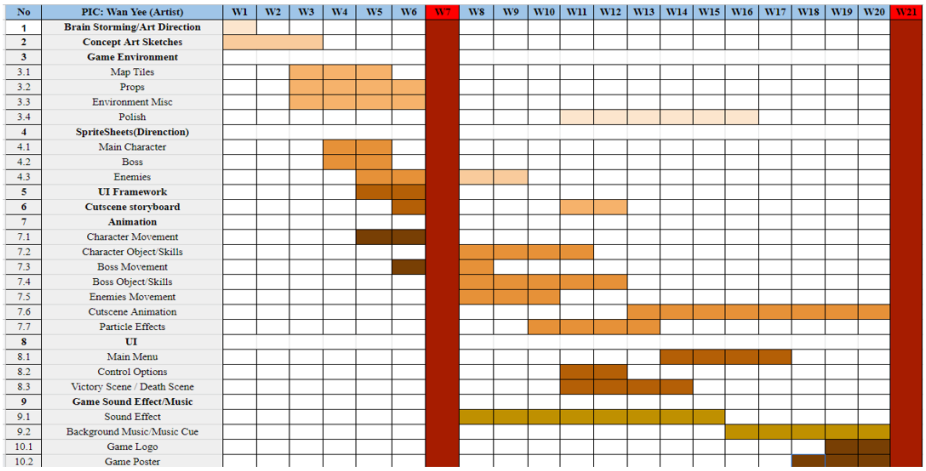
Schedule / Gantt Chart (Wei Yon)

No.	Wei Yon (Programmer)	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21
0	**Split Screen (2 Players)**																					
1	**Room Lobby**																					
1.1	Basic Room Lobby																					
1.2	Extended Room Lobby																					
2	**Player**																					
2.1	Movement																					
2.2	Pick Up Object																					
2.3	Use Object In Hand																					
2.4	Animations																					
2.5	Networked Player																					
3	**AI Enemies**																					
3.1	Movement																					
3.2	Systems																					
3.3	Networked AI Enemies																					
4	**Boss Fights**																					
4.1	Basic Boss Fight																					
4.2	Networked Boss Fight																					
5	**Screen Transition (Split & Join)**																					
6	**In-Game Puzzle Mechanics**																					
7	**Game Music**																					

Schedule / Gantt Chart (Elias)



Schedule / Gantt Chart (Wan Yee)



Budget (6 Months)

Name	Per Month	Cost	Total Cost
House Electrical Expenses	RM500 x 3	RM1,500 x 6	RM9,000
House Water Expenses	RM30 x 3	RM90 x 6	RM540
Staff Salary	RM2,000 x 3	RM6,000 x 6	RM36,000
Development Hardwares	-	RM4000 x 3	RM12,000
Software Licenses	RM967	RM967 x 6	RM5,802
Emergency Budgets	-	RM20,000	RM20,000
		Overall Total Cost	**RM83,342**

Softwares & Hardwares

- Unity 2019.4.13f1
- Visual Studio 2017
- Github Desktop
- Photoshop CC 2019
- Discord

Individual Research Topics

Research Titles

Koh Wan Yee:

- Effects of the facing direction of character to the player's emotion when animation occur.
    - Is the player focused on the facial expression of the character during gameplay?
    - Is the player more immersed when the character animation shown in front view?
    - Why does the player feel more immersed when the animation is shown in a specific view?
    - How does the facial expression affect the player's emotion compared with body language only animation?

Research Titles

Elias Leong:

- The influences of game level design on player's immersion.
    - Does platform matters in level design to affect the player immersion?
    - Will repetitive level design mechanics ruin the player immersion?
    - What is the appropriate complexity/difficulty required for the player to be fully immersed when playing the level?
    - Is the graphic quality important in level design to enhance the player immersion?

Research Titles

Tan Wei Yon:

- The effects of the uncontrollable key input on the player's experience.
    - Does the player experience get worse when implement uncontrollable input in the game?
    - Is it possible to create a satisfied player experience with the uncontrollable input?
    - What is the effect of the frequency of the uncontrollable input on the player experience?
    - If the timing of the uncontrollable input is predictable, will it makes the player experience more enjoyable?

The End

Appendix B: Questionnaires

The Effect of Puzzle Design on Player's Experience

* Required

1. 1. How old are you? *

Mark only one oval.

- 12 years old or below
- Above 12 years old

2. 2. Did you play any 2D action-adventure game before? *

Mark only one oval.

- Yes, I played before.
- No, this is my first time to play.

3. Q1. Are you able to guess / know what you need to do when solving the puzzles below? Tick the checkboxes below if your answer is yes.

Check all that apply.

☐ (Level 1) Stepping Puzzle

☐ (Level 1) 8x8 Pixel Drawing Puzzle

☐ (Level 1) Simple Light Mirror Puzzle

☐ (Level 2) 10x10 Pixel Drawing Puzzle

☐ (Level 2) Full Light Mirror Puzzle

☐ (Level 2) Three Rotator Puzzle

4. Q2. Are the puzzles below too challenging for you? Tick the checkboxes below if your answer is yes. Answer Q3 only if any of the checkboxes is **ticked**.

Check all that apply.

☐ (Level 1) Stepping Puzzle

☐ (Level 1) 8x8 Pixel Drawing Puzzle

☐ (Level 1) Simple Light Mirror Puzzle

☐ (Level 2) 10x10 Pixel Drawing Puzzle

☐ (Level 2) Full Light Mirror Puzzle

☐ (Level 2) Three Rotator Puzzle

5. Q3. Please elaborate which parts make you feel too challenging to solve.

6. Q4. Do you play collaboratively with another player to solve the puzzles below? Tick the checkboxes below if your answer is yes. Answer Q5 only if any of the checkboxes is **unticked**.

Check all that apply.

☐ (Level 1) Stepping Puzzle

☐ (Level 1) 8x8 Pixel Drawing Puzzle

☐ (Level 1) Simple Light Mirror Puzzle

☐ (Level 2) 10x10 Pixel Drawing Puzzle

☐ (Level 2) Full Light Mirror Puzzle

☐ (Level 2) Three Rotator Puzzle

7. Q5. Please elaborate how you able to solve the puzzle(s) without collaboration with other player.

8. Q6. Do the puzzles below make logical sense to you? Tick the checkboxes below if your answer is yes. Answer Q7 only if any of the checkboxes is **unticked**.

Check all that apply.

☐ (Level 1) Stepping Puzzle

☐ (Level 1) 8x8 Pixel Drawing Puzzle

☐ (Level 1) Simple Light Mirror Puzzle

☐ (Level 2) 10x10 Pixel Drawing Puzzle

☐ (Level 2) Full Light Mirror Puzzle

☐ (Level 2) Three Rotator Puzzle

9. Q7. Please elaborate on which part(s) of the puzzle(s) do not make sense for you.

10. Q8. Rate you level of satisfaction after the puzzles are solved. *

Mark only one oval per row.

	Very Satisfied	Satisfied	No feeling	Dissatisfied	Very Dissatisfied
(Level 1) Stepping Puzzle					
(Level 1) 8x8 Pixel Drawing Puzzle					
(Level 1) Simple Light Mirror Puzzle					
(Level 2) 10x10 Pixel Drawing Puzzle					
(Level 2) Full Light Mirror Puzzle					
(Level 2) Three Rotator Puzzle					

11. Q9. In your opinion, what is still lacking in the puzzles, and how can the puzzles improve to become better? (optional)

Appendix C: Logbooks

Appendix A

Project Paper Consultation Logbook	
Project Title	Twin's Elude
Student Name	Tan Wei Yon
Student ID	1600825
Year/Semester	Year 3 Semester 2
Supervisor	Mr.Benedict Ng *AND* Ms. Chow Mee Mooi

WEEK 01	
Comments: - Team agreed to go with 2D or 2.5D art direction. - Discussed and decided the direction of the narratives, core gameplay of both the proposed game ideas. - Need to do more researches on the both proposal ideas and individual research topics.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 2/11/2020

WEEK 02	
Comments: - Suggest online multiplayer instead of local multiplayer due to the difficulty to demo the game if MCO still remains. (Game Idea 1) - More visual supports for both the game ideas. - Use our own sketches, instead of taking from other games. - Need to show more concrete gameplay to let the supervisors understand generally how the gameplay works	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 6/11/2020

WEEK 03	
Comments: - The supervisors are OK with both game proposal ideas. - Think carefully which game title we prefer to work with. - Team agreed to go with first game title (Twin's Elude). - Start working on basic stuff : 1) Connect two players to a room. 2) Basic player movement script. 3) Split screen on two players.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 13/11/2020

WEEK 04	
Comments: - work on gameplay function (pick,drop,use item, puzzle...) - always synchronize one function before going to next one. - modify research chapter 1 * lack budget, schedule, project scope, ... * mechanics explain too details * use formal words (NO I, we, they, our...) - write up on chapter 2 *various ai pathfinding method in 2d games *analysis advantages & disadvantages	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 21/11/2020

WEEK 05	
Comments: gameplay: - Breaking the second wooden block will only drop the key. - The two puzzles require cooperation elements. - speed up for enemies, items, etc. - too much works, reduce the number of enemies. - help indicator to notify another player. research: - chapter 2 still got a lot work, continue do. - refine chapter 1 based on feedback given.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 28/11/2020

WEEK 06	
Comments: gameplay: - boss fight & other stuff - stable version	**Supervisor signature:** Ng No consultation
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 07/12/2020

WEEK 07	
Comments: gameplay: - prioritize on able to play the game from start to end - prioritize on boss & player's animation - make boss stationary (easy to work in multiplayer) - Need to prepare presentation slides & briefly talk about what you have done. - put as much as arts inside the game. research: - none progress	**Supervisor signature:** Ng
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 12/12/2020

Appendix A

Project Paper Consultation Logbook	
Project Title	Twin's Elude
Student Name	Tan Wei Yon
Student ID	1600825
Year/Semester	Year 3 Semester 3
Supervisor	Mr.Benedict Ng *AND* Ms. Chow Mee Mooi

WEEK 01	
Comments: gameplay: - fix grid gaps between tiles - add global light effect (ease to see enemy's attack range) - fix slime attack anim - knockback to give gap between enemy and player - test art assets in unity straight away. - aware characters' shadow - cutscene & storyboard - objects in the scene need to have purpose.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 22/1/2021
WEEK 02	
Comments: gameplay: - Finish level 1 in Week 3/Week 4 - Finalize the ui, animation, and graphics. - Smoothen the workflow, let other members handle the animation adjustment, so that programmers can do bug fixes and function.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 29/1/2021

WEEK 03	
Comments: gameplay: - make fully-functioned level 1 and do some level 2 functions if have extra time before week 5 - simple tutorial screen that tells player what they can do. - effects, hints, sounds should be in place before Week 5. - The game is still not having fun at the moment. research: - rework chapter 2.3.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 6/2/2021

WEEK 04	
Comments: progression: - player damaged effect (cam shake, blood) - bug fixes - tutorial basement	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:**

WEEK 05	
Comments: progression: - sound effects - bug fixes - integrate animations - refine level 1 - able to restart game	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:**

WEEK 06	
Comments: gameplay: - content is empty - think about level 2 collaborative puzzle - think about fun aspects of game progression: - methodology research - 2 puzzles	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 24/2/2021

WEEK 07	
Comments: gameplay: - introduce components of puzzle part by part - make sure player knows 'interact' key is important, by implanting this behavior in their brain. research: - Change C2 & C3 based on feedback given. progression: - light mirror puzzle, pixel drawing puzzle, bug fixes	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 3/3/2021

WEEK 08	
Comments: gameplay: - show actual level 2 next week. progression: - three rotate puzzle	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 14/3/2021

WEEK 09	
Comments: gameplay: development plan from W10 to W12. research: submit the questionnaire to the shared folder. progression: - split area door that teleports player into different area. - set up level 2 basement, able play from start to end.	**Supervisor signature:** Ng
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 20/3/2021

WEEK 10	
Comments: this week plan: - level 1 integration + bug fixes progression: - fire trap shoot (level 2) - critical bugs fix on puzzles (level 2)	**Supervisor signature:** Ng
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 28/3/2021

WEEK 11	
Comments: this week plan: - level 2 boss fight gameplay: - polish up the hint text, ui - add narrative/ story/ cutscene at the beginning/ level transition/ ending to make it feel more complete.	**Supervisor signature:** Ng
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 3/4/2021

WEEK 12	
Comments: this week plan: - sound effect integration, narrative supports. gameplay: - let boss have more bullet variations pattern. - next week shows a build that is representative for our game. - by next week, put everything from start to end inside even incomplete.	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:**

WEEK 13	
Comments: this week plan: - fix bugs gameplay: - can add hidden room that simply destroys boxes - make more sense if door frame has collider - diamond is hard to pick up - encounter player death bugs (not sync health)	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:**

WEEK 14	
Comments: this week plan: - test play & fix bugs - last page will back to main menu automatically - refine UI, fonts, narratives & others research: - design specification	**Supervisor signature:**
Progress (please circle the feedback) 1 2 3 4 5 Poor Satisfactory Good	**Date:** 23/04/2021

Appendix D: Final Project Title Form

Appendix E

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
1705608	Muhamad Elias Bin Mohd Alif Leong	elias.leong@outlook.com 016-2001 707
1801385	Koh Wan Yee	aruyuxbl@gmail.com 011-2643 1374
1600825	Tan Wei Yon	tanweiyon@hotmail.com 017-2188 425

Supervisor: Mr. Benedict Ng AND Ms. Chow Mee Mooi

Project Title:
Twin's Elude

Project description:-

Twin's Elude is a 2D action-adventure co-op game where two players are required to collaborate to complete the level. The game concept is about sharing of a split screen which enables the pair of players to know the situation from others, and work together to go through the puzzles and monsters in the game.

Student name	Individual Project Scope
Muhamad Elias Bin Mohd Alif Leong	Game Design Document / Item Props Design & Behaviour / Enemy Behaviour Design / Level Design / Props Placement / Character Animation Adjustment / Bug Tester / Narrative / Game Mechanics / Game Trailer / Game Lightning & Fog Effects / Sound Effects & BGM / Manager Overall Project Progression
Koh Wan Yee	Character & Enemies Sprite Sheets / Item Sprite Sheets / Character & Enemies Animation / Game UI Design / Cutscene Storyboard / Game Cutscene / Bug Tester / Game Promotional Material
Tan Wei Yon	Player Functions / AI or Boss Fight Functions / Item Functions / Animation Functions / Screen Functions / Networking / Puzzle Functions / Narrative Functions / Sound Functions / UI Functions / Manager Github