The Reward for Luck: Understanding the Effect of Random Reward Mechanisms in Video Games on Player Experience

Michael Yin
University of British Columbia
Vancouver, BC, Canada
jiyin@cs.ubc.ca

Robert Xiao
University of British Columbia
Vancouver, BC, Canada
brx@cs.ubc.ca

(a) (b) (c)

Figure 1: Screenshots of RRMs in popular video games: (a) Loot box system (Hextech Chests) in *League of Legends* (image © Riot Games); (b) Power-up system (Boons system) in *Hades* (image © Supergiant Games); (c) Randomized loot drop in *Maplestory* (image © Nexon).

ABSTRACT

Random Reward Mechanisms (RRMs) in video games are systems in which rewards are issued probabilistically upon certain trigger conditions, such as completing gameplay tasks, exceeding a playtime quota, or making in-game purchases. We investigated the relationship between RRM implementations and user experience. Video analysis of 35 RRM systems allowed for the creation of a classification system based on contrasting observed dimensions. Interviews with 14 video game players provided insights into how factors such as the affordances of non-optimal rewards and the trade-off between random luck and skill impact player perception and interaction with RRMs. We additionally investigated the relationship between auditory, visual, and gameplay design decisions and player expectations for RRM reward presentations, finding that the resources required to obtain the reward and the relative value of the reward impact its expected presentation. Finally, we applied our findings to propose design methodologies for creating engaging and significant RRM systems.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**.

CHI '22, April 29-May 5, 2022, New Orleans, LA, USA

ACM ISBN 978-1-4503-9157-3/22/04…$15.00
https://doi.org/10.1145/3491102.3517642

KEYWORDS

video games, reward systems, player experience

ACM Reference Format:
Michael Yin and Robert Xiao. 2022. The Reward for Luck: Understanding the Effect of Random Reward Mechanisms in Video Games on Player Experience. In *CHI Conference on Human Factors in Computing Systems (CHI '22), April 29-May 5, 2022, New Orleans, LA, USA.* ACM, New York, NY, USA, 14 pages. https://doi.org/10.1145/3491102.3517642

1 INTRODUCTION

Video games have the ability to grant engaging and interactive experiences to its players [23, 47, 101, 119] - they can evoke a wide range of emotional responses [12, 13] and an even wider range of outcomes [42, 62, 102]. With the meteoric rise in popularity of video games, it has become increasingly important to understand how they can impact player emotions and feelings in order to encourage positive player experiences. Thus, researchers have aimed to understand the underlying mechanics of video games that make them fun and emotional, and how these mechanics may tie into basic human motivations. Bartle states that players may subconsciously evaluate video games based on several factors that contribute to engagement and enjoyment [8]. These factors directly tie into research on player motivations in video games, which has shown that people play video games for various motivational reasons, such as demonstrations of competency and collection of achievements [103, 106, 130]. To feed into and amplify these motivations, players typically require some sort of positive feedback, which comes in the form of reward systems. For example, if a player completes a difficult task in a game, they will expect to receive a reward of high value, such as a high score, a rare achievement, or a valuable in-game item.

Building reward systems is a challenging problem involving a plethora of design considerations. The type of reward received by players (e.g. score-based, item-based, etc.) is largely dependent on the type of game and the goals of the developer. Prior research has investigated game rewards in detail, looking at which factors differentiate reward systems and how such factors may affect the emotions and motivations evoked within the player, oft leading to taxonomical classifications based on these factors [63, 68, 90, 97, 98]. For example, having a variety of reward types [96] or offering a choice of reward [111] can have a positive impact on player experience and engagement. Ultimately, good reward systems can help improve the "flow" of the game - the balance of challenge and skill to achieve optimal experiences [41, 78, 85]. On the contrary, reward systems with unsuitable, non-player-friendly design decisions can lead to negative public reception and social backlash [105].

One subset of reward systems are Random Reward Mechanisms (RRMs) [93]. We appropriate Nielsen's definition of RRMs as reward systems in which a programmed trigger ("eligibility") condition leads to a probabilistic procedure that generates the reward received. As such, the reward initially assumes an unknown, probabilistic state, until it materializes through user interaction into one of many possible rewards. RRMs can take on different forms in various games, for example:

- Killing monsters and receiving randomized loot
- Picking up random weapons in battle royales
- Attaining random bonuses and items in roguelike games
- Obtaining characters or items through gacha systems
- Opening loot boxes for cosmetic items

Although RRMs have been present in video games for a long time [46], they have recently gained increased attention and notoriety as the latter two subsets of the above list have formed some of the largest, rapidly-growing revenue streams in the modern video game industry [122, 133]. However, such RRMs have also garnered significant controversy and critique among policymakers, politicians, and researchers for their addictive, gambling-like qualities [10, 16, 82, 87, 134]. Research into such rewards have shown that they are correlated with problematic gambling behavior, resulting in negative feelings of addiction and excessive expenditures of a player's time and money [14, 16, 80, 109]. The perpetuity of this issue is exacerbated as players themselves do not always perceive virtual RRMs as gambling behavior [118]. However, not all such RRMs are viewed negatively; for instance, microtransactions in *League of Legends* have been perceived positively as a "fair" free-to-play model [69]. The ability for different RRMs to generate varying player perceptions sparks further motivation into their study to understand what specific characteristics elicit certain beneficial experiences and outcomes.

Despite the fact that RRMs are widely prevalent in present games, there has been a limited amount of academic research on user interaction with these systems. This study aims to understand how users interact with RRMs, placing a specific focus on how randomness in particular can introduce novel player experiences. Although RRMs can vary greatly in form and function, they are fundamentally similar in that each reward is an outcome of a probabilistic calculation. Every RRM builds upon this basic foundation, with differences arising in terms of how the RRM is integrated within the core gameplay, what resources are needed to trigger the RRM, what type of visual and audio cues are associated with the reward presentation, etc. We investigate how these factors impact user experience both within the context of the reward process as well as within the game as a whole. We also consider user perception of the social responsibility aspects of RRMs, and what design choices they deem would be crossing the line from gaming to gambling.

To facilitate our investigation, we first perform a video analysis study of 35 different RRMs from 28 different games. Using our findings, we create an initial classification system based on observed differences in design decisions among the investigated RRMs. We then perform a series of semi-structured interviews involving 14 video game players, each shown a common set of different RRMs, with the goal of drawing insights into player attitudes towards RRMs, trade-offs in their implementation, and the effects of various design decisions on user motivations, engagement, and enjoyment. By understanding user perception and interaction with present RRMs, we then develop design considerations for the generation of user-friendly, engaging, and significant RRM systems. Ultimately, the main contributions of this study are 1) the development of a classification system for RRMs, 2) empirical findings on the impact of RRMs on player experience, and 3) methodological considerations for game developers regarding the implementation of RRMs.

2 RELATED WORK

In developing a classification system for RRMs, we first consider prior methodologies employed in developing taxonomies and classifications for general video game reward structures. To better contextualize the experiential impact of the randomness aspect of RRMs, we consider the broader impact of uncertainty and unpredictability within games. To better frame our discussion on how RRMs impact player emotions, we look at ways in which the player experience can be influenced and shaped through multimodal mediums. Lastly, to better understand the rationale behind player perceptions of RRMs, we look at past research into the relationship between video game rewards and human psychological motivators.

2.1 Reward Classifications

To understand how to build a classification system for RRMs, we look at prior research in the field of general reward classifications. Wang and Sun proposed an initial classification system based on the form of the reward and the mechanics involved, taxonomizing rewards into eight specific classes - score systems, EXP systems, item granting, resource collections, achievement systems, feedback messages, plot animations, and additional game content - with four contextual dimensions - social value, effect on gameplay, suitability for collection, and time required to earn and receive the reward [63]. Changes in these dimensions alter the experience in which users interact and relate with the rewards that they receive. Much research in the past has focussed on the second of these dimensions, looking to better understand the motivations and player attitudes towards rewards that are purely cosmetic, i.e. have no pure gameplay value [51, 52, 91, 120]. Hallford and Hallford developed an alternative reward classification system focussed on their motivation and outcomes [60, 97], classifying each reward into one of

rewards of access, rewards of facility, rewards of sustenance, or rewards of glory. This was extended upon by Phillips et al. to include rewards of positive feedback and rewards of sensory feedback [97]. The motivational factors for rewards have been further explored as a primary classification feature. For instance, the concept of intrinsic rewards, where the performance of a task earns a reward that motivates further performance of the task, is in contrast to extrinsic rewards, where the reward signifies the end of the task [99]. With the aim of illustrating the difference among intrinsic and extrinsic rewards in practice, Miklasz outlines 10 dimensions based on the structure of reward systems to show how real-world reward systems fall under these dimensions [90]. Overall, research into the effects of different reward types and the ways in which certain rewards are shown to the user have shown that even small changes in the scheduling and presentation of rewards can have a large impact on task completion and player enjoyment [81, 111].

Many past reward classification studies have been based upon the effects of the reward after the user has received it, focussing on the *post hoc* interactions that a user has with a materialized reward. However, the introduction of a random process that probabilistically selects a materialized reward changes the nature of how users interact with the system before, during, and after the process. Some past research, such as the work of Sato et al. and Ballou et al. [6, 132], has focussed on classifying random rewards garnered specifically through monetary resources. Furthermore, although a classification system for generalized random rewards has been proposed in the past [93], this system focussed largely on reward utility rather than observed design decisions. The importance of classifying such design features within our study is to understand how these observable design decisions, such as visual embellishments, can affect player experience.

2.2 Uncertainty and Unpredictability in Games

To frame our study on the experiential factors of random rewards in video games, we consider past research into the fundamental uncertainty and unpredictability of games. Unpredictability and uncertainty have long been key factors in games and play. For example, shuffling a deck of cards or tossing a die are unpredictable, random events that have lasting effects on the outcomes of games [71, 88]. Caillois argued for the inclusion of uncertainty as a key factor for enjoyable play, asserting that certainty results in a less pleasurable experience [18]. Bogost stated that randomness within games introduces a level of interactivity, as unpredictable consequences lead to a constant stream of player-computer interaction [11]. Empirical studies have largely supported these claims in showing that unpredictable elements within games can often have beneficial outcomes. For instance, Howard-Jones and Demetriou contrasted the experiential outcomes of a random reward with a deterministic reward with the same expected value [65], showing that the random reward led to more intense and contrasting emotions, including frustration and excitement, and was generally preferred by the participants. Researchers have also shown that uncertainty not only affects player emotions, but how players engage with games as well [55, 95]. For instance, a player's personal perception on luck versus chance may influence the way they make decisions in an unpredictable game environment [55].

Costikyan and Consalvo performed a comprehensive examination of popular games to understand the sources of uncertainty within them [40]. The authors generated a categorization system for uncertainty, drawing distinctions between performative uncertainty (uncertainty in physical performance), player unpredictability (uncertainty in regards to other players), randomness (uncertainty based on probabilistic chance), and other forms of uncertainty found in games. Johnson performed a comprehensive theoretical overview of unpredictability in games [71], presenting a typology based on three areas in which unpredictability may occur - within the starting conditions, during the course of the game, and during the final outcomes. To further concretize the concept of unpredictability and uncertainty, Power et al. found five constituent factors that define uncertainty as a concept [100]. Our study of RRMs ties into several of these factors, for example, external uncertainty - the perception of the game system itself being unpredictable. Ultimately, within this study, we conduct an empirical investigation to extend upon the past theoretical findings on the experiential impacts of uncertainty, focussing on one element of unpredictability within games in particular - random rewards.

2.3 Player Experience in Video Games

In recent years, there has been an increased number of video games focussing on delivering engaging and emotional experiences to players [1]. Video games have been described as "structures of feeling" [1] and "sequences of emotional experiences" [54]; the ability for video games to generate strong, visceral feelings have been studied in literature, likening them to other traditional forms of art [56, 67, 94]. Accordingly, methods by which such engagement and emotions can be developed have been similarly studied. The concept of "emotioneering" explores a vast assortment of techniques that can evoke emotions and immersion for players in video games, including music, sound effects, narrative writing, among others [54]. As one example, past research has looked at the impact of sound in video games and its importance in contributing to emotional experiences and player engagement [43, 76]. Sound effects can inform the player that something important is happening, and changing the tempo of background music can impact whether the player feels a sense of peace or a sense of action, providing balance and control over user mood states [76].

Wingstedt explored how the interplay of sound and visuals as a whole can create multimodal statements in multimedia experiences [126]. Visual properties, such as colour and cinematography, can generate effects on user mood and engagement similar to sound [17, 61]. Certain combinations of colours and differing colour palettes can evoke varying emotions and feelings among users in a video game, ranging from fear to serenity, from joy to peace [61]. Researchers have defined the general term "juiciness" to refer to the positive visual and audial embellishments found in games [72, 73, 77]. Research has shown that juicy effects can affect play time, intrinsic motivation, and performance [73, 112]; however, a direct investigation of juicy effects on loot boxes has shown that their player experience effects were generally muted [74]. Overall, a variety of factors can affect player emotions within games. To assess the wide range of emotional effects that may arise, models have been designed to help developers and researchers better construct

and quantify the emotional requirements in video games [19, 20]. In this study, we draw inspiration from past research to investigate how factors such as juiciness affect player emotion, enjoyment, and engagement during RRM processes in video games.

2.4 Reward System Motivations and Perceptions

Investigating the motivations for which people play video games is fundamental to understanding what they expect to get out of the experience, i.e. the rewards that users receive from playing the games. Much research has been done in this subject, extracting several core reasons that underpin player motivation for gaming, including demonstration of competency, exploration of new worlds, socialization with other players, and so on [7, 131]. Past research has framed these motivations under cognitive evaluation theory (CET), emphasizing the importance of the factors of autonomy - the ability for players to voluntarily make choices, explore strategies, and set goals, and competence - the need to feel challenged, demonstrate skills and receive positive feedback, as internally motivating factors within video games [103, 106]. With respect to this positive feedback, video games tend to have reinforcement and reward schedules that can potentially optimize for motivation [86].

Studies have been done into the perception of random rewards, especially those that involve real-world currency (loot boxes in particular). Sakhapov and Brown found that player perception of fairness was largely swayed by transparency - whether the odds for the reward are shown to the player [107]. They also found that players were not fundamentally against the system of random loot boxes, and occasionally found the process of opening them fun in a balanced system. Johansson and Grönström looked at loot boxes in *Counter Strike: Global Offensive* through a perspective of player utility, showing how game companies could use techniques to generate perceived utility for loot box systems [70]. Nielsen's investigation on RRMs highlighted similarities between certain random rewards and gambling, as well as demonstrated how random rewards may generate artificially-created value for players [93]. Overall, we extend upon these past works but place an emphasis on player perspectives and experiences, exploring the interplay between random rewards and the fundamental motivations for playing video games. For instance, we consider how the introduction of abstract factors such as luck and randomness may influence feelings of autonomy and competency for players.

3 METHODOLOGY

3.1 Material Collection and Video Analysis

To better understand the differences and similarities among RRM systems, we performed an initial video analysis study on currently existing RRM systems within present video games. To motivate the selection of a sample of video games among the innumerable games that exist, we revisited our overarching evaluation goal of understanding the effect of different RRM systems on (primarily positive) player experience and outcomes. Thus, we aimed to select a sample of video games and associated rewards that promote such experiences. This was accomplished through a series of independent criteria listed below.

- High number of active daily players - For this criteria, we used Steam as a database for games, and considered games that fell into the top 100 of active daily players on Steam [114]. We considered active daily players to be a representative metric of the outcomes of high user engagement and sustained engagement over time.
- High revenue numbers - For this criteria, we considered games that have grossed over $100 million USD in revenue [123]. We considered high revenue numbers to be a representative metric of the outcomes of player willingness to spend monetary resources on the game.
- High number peak player count - We considered games that have had a peak player count of over 10 million [124, 125]. In contrast to the first criteria chosen, this is considered to be a representative metric of the outcomes of high short-term engagement and possible virality.

We recognized that these criteria may be largely influenced by factors other than RRMs; nonetheless, we use these criteria as basic metrics to select a sample set of games. We strove to select an equal number of games from each of these criteria to generate a diverse set of games and rewards. In addition to these factors, we selected between a mix of games in which the researchers had some prior personal experience with and games that were unfamiliar to the researchers. The games in which the researchers had engaged with before helped provide a baseline of understanding for how RRM systems function in those games and allowed for a reference of comparison for previously unseen systems. In doing so, the researchers brought some aspect of *a priori* knowledge towards the RRMs, which would help with the subsequent analysis methods. Within each game, we verified the existence of RRMs. As several games had fundamentally different RRM systems, we investigated each of these independently. Overall, we found that 35 RRMs from 28 games provided us with a sufficient number of rewards to investigate; at that point, we found that additional RRMs only minimally increased the variation and provision of new information among the investigated rewards. The full list of RRMs and associated games can be found in this work's supplementary materials.

A video analysis was performed on each RRM system. Firstly, for each RRM, we extracted a video from before the reward was received until right after. These videos were either extracted from personal playthroughs (when the game was easily accessible) or videos of others' playthroughs found online. Detailed observational notes were taken for each of the videos. We focussed solely on objective, technical characteristics of the reward, such as what the reward was, what animations played when receiving the reward, what the trigger condition was, etc., and excluded any subjective human factors from our analysis, such as player reaction to receiving the reward. As this method would only allow us to understand short-term, singular instances of the reward, the observational notes were further augmented with additional details found on in-game menu screens, official game websites [4, 24, 48, 49, 121], and dedicated crowdsourced wiki pages [25–32, 34, 36–38, 115], which have been shown to be reliable through past research [2, 44]. In addition, notable discussion of reward processes on popular online forums such as Reddit was also noted [3, 104, 129].

Table 1: The 9-dimensional final representation for RRM grouping and coding. Some dimensions included codes of "Not Applicable" and "Unable to Tell".

Reward characteristics within the context of the overall game: • Genre of game, *e.g.* first-person shooter, MOBA, roguelike • Type of reward, *e.g.* equipment, in-game currency, character cosmetics, a mix of the prior • Effect on gameplay • Reward frequency
Integration of RRM system within the game: • Trigger condition to receive random reward, *e.g.* intrinsic (receiving rewards from playing the game) vs extrinsic (receiving rewards without engaging in the core gameplay) • Materialization of random reward into received reward, *i.e.* the process in which the random reward materializes into one of the possible options and is received by the player • Interaction with received reward
Factors involved in the presentation of the reward: • Auditory and visual effects for individual rewards • Indicators for the rarity or relative value of individual rewards

With a textual representation of 35 RRM systems, we conducted thematic analysis [15] with the goal of extracting the various factors - the similarities and dissimilarities - between such systems. We leaned towards a deductive approach for thematic analysis, drawing on our knowledge of prior literature and anecdotal understanding of video game rewards in order to guide our analysis process. To perform the analysis, a round of open line-by-line coding was performed on the textual data for each RRM. At this stage, coding labels revolved around the basic observable concepts, such as whether sound effects existed during the reward opening process, whether the reward was a result of monetary, time, or effort expenditure, etc. These initial coding labels were then grouped and categorized to generate the fundamental categorical dimensions of the rewards - aspects such as the the specific type of reward, their effect on gameplay, their integration into the game, etc. These categories formed the basis for a diverse set of variables within our RRM classification system. To distill these into meaningful dimensions for a classification system, we performed a round of refinement through a final review of these categories; removing redundant ones that were either too narrow and applicable to only a subset of RRM systems or too broad and applicable to all of them. Overall, this resulted in a RRM representation of 9 dimensions (Table 1). These dimensions formed the classification system for RRMs drawn from our observations, based on observed and implicit details.

A second round of analysis was performed to group these reward dimensions into broader categories based on the impact of the dimension within the game. These categories included the terms "Reward Characteristics Within the Game", "Reward Integration within the Game" and "Reward Presentation". These categories would later give rise to an understanding into the areas in which the reward could impact the player experience, forming some of the basis for subsequent interview questions and findings.

3.2 Interviewee Recruitment

Potential participants were identified through personal connections and snowball recruitment. All of the potential interviewees were identified as people who currently play video games and have current or past experience with RRM systems. We reached out to these participants through online channels of Facebook Messenger, Discord, and email. We used purposive sampling to help further narrow the recruitment of people to those more ingrained in the gaming community, who had a broad range of games experience, and who had greater exposure to a variety of RRMs. Ultimately, we narrowed down our recruitment to 14 video game players (Table 2), with whom we conducted semi-structured interviews through remote video calls.

3.3 Interview Protocol

The goals of the interviews were to understand how the expression of emotional feelings and engagement within players vary with different auditory, visual, and other experiential design decisions as well as to convey overall player thoughts about their motivation and autonomy when faced with unpredictable RRM systems under various contexts. Interviews were audio-recorded when permission was granted, and personally identifiable information was removed.

Participants indicated a variety of different RRMs they had previously engaged with, coming from a diverse set of games, not all of which were familiar to the researchers. To unify the experience and to ensure that each participant would see a diverse set of RRMs with different characteristics, participants were asked to watch video clips from 7 representative RRMs from 7 different games. These RRMs were selected based on our prior classification system, with the aim of introducing diversity by selecting a subset of RRMs that essentially covered all the coded labels. These RRMs were:

- Hextech Chests from *League of Legends* [58]
- Packs from *Apex Legends* [50]
- Weapon Cases from *Counter Strike: Global Offensive* [116]
- Tower of Oz Ring Boxes from *Maplestory* [127]
- Wishes from *Genshin Impact* [89]
- Quest Rewards from *Monster Hunter World* [21]
- Boons from *Hades* [59]

Table 2: Summary of Interviewees

ID	Age	Sex	Hours Playing Games / Week
1	24	M	20
2	24	M	25
3	23	M	20
4	23	F	5
5	24	M	5
6	20	F	5
7	23	M	4
8	23	M	10
9	24	F	5
10	23	F	21
11	30	M	16
12	24	M	5
13	23	F	10
14	23	M	20

Participants were provided with the context of each of these systems, including information about how frequently the reward occurs, what trigger condition gives rise to the reward, and how the rewards could be used in game. Participants were asked if they had prior experience engaging in any of these selected games. This was noted down to better shape the direction of the interview when discussing these RRMs. For each video clip, users were asked about what aspects they liked and disliked about each reward system and why. A variety of features were discussed, including the impact of auditory and visual characteristics, the integration of the RRM within the game, etc. After watching all of the clips, participants were asked to compare and contrast the RRM implementations, focussing on which dimensions of the RRMs had the most significant impact on their overall experience and enjoyment, and how each RRM system affected their motivations and goals within the context of the game. Participants also contributed information and experiences relating to RRMs that they were most personally familiar with. The interview script with the various questions asked can be found in the work's supplementary materials. Overall, each interview was approximately 60 minutes long, and interviewees were compensated $10 CAD per hour for their participation.

3.4 Data Analysis

Each interview was transcribed and then coded using a thematic analysis method in order to extract the common themes among participants [15]. First, an initial round of line-by-line open-coding was performed in order to summarize and better understand the relevance of each line in the transcription. This was followed by a secondary, more focussed coding round revolving on grouping the initial coded data into final codes associated with broader categories and ideas. These final codes were then clustered to generate an affinity diagram representing a hierarchical system of information across all the interviewees, which would form the basis for our extracted themes and findings. Prior knowledge from our initial RRM video analysis study, as well as background research in the area, provided further deductive guidance and motivation for the themes.

4 FINDINGS

4.1 Attitudes towards RRMs

4.1.1 RRMs and Uniqueness in Playthroughs. Generally, all participants expressed positive attitudes towards certain implementations of RRMs and towards randomness in games in general. One common sentiment was that random rewards added a sense of freshness and uniqueness to gameplay. In games such as RPGs, receiving different rewards would force players to adjust their playstyle towards these rewards, so they cannot simply rely on walkthroughs to replicate the behaviour of others. For certain games which rely on replayability, such as battle royales or roguelikes, this sense of freshness provides individuality for each playthrough, as each instance would play out differently depending on the random rewards the player would get, e.g. *"The fun comes from the fact that the playthrough is fresh and unique, especially in roguelikes where you have to have each playthrough not be the same to have that replayability"* (P2). In comparison to non-random reward systems, i.e. deterministic rewards, most people expressed an attitude akin to *"if everything is very deterministic, it's not very exciting anymore. Introducing some randomness creates flexibility and introduces diversity into the game"* (P5). This corroborates the work of Costikyan and Consalvo, who argue that one of uses of randomness within games is to generate asymmetry, which creates different ways to play [40]. Some participants indicated that RRMs evoke a larger spectrum of emotions than deterministic rewards. As the random process inherently allows for a spectrum of different possible rewards, some with higher or lower personal or inherent value, the reward result can be a source of both intense disappointment or elation. Past studies in uncertainty have shown similar results - uncertainty can generate a more diverse and emphatic set of emotions within players [65]. In particular, our studies revealed that players have a heightened sense of anticipation and hope before the reward is presented, tying into past research on how the deferral of eventual rewards can generate increased anticipation [84].

4.1.2 Trade-Off Between Luck and Skill. Participants stated that non-cosmetic random rewards that directly affect gameplay often introduce a trade-off between skill, which users defined as the competency a user has in playing the game, and luck. With random rewards, players who are less skilled can sometimes match up against those who are more skilled if the former receives significantly better rewards. Although participants recognized that this may sometimes not be the desired result, especially in more competitive settings, many shared the sentiment that on a casual level it makes the game more fun and less frustrating, especially for the "less-skilled" majority. As one participant expressed, *"it makes [Apex Legends] fun since people with different skill levels play the game. Right now, a bad player with a good gun can fight it out with a good player with a bad gun, so [RRMs] offers a chance for it to even out the skill level among multiplayer games"* (P1).

Although random rewards may attenuate the impact of gameplay skill, we noticed that from a different perspective, it also introduces a new skill - adaptability, which we define as the ability to optimally adjust playstyles and decision-making processes based on the received random reward. As such, although RRMs may be perceived as a mechanic involving a trade-off between skill and luck, they

can also represent a trade-off between different sets of required skills. When discussing the reward of obtaining random loot (i.e. guns) in *Apex Legends*, one participant indicated that *"you have to play accordingly and strategically based on which gun you have, so it allows more creativity"* (P7). The ability for players to flexibly adapt their strategy to any of the rewards that are received is a type of novel skill that is unique to games with RRMs, necessitated by the fact that users may get any range of rewards with different attributes, stats, and features. Another example of adaptability can be seen in the game of poker. In poker, the ability of players to adapt their strategy to each materialized random variable is considered a major contributor to skill level within the game [40]. Thus, on one hand, for less-skilled players (in terms of gameplay), RRMs can be an important factor to help them keep playing. On the other hand, for skilled players, RRMs assesses their competency in adaptability. Thus, RRMs may elevate players' motivation to play the game, whether they are skilled or not.

4.1.3 Player Frustrations Regarding Gameplay-Obstructing RRMs. Due to the nature of RRM systems, rewards may have different affordances that affect how they can be used in the game. Some participants levied criticism toward the implementation of these RRMs in drastically impacting in-game progression. In certain cases, players perceived that they were almost required to attain certain rewards through a RRM system in order to gain progression through the game. One pointed to *Maplestory* as an example of *"A game where if you don't pay money or put in a lot of time, you can't play most of the game"* (P8). Ultimately, participants disliked implementations of RRMs in which game progress is largely stalled or impeded unless the user can either pay money or put in a perceived disproportionate amount of time to "grind" for the necessary optimal rewards. Grinding has been described as the process of continually performing an in-game action until an outcome has been reached. Although grinding can sometimes be viewed as a motivator for gameplay (especially if the action is enjoyable to the player) [64], it can also incur feelings of boredom when players view their actions solely as a means towards an end [71]. An example of grinding can be seen in *Maplestory* - in order to progress certain questlines, users need to complete the task of collecting a certain number of loot items dropped according to random chance by monsters. One player stated that their mentality when engaging in this sort of grinding was that *"you're just hoping the items drop, you're sort of wondering am I just unlucky or am I spending more time than I really should be doing this sort of thing"* (P10). This player recognized that systems of grinding for rewards is not unique to RRMs - grinding also can be deterministic (e.g. in *Maplestory*, certain other questlines require you to kill a specified number of monsters). However, this player ultimately stated that a deterministic system was much preferred over a random one - *"I definitely prefer the deterministic one ... it definitely just feels a little better to just know that you'll be done once and for all if you do it in a deterministic way"* (P10), which corroborates past research on the impact of stochastic rewards [39]. Overall, the uncertainty in player expenditure of time and effort can make randomized grinding a generally unappealing aspect to players.

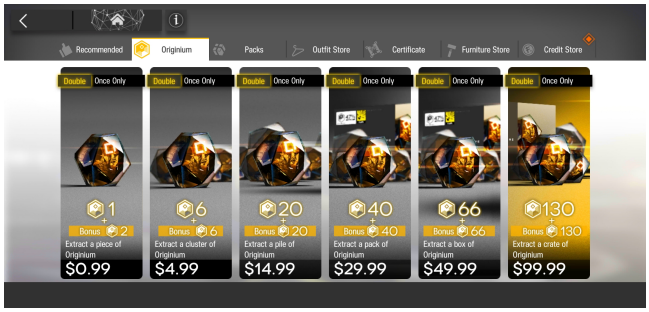

Figure 2: *Arknights*' in-game currency can be purchased by expending real-world money. This in-game currency can eventually be traded in for a "headhunting pull", the game's gacha system that provides players with randomly-drawn operators (in-game usable characters) [35] (image © Hypergryph).

4.1.4 "Simulated Determinism" and Disengagement through Repetition. Another criticism of RRM implementations relates to real-world currency as a trigger condition for the reception of the reward (an example of this from the game *Arknights* [66] is shown in Figure 2). In the RRMs that were viewed as having non-problematic effects, rewards were largely received through an *intrinsic trigger*, conditions that trigger automatically through simply playing the core game. In these cases, the reception of the reward is gated by the time and effort to trigger certain programmed game conditions. However, in gacha-like implementations, items are received through the *extrinsic trigger* of paying in-game currency, often exchanged from real-life money. Thus, the concept of time and effort as necessary trade-offs for the reception of earned rewards is lost - disposable financial resources outweigh these factors, which players reacted negatively towards. When players are willing to pay money for rewards, these rewards essentially occur at a continuous schedule so long as the player continually puts in money, leading to a highly repetitive reward process [53]. As some participants indicated, this allows them to exploit the probabilistic nature of RRMs in order to increase their probabilities of getting their desired, often-rare rewards.

One participant stated that *"I go in with the expectation that I will pull this character, and have a budget for my pulls"* (P3). In these cases, players are essentially simulating the reception of a deterministic desired reward through continually triggering random rewards at the cost of money. In these cases, the previously discussed positives of random rewards - diversity in gameplay, adaptation to provided rewards, and excitement from uniqueness - are lost. The same participant stated that when they engage in these systems, they view all other rewards with apathy, and even when they get the desired reward, they may feel *"happy, but also unlucky if it took too many tries"* (P3). Risking real money puts an overemphasis on the outcome of the RRM [40], and when the outcome is undesirable, users tend to react negatively. In addition, due to the continuous trigger of the reward process, the RRM process tended to become stale to users quickly and users tended to disengage from the reward process, e.g. *"I feel if I were to open a lot, e.g. like 100 or 300, I would like to skip the animation ... it would get annoying after a*

while" (P2), *"getting so much loot I'm not as excited because it's so repeated"* (P9), or simply *"it's too much, it's too repetitive* (P11).

4.1.5 Perceived Gambling, Entrapment, and Near Miss. Some participants likened RRM systems that allowed the use of real-life money to gambling, and put the blame on companies for exploiting the playerbase. For example, when recounting their past experience with gacha games, one participant stated that *"I'm not a huge fan of the system because they are optimized to make more money, they are designed so that if you don't spend money your progress is a lot more limited. [Companies] have psychological tricks to make you spend more money"* (P8). This participant referred to tricks as possible psychological stratagems that encourage harmful playing. From our interviews, we were able to identify two such examples of these tricks - entrapment and near miss [75].

Entrapment is a phenomenon in which players feel obligated to continue investing resources in obtaining a reward, despite constant loss [75]. Within the context of RRMs involving real-money, entrapment can manifest when players continually purchase rewards with the goal of obtaining a high-rarity one. Xiao and Henderson argue that the "pity system" mechanic prevalent in games may give rise to such effects [128]. Through our material collection and observation of existing RRM systems, pity systems (systems in which the probability of getting a higher value, and thus more desirable, reward increases with the number of times a user triggers the condition to receive the reward [33, 135]) were found to be most prevalent in RRMs that exchange real-life money for rewards. Although such systems can be seen as player-friendly mechanics that help players achieve their desired results faster at a statistically lower financial cost (e.g. *"it feels better to pull with a more guarantee at the back of your mind"* (P2) and *"[a pity system] encourages the player to keep going since they expect they will get something better"* (P5)), they also served as temptations for users to spend money for better odds; money users may not otherwise spend in the absence of such a system. At least one player stated that they would likely not spend money on games without pity systems, e.g. *"I think you have to have a pity system or else I would get so mad in not getting the item forever that I would actually quit the game"* (P14).

Near miss is a phenomenon in which the player feels that they are close to winning despite a loss, even if this is not necessarily the case [75, 108]. Within the context of RRMs involving real-money, near misses arise when players feel they are close to getting their desired reward, thus being encouraged to pay again for another chance at the reward. An example of such a system is weapon cases in *Counter Strike: Global Offensive*. In the presentation of the reward, a virtual roulette wheel showing all possible receivable items spins until it stops at a single weapon. When the user receives an undesired item that is spatially close to a desired item, players feel as though they were close to receiving that item, even though in reality this may not be the case, e.g. *"you're just like praying it lands on a spot that is really good, it's like oh, I was so close to getting this purple one"* (P6), with purple indicating a rarer and more valuable reward. However, some participants did catch onto this phenomena, e.g. *"I don't like how it baits you with "almost" getting rare items"* (P3).

4.2 RRM Presentation

4.2.1 Auditory, Visual, and Integration Design Decisions. From our interviews, we found that the auditory and visual features involved in the presentation of RRM rewards played a large part in player enjoyment and engagement of the overall game. Players noted that suitable auditory and visual features were highly dependent on the context of the reward in the game. Participants expressed a desire for a more "juicy" presentation - one that is more visually and auditory stimulating and involves more polished animations and particle effects - if they are putting in a large amount of resources (time, effort, and/or monetary value) in order to trigger the condition for the RRM reward, e.g. *"you expect the presentation to be very satisfying, you want a kinda wow, amazing type of visual and audio cue"* (P2). Ultimately, this finding helps contextualize prior research on the relationship between juicy effects and player experience in RRM systems [74], showing that the level of juiciness in reward presentation should be commensurate with the resources involved in obtaining the reward in order to have a positive effect.

However, the presentation experience also depends on how the condition for the RRM is integrated within the core gameplay. One participant stated that *"If the gameplay is related to what and how you receive [the reward], it's ideal that it doesn't break the gameplay flow"* (P3), demonstrating that an RRM triggered by a core gameplay event, an intrinsic trigger, differs from an RRM triggered by an external event, an extrinsic trigger. Participants indicated that most RRMs should typically match the *"pace"* (P14) or *"flow"* (P3) of the game, explaining that frequent RRMs received from intrinsic rewards from playing the game should be presented directly within the game without the need to break the core gameplay session. These rewards tended to feel less significant to the user, for example, in regards to the upgrade system in Hades, interviewees stated that *"I don't really feel the weight as much"* (P3). However, it was noted that infrequent, high-effort RRMs can be presented within a separate menu as contrast, as the additional work done by the user (in the form of button clicks) can introduce variety in how rewards are presented and emphasize the importance and value of specific reward mechanisms.

4.2.2 Rewarding Luck. Compared to other reward mechanisms, RRMs may take on any range of possible rewards, some significantly better or worse than others. Ultimately, the determining factor in determining where this reward falls on the spectrum comes down to a probabilistic dice roll, where the concept of luck plays a major role. The relative value of the reward provided by the RRM is frequently indicated by "rarity" - a common term across video games typically denoting the value of a reward. In RRMs, high rarity rewards are typically much scarcer, resulting in lower percentage odds of materializing for the user [79, 121]. However, rare rewards are typically much more desirable for the player to obtain, due to the fact that they typically provide better in-game stats, are more aesthetically pleasing, etc. Interview participants tended to express greatly positive sentiments towards obtaining rare items, e.g. *"I feel very happy if I get a really rare item"* (P7). However, one consequence of having tiers of rarity is that lower-rarity rewards are often treated with indifference, despite the fact that they are technically still beneficial rewards provided to the user. When describing the attitude towards lower-rarity rewards, participants

Figure 3: Rewards in the form of gun skins from opening packs in the game *Apex Legends* have different associated colours and effects depending on their rarity - (a) a common (gray), (b) rare (blue), (c) epic (purple), and (d) legendary (gold) gun skin (image © Electronic Arts).

typically responded with displeasure, e.g. *"if I get something [not as good] I feel worse"* (P6), or apathy, e.g. *"oh well, unlucky"* (P3). A greater disparity in reward value and presentation tended to induce stronger negative emotions for users when receiving lower-valued rewards. Despite this, users still showed a preference for having different values of rarities clearly displayed, with the common sentiment being that the elation of infrequently receiving rare rewards heavily outweighed the disappointment or apathy of getting many non-rare ones.

The rarity of an item is one of the most important factor in RRM rewards. The random aspect of rarity contributes to a heightened feeling of drama and suspense within the player just before receiving the reward [40], and additional factors, such as auditory cues and visual effects, work together in tandem to reinforce these feelings. During the interviews, nearly all participants emphasized the need for high-rarity items to be clearly represented to have a stronger emotional impact through the use of special auditory and visual cues. Users mentioned the common standards of colours used across many video games to denote the rarity of items. Gray, blue, purple, gold in order of increasing rarity is a common pattern, with variations existing depending on the game and the number of rarity tiers. For example, gun skins in *Apex Legends* (Figure 2) fall into four rarity tiers and follow the aforementioned colour standard. Users indicated that games should generally follow these existing standards due to the acclimatization of these colours to evoke certain expectations. Participants also mentioned a variety of methods used to present high-rarity items that would increase their positive emotional effect on the user, including *"the animation should take longer to build suspense"* (P2), *"if the reward is very rare, it deserves a better animation"* (P5), and *"adding delay and baiting the colours of the rarity for the thrill"* (P3). Users indicated that the existence or non-existence of juicy visual and audio cues in games can have drastically different effects on their emotions, for example, *"In Genshin Impact I feel I got something really good because I can see that it shows that I got something really good. whereas in [League of Legends] they feel all the same, …, so I don't really care about the skin I get it's all just whatever* (P14).

4.2.3 Reward Presentation as a Reward. The reward presentation process of RRMs can be seen as a reward in itself. The juiciness of the presentation, in the form of visual effects, animations, sound effects, and music, may be used to generate anticipation and excitement. For example, when packs are opened in *Apex Legends*, players are presented with a short animation in which a robot appears, spins around with multicoloured lights corresponding to the rarity of the items the robot contains, and then drops these randomized items for the user. This process was well received by the interviewees, who stated that *"it's just visually appealing to look at"* (P8), and *"you get a flash of light at the beginning, and you're like oh ****, … it's really exciting you know."* (P5). Similar sentiments were issued for games with high quality animations and polished effects, such as *Genshin Impact* and *Monster Hunter World*. Participants indicated that having these juicy animations and effects strongly affected their emotions and anticipation. As a result, the combination of these various factors constituting the reward presentation as a whole can be treated as a reward - an audiovisual experience provided to recognize the player's efforts on top of the received reward. Participants noted that these features feel particularly rewarding when they have put in a large amount of time, effort, or monetary value into obtaining the reward and are thus expecting to receive a highly valuable reward.

On the contrary, when users invest these factors, and the presentation lacks these juicy factors, it can hinder the user's enjoyment of the reward. In *Maplestory*, when users complete a "Tower of Oz" run and receive a ring box, the opening of the reward is presented with minimal visual effects and sound effects. As a result, participants reacted negatively, stating that *"I think it's pretty bad … it's not something that is super spectacular, or something that makes you feel really great and stuff"* (P1), *"It's like another chore"* (P13), *"don't feel excited to get it"* (P9), and that *"Wow, this is the most boring opening I've ever seen. It feels like you're doing homework, feels like you're just clicking buttons. There's no visual feedback or visual reward"* (P7). In this case, users felt demonstrably worse compared to the expressed sentiments for other RRM reward presentations, noting that this presentation could devalue the received reward for them as well. This illustrates the importance of suitable effects in presenting RRMs, essentially turning the reward process into a reward in itself and generating additional feelings of competence and accomplishment for the player. One participant expressed that they enjoyed high-quality animations during the reward presentation *"because it shows appreciation from developers when you get rewards so [the animation is] in a sense a reward for progression"* (P1).

However, even with juicy effects, the way in which these effects are implemented may impact player enjoyment as well; ultimately, users' subjective feelings play a part in impacting their experience. One controversial reward presentation is the opening of weapon cases in *Counter Strike: Global Offensive*, which uses a virtual roulette as described previously. Participants were split on whether or not they liked this roulette animation. Some users stated that *"I really like how you can see all the possibilities of stuff you can get, and you're just like praying it lands on a spot that is really good"* (P14) whereas others stated that *"I think it might annoy me"* (P8). Participants were almost universally in agreement that this reward presentation was the closest to gambling, with many expressing similarities to slot machines. Although this was mostly seen as a negative aspect, some people stated that they liked it because it was similar to virtual gambling, e.g. *"I like it very much … it's like you go to the casino to play slots"* (P5).

5 DISCUSSION

5.1 Implementing and Designing RRM Systems

5.1.1 Randomness and its Effect on Player Experience. Our findings indicated that random rewards have a number of different experiential design considerations that must be considered by game developers. It is important to understand the benefits and detriments of having RRM systems versus the direct alternative - non-random (deterministic) reward systems - where the same reward is provided to all players upon their trigger condition. As a RRM reward can take on a spectrum of different rewards, RRM systems must consider the affordances and consequential player experience provided by all levels of rewards - i.e. how player experience differs when different rewards are provided and how players may adapt to different rewards. From our findings, players feel apathy and annoyance when the random process provides them with rewards that lack personal or relative value compared to what they could have received. When players obtain perceived undesirable rewards, the game designer must consider what subsequent actions a player may take to alleviate these negative emotions. Will players tend to trigger the condition to obtain the reward again (requiring repetition and more time and effort) or will they tend to adapt to what they have and be forced to continue the game (requiring the user to adapt to worse rewards)? The interaction of users with random rewards introduces unique challenges and emotional considerations for game designers to consider.

In some extreme cases, users may feel as though they must obtain certain rewards in order to progress the game in their desired manner. If there are certain aspects or features of the game users cannot access until they obtain the correct reward, we hypothesize from our findings that users will tend to view this extremely negatively in terms of engagement and enjoyment. Grinding for the sole purpose of receiving a reward is viewed negatively by players, and the process of repeating an action they otherwise would not until they eventually achieve the correct reward can be extremely frustrating and boring [71, 92]. Thus, one proposed design rule is that gameplay features should not be blocked based on the reward that a player gets from a RRM. Game developers should not let the player experience greatly suffer when luck provides players with less valuable rewards from RRMs.

Our findings also indicated that the implementation of RRM mechanics heavily places player anticipation and associated positive emotions on the most valuable, highest-rarity rewards provided from the RRM system. Players view all other rewards largely with indifference and apathy, treating them as obstacles or hindrances between them and the higher value rewards. When designing an RRM system, developers should consider whether this emotional trade-off fits within the context of their game - is it worth it for players to feel better receiving scarce good rewards if it means that they must feel worse when receiving the plentiful poor rewards? In some cases, this may depend on the odds in which different rewards are randomly manifested. Our interviews have shown that users who continually receive poor rewards start to quickly feel highly negative emotions. Developers should consider whether or not it is worth implementing a system for a player to eventually receiving a good reward, evoking positive emotions and feelings of appreciation in the player, after obtaining multiple poor rewards from an RRM, e.g. through a pity system. Similar to prior recommendations regarding uncertainty in games [40], game developers must ultimately aim to strike a balance between the experiential outcomes of RRM systems based on the experience they aim to induce.

5.1.2 Luck versus Skill: A Question of Fairness. When RRMs directly affect gameplay elements, it was noted that some portion of skill was traded off for luck - a lower-skilled player could match up with a higher-skilled player if the rewards received are objectively favourable towards the lower-skilled player. Although many interview participants indicated that this has many benefits, such as making the game less frustrating for novice players, participants also provided potential drawbacks of this trade-off. These drawbacks were especially evident in competitive multiplayer games, e.g. *"it could make some players very mad because luck is random, so if they lose to someone worse because of luck it might make them very uncomfortable or very sad or feel that it is unfair."* (P7). Certain players may feel slighted or annoyed when the factor of luck native to RRMs cause them to lose to perceived worse players. On the other hand, Costikyan argues that many players want to feel that they won through their skill at the game, and not random luck [40]. Framing these arguments in terms of past research in video game motivation [103, 106], RRMs may cause players to feel a loss of autonomy because they relinquish some aspect of control in terms of what sort of rewards they get. Furthermore, players may feel slighted because their perceived competence goes unrewarded, leading to increased frustration and disengagement from the game. Past research in the area has shown that a mismatch in skill levels for competitive games can cause enjoyment to deteriorate for all; attempts to balance the game, while helpful in decreasing the skill gap and increasing enjoyment for certain users, can be controversial when considering perceived fairness [9, 22, 117].

It was noted that for competitive games with consequences, e.g. esports, factors of luck may undermine the competitive integrity of the game. Many interview participants perceived luck in these games to be largely detrimental, aligning with the view that competency, the skill of performing the core gameplay of a game, should be the determining factor in who wins in a competitive setting. Although the concept of luck undermining competitiveness is a common view, past research has argued that subtle amounts of luck may in fact enhance competitiveness and add suspense to the results of competitive contests [110]. In addition, as argued before, unpredictability from random rewards can incite the development of an additional skillset - adaptability, the ability for a player to adjust their strategy based on random variables [40]. Thus, top players can differentiate themselves not only through pure gameplay skill, but through adaptability as well. Overall, games that are highly dependent on random rewards have worked as competitive esports in the past [5, 57], yet have also been criticized for this exact factor as well, as developers struggle to balance rewards for both casual and competitive players [83, 113].

5.1.3 Designing for Emotional Significance. From our findings, we recognized that the rewards users receive from RRM systems can provide various levels of emotional impact to the player based on 3 key factors:

- The time required for the user to trigger the condition to receive the reward.
- The effort required for the user to trigger the condition to receive the reward.
- The relative value of the received reward.

As well as one additional optional factor:

- The equivalent monetary value required to receive the reward (depending on whether or not the RRM can be achieved through monetary spending).

For RRMs that require more time, effort, or monetary value in order to receive the reward, users had a tendency to attach more sentimental meaning and emotional significance into the reception of the reward. In doing so, they expected that the visual and auditory features in the presentation of the reward should be proportional to its significance - the presentation should be more juicy. Unique to RRM systems is that, despite the resources that a player puts into receiving the reward, they may still receive a relatively poor reward that they feel is disproportionate to the resources they have put in. From our findings, we understand that there is still purpose in having poor rewards that are presented with much less audiovisual fanfare - the contrast they provide makes the reception of higher value rewards feel much more emotional and meaningful to the user. When users receive a rare reward when this contrast exists, they feel as though, in addition to their time and effort, their luck has also finally been rewarded as well. The contrast and disparity between different relative values of rewards from the same RRM system was seen as an overall positive throughout the interviews.

We also found that the significance and personal value of the reward is directly tied to the presentation of the reward, including how the player should navigate to receive their reward (whether they need to navigate to a separate menu) and its juiciness. When the reward process was polished and included added features such as animations and particle effects, positive emotions including appreciation and happiness were induced - the reward process itself was perceived to be an added reward on top of the already received reward. Decisions such as having the reward process take place on a menu separate from the core gameplay could provide additional anticipation and excitement to the process, despite inconveniencing the player through executing more button clicks. On the other hand, mismatches between the presentation of the reward and the perceived value of the reward introduced negative feelings of annoyance, apathy and boredom.

To illustrate how these design decisions differ across two distinct RRMs, we contrast the "boon system" in *Hades* to the "hextech chests system" in *League of Legends* (Figure 1). *Hades* is a hack-and-slash roguelike in which players continually clear rooms and fight bosses at the end of every stage. In many rooms, users are able to obtain boons - upgrades to their character - after clearing them. For this reward, the time and effort required for the user to clear the room is relatively low, the condition of clearing a room is tied in intrinsically with the gameplay progression, and users frequently clear many rooms in a single run. On the contrary, *League of Legends* is a MOBA in which players engage in 5-on-5 games. Users obtain keys and chests by playing games and performing well. They can then use these items on a separate menu to craft new champions, skins, emotes, etc. For this reward, users require substantially more time and effort to obtain the necessary prerequisite items, the condition of unlocking a chest is done on a menu separate to the core gameplay, and the reward is presented much less frequently. Participants expressed drastically different expectations between these two reward processes - the hextech chests were viewed more critically in terms of the auditory and visual qualities. On the contrary, when discussing Hades' boon system, users stated that *"it doesn't need to look flashy, it's part of the game."* (P8), *"it's a different mechanic compared to the others … because it is so common, it should be faster."* (P14), and *"I kinda approach it with a different mindset, not about satisfaction or coolness, it's just after you see the choices, which one should you choose for your character"* (P2).

Thus, when designing RRMs, it is important to consider the potential perceived significance of a reward for the player, which is typically proportional to the resources expended to receive the reward. Different amounts of required resources induce different expectations within players in regards to reward presentation and reception. The design of the RRM presentation, including the juiciness of the auditory and visual effects, ultimately involve a trade-off between gameplay flow (and the possible introduction of typically non-user friendly design decisions) for a higher emotional impact and higher perceived significance. If the design of the RRM presentation fails to match player expectations, players may become frustrated and annoyed, leading to disengagement from the game.

6 LIMITATIONS

We identify several methodological limitations within the scope of our study. Firstly, it is not guaranteed that our selection of 28 games and 35 RRMs provided us with enough information to make statements regarding all RRMs. We recognize that some of this derives from the arbitrariness in criteria in game selection. This issue was brought on by the limitations and difficulties in gathering summative information across games. Whereas it was simple to find a list of the games with the highest player-counts, it proved difficult to find lists of games sorted by other experiential aspects, such as player enjoyment of the game. Another limitation in the selection process was that certain games were already familiar to the researchers. Although this helped with performing deductive thematic analysis, it also introduced selection bias within the findings. Overall, a more comprehensive study may use a broader selection of games and rewards within games to better capture a more representative set of RRMs.

The participants for our interview study tended to skew towards young men. Past research has looked into differences in gender on perception of luck [45], and further research is required to better generalize our findings towards the representative population of video game players. In addition, the sampling methods used (personal recruitment and snowball sampling) are cheap and efficient, but sampling bias may cause issues of generalizability to the entire population. Furthermore, our study looks only at the perspective towards RRMs by video game players. Further interviews with other stakeholders involved in the design and implementation of RRMs, such as game designers, could provide deeper insight into the rationale into the value of RRMs, what experience they are designing for players, what kind of emotional expectations do they have for their reward system, etc.

During our interview study, we had players view RRMs through short clips, however, the full context of the game could not be provided due to the limited time. Alternative methodologies were considered, for example, having players actually play the games involved to fully capture the context regarding the resources required to achieve the rewards, however, this was decided against due to time and technological constraints. Lastly, although we identified a classification system and developed some methodological suggestions for RRM design based on our qualitative findings, the use of our suggestions in RRM design was not tested quantitatively. To do so, possible statistical tests based on user satisfiability and user experience surveys could be done between existing RRM systems and RRM systems improved through our design suggestions in order to demonstrate the applicability of our recommendations.

7 CONCLUSION

This work examined how video game players interact and perceive RRMs in video games, with a focus on understanding how RRMs impact the player experience. Through a video analysis of prevalent common RRM systems, an initial classification system based on 9 dimensions was developed. Furthermore, an interview study revealed that while players may find many aspects of the random process engaging and fun, such as its abilities to create fresh experiences in gameplay and to balance out skill levels, certain aspects are found to be frustrating, such as when RRMs inhibit aspects of gameplay. The interviews also revealed that users have a negative perception of RRMs that use real-life currency as a trigger condition; these RRMs also create a sense of disengagement for the players, who treat them more as repetitive tasks rather than rewards. The results also revealed that the presentation of an RRM reward can play a major part in the the emotional impact that a user experiences when receiving a random reward. Using the findings, some proposed methodological suggestions were made on how to develop more emotionally-engaging and user-friendly RRM systems.

ACKNOWLEDGMENTS

This work was supported in part by the Natural Science and Engineering Research Council of Canada (NSERC) under Discovery Grant RGPIN-2019-05624.

REFERENCES

[1] Aubrey Anable. 2018. *Playing With Feelings: Video Games and Affect.* University of Minnesota Press, Minneapolis, MN, USA.
[2] Denise Anthony, Sean W. Smith, and Timothy Williamson. 2009. Reputation and Reliability in Collective Goods: The Case of the Online Encyclopedia Wikipedia. *Rationality and Society* 21, 3 (2009), 283–306. https://doi.org/10.1177/1043463109336804 arXiv:https://doi.org/10.1177/1043463109336804
[3] arcticfox4. 2019. *Ex Neverwinter Dev Tweets about Loot Boxes.* Reddit. Retrieved February 16, 2022 from https://www.reddit.com/r/Neverwinter/comments/bq3sdg/ex_neverwinter_dev_tweets_about_loot_boxes/
[4] Electronics Arts. 2022. *Apex Legends FAQ.* Electronics Arts. Retrieved February 16, 2022 from https://www.ea.com/games/apex-legends/about/frequently-asked-questions
[5] Electronics Arts. 2022. *Apex Legends Global Series.* Electronics Arts. Retrieved February 16, 2022 from https://www.ea.com/games/apex-legends/compete/overview
[6] Nick Ballou, Charles Gbadamosi, and David Zendle. 2020. *The Hidden Intricacy of Loot Box Design: A Granular Description of Random Monetized Reward Features.* PsyArXiv. https://doi.org/10.31234/osf.io/xeckb
[7] Richard Bartle. 1996. Hearts, Clubs, Diamonds, Spades: Players who Suit MUDs. *Journal of MUD research* 1, 1 (1996), 27 pages.
[8] Richard A. Bartle. 2004. *Designing Virtual Worlds.* New Riders, San Francisco, CA, USA.
[9] Scott Bateman, Regan L. Mandryk, Tadeusz Stach, and Carl Gutwin. 2011. Target Assistance for Subtly Balancing Competitive Play. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Vancouver, BC, Canada) *(CHI '11)*. Association for Computing Machinery, New York, NY, USA, 2355–2364. https://doi.org/10.1145/1978942.1979287
[10] BBC. 2019. *Gaming loot boxes: What happened when Belgium banned them?* BBC. Retrieved August 27, 2021 from https://www.bbc.com/news/newsbeat-49674333
[11] Ian Bogost. 2008. *Unit Operations: An Approach to Videogame Criticism.* MIT Press, Cambridge, MA, USA.
[12] Julia Ayumi Bopp, Elisa D. Mekler, and Klaus Opwis. 2015. "It Was Sad But Still Good": Gratifications of Emotionally Moving Game Experiences. In *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems* (Seoul, Republic of Korea) *(CHI EA '15)*. Association for Computing Machinery, New York, NY, USA, 1193–1198. https://doi.org/10.1145/2702613.2732852
[13] Julia Ayumi Bopp, Elisa D. Mekler, and Klaus Opwis. 2016. Negative Emotion, Positive Experience? Emotionally Moving Moments in Digital Games. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (San Jose, California, USA) *(CHI '16)*. Association for Computing Machinery, New York, NY, USA, 2996–3006. https://doi.org/10.1145/2858036.2858227
[14] Andrew Brady and Garry Prentice. 2021. Are Loot Boxes Addictive? Analyzing Participant's Physiological Arousal While Opening a Loot Box. *Games and Culture* 16, 4 (2021), 419–433. https://doi.org/10.1177/1555412019895359
[15] Virginia Braun and Victoria Clarke. 2012. *Thematic Analysis.* American Psychological Association, Washington, D.C., USA, 57–71.
[16] Gabriel A. Brooks and Luke Clark. 2019. Associations Between Loot Box Use, Problematic Gaming and Gambling, and Gambling-Related Cognitions. *Addictive Behaviors* 96 (2019), 26–34. https://doi.org/10.1016/j.addbeh.2019.04.009
[17] Paolo Burelli. 2013. Virtual Cinematography in Games: Investigating the Impact on Player Experience. In *Proceedings of the 8th International Conference on the Foundations of Digital Games, FDG 2013*. Society for the Advancement of the Science of Digital Games, 134–141.
[18] Roger Caillois. 2001. *Man, Play, and Games.* University of Illinois Press, Champaign, IL, USA.
[19] David Callele, Eric Neufeld, and Kevin Schneider. 2006. Emotional Requirements in Video Games. In *14th IEEE International Requirements Engineering Conference (RE'06)*. IEEE, Manhattan, NY, USA, 299–302. https://doi.org/10.1109/RE.2006.19
[20] Alessandro Canossa, Jeremy B Badler, Magy Seif El-Nasr, and Eric Anderson. 2016. Eliciting Emotions in Design of Games-a Theory Driven Approach. In *Proceedings of the 4th Workshop on Emotions and Personality in Personalized Systems co-located with ACM Conference on Recommender Systems (RecSys 2016)*. Association for Computing Machinery, New York, NY, USA, 34–42.
[21] Capcom. 2018. *Monster Hunter: World.* Capcom. "http://www.monsterhunterworld.com/us/"
[22] Jared E. Cechanowicz, Carl Gutwin, Scott Bateman, Regan Mandryk, and Ian Stavness. 2014. Improving Player Balancing in Racing Games. In *Proceedings of the First ACM SIGCHI Annual Symposium on Computer-Human Interaction in Play* (Toronto, Ontario, Canada) *(CHI PLAY '14)*. Association for Computing Machinery, New York, NY, USA, 47–56. https://doi.org/10.1145/2658537.2658701
[23] Giuseppe Chiazzese, Giovanni Fulantelli, Vito Pipitone, and Davide Taibi. 2018. Engaging primary school children in computational thinking: Designing and developing videogames. *Education in the Knowledge Society* 19, 2 (2018), 63–81.
[24] ColonelPanic. 2018. *Random Box Reward Rates.* Nexon. Retrieved February 16, 2022 from https://maplestory.nexon.net/micro-site/36184
[25] Fandom Contributors. 2015. *List of Cartel Pack Contents.* Fandom. Retrieved February 16, 2022 from https://swtor.fandom.com/wiki/List_of_Cartel_Pack_contents
[26] Fandom Contributors. 2020. *Crates.* Fandom. Retrieved February 16, 2022 from https://pubg.fandom.com/wiki/Crates
[27] Fandom Contributors. 2020. *Treasure.* Fandom. Retrieved February 16, 2022 from https://dota2.fandom.com/wiki/Treasure
[28] Fandom Contributors. 2021. *Boons.* Fandom. Retrieved February 16, 2022 from https://hades.fandom.com/wiki/Boons
[29] Fandom Contributors. 2021. *Card Pack.* Fandom. Retrieved February 16, 2022 from https://hearthstone.fandom.com/wiki/Card_pack
[30] Fandom Contributors. 2021. *Loot Chest.* Fandom. Retrieved February 16, 2022 from https://heroesofthestorm.fandom.com/wiki/Loot_Chest
[31] Fandom Contributors. 2021. *MonoMono Machine.* Fandom. Retrieved February 16, 2022 from https://danganronpa.fandom.com/wiki/MonoMono_Machine
[32] Fandom Contributors. 2022. *Container.* Fandom. Retrieved February 16, 2022 from https://counterstrike.fandom.com/wiki/Container
[33] Fandom Contributors. 2022. *Headhunting.* Fandom. Retrieved February 16, 2022 from https://mrfz.fandom.com/wiki/Headhunting
[34] Fandom Contributors. 2022. *Loot Box.* Fandom. Retrieved February 16, 2022 from https://overwatch.fandom.com/wiki/Loot_Box
[35] Fandom Contributors. 2022. *Originite Prime.* Fandom. Retrieved February 16, 2022 from https://mrfz.fandom.com/wiki/Originite_Prime

[36] Fandom Contributors. 2022. *Summon*. Fandom. Retrieved February 16, 2022 from https://feheroes.fandom.com/wiki/Summon

[37] Fandom Contributors. 2022. *Titanium Crate*. Fandom. Retrieved February 16, 2022 from https://terraria.fandom.com/wiki/Titanium_Crate

[38] Fandom Contributors. 2022. *Wishes*. Fandom. Retrieved February 16, 2022 from https://genshin-impact.fandom.com/wiki/Wishes

[39] Brice Corgnet, Simon Gaechter, and Roberto Hernán-González. 2020. Working Too Much for Too Little: Stochastic Rewards Cause Work Addiction. *IZA Discussion Papers* 12992 (2020), 69 pages.

[40] Greg Costikyan. 2013. *Uncertainty in Games*. MIT Press, Cambridge, MA, USA.

[41] Ben Cowley, Darryl Charles, Michaela Black, and Ray Hickey. 2008. Toward an Understanding of Flow in Video Games. *Comput. Entertain.* 6, 2, Article 20 (jul 2008), 27 pages. https://doi.org/10.1145/1371216.1371223

[42] Sarah M. Coyne, Laura M. Padilla-Walker, Laura Stockdale, and Randal D. Day. 2011. Game On… Girls: Associations Between Co-playing Video Games and Adolescent Behavioral and Family Outcomes. *Journal of Adolescent Health* 49, 2 (2011), 160–165. https://doi.org/10.1016/j.jadohealth.2010.11.249

[43] Penny de Byl. 2015. A Conceptual Affective Design Framework for the Use of Emotions in Computer Game Design. *Cyberpsychology* 9 (10 2015), 19 pages. https://doi.org/10.5817/CP2015-3-4

[44] Bram De Wever, Hilde Keer, Tammy Schellens, and Martin Valcke. 2011. Assessing Collaboration in a Wiki: The Reliability of University Students' Peer Assessment. *Internet and Higher Education* 14 (09 2011), 201–206. https://doi.org/10.1016/j.iheduc.2011.07.003

[45] Kay Deaux, Leonard White, and Elizabeth Farris. 1975. Skill Versus Luck: Field and Laboratory Studies of Male and Female Preferences. *Journal of Personality and Social Psychology* 32, 4 (1975), 629.

[46] The NetHack DevTeam. 1985. *NetHack*. The NetHack DevTeam. https://www.nethack.org/

[47] Michele D Dickey. 2005. Engaging by Design: How Engagement Strategies in Popular Computer and Video Games Can Inform Instructional Design. *Educational Technology Research and Development* 53, 2 (2005), 67–83. https://doi.org/10.1007/BF02504866

[48] Blizzard Entertainment. 2022. *Card Sets*. Blizzard Entertainment. Retrieved February 16, 2022 from https://playhearthstone.com/en-us/expansions-adventures/

[49] Blizzard Entertainment. 2022. *Gear Up and Go!* Blizzard Entertainment. Retrieved February 16, 2022 from https://us.shop.battle.net/en-us/product/overwatch-loot-box

[50] Respawn Entertainment. 2019. *Apex Legends*. Electronic Arts. https://www.ea.com/games/apex-legends

[51] Wenqi Fan. 2019. *Motivational Factors on Purchase Intention of In-game Hero Skins in MOBA Games*. Master's thesis. Northeastern University.

[52] John Jack Joseph Fennimore. 2020. *Are They Really Just Cosmetic? the Impact of Cosmetic Items on Fortnite's Gameplay and Game Design*. Master's thesis. The University of Wisconsin-Milwaukee.

[53] Charles B Ferster and Burrhus Frederic Skinner. 1957. *Schedules of Reinforcement*. Appleton-Century-Crofts, New York, NY, USA.

[54] David Freeman. 2004. Creating Emotion in Games: The Craft and Art of Emotioneering™. *Comput. Entertain.* 2, 3 (jul 2004), 15. https://doi.org/10.1145/1027154.1027179

[55] Nehemia Friedland. 1998. Games of Luck and Games of Chance: The Effect of Luck-Versus Chance-Orientation on Gambling Decisions. *Journal of Behavioral Decision Making* 11, 3 (1998), 161–179. https://doi.org/10.1002/(SICI)1099-0771(199809)11:3<161::AID-BDM296>3.0.CO;2-S

[56] Jennifer Gallup and Barbara Serianni. 2017. Developing Friendships and an Awareness of Emotions Using Video Games: Perceptions of Four Young Adults with Autism. *Education and Training in Autism and Developmental Disabilities* 52, 2 (2017), 120–131. https://www.jstor.org/stable/26420384

[57] Epic Games. 2021. *Fortnite Champion Series*. Epic Games. Retrieved February 16, 2022 from https://www.epicgames.com/fortnite/competitive/en-US/events/championseries-ch2s7/overview

[58] Riot Games. 2009. *League Of Legends*. Riot Games. https://www.leagueoflegends.com/

[59] Supergiant Games. 2020. *Hades (Supergiant Games)*. Supergiant Games. https://www.supergiantgames.com/games/hades/

[60] Alison Gazzard. 2011. Unlocking the Gameworld: The Rewards of Space and Time in Videogames. *Game Studies* 11, 1 (2011), 9–13.

[61] Erik Geslin, Laurent Jégou, and Danny Beaudoin. 2016. How Color Properties Can Be Used to Elicit Emotions in Video Games. *International Journal of Computer Games Technology* 2016 (01 2016), 1–9. https://doi.org/10.1155/2016/5182768

[62] Tobias Greitemeyer and Dirk O. Mügge. 2014. Video Games Do Affect Social Outcomes: A Meta-Analytic Review of the Effects of Violent and Prosocial Video Game Play. *Personality and Social Psychology Bulletin* 40, 5 (2014), 578–589. https://doi.org/10.1177/0146167213520459 PMID: 24458215.

[63] Wang Hao and Sun Chuen-Tsai. 2011. Game Reward Systems: Gaming Experiences and Social Meanings. In *DiGRA '11 - Proceedings of the 2011 DiGRA International Conference: Think Design Play*. DiGRA/Utrecht School of the Arts, 15 pages. http://www.digra.org/wp-content/uploads/digital-library/11310.20247.pdf

[64] Joseph Hilgard, Christopher Engelhardt, and Bruce Bartholow. 2013. Individual Differences in Motives, Preferences, and Pathology in Video Games: The Gaming Attitudes, Motives, and Experiences Scales (GAMES). *Frontiers in Psychology* 4 (2013), 13 pages. https://doi.org/10.3389/fpsyg.2013.00608

[65] Paul A. Howard-Jones and Skevi Demetriou. 2008. Uncertainty and Engagement With Learning Games. *Instructional Science* 37, 6 (2008), 519–536. https://doi.org/10.1007/s11251-008-9073-6

[66] Hypergryph. 2019. *Arknights*. [Hypergryph, Yostar]. https://www.arknights.global/

[67] Barry Ip. 2011. Narrative Structures in Computer and Video Games: Part 2: Emotions, Structures, and Archetypes. *Games and Culture* 6, 3 (2011), 203–244. https://doi.org/10.1177/1555412010364984

[68] Mikael Jakobsson. 2011. The Achievement Machine: Understanding Xbox 360 Achievements in Gaming Practices. *Game Studies* 11, 1 (2011), 1–22.

[69] Josh Jarrett. 2021. Gaming the Gift: The Affective Economy of League of Legends 'Fair' Free-To-Play Model. *Journal of Consumer Culture* 21, 1 (2021), 102–119. https://doi.org/10.1177/1469540521993932

[70] Albin Johansson and Sebastian Grönström. 2020. The Perceived Value of Loot Boxes: A Qualitative Study on the Service Outcome of Loot Boxes.

[71] Mark R. Johnson. 2018. *The Unpredictability of Gameplay*. Bloomsbury Publishing, New York, NY, USA.

[72] Jesper Juul and Begy Jason. 2016. Poster: Good Feedback for Bad Players? A Preliminary Study of 'Juicy' Interface Feedback. In *Proceedings of 1st Joint International Conference of DiGRA and FDG*. DiGRA, 1 pages. http://www.digra.org/145807/

[73] Dominic Kao. 2020. The Effects of Juiciness in an Action RPG. *Entertainment Computing* 34 (2020), 100359. https://doi.org/10.1016/j.entcom.2020.100359

[74] Dominic Kao. 2020. Infinite Loot Box: A Platform for Simulating Video Game Loot Boxes. *IEEE Transactions on Games* 12, 2 (2020), 219–224. https://doi.org/10.1109/TG.2019.2913320

[75] Faltin Karlsen. 2011. Entrapment and Near Miss: A Comparative Analysis of Psycho-Structural Elements in Gambling Games and Massively Multiplayer Online Role-Playing Games. *International Journal of Mental Health and Addiction* 9, 2 (2011), 193–207. https://doi.org/10.1007/s11469-010-9275-4

[76] Benjamin Kenwright. 2020. There's More to Sound Than Meets the Ear: Sound in Interactive Environments. *IEEE Computer Graphics and Applications* 40, 4 (2020), 62–70. https://doi.org/10.1109/MCG.2020.2996371

[77] Hicks Kieran, Dickinson Patrick, Holopainen Jussi, and Gerling Kathrin. 2018. Good Game Feel: An Empirically Grounded Framework for Juicy Design. In *DiGRA '18 - Proceedings of the 2018 DiGRA International Conference: The Game is the Message*. DiGRA, 17 pages. http://www.digra.org/wp-content/uploads/digital-library/DIGRA_2018_Paper_35.pdf

[78] Kristian Kiili, Sara de Freitas, Sylvester Arnab, and Timo Lainema. 2012. The Design Principles for Flow Experience in Educational Games. *Procedia Computer Science* 15 (2012), 78–91. https://doi.org/10.1016/j.procs.2012.10.060 4th International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES'12).

[79] Austin King. 2021. *Genshin Impact's Wish & Banner Pull Rates Explained*. Screen Rant. Retrieved February 18, 2022 from https://screenrant.com/genshin-impact-wish-characters-weapons-banner-pull-rates/

[80] Søren Kristiansen and Majbritt Severin. 2019. Loot Box Engagement and Problem Gambling Among Adolescent Gamers: Findings From a National Survey. *Addictive Behaviors* 103 (2019), 106254. https://doi.org/10.1016/j.addbeh.2019.106254

[81] Chun-I Lee, I-Ping Chen, Chi-Min Hsieh, and Chia-Ning Liao. 2017. Design Aspects of Scoring Systems in Game. *Art and Design Review* 05 (01 2017), 26–43. https://doi.org/10.4236/adr.2017.51003

[82] Maddie Level. 2019. Unboxing the Issue: The Future of Video Game Loot Boxes in the US. *Kansas Law Review* 68, 1 (2019), 25 pages.

[83] Chris Littlechild. 2019. *Epic Chose Casual Players Over Pros When It Came To Fortnite's Controversial Changes*. TheGamer. Retrieved August 18, 2021 from https://www.thegamer.com/epic-chose-casual-players-over-pros-health-on-kill-820/

[84] George Loewenstein. 1987. Anticipation and the Valuation of Delayed Consumption. *The Economic Journal* 97, 387 (1987), 666–684. http://www.jstor.org/stable/2232929

[85] Shane J. Lopez and Charles R. Snyder. 2009. *The Oxford Handbook of Positive Psychology*. Oxford University Press, Oxford, UK.

[86] Robert Lorenz, Tobias Gleich, Jürgen Gallinat, and Simone Kühn. 2015. Video Game Training and the Reward System. *Frontiers in Human Neuroscience* 9 (02 2015), 40. https://doi.org/10.3389/fnhum.2015.00040

[87] Joseph Macey and Juho Hamari. 2019. eSports, Skins and Loot Boxes: Participants, Practices and Problematic Behaviour Associated With Emergent Forms of Gambling. *New Media & Society* 21, 1 (2019), 20–41. https://doi.org/10.1177/1461444818786216

[88] Thomas M. Malaby. 2007. Beyond Play: A New Approach to Games. *Games and Culture* 2, 2 (2007), 95–113. https://doi.org/10.1177/1555412007299434

[89] miHoYo. 2020. *Genshin Impact*. miHoYo. https://genshin.hoyoverse.com/en/

[90] Kevin Miklasz. 2020. *Intrinsic Rewards in Games and Learning*. Carnegie Mellon University, Pittsburgh, PA, USA.

[91] Ilya Musabirov, Denis Bulygin, Paul Okopny, and Alexander Sirotkin. 2017. Deconstructing Cosmetic Virtual Goods Experiences in Dota 2. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (Denver, Colorado, USA) *(CHI '17)*. Association for Computing Machinery, New York, NY, USA, 2054–2058. https://doi.org/10.1145/3025453.3025893

[92] Jerome Neu. 1998. *Boring from Within*. Oxford University Press, Oxford, UK, 158–170.

[93] Rune Kristian Lundedal Nielsen and Paweł Grabarczyk. 2019. Are Loot Boxes Gambling? Random Reward Mechanisms in Video Games. *Transactions of the Digital Games Research Association* 4 (2019), 20 pages.

[94] Federica Pallavicini and Alessandro Pepe. 2019. Comparing Player Experience in Video Games Played in Virtual Reality or on Desktop Displays: Immersion, Flow, and Positive Emotions. In *Extended Abstracts of the Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts* (Barcelona, Spain) *(CHI PLAY '19 Extended Abstracts)*. Association for Computing Machinery, New York, NY, USA, 195–210. https://doi.org/10.1145/3341215.3355736

[95] Rohit Parikh, Çağıl Taşdemir, and Andreas Witzel. 2012. *Choice and Uncertainty in Games*. Springer, New York, NY, USA, 244–255.

[96] Cody Phillips, Daniel Johnson, Madison Klarkowski, Melanie Jade White, and Leanne Hides. 2018. The Impact of Rewards and Trait Reward Responsiveness on Player Motivation. In *Proceedings of the 2018 Annual Symposium on Computer-Human Interaction in Play* (Melbourne, VIC, Australia) *(CHI PLAY '18)*. Association for Computing Machinery, New York, NY, USA, 393–404. https://doi.org/10.1145/3242671.3242713

[97] Cody Phillips, Daniel Johnson, and Peta Wyeth. 2013. Videogame Reward Types. In *Proceedings of the First International Conference on Gameful Design, Research, and Applications* (Toronto, Ontario, Canada) *(Gamification '13)*. Association for Computing Machinery, New York, NY, USA, 103–106. https://doi.org/10.1145/2583008.2583025

[98] Cody Phillips, Daniel Johnson, Peta Wyeth, Leanne Hides, and Madison Klarkowski. 2015. Redefining Videogame Reward Types. In *Proceedings of the Annual Meeting of the Australian Special Interest Group for Computer Human Interaction* (Parkville, VIC, Australia) *(OzCHI '15)*. Association for Computing Machinery, New York, NY, USA, 83–91. https://doi.org/10.1145/2838739.2838782

[99] Thane Pittman, Jolee Emery, and Ann Boggiano. 1982. Intrinsic and Extrinsic Motivational Orientations: Reward-Induced Changes in Preference for Complexity. *Journal of Personality and Social Psychology* 42 (05 1982), 789–797. https://doi.org/10.1037/0022-3514.42.5.789

[100] Christopher Power, Paul Cairns, Alena Denisova, Themis Papaioannou, and Ruth Gultom. 2019. Lost at the Edge of Uncertainty: Measuring Player Experience in Digital Games. *International Journal of Human-Computer Interaction* 35, 12 (2019), 1033–1045. https://doi.org/10.1080/10447318.2018.1507161

[101] Marc Prensky. 2003. Digital Game-Based Learning. *Comput. Entertain.* 1, 1 (oct 2003), 21. https://doi.org/10.1145/950566.950596

[102] Brian A. Primack, Mary V. Carroll, Megan McNamara, Mary Lou Klem, Brandy King, Michael Rich, Chun W. Chan, and Smita Nayak. 2012. Role of Video Games in Improving Health-Related Outcomes A Systematic Review. *American Journal of Preventive Medicine* 42, 6 (2012), 630–638.

[103] Andrew K. Przybylski, C. Scott Rigby, and Richard M. Ryan. 2010. A Motivational Model of Video Game Engagement. *Review of General Psychology* 14, 2 (2010), 154–166. https://doi.org/10.1037/a0019440

[104] Real-Hayase-Nagatoro. 2021. *Dota 2 Featured in "How Young Gamers Are Turning Into Gamblers: Loot Box Danger Parents Should Know" Short Documentary"*. Reddit. Retrieved February 16, 2022 from https://www.reddit.com/r/DotA2/comments/p0hy00/dota_2_featured_in_how_young_gamers_are_turning/

[105] Adam Rosenberg. 2017. *'Destiny 2' Has Been Misleading Players*. Mashable. Retrieved August 27, 2021 from https://mashable.com/article/destiny-2-xp-scaling-bungie-statement

[106] Richard M Ryan, C Scott Rigby, and Andrew Przybylski. 2006. The Motivational Pull of Video Games: A Self-Determination Theory Approach. *Motivation and Emotion* 30, 4 (12 2006), 344–360. https://doi.org/10.1007/s11031-006-9051-8

[107] Albert Sakhapov and Joseph Alexander Brown. 2020. Players Perception of Loot Boxes. In *International Conference on Entertainment Computing*. Springer, Springer, New York, NY, USA, 134–141. https://doi.org/10.1007/978-3-030-65736-9_12

[108] Alexander Sandqvist. 2021. Correlations and Similarities between Loot Boxes and Gambling.

[109] Akiko Shibuya, Mizuha Teramoto, Akiyo Shoun, and Kumiko Akiyama. 2019. Long-Term Effects of In-Game Purchases and Event Game Mechanics on Young Mobile Social Game Players in Japan. *Simulation & Gaming* 50, 1 (2019), 76–92. https://doi.org/10.1177/1046878118819677

[110] Robert Simon. 2007. Deserving to Be Lucky: Reflections on the Role of Luck and Desert in Sports. *Journal of the Philosophy of Sport* 34, 1 (2007), 13–25. https://doi.org/10.1080/00948705.2007.9714706

[111] Kristin Siu and Mark O. Riedl. 2016. Reward Systems in Human Computation Games. In *Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play* (Austin, Texas, USA) *(CHI PLAY '16)*. Association for Computing Machinery, New York, NY, USA, 266–275. https://doi.org/10.1145/2967934.2968083

[112] Jolie H. K. Smets and Erik D. van der Spek. 2021. That Sound's Juicy! Exploring Juicy Audio Effects in Video Games. In *Entertainment Computing – ICEC 2021*, Jannicke Baalsrud Hauge, Jorge C. S. Cardoso, Licínio Roque, and Pedro A. Gonzalez-Calero (Eds.). Springer International Publishing, Cham, 319–335.

[113] Sergio Solorzano. 2019. *Shroud Thinks Battle Royale Is Too Luck-Based To Be Competitive*. TheGamer. Retrieved August 18, 2021 from https://www.thegamer.com/shroud-thinks-battle-royale-too-luck-based/

[114] SteamDB. 2021. *SteamDB — Steam Charts*. SteamDB. Retrieved Dec 9, 2021 from https://steamdb.info/graph/

[115] StrategyWiki. 2020. *Maplestory/Tower of Oz*. StrategyWiki. Retrieved February 16, 2022 from https://strategywiki.org/wiki/MapleStory/Tower_of_Oz

[116] Valve and Hidden Path Entertainment. 2012. *Counter-Strike: Global Offensive*. Valve. https://store.steampowered.com/app/730/CounterStrike_Global_Offensive/

[117] Rodrigo Vicencio-Moreira, Regan L. Mandryk, and Carl Gutwin. 2015. Now You Can Compete With Anyone: Balancing Players of Different Skill Levels in a First-Person Shooter Game. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (Seoul, Republic of Korea) *(CHI '15)*. Association for Computing Machinery, New York, NY, USA, 2255–2264. https://doi.org/10.1145/2702123.2702242

[118] Heather Wardle. 2021. *Games Without Frontiers?: Socio-historical Perspectives at the Gaming/Gambling Intersection*. Palgrave Macmillan, London, UK.

[119] René Weber, Katharina-Maria Behr, and Cynthia DeMartino. 2014. Measuring Interactivity in Video Games. *Communication Methods and Measures* 8, 2 (2014), 79–115. https://doi.org/10.1080/19312458.2013.873778

[120] Johanna Westerlund and Alexander Baxter. 2015. Do I Look Good In This?: How skilled players look upon cosmetic items in Team Fortress 2 and Dota 2.

[121] whatacoolwitch. 2019. *Hextech Crafting FAQ*. Riot Games. Retrieved February 16, 2022 from https://support-leagueoflegends.riotgames.com/hc/en-us/articles/360036422453-Hextech-Crafting-FAQ

[122] Wikipedia. 2021. *List of highest-grossing mobile games*. Wikimedia Foundation. Retrieved August 27, 2021 from https://en.wikipedia.org/wiki/List_of_highest-grossing_mobile_games

[123] Wikipedia. 2021. *List of highest-grossing mobile games*. Wikimedia Foundation. Retrieved Dec 9, 2021 from https://en.wikipedia.org/wiki/List_of_highest-grossing_mobile_games

[124] Wikipedia. 2021. *List of most-played mobile games by player count*. Wikimedia Foundation. Retrieved Dec 9, 2021 from https://en.wikipedia.org/wiki/List_of_most-played_mobile_games_by_player_count

[125] Wikipedia. 2021. *List of most-played video games by player count*. Wikimedia Foundation. Retrieved Dec 9, 2021 from https://en.wikipedia.org/wiki/List_of_most-played_video_games_by_player_count

[126] Johnny Wingstedt, Sture Brändström, and Jan Berg. 2010. Narrative Music, Visuals and Meaning in Film. *Visual Communication* 9, 2 (2010), 193–210. https://doi.org/10.1177/1470357210369886

[127] Wizet. 2003. *Maplestory*. Nexon. https://maplestory.nexon.net/landing

[128] Leon Y. Xiao and Laura L. Henderson. 2021. Towards an Ethical Game Design Solution to Loot Boxes: a Commentary on King and Delfabbro. *International Journal of Mental Health and Addiction* 19 (2021), 177–192.

[129] xSaber0022. 2018. *Summoning animations*. Reddit. Retrieved February 16, 2022 from https://www.reddit.com/r/FireEmblemHeroes/comments/82jtfl/summoning_animations/

[130] Nick Yee. 2006. The Labor of Fun: How Video Games Blur the Boundaries of Work and Play. *Games and Culture* 1, 1 (2006), 68–71. https://doi.org/10.1177/1555412005281819

[131] Nick Yee. 2006. Motivations for Play in Online Games. *CyberPsychology & Behavior* 9, 6 (2006), 772–775. https://doi.org/10.1089/cpb.2006.9.772 PMID: 17201605.

[132] Sato Yukiko, Brückner Stefan, Kurabayashi Shuichi, and Waragai Ikumi. 2020. An Empirical Taxonomy of Monetized Random Reward Mechanisms in Games. In *DiGRA '20 - Proceedings of the 2020 DiGRA International Conference: Play Everywhere*. DiGRA, 20 pages. http://www.digra.org/wp-content/uploads/digital-library/DiGRA_2020_paper_168.pdf

[133] David Zendle, Rachel Meyer, and Nick Ballou. 2020. The Changing Face of Desktop Video Game Monetisation: An Exploration of Exposure to Loot Boxes, Pay to Win, and Cosmetic Microtransactions in the Most-Played Steam Games of 2010-2019. *PLOS ONE* 15, 5 (05 2020), 1–13. https://doi.org/10.1371/journal.pone.0232780

[134] David Zendle, Lukasz Walasek, Paul Cairns, Rachel Meyer, and Aaron Drummond. 2021. Links Between Problem Gambling and Spending on Booster Packs in Collectible Card Games: A Conceptual Replication of Research on Loot Boxes. *PLOS ONE* 16, 4 (04 2021), 1–17. https://doi.org/10.1371/journal.pone.0247855

[135] Amelia Zollner. 2021. *Genshin Impact Pity System: What is Pity and How Does it Work?* Rock Paper Shotgun. Retrieved August 29, 2021 from https://www.rockpapershotgun.com/genshin-impact-pity-system