Effect of Random Item Dropping on Game Immersion

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ABSTRACT
Random item dropping refers to the process where the game randomly determines when and/or whether to give a virtual item to a player after certain conditions have been met by the player. This mechanism has been widely used as a reward system in many types of games and impacts on the gaming experience from multiple perspectives. However, since the dropping process is out of the player's control, players do not all receive the same items at the same time. Receiving different items at various stages of the game creates diverse gameplay from different statues, and leads to different gaming experiences. This project investigated these differences in order to understand how item dropping affects gaming experience. A mixed design experiment was conducted to investigate the impact of item types (character competency or visual authority) and dropping time (early or late), on the level of immersion experienced. The results showed that different dropping conditions do not have significant effects on immersion, which suggested that maintaining immersive experience is not a factor that needs to be prioritised in the design of random dropping systems.

Author Keywords
Immersion; games; reward; controlled experiment.

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1. INTRODUCTION

Video gaming is a blooming industry. In April 2016 alone, $6.2 billion dollars were generated from digital game sales [6] and game industry sales exceeded cinema box office takings [7]. In terms of popularity, 80% of homes in the UK own a next-generation videogame console [23]. The need to understanding gaming experiences in this growing industry are consequently increasing.

Concept of immersion was explored by research in order to define and measure gaming experience. The term immersion refers to the engagement and involvement players experienced when playing video games [5]. Immersion takes place on three different levels: engagement, engrossment and total immersion [3] and can be divided into three types: sensory immersion, challenge-based immersion and imaginative immersion [10]. Quantitative measures of immersive experience have been developed [15], and factors such as challenge [8] and performance [14], which cause effects on immersion were investigated.

Numerous yet-to-be discovered gaming elements might impact upon the immersion players experienced. This paper focuses on random item dropping as it is an interesting element that exists in many games across a multitude of genres. It is a form of reward [24] that distributes virtual in-game items to players at certain rates based on certain conditions. Receiving rewards always make players happy, since items could bring one or more values to players including enjoyment value, character competency value, visual authority value and monetary value [19]. Meanwhile, items may act differently across different stages of the game, in terms of affecting the level of challenge and pleasure of anticipation [18,21].

An experimental approach was taken to investigate how different dropping conditions would influence immersive experience. Participants were divided into two groups, where one group receive items earlier than the other group. Each participant played two rounds of games and received different types of items, which covered the most typical two values: character competency value and visual authority value. Their performance in the games were measured to check if the items affected their characters' abilities and individual immersion levels were measured by using the Immersive Experience Questionnaire (IEQ) [15]. It was hypothesized that participants who received items earlier were likely to be more immersed than the late group in the condition of character competency value due to lengthier

item usage times and potentially better performance. Immersion in the condition of visual authority value was expected to be at a medium level and not affected by the factor of timing.

Results from the experiment showed no significant difference on how immersed players feel, regardless of conditions. It could be derived that item dropping conditions do not have any impact on immersion, which was a meaningful result for game developers indicating that the design of random dropping systems does not need to be constrained by immersion. However, performance was not significantly different amongst subjects, suggesting that the manipulation of item dropping was not effective. Reflections on the factors which might cause the effect to be ambiguous were discussed and recommendations on potential improvements were made.

2. LITERATURE REVIEW

2.1 Immersion

Immersion is a term referring to the engagement and involvement experienced by a person when playing a digital game [5]. Brown and Cairns [3] performed interviews with gamers to find out their interpretations of this term. Following analysis of the interview data using Grounded Theory, they found that gamers were able to distinguish different degrees of involvement. Brown and Cairns described the stages of immersion in an order of ascending involvement level: engagement, engrossment, and total immersion. The basic stage is engagement and relates to a player's willingness to invest time, effort and attention. As players started losing track of time, feelings of guilt may arise. The second stage, engrossment, is when gamers are more emotionally involved with the game. Players may feel emotionally "drained" if they stop playing. The highest stage is total immersion. This relates to the experience of complete involvement where nothing matters but the game. At this stage, players do not feel like they are playing games but just "being in the game". Brown and Cairns also referred to the existence of barriers between stages which need to be removed before progressing to the next level.

To define the attributes of immersion, Ermi and Mäyrä [10] proposed a model of immersion called the SCI model. They divided immersive experience into three types: sensory, challenge-based, and imaginative. Sensory immersion is related to the perceptual impact of the virtual environment created by game features on users. Challenge-based immersion comes with challenges met by players and their abilities to perform well. Imaginative immersion is linked with emotional involvement with the imaginary world created in games. Although overlaps within challenge-based immersion and imaginative immersion were pointed out by Cairns, et al. [5], modifications or models proposed by other researchers including Arsenault [2] and Adams [1] did not elucidate clearer classifications than those proposed by Ermi and Mäyrä [5].

In particular, Cox, et al. [8] investigated the effect of challenge on immersion experienced by players. Three experiments were conducted under different settings of physical challenges and cognitive challenges and involved different levels of expertise. Results from the three experiments indicated that increasing cognitive demand leads to higher levels of immersion, whilst increasing physical demands did not have such impacts. They also indicated that challenges encountered by players are a compound of the challenges provided by games and players' expertise.

Jennett and Cox [14] investigated the relationship between feedback and immersion. They found that positive feedback and positive perceptions of performance would cause higher immersive experience and less awareness of distractions. As part of their findings, even when the indicator of performance was clearly unrelated to players' real performance, they still interpreted it as meaningful and claimed to be more immersed.

2.2 Reward Systems

Immersion and general gaming experience is a product of integrated gaming elements. Each element may have multiple rationales to appear in the game and affect the gaming experience from multiple perspectives, such as reward systems which commonly exist in video games. With a reward system, players are able to receive virtual resources, get points, or unlock more playable contents after accomplishing certain events. For examples, players receive virtual coins and items by completing quests in *World of Warcraft*, score points by clearing blocks in *Tetris*, and unlock new levels by accumulating stars in *Cut the Rope*. They provide a sense of fun by motivating players and easing disappointments [24] and also bring social meanings to players within or outside the game [20,22].

Rewards can be given to players in different forms. Wang and Sun [24] categorized rewards systems of video games into eight groups: a score system which represents performances of players in numbers; experience points to level up developable avatars; virtual items which can be used by players or their characters; collectible and usable in-game resources; achievements which challenge players to collect them; feedback messages to stimulate players' emotions; animations or pictures serving as milestones after significant events; and unlocking more contents to play.

2.3 Value of Virtual Items

Among the categories proposed by Wang and Sun [24], the virtual item is the most complicated one since it includes a large variety of different items and influences gaming experience in many different ways. Despite specific functionalities related with the game, virtual items contain values which can be interpreted by players. These values are what players obtained from the item and therefore can affect their gaming experience.

Park and Lee [19] divided values of virtual items into four groups: enjoyment value, character competency value, visual authority value and monetary value. Enjoyment value stands for fun, playfulness, and pleasure perceived by players. Character competency value is the value which enhances players' abilities and makes their avatars stronger and more competent. Visual authority value comes with decorations which fulfill players' vanity and increase their social status. Monetary value often exists when the item is tradable.

Wang and Sun [24] also summarized four properties which can be used to evaluate how well the rewards are designed. The first is social value of rewards, where virtual items enable comparison between players. Rare pieces of equipment can be used to show off accomplishments and draw attention from other players. Wang and Sun [24] observed that items obtained by luck or skill were more commonly used for these purposes, rather than those that can be purchased using currencies.

The second aspect is the function of rewards on gameplay. The effect of virtual items varies between different games and different rarity within a game however, in most cases reward items accelerate game progression (e.g. in Role-Play games) or enlarge possible explorations (e.g. in Collectible-Card games).

The third attribute is the suitability of rewards for collection and review, which is motivated by a sense of accomplishment and preserving memories [11]. This gives additional value to items apart from its functionality in the game, strengthening feelings of completion and perfection [9].

The fourth one is the time required to receive a reward. Appropriately timed rewards create a sense of accomplishment and value while inappropriately timed rewards lead to players abandoning the game and move on to another [12,17]. The quality of item rewarded needs to be comparable to the effort invested to achieve the reward [16].

2.4 Random Dropping of Items

Apart from granting a particular item after fulfilling a particular condition, the chance to simply acquire an item could also be seen as a reward. These random and uncertain rewarding mechanisms are called item drop in games, referring to the process that virtual items are randomly distributed to players under certain criteria. There would be a list of items players might receive if they met the conditions, with probabilities assigned to each item, making it random. Item drop normally appears in two forms: one completely random form where enemies have a rate to drop items when defeated (often seen in role-playing games) and a second form which acts as a "treasure chest" to be opened by players. These treasure chests contain unknown items with a guaranteed minimal outcome and a small chance to win rare and valuable virtual items. Treasure chests can act as rewards for accomplishing any events or be exchanged with in-game or real-world currencies. This concept can easily be adapted and applied to all types of games involving collectible elements, from role-play games like *World of Warcraft* to multiplayer online battle arena games like *DOTA 2* as well as to first-person shooting games like *Counter-Strike: Global Offensive.*

With a system of item dropping, failing to gain items does not represent a non-pleasurable experience. In games like the Diablo series, item collection was originally the main source of fun [24] and the dropping rate acts as a challenge for collecting them. Besides, unknown rewards could create more fun than those with known outcomes. According to Caillois's [4] consideration of games involving gambling, chance itself also adds fun to the reward. Similar to gamblers, interests and expectations of gamers are increased when they receive rewards at random intervals [13]. Simply knowing that a chance exists to obtain an item and actually seeing others get one could also raise players' expectations. Loewenstein [18] and Rozin [21] indicated that pleasure of anticipation is an important aspect of positive gaming experiences. In this case, it should be noted that the quality of a rewarded item needs to be balanced with players' anticipation. Furthermore, if details of the rewards are not revealed to players, the learning process to figure these details out was considered to be enjoyable [24].

3. RESEARCH QUESTION

Item dropping is a reward mechanism widely used in games. Research in this area has illustrated some of the potential impacts of this reward mechanism on the gaming experience, such as challenges, value for players, emotions, etc. However these theories are difficult to work together since they play different roles on different types of items and at different stages through the game. For instance, items containing social value can be seen as valuable in both early stage and late stage of a game; however, items strengthening abilities might reduce cognitive demands more significantly in early games and lead to less immersive gaming experience [8]. With the uncertainty of random dropping systems, there will always be players who get rare pieces of items early and those who get them later, thus their gaming experiences will not necessarily be the same.

This study focuses on the difference of gaming experience caused by different dropping conditions which include two main factors: dropping time and item type. The factor of dropping time refers to the difference between players who receive items early on in games and players who receive them at a later stage of the game. More specifically, the current study examines what happens mid-game when comparing players who have already received items versus those who have not received items but are aware that other players have. Additionally, the consequential immersion experienced by players in this situations will be examined. The factor of item type takes two major values of the item into account: character competency value and visual

authority value. For items carrying character competency value (e.g. strengthen abilities), players obtaining them early in games would play with better performance or perceived performance, whilst players obtaining them later would face more challenges. For items carrying visual authority value (e.g. change appearance), players obtaining them early on in games would play with an expression of identity and be more noticeable, whilst players obtaining them later would play with higher anticipation.

	Early	Late
character competency value	High	Medium
visual authority value	Low	Low

Table 1. Predicted performance

Table 1 shows the predicted performance. Items with visual authority value are not expected to result in any differences on player performance. Items with character competency value are expected to enhance a player's performance which will be greater the earlier the item is received in the game.

	Early	Late
character competency value	High	Low
visual authority value	Medium	Medium

Table 2. Predicted immersion level

Table 2 shows the predicted immersion level experienced by players. For character competency value, players who obtain the item earlier in games are expected to be more immersed due to longer use of the given item and potential better performance. For visual authority value, the immersion level is not expected to be affected by gaining time since all the players may get the item eventually, thus it is expected to be at a medium level due to higher imaginative immersion.

4. METHOD

4.1 Participants

A total of 40 post-graduate students participated in the experiment (10 groups of 4 participants). However, one group's results were removed due to accidentally shortened gaming sessions.

Among the 36 participants, there were 14 females and 22 males, whose ages ranged from 22 to 37 years, with the average age being 25.9 years. Most participants rated their gaming skills as average, and a few of the participants claimed that they play games regularly. PC and mobile were favoured over console and handheld as their preferred gaming device and their favourite game types were strategy, role-play, and adventure.

Participants were recruited individually, then paired based on their background. Each of the four participants in the same group shared some similarities (e.g. they were classmates in the same course or came from the same foreign country), in an attempt to increase interactions between players.

The highest scorer in each group of 4 participants received 10 GBP in cash as compensation.

4.2 Design

This experiment was a mixed between-within design. The within-subject independent variable was the value brought by items obtained in games: visual authority value and character competency value. This was manipulated by giving participants different items via console commands, and the order was counterbalanced. Items providing visual authority value aesthetically changed the appearance of their in-game characters without affecting their abilities, while items providing character competency value enhanced their abilities in the gameplay without a noticeable appearance. The between-subject independent variable was the item obtaining stage: early stages of the games or later stages of the games.

The dependent variable was participants' immersion scores on the IEQ [15]. In order to check whether players do perform better or not, the total different types of cubes they collected were recorded as a measure of their true performance.

Gaming sessions were audio recorded in order to analyse the interactions between players.

4.3 Materials

The game used in this study was Minecraft, which is a sandbox game allowing players to control a human character to collect cubes, create artefacts and build constructions in a pixel 3D virtual world. Multiple players can be connected through the Internet or local area network (LAN) and they are able to see and interact with other players within the virtual world. Minecraft is easy to get started, easy to control, and allows plenty of interactions and explorations in the game.

The virtual world they played in was generated to be identical for each group. The difficulty level was set to peaceful so that players could not be harmed by others or monsters. Time shift and weather shift were turned off to keep the environment bright.

Figure 1. Minecraft

A group of 4 participants played the game at the same time. A task was given to participants as their objective and to

provide a measure of their performance. Within the limited time, each participant was required to build a 1*1 column with as many different types of cubes as possible. Only the cubes located inside their perpendicular 1*1 spaces were counted, and the total different types of cubes that appeared were recorded as their performance score – how well they completed the objective. In order to score higher in this task, participants needed to collect different cubes from plants, animals, and minerals. Additionally, they needed to find a way to build things higher since their character needed to reach the top of their columns but could only jump onto a surface with a height of 1 cube. Basic stone tools and torches were given to participants to help them complete the task. Participants were allowed to collaborate (e.g. share mines) or compete (e.g. possess rare cubes) with others, however damaging the columns built by other players was prohibited.

Figure 2. Columns built with different cubes

Items given to participants were diamond armour and diamond pickaxe. Diamond armour changes the appearance of characters, making them shiny and thereby more noticeable. Consequently, it enhances the hit point of a character, but hit points were not relevant parameters in the given task. Overall, diamond armours act as "skins" which bring enjoyment value and visual authority value to players without any impact on their ability. On the other hand, diamond pickaxe allows players to mine faster than is possible using bare hands and stone tools. Furthermore, it enables players to break numerous types of cubes and is more durable than stone tools. Tools cannot be seen by others unless they are actively used, and the only difference in appearance is the colour. Therefore, a diamond pickaxe brings enjoyment value and character competency value to players, with very little visual authority value.

Figure 3. Stone pickaxe (left) and diamond pickaxe (right)

Figure 4. Unarmoured (left) and diamond armoured (right)

The experiment was conducted in the same computer room with the same lighting conditions and room temperature.

4.4 Procedure

Participants took part in the experiment in groups of 4. They were seated in two rows of two people with a computer in front of each of them. A demographic questionnaire was completed, followed by a video tutorial of basic controls and objectives. Basic instructions and tips were also printed on a piece of paper placed on the desk in front of each participant.

When participants were ready for the first session, the instructor launched the game and gathered all participants together. Each participant was given a 1*1 base to build their column, then they started playing and a timer was started. The instructor also played in the game as a rule keeper and was in charge of entering commands. Five minutes into the timed game, two participants seated on the left-hand side of the room received the same items – either diamond armour or a diamond pickaxe. After another 10 minutes of playing, two participants seated on the right-hand side of the room also received items that were identical to the ones the previous 2 participants received. They continued playing for 5 more minutes, then the first session ended and their performance scores were counted. Participants filled out the IEQ immediately after they finished playing.

Participants were given a short break after filling out the questionnaire. When they were ready for the second session, the procedure of the first session was repeated with the exception of the item given to all participants as this was swapped with the item that they did not receive in the first session. The two gaming sessions were audio recorded.

5. RESULT

A statistical analysis was performed using IBM SPSS 22.0. The performances were measured by counting the different types of cubes built by players. The immersion scores were calculated by summing up the responses to each question. The responses to question 6, 8, 9, 10, 18 and 20 were reversed (e.g. 1 became 7, 2 became 6, 3 became 5, and so on).

5.1 Performance

Table 3 shows the mean scores (and standard deviations) of the performances under each condition. The label "Tool"

refers to diamond pickaxes which carry character competency value, and the label "Skin" refers to diamond armours which carry visual authority value.

	Early	Late
Tool	6.5 (2.7)	6.1 (2.1)
Skin	6.3 (1.5)	5.4 (2.7)

Table 3. Performances of players

A 2*2 mixed between-within ANOVA was conducted to explore the impact of obtaining stage and type of item on participants' performances. The obtaining stage (early or late) was the between-subject independent variable, and the type of item (Tool or Skin) was the within-subject independent variable. The interaction effect [$F(1,34)=0.220$, $p=0.642$] was not significant. There was no statistically significant effect on performance for both the obtaining stage [$F(1,34)=1.249$, $p=0.272$] and type of item [$F(1,34)=0.879$, $p=0.355$].

5.2 Immersion

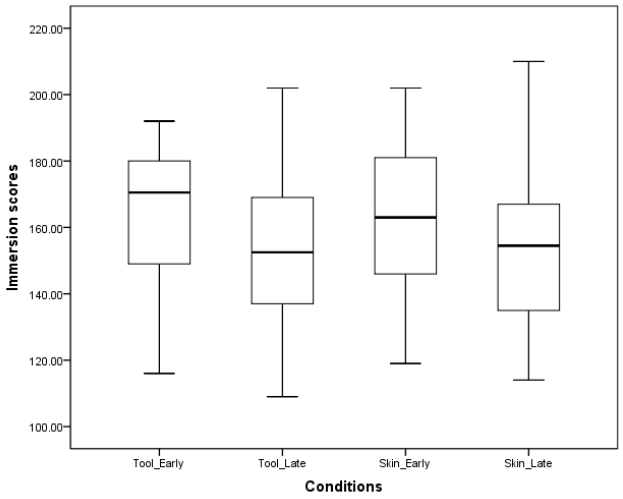

Figure 5. Boxplot of immersion scores

Figure 5 shows the boxplot of immersion scores. The mean scores (and standard deviations) are summarised in Table 4.

	Early	Late
Tool	161.9 (23.3)	155.4 (26.0)
Skin	162.7 (23.4)	152.8 (24.5)

Table 4. Immersion scores

Another 2*2 mixed between-within ANOVA was conducted to explore the impact on the level of immersion experienced by participants. The interaction effect [$F(1,34)=0.326$, $p=0.572$] was not significant. There was no statistically significant effect for both the obtaining stage [$F(1,34)=1.191$, $p=0.283$] and type of item [$F(1,34)=0.089$, $p=0.767$].

6. DISCUSSION

Results from this experiment did not support the hypothesis. Regardless of conditions, no significant differences were found in participants' performances and immersion scores. Participants built columns that were similar in height and experienced comparable levels of immersion.

The non-significant result on performance suggested that the manipulation of items did not produce the expected level of impact. It was hypothesized that receiving skins would not have any influence on task completion but that receiving tools would be influential. Given that the results did not show any significant differences in performance suggests that tools do not make players more competent. This could potentially be due to the fact that participants faced too many different challenges when they were playing the game. Some participants got lost in the field and spent a long time trying to find their way back, some did not manage their time properly and did not leave enough time for building, and some accidentally had their characters fall into lava or drown in water. Receiving the diamond pickaxe tool did help them in terms of mining, however this was not enough to impact results compared to the overall challenge level. Therefore, the tool did not convey enough character competency value to participants to enhance their performance significantly.

There was a hint that the early group performed slightly better than the late group when mean scores were compared. A possible explanation is that the process of receiving something motivated the early group and encouraged them to perform better for a longer period of time. Participants asked questions like "can I mine faster with this suit?" when they received diamond armours, which suggested that participants were curious and had increased expectations once the item was received. Participants in the late group complained about not receiving a tool, which may have slightly impacted on their level of excitement. However, it is also plausible that this small difference was caused by individual differences. Since timing was a between-subject factor and participants were randomly allocated into the two groups, participants from the early group may have just been better at this game due to a relatively small sample size.

The result on immersion scores could be the real effect of random dropping. That is, the timing of item dropping and the type of item dropped could have no impact on players' immersive experience at all. Although the early group showed hints of being more immersed than the late group when comparing their mean scores, results supported the effect found by Jennett and Cox [14] since they also performed slightly better. During the experiment, participants were so immersed in the game that they lost track of time. Most of the participants expressed shock when they looked at the timer and realised how little time they had left. Since the experiment did not involve the use of treasure chests, receiving a completely random dropped item could act as only a tiny bonus to their immersive experience. Therefore, if the game itself is immersive

enough the timing of receiving items and the types of items received may make little difference to one's immersive experience. This could explain why different dropping conditions did not result in significantly different immersion scores. For game developers, this effect could be taken into account when designing random dropping systems. For instance, prioritising other factors like financial decisions or social interactions may be preferable to increasing immersive experience.

In contrast, it is also possible that immersion should be influenced by different dropping conditions, however the difference was not big enough to reach the significance level. This suggested that some design of the study might not be able to deliver the impact effectively. First is the choice of items. As previously discussed, diamond pickaxe did not express the character competency value sufficiently. Meanwhile, the visual authority value represented by diamond armours might not be impactful enough to change the level of immersion. A participant said "hey look at this blue guy!" to other participants during the experiment, which suggested that players may see it as a change in colour rather than a promotion in appearance. Second is the design of task. The task of collecting different cubes and building them up resulted in participants spending a large portion of their time in the field seeking out cubes. However, only a few of them (about 3 pairs in the total of 36) collaborated during this process, and most participants behaved competitively and immediately commenced on their adventures alone after being told to begin. It was observed that most of the interactions between players happened when they were building the "columns". These interactions included building stairs together, comparing their columns, asking where other players found rare cubes which they did not have yet, etc. Therefore, there were minimal interactions between participants' in-game characters for the majority of time as they were looking for cubes individually. This may have influenced the effect of visual authority value. Third is the level of engagement. Since participants were not regular players of the game, barriers existed with respect to understanding the value of items. Participants occasionally forgot that they had a diamond pickaxe which was better than their original pickaxe and did not frequently use the diamond one. It is common for players to get an item in a game which they do not fully understand, however in an experimental context this could lead to a biased result to some extent. Besides, the length of experiment was too short for participants to explore all the in-game elements such as available cubes from different terrains and biomes. The participants were still in an early exploration status when the experiment ended, and the total gaming time was too short to reveal effects which may have occurred if the game time was longer. Given that all these factors could have had some degree of influence on the results, further research would be required to reveal whether there are any true effects of the experimental variables.

Future researchers would need to cautiously consider the design of study. The value of items used in future studies should be explicitly stated and interactions between players should be encouraged. Having participants collaboratively working on a single objective together can be a choice. In addition, performance measures need to be taken into consideration as a value with a larger figure could better differentiate results in subsequent studies. Furthermore, although Minecraft was easy to handle even for those participants who seldom played video games, it might not be the best choice of game in terms of manipulating the conditions. Future games in this type of research area should include criteria that involve interactions, manipulative or tradable equipment, changeable appearances, and measurable performance. The learning curve is also important (especially for role-play games which require long tutorials), hence finding a qualified game and recruiting regular players from relevant forums as participants could be an option. Having a larger sample size could also lead to clearer results.

7. CONCLUSION

This study investigated the effect of item dropping on players' gaming experience. A 2*2 mixed between-within experiment was conducted to test if the timing of item dropping and the type of item dropped would influence players' gaming performance and the level of immersion they experienced. Results from the experiment showed no significant difference on both performance and immersion, regardless of conditions. This suggested that in an immersive video game, when and what players receive from random dropping does not affect the level of immersion they experience. This finding could inform the design of random dropping systems for game developers. If the dropping happens randomly, such as a rate after defeating monsters, this effect could broaden the design space since the factor of maintaining immersive experience does not need to be prioritised in decision making.

Further studies involving treasure chests opening would be interesting and the results could be completely different due to higher levels of expectation and subsequent frustration.

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APPENDIX 1: IMMERSIVE EXPERIENCE QUESTIONNAIRE (IEQ)

Your Experience of the Game: Please answer the following questions by circling the relevant number (1-7). In particular, remember that these questions are asking you about how you felt at the end of the game.

1. To what extent did the game hold your attention?
   Not at all 1 2 3 4 5 6 7 *A lot*

2. To what extent did you feel you were focused on the game?
   Not at all 1 2 3 4 5 6 7 *A lot*

3. How much effort did you put into playing the game?
   Very little 1 2 3 4 5 6 7 *A lot*

4. Did you feel that you were trying you best?
   Not at all 1 2 3 4 5 6 7 *Very much so*

5. To what extent did you lose track of time, e.g. did the game absorb your attention so that you were not bored?
   Not at all 1 2 3 4 5 6 7 *A lot*

6. To what extent did you feel consciously aware of being in the real world whilst playing?
   Not at all 1 2 3 4 5 6 7 *Very much so*

7. To what extent did you forget about your everyday concerns?
   Not at all 1 2 3 4 5 6 7 *A lot*

8. To what extent were you aware of yourself in your surroundings?
   Not at all 1 2 3 4 5 6 7 *Very aware*

9. To what extent did you notice events taking place around you?
   Not at all 1 2 3 4 5 6 7 *A lot*

10. Did you feel the urge at any point to stop playing and see what was happening around you? *Not at all* 1 2 3 4 5 6 7 *Very much so*

11. To what extent did you feel that you were interacting with the game environment?
    Not at all 1 2 3 4 5 6 7 *Very much so*

12. To what extent did you feel as though you were separated from your real-world environment?
    Not at all 1 2 3 4 5 6 7 *Very much so*

13. To what extent did you feel that the game was something fun you were experiencing, rather than a task you were just doing?

    Not at all 1 2 3 4 5 6 7 *Very much so*

14. 14. To what extent was your sense of being in the game environment stronger than your sense of being in the real world?
    Not at all 1 2 3 4 5 6 7 *Very much so*

15. At any point did you find yourself become so involved that you were unaware you were even using controls, e.g. it was effortless?

    Not at all 1 2 3 4 5 6 7 *Very much so*

16. To what extent did you feel as though you were moving through the game according to your own will?

Not at all 1 2 3 4 5 6 7 *Very much so*

17. To what extent did you find the game challenging?

Not at all 1 2 3 4 5 6 7 *Very difficult*

18. Were there any times during the game in which you just wanted to give up?

Not at all 1 2 3 4 5 6 7 *A lot*

19. To what extent did you feel motivated while playing?

Not at all 1 2 3 4 5 6 7 *A lot*

20. To what extent did you find the game easy?

Not at all 1 2 3 4 5 6 7 *Very much so*

21. To what extent did you feel like you were making progress towards the end of the game?

Not at all 1 2 3 4 5 6 7 *A lot*

22. How well do you think you performed in the game?

Very poor 1 2 3 4 5 6 7 *Very well*

23. To what extent did you feel emotionally attached to the game?

Not at all 1 2 3 4 5 6 7 *Very much so*

24. To what extent were you interested in seeing how the game's events would progress?

Not at all 1 2 3 4 5 6 7 *A lot*

25. How much did you want to "win" the game?

Not at all 1 2 3 4 5 6 7 *Very much so*

26. Were you in suspense about whether or not you would do well in the game?

Not at all 1 2 3 4 5 6 7 *Very much so*

27. At any point did you find yourself become so involved that you wanted to speak to the game directly?

Not at all 1 2 3 4 5 6 7 *Very much so*

28. To what extent did you enjoy the graphics and the imagery?

Not at all 1 2 3 4 5 6 7 *A lot*

29. How much would you say you enjoyed playing the game?

Not at all 1 2 3 4 5 6 7 *A lot*

30. When it ended, were you disappointed that the game was over?

Not at all 1 2 3 4 5 6 7 *Very much so*

31. Would you like to play the game again?

Definitely no 1 2 3 4 5 6 7 *Definitely yes*

APPENDIX 2: PERFORMANCE AND IMMERSION DATA

	Ob_Stage	Performance_T	Challenge_T	Control_T	Real_Worl...	Emo_Involv_T	Cog_Involv_T	Immersion_T	Performance_S	Challenge_S	Control_S	Real_world...	Emo_Involv...	Cog_Involv_S	Immersion_S
1	Early	8.00	11.00	34.00	43.00	36.00	61.00	185.00	6.00	16.00	33.00	36.00	35.00	61.00	181.00
2	Early	7.00	20.00	24.00	29.00	24.00	60.00	157.00	5.00	19.00	25.00	27.00	25.00	55.00	151.00
3	Early	2.00	19.00	31.00	43.00	32.00	55.00	180.00	7.00	20.00	29.00	43.00	36.00	59.00	187.00
4	Early	6.00	19.00	32.00	43.00	38.00	60.00	192.00	7.00	24.00	34.00	41.00	42.00	61.00	202.00
5	Early	6.00	20.00	28.00	36.00	32.00	53.00	169.00	6.00	19.00	29.00	41.00	33.00	54.00	176.00
6	Early	8.00	18.00	32.00	33.00	35.00	60.00	178.00	6.00	20.00	31.00	33.00	37.00	61.00	182.00
7	Early	6.00	17.00	23.00	32.00	32.00	52.00	156.00	6.00	16.00	23.00	29.00	32.00	55.00	155.00
8	Early	8.00	18.00	23.00	28.00	28.00	48.00	145.00	6.00	16.00	20.00	32.00	27.00	37.00	132.00
9	Early	7.00	20.00	24.00	28.00	32.00	45.00	149.00	8.00	18.00	26.00	38.00	37.00	60.00	179.00
10	Early	7.00	18.00	26.00	34.00	40.00	62.00	180.00	4.00	20.00	24.00	28.00	26.00	46.00	144.00
11	Early	3.00	18.00	32.00	35.00	31.00	58.00	174.00	4.00	15.00	33.00	33.00	30.00	52.00	163.00
12	Early	14.00	15.00	18.00	27.00	21.00	35.00	116.00	8.00	16.00	22.00	34.00	35.00	56.00	163.00
13	Early	5.00	20.00	26.00	35.00	29.00	49.00	159.00	5.00	19.00	24.00	33.00	26.00	49.00	151.00
14	Early	4.00	19.00	27.00	38.00	37.00	55.00	176.00	5.00	19.00	20.00	32.00	29.00	46.00	146.00
15	Early	10.00	14.00	31.00	48.00	37.00	53.00	183.00	9.00	24.00	32.00	45.00	37.00	59.00	197.00
16	Early	6.00	13.00	17.00	25.00	25.00	38.00	118.00	6.00	13.00	21.00	28.00	17.00	40.00	119.00
17	Early	4.00	21.00	26.00	31.00	37.00	57.00	172.00	9.00	22.00	25.00	28.00	39.00	56.00	170.00
18	Early	6.00	15.00	21.00	33.00	18.00	38.00	125.00	6.00	15.00	22.00	30.00	24.00	40.00	131.00
19	Late	5.00	22.00	34.00	43.00	41.00	62.00	202.00	8.00	28.00	32.00	46.00	42.00	62.00	210.00
20	Late	4.00	21.00	23.00	36.00	31.00	58.00	169.00	0.00	22.00	22.00	34.00	26.00	41.00	145.00
21	Late	6.00	22.00	21.00	29.00	23.00	42.00	137.00	6.00	20.00	25.00	42.00	28.00	52.00	167.00
22	Late	7.00	18.00	21.00	35.00	32.00	46.00	152.00	5.00	20.00	22.00	33.00	26.00	39.00	140.00
23	Late	5.00	18.00	25.00	38.00	25.00	46.00	152.00	8.00	16.00	19.00	31.00	22.00	47.00	135.00
24	Late	10.00	19.00	23.00	27.00	32.00	47.00	148.00	10.00	20.00	22.00	28.00	31.00	49.00	150.00
25	Late	6.00	22.00	31.00	39.00	36.00	54.00	182.00	9.00	22.00	32.00	31.00	30.00	52.00	167.00
26	Late	4.00	22.00	16.00	41.00	18.00	38.00	135.00	6.00	22.00	25.00	40.00	23.00	54.00	164.00
27	Late	6.00	15.00	22.00	36.00	28.00	49.00	150.00	5.00	17.00	21.00	30.00	28.00	41.00	137.00
28	Late	5.00	22.00	28.00	32.00	26.00	53.00	161.00	3.00	20.00	25.00	38.00	33.00	53.00	169.00
29	Late	10.00	12.00	14.00	27.00	20.00	36.00	109.00	7.00	15.00	21.00	30.00	17.00	40.00	123.00
30	Late	7.00	7.00	19.00	27.00	28.00	30.00	111.00	4.00	12.00	23.00	26.00	21.00	32.00	114.00
31	Late	10.00	23.00	33.00	41.00	38.00	63.00	198.00	1.00	18.00	26.00	36.00	35.00	51.00	166.00
32	Late	6.00	22.00	27.00	42.00	33.00	56.00	180.00	5.00	24.00	31.00	37.00	35.00	60.00	187.00
33	Late	4.00	17.00	20.00	31.00	23.00	37.00	128.00	6.00	16.00	21.00	27.00	26.00	38.00	128.00
34	Late	6.00	18.00	22.00	35.00	29.00	49.00	153.00	6.00	19.00	17.00	29.00	24.00	35.00	124.00
35	Late	4.00	22.00	25.00	37.00	35.00	49.00	168.00	2.00	21.00	26.00	35.00	31.00	46.00	159.00
36	Late	4.00	21.00	23.00	36.00	32.00	51.00	163.00	6.00	21.00	26.00	35.00	32.00	51.00	165.00