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Random rewards in video games and their impact on player engagement

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ALEX MODEE

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ABSTRACT

By their very nature, video games are designed to be engaging which has played a major factor in their commercial success. Reward systems are an important aspect when it comes to creating an engaging experience as they serve as motivators for the player. Many such reward systems incorporate varying degrees of randomness. This brings the question of how the implementation of random rewards affects the gameplay experience and in particular, how it affects the level of engagement with the player.

To investigate this, two versions of a simple video game were created, one with a randomized rewards system and one with a non-random rewards system. The study was conducted with the help of 17 participants where 15 were from the Media technology program at kth and the other 3 had a similar background. Participants were divided into two groups where both groups got to play both versions of the game but one would start with the random version and one with the non random version. After playing both versions of the game participants got to fill in a questionnaire with questions about their experience with the game. The result of the study did not show a significant difference between the two versions in terms of player engagement. The non random version was however seen as more enjoyable as well as allowing significantly greater autonomy when playing the game. Overall the result indicated that a non random rewards system may result in players enjoying the game more as compared to randomized one. That said, because the reason for players enjoying the game was in large part due to how the rewards system affected the gameplay experience, the result might not be applicable to rewards systems which affect gameplay in different ways other than the one used for the study.

SAMMANFATTNING

Datorspel är av sin natur designade för att vara engagerande vilket har spelat en viktig faktor i deras kommersiella framgång. Belöningssystem är en viktig aspekt när det gäller att skapa en engagerande spelupplevelse eftersom de motiverar spelaren. Många sådana belöningssystem innehåller olika grader av slumpmässighet. Detta väcker frågan om hur implementeringen av slumpmässiga belöningar påverkar spelupplevelsen och i synnerhet hur det påverkar nivån av engagemang hos spelaren.

För att undersöka detta skapades två versioner av ett enkelt datorspel, en med ett slumpmässigt belöningssystem och en med

ett icke-slumpmässigt belöningssystem. Studien genomfördes med hjälp av 17 deltagare där 15 var från medieteknikprogrammet på kth och de andra 3 hade en liknande bakgrund. Deltagarna delades in i två grupper där båda grupperna fick spela båda versionerna av spelet men ena gruppen började med den slumpmässiga versionen och den andra gruppen med den icke slumpmässiga versionen. Efter att ha spelat båda versionerna av spelet fick deltagarna fylla i ett frågeformulär med frågor om deras erfarenhet av spelet. Resultatet av studien visade ingen signifikant skillnad mellan de två versionerna när det gällde nivån av engagemang hos spelaren. Den icke slumpmässiga versionen sågs dock som mer underhållande samt ansågs också ge signifikant större autonomi när man spelade spelet. Sammantaget visade resultatet att ett icke-slumpmässigt belöningssystem kan leda till att spelare tycker om spelet mer jämfört med ett slumpmässigt. Med detta sagt, eftersom anledningen till att spelare gillade spelet till stor del berodde på hur belöningssystemet påverkade spelupplevelsen, är resultatet kanske inte tillämpligt på belöningssystem som påverkat spelet på andra sätt än det som användes för studien.

1. INTRODUCTION

Video games typically contain feedback elements to reward player achievements or as they are often referred to as, rewards systems [1, 2]. These include everything from ranking systems and scoreboards to various in game items that may enhance the gameplay in various ways [10]. Some of these rewards systems exist entirely within the world of the game, that is to say that the rewards can only be earned through gameplay. For example, there is the concept of drops where enemies may drop certain items after being defeated. Another example are systems that allow players to collect in game currency which can then be traded for various game items. There is also the concept of pickups where players may be able to pick up items spread out across the game map. Though these kinds of systems may not always fit within the category of rewards systems they nonetheless share some similarities. Aside from reward systems that exist entirely within the games there are also those that allow players to earn in-game rewards by spending real world money [3].

What is common across all of these categories of reward systems is that they often contain a degree of randomness. When it comes to items being dropped by defeated enemies the items dropped often are not known beforehand and are not necessarily the same every time the game is played. Pickup systems may sometimes

give items an anonymous visual representation with the nature of the item not being revealed before it's picked up; A good example of this can be found in the Mario Kart games by Nintendo where items are represented by boxes placed at various locations on the game map.

Video games have an inherent need to be engaging in order to make users want to continue playing[7] and in-game rewards are one element that can serve to motivate players[10]. The question then is how, if at all, the inclusion of a random factor contributes to player engagement compared to an equivalent non random reward system. One interesting parallel that comes up when asking this question is the similarities that at least some of these random reward systems have with conventional gambling. These parallels are of particular interest in the context of rewards systems that involve real world currency, an example of these being so called *loot boxes*[12], which has become the focus of much contemporary research related to video games [3, 11, 12, 13].

In this study, two versions of a simple video game were created with the purpose of investigating what effects implementing random vs a non-random reward system might have on the level of engagement with the player. The two versions of the game were then tested and evaluated with the help of a number of study participants. Lastly the results from the two versions of the game were compared using the participants' feedback. Overall, this paper sought to answer the question of:

What impact does random reward systems in a video game setting have on player engagement?

2. BACKGROUND

2.1 Motivation & engagement

The concepts of *intrinsic* and *extrinsic* motivation are commonly occurring in the fields of motivation theory[5]. *Intrinsic motivation* refers to when individuals do activities out of self interest or interest in the activity whereas *extrinsic motivation* refers to when individuals do activities for instrumental reasons, such as in order to receive a reward [5]. *Self-Determination Theory (SDT)* builds upon the intrinsic theories by aligning them with autonomous forms of motivation which tend to be more intrinsic, and controlled forms of motivation, which tend to be extrinsic[4]. These aligned motivations are then weighed against the basic human psychological needs which are listed as: (1) the need for competence, (2) the need for autonomy and (3) the need for relatedness [5]. An important area within SDT theory is labeled as the *Cognitive evaluation theory (CET)*[5]. According to CET, extrinsic and intrinsic motivation are not additive. More weight on extrinsic motivation often shifts focus on the individual level away from enjoying the activity and more towards doing the activity for the reward [1]. These motivations can however become additive when it comes to unexpected rewards, as this would mean that the person was doing the task without pre-existing knowledge of a reward [4].

The level of motivation is the most directly observable in the intensity of an individual's engagement [1]. An individual's level of engagement in an activity is therefore based on their motivation and in turn, the perceived intrinsic and extrinsic value of the activity, whether this be generated by different kinds of rewards or

more intrinsic reasons such as enjoying the activity itself. In order for an activity to sustainably remain engaging [6] argue it is critical that the motivations behind it are not only extrinsic, meaning they cannot just be based on predictable rewards.

2.2 Engaging by design & Measuring player engagement

As of 2020, the video game industry is bigger than that of the movie industry and the entire North American sports industry combined [9]. [8] Argues that the reason for the commercial success of video games is because they are designed to be engaging. Strategies for engaging by design are listed as focused goals, challenges with progressing difficulty, affiliation with others and interactive choices [8]. The engaging design of video games are tied to underlying motivational needs such as the need for competence (challenges and progression), autonomy (freedom of choice and interaction) and relatedness (affiliations with others) as the inherent experiences create intrinsic motivation to a player[1]. Video games can also through their design provide extrinsic motivation, which when predictable and repetitive can pose a detriment to the intrinsic motivation [1]. An example could be within esports where players play the game largely in order to win an external reward.

In a video game setting [7] argues that the concept of player engagement can be defined as the level of continuation desire or the motivation to proceed experienced in-game over a sustained period of time. When discussing methods of measuring player engagement in a video game setting, [7] refer to an article by Mayes and Cotton (2001) who in turn present an Engagement Questionnaire (EQ) intended to investigate five different aspects of player engagement (interest, authenticity, curiosity, involvement and fidelity). In their study [1] also ties the motivational and engaging factors to base fundamental needs (described in SDK) and uses it as a model to predict player motivation and engagement in a video game.

2.3 Reward systems in a video game setting

Playing video games may as a whole be seen as a rewarding experience but in the interest of discussing rewards in the video game setting a clearer idea of what specific components may be considered rewards. One definition of video game rewards systems proposed by [2] is "*a positive return that serves to reinforce player behavior within a video game*". This definition excludes game aspects that may be rewarding but "*in which no formal return is given to the player*" thus providing a clearer focus. This definition also excludes reward systems that are inherently extrinsic to the game, for example where the reward consists of real world money.

For a more detailed categorisation of video game rewards [10] proposes the following list of reward types.

1. **Score systems**
achievement based scores are calculated with the aim of self assessment and or comparison with other players
2. **Experience point reward systems**
Players or rather player controlled game characters earn experience points which as the game progresses enhances their attributes within the game.

3. **Items**
Players can earn virtual items that either serve to enhance the gameplay, as collectables or often as a combination.
4. **Resources**
Similar to item granting systems in that players can get gameplay enhancing items.
5. **Achievements**
Players can earn certain achievement markers such as avatar bound titles.
6. **Feedback**
Various forms of audio visual feedback that are given more or less directly as players complete tasks.
7. **Plot**
Players earn rewards that advance the story of the game as well as to further advance the story; often in the form of plot related images and animations.
8. **Unlocking**
Rewards that allow players to access previously unavailable game content, for example new locations within the game.

In order to discuss how these rewards systems impact players [10] use a number of categories of rewards characteristics. For example some rewards systems are noted to have a direct impact on gameplay while others may only have an indirect impact or no impact on gameplay at all. Another characteristic is how well rewards might be used for social interaction between players; players might for example enjoy showing off items they have collected or achievements they have unlocked to other players.

[10] also proposes a set of categories describing how rewards are utilized by players. *Advancement* refers to players using rewards to make advancements within the game; a player might for example use earned skill points to strengthen their in-game avatar or unlock rewards that might allow them to advance further in the game. Players might also find it entertaining to *review* the rewards they have collected; this might include in-game items or achievement badges. *Sociality* refers to players using collected rewards in the context of socialising with other players; they might for example share information with other players or show off their achievements. Finally players also use rewards to *cooperate* and / or *compete* by for example collecting items to gain an advantage over other players, exchange items or simply see who can earn the highest score.

2.4 Random reward systems in video games

Much of the research into randomised rewards systems within the context of video games seems to be focused on so-called loot boxes: loot boxes can be described as mechanics allowing players to buy randomized in-game items for real world money[13]. Research in this area also often seems to center around the similarities between loot boxes and conventional gambling and by extension between randomized rewards systems and gambling. For example [3] make the case that there exist distinct categories of loot boxes although they argue that *Random rewards mechanics (RRMs)* is a better term. They also conclude that while not all forms of RRM should be classified as gambling some have clear similarities.

In [11] a discussion is presented of how some practices in game design and gambling are shared between both industries, and that designers in both areas are sometimes aware of each-other's research. Another example of research making the connection between loot boxes and gambling can be found in [13] which points to a correlation between loot boxes and problematic

gambling behaviour. In their conclusion they focus on how loot boxes should be legally regulated and argue that there is reason for loot boxes to be regulated similarly to gambling.

2.5 Previous studies

While no studies investigating the exact same question as this paper were identified, there are other studies regarding random reward structures in video games and their effects. One such study that was carried out in [14] centered around how various random and selective reward systems impacted the player experience in human computation games. This study concluded that study participants would overall complete tasks more effectively with a choice based reward system. In conclusion, based on their results [14] suggest that "*offering players choice of rewards leads to better task completion and a more engaged player experience*".

2.6 Purpose

This study investigates whether there is a correlation between random rewards being utilized within the design of a video game and the effect this has on player engagement and motivation. As such, the purpose of this study is to further existing research regarding engaging design and reward structures in video games.

3. METHOD

The method used for this study was divided into two different parts. Firstly, a simple prototype game was designed with two different versions being made. The only difference between these two versions was that one had a random reward system while the other had a non random reward system. The method thus had many similarities with the method used in [14] where the game in question was a human computation game with a random and a non-randomized reward system. These two versions of a game were played by a set of study participants who then got to answer an evaluation questionnaire. This questionnaire contained aspects of the engagement questionnaire (EQ) presented in [7] while also including some questions related to the method of measuring the motivational model of a video game presented in [1].

3.1 Prototype game design

In order to conduct this study a simple game was created with two different versions being made; *version A*, referred to as the *selective version* and *version B*, referred to as the *random version*. The reason for creating a new game as opposed to using two existing ones is that it allowed for the creation of two versions with the reward system as the only difference between them. By contrast using two different games would have meant contending with additional parameters such as differences in graphics, audiovisual feedback etc. This in turn would have made it hard to determine if any differences in player experience were due to the rewards system or to other parameters. The two versions of the game were designed to be engaging while at the same time not being too time-consuming to create, as the game itself is not the centerpiece of this paper. The prototype game was created using the Unity game engine. Unlike in [14], where a human computation game was used, this study was built around a simple top-down game.

In the game, the player would control a blue sphere that could go up, down and towards either side of the screen. The goal for the player was to get to the green cube (shown left in figure 1) while avoiding all the red cubes and rectangles. The selective version of the game featured a reward system in which the player could freely select one of several rewards between each level of the game whereas the random version featured a reward system in which the player received a randomized reward. The game was designed to be engaging according to the strategies brought up in [8]. The focused goals were applied in the player having to reach the green cube to proceed to the next level while avoiding the red zones. The levels were set to progressively be more challenging and difficult as the player advanced through the game and, finally, the game allowed the player to make interactive choices in how to proceed.

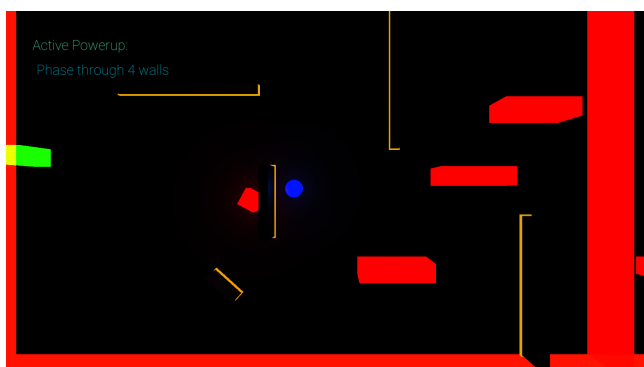


Figure 1. Image showing a screenshot of the game created for this study and its various gameplay aspects.

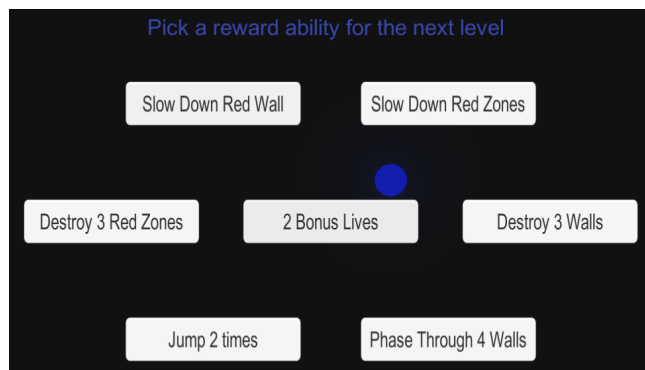


Figure 2. Selective version, with the user being able to select their reward.

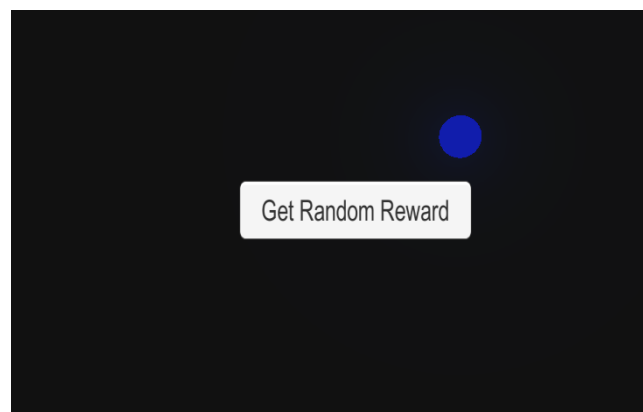


Figure 3. Random version, with the user pressing a button to receive a random reward.

3.2 Evaluation questionnaire

A questionnaire was used to evaluate the participants' experience of the game. The questionnaire included a number of questions that were repeated twice. These questions were asked one time for each version of the game so the results could be compared on a per-group basis as well as a per-game version basis. The questionnaire also included a few questions focused on comparing the two versions of the game, where the study participants could state their preferred version as well as give an explanation to why they preferred that version

The main questions were formulated to try to capture how engaged participants felt while playing the game and how motivating they had found it. Five questions in the questionnaire resemble the questions found in the engagement questionnaire as presented in [7] where each question targeted one of the five listed aspects of player engagement (interest, curiosity, authenticity, involvement and fidelity). The questionnaire also included a number of questions relating to intrinsic and extrinsic motivators as well as questions that tie into the fundamental needs described in SDT, tying our study into the method of measuring the motivational model used in [1]. There were also a set of open-ended questions in which the participants could present a more detailed insight into their thought process regarding what version of the game they preferred and, in the case of one level being more difficult; describing what effect this had on their motivation. Overall the questions were meant to capture participants' level of engagement as well as try and understand the reason for their motivation as well as to tie this into relevant motivational theories. Aside from this there were also a number of questions about the participants themselves, such as age and gender.

3.3 Study participants

15 students from the media technology program at KTH were recruited. The recruitment process was done through the course DM1578 as part of which students had to participate in one or more studies conducted by other students in the course. In addition 3 more participants were recruited directly by the study authors for a total of 18 study participants; though it should be noted that one participant did not answer the questionnaire so the

actual number of participants was 17. All participants were of similar age and had a similar educational background, including those recruited directly by the authors.

During the study, the participants were divided into two groups; group A and group B, with 9 students allocated to each group. The group allocation corresponded to which game version participants got to play first where group A got to play the selective version of the game (version A) first and group B got to play the random version (version B) first; though both groups got to play both versions of the game. This was done in order to have an equal number of students first experiencing the random as well as the non-random version of the game which in turn decreases the potential impact that prior knowledge of the game would have on the resulting level of engagement.

4. RESULTS

In this section the result of the study is presented. Subsection 4.1 presents the results for the selective reward version of the game (version A). In subsection 4.2 the equivalent results for the random rewards version of the game (version B), is presented. Subsection 4.3 contains the results for a number of questions aimed at directly comparing the two versions of the game.

For both versions of the game, participants were asked to rate various aspects of the game on a scale from one to five in likert scale questions. These included game aspects like how fun and engaging they found the game as well how their motivation to play changed between the first and last level. Participants were also asked a couple of questions aimed at identifying the source of their motivation for playing the game. One such question focused on the basis for the player's motivation; if they were motivated to play the game simply to complete the study or for the sake of the game itself. In this question, the scale corresponded to 1 meaning that they played just to complete the study and 5 that the game itself was the main source of motivation. Participants were also asked about how challenging they found the game as well as how free to play on their own terms they feel as both of these categories had been identified to have a possible correlation with levels of motivation.

Since the study was conducted in Sweden it was more practical to have the questions in Swedish and thus the answers were also in Swedish. Because of this the questions and answers as presented here have been translated; the original questions in Swedish can be found in the appendix.

4.1 Selective reward version

On average, the time it took for each participant to play through the selective reward version of the game (version A) was ~6.5 minutes; this time was slightly shorter for those in group B. Out of the 17 participants, 14 played through the entire version of the game while 3 only played until level 6; all of them were in study group B.

Fig 4 and 5 shows the average answers for the selective version of the game. Fig 4 shows the average score for the questions corresponding to enjoyment, engagement, initial- and final motivation. These questions all got average scores that were quite close to 3 which can be seen as the neutral point on the 5 point scale; that is to say that overall participants did not seem overly positive nor overly negative when it came to these aspects of the game. Fig 5 shows the average scores for the questions

concerning level of challenge, autonomy and extrinsic vs intrinsic motivation. These questions also got average scores that were quite close to 3. In the question about intrinsic versus extrinsic motivation this can be interpreted as participants being about equally motivated by completing the study (extrinsic) and by the game itself (intrinsic); 1 corresponded to only being extrinsically motivated and 5 to only being intrinsically motivated. There didn't seem to be any remarkable differences between groups A and groups B though groups B had quite a bit lower averages on the questions corresponding to initial motivation, final motivation as well on extrinsic versus intrinsic motivation.

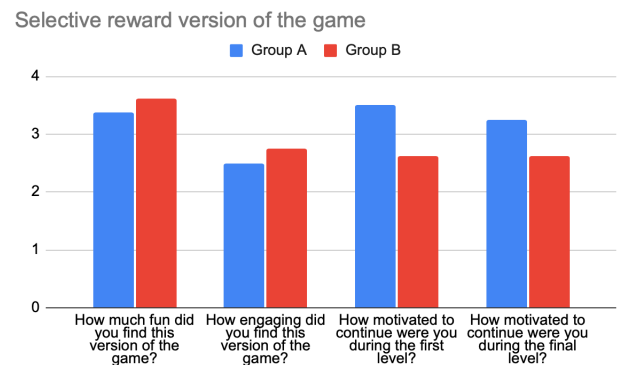


Figure 4. Results from questions relating to motivation and engagement from the selective version

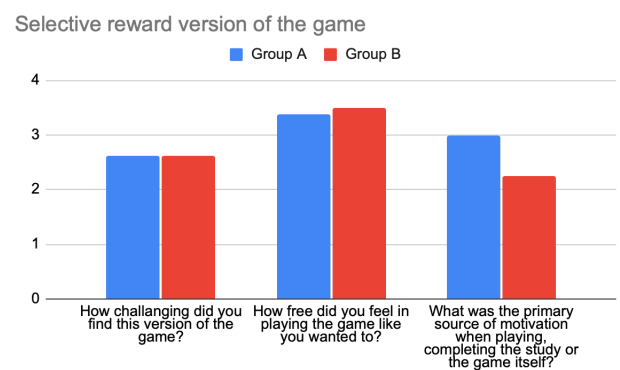


Figure 5. Results from questions relating to challenge, autonomy and source of motivation from the selective version of the game by group. In the third question listed (furthest to the right) according to the scale; 1 refers to participants being solely motivated by completing the study (extrinsic) and 5 refers to participants being solely motivated by the game itself (intrinsic)

As shown in figure 6 the majority of participants felt that the ability to choose a reward increased their engagement; this answer was also evenly split between the two groups. Only three participants felt that it decreased their level of engagement; All three were in group B meaning that they had tried the random version, denoted version B, first. On the other hand all participants from group A felt that it either increased or didn't affect their level of engagement.

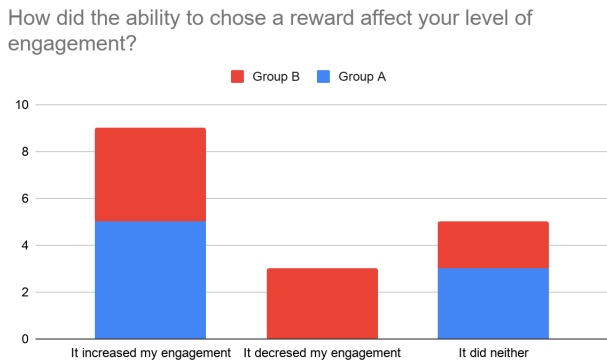


Figure 6.

4.2 Random reward version

On average, it took the participants roughly ~6.4 minutes to play through the random reward version of the game (version B). The time difference between the two groups was much more noticeable than in the selective version of the game; those in group A averaged 5.75 minutes whereas those in group B averaged ~7.13 minutes. Out of the 17 participants, 14 played through the entire version of the game, 2 played until level 6 and 1 played until level 3.

Fig 7 shows the average score for the questions corresponding to enjoyment, engagement, initial- and final motivation. As can be seen these questions all got averages quite close to 3 which can be seen as a neutral point on the 5 point scale. Enjoyment and initial motivation got a bit higher averages while scores for engagement and final motivation were a bit lower. Averages were a bit lower for participants in groups B across all categories though there wasn't a remarkable difference. Fig 8 shows the average scores for the questions concerning level of challenge, autonomy and extrinsic vs intrinsic motivation. Perceived challenge was close to 3 for both groups while the score for autonomy was a bit lower. The average for extrinsic versus intrinsic motivation was close to 2 which indicates that on average players felt more motivated by completing the study (extrinsic) than by the game itself (intrinsic).

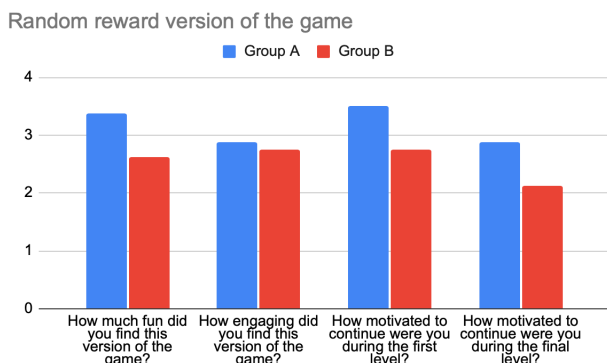


Figure 7. Results from questions relating to motivation and engagement from the random version

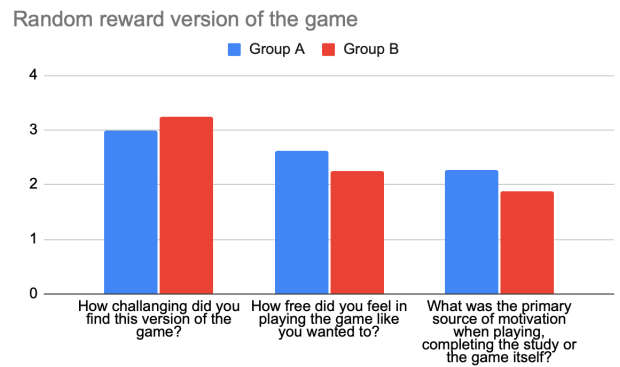


Figure 8. Results from questions relating to challenge, autonomy and source of motivation from the random version of the game by group. In the third question listed (furthest to the right); according to the scale; 1 refers to participants being solely motivated by completing the study (extrinsic) and 5 refers to participants being solely motivated by the game itself (intrinsic)

As shown in fig 9 most participants felt that being assigned a reward at random either decreased or didn't affect their level of engagement. Of the participants who felt that it decreased their level of engagement the majority were in group A. On the other hand the majority of participants who were in group B felt that it didn't affect their level of engagement. Only two participants felt that it increased their motivation, one from group A and one from group B.

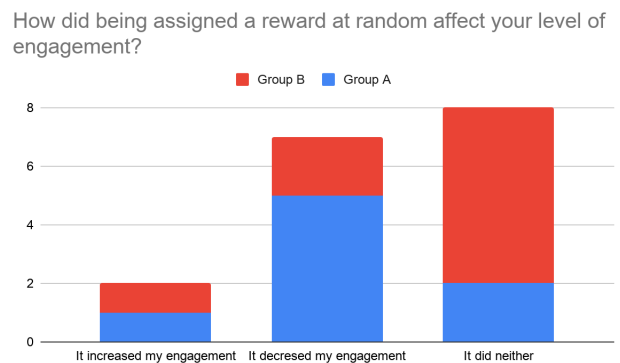


Figure 9.

4.3 Direct reward system comparison

This subsection focuses on a comparison between the results from both versions of the game. The results are provided as based on the averaged 5-point scale results from both groups combined for each game which are presented side-by-side.

The result shows that on average, the participants expressed a near identical sense of enjoyment for both game versions. The selective rewards version, that is to say version A, got a bit higher score when it came to engagement. While motivation at the beginning of the game was almost the same it was a bit higher for version A at the end of the game.

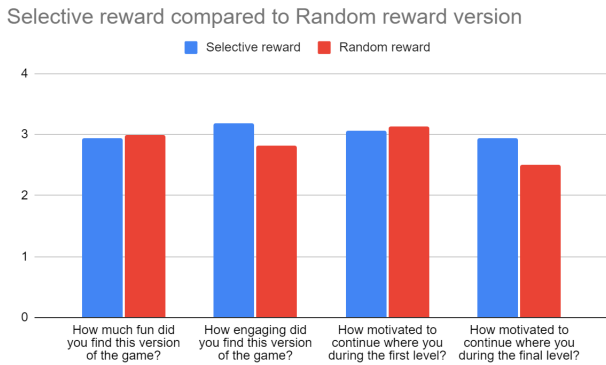


Figure 10. Results from questions relating to motivation and engagement from the selective reward as well as the random reward versions of the game side by side

In general the random reward version of the game was expressed as more challenging, while the selective reward version of the game allowed for greater autonomy. When playing the selective version participants also seemed more motivated by the game itself rather than just by completing the study; that is to say that participants were more intrinsically motivated to play the selective version than the random version.

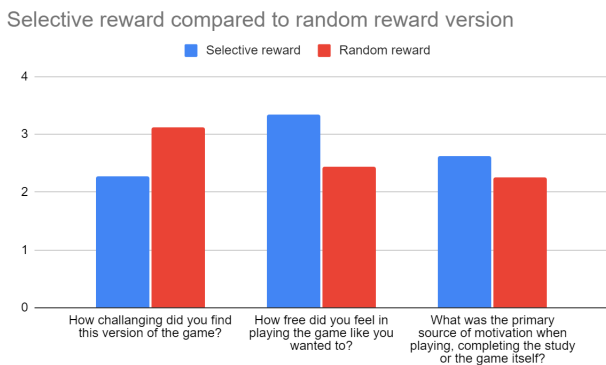


Figure 11. Results from questions relating to challenge, autonomy and source of motivation from the selective as well as the random reward versions of the game side by side

For most of the mentioned aspects, the difference between the two versions were not found to be significant. The level of autonomy felt was however shown to be significantly higher for the selective version than for the random version with a mean difference of -1, $p=0.004$ and effect size ≈ 0.56 indicating a moderate effect.

	Statistic	p	Mean difference	Effect Size
Time	139.0	0.862	8.61e-6	0.0381
Enjoyment	140.0	0.884	2.02e-5	0.0311
Engagement	111.0	0.220	-7.01e-6	0.2318
InitialMotivation	139.0	0.858	2.67e-5	0.0381
FinalMotivation	113.0	0.268	-4.62e-5	0.2180
Challenging	99.0	0.108	1.000	0.3149
Autonomy	63.5	0.004	-1.000	0.5606
IntrinsicExtrinsic	116.5	0.320	-3.28e-5	0.1938

Figure 12. Excerpt from independent sample T-test (Mann-WhitneyU) testing for significant difference between the two game versions (A and B)

Participants were also asked directly which version of the game they preferred with a majority answering the selective version (version A). Following this participants were asked to motivate why they preferred that particular version of the game. Overall it seemed that most participants preferred the selective version due to how it affected the gameplay and more specifically participants seemed to appreciate how being able to choose a reward gave greater freedom to play the game the way they wanted; this is to say that they felt greater autonomy in playing the game. For example one participant answered that “it was more fun to choose power-ups so that one could develop one’s own strategy”. Another participant answered that “thought it was a bit frustrating when one got a bad powerup at random” but while he preferred the selective version he also thought a good thing with the random version was that “One couldn’t choose the best reward each time. Gets less monotonous that way”. Among the participants that preferred the random version one answered that “Is too easy if one can choose power-ups”. The interpretation that participants preference for the selective version was due to the effect on gameplay can also be supported by said version getting a significantly higher average score on the question about player autonomy.

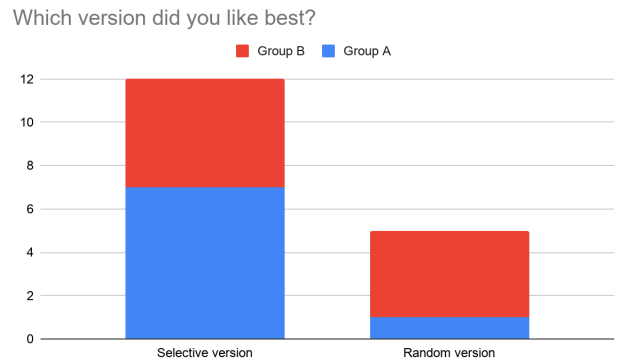


Figure 13. Preferred game version across both groups

When looking at the correlation between each of the measured factors towards the overall stated level of engagement the two aspects with the strongest correlating value was intrinsic motivation (with a Pearson’s r-value of 0.725) and the initial level of motivation (with a Pearson’s r-value of 0.711). The factors that appeared to have a weaker tie to the level of engagement with the participants was how challenging the participants found the game, where a higher experienced level of challenge did not increase their level of engagement. This was also the case with autonomy, where there was not a strong correlation between how autonomous the participants felt when playing the game and their level of engagement.

Correlation Matrix		Time	Enjoyment	Engagement
Time	Pearson's r	—		
	p-value	—		
Enjoyment	Pearson's r	0.560 ***	—	
	p-value	<.001	—	
Engagement	Pearson's r	-0.029	0.127	—
	p-value	0.869	0.474	—
InitialMotivation	Pearson's r	-0.269	-0.133	0.711 ***
	p-value	0.124	0.452	<.001
FinalMotivation	Pearson's r	-0.344 *	0.082	0.462 **
	p-value	0.046	0.647	0.006
Challenging	Pearson's r	0.596 ***	0.297	-0.258
	p-value	<.001	0.088	0.140
Autonomy	Pearson's r	-0.323	-0.112	0.145
	p-value	0.062	0.530	0.415
IntrinsicExtrinsic	Pearson's r	-0.247	0.045	0.725 ***
	p-value	0.158	0.801	<.001

Note. * p < .05, ** p < .01, *** p < .001

Figure 14. Excerpt of correlation matrix testing for correlation between listed aspects of the game

5. DISCUSSION

5.1 Perceived effects on engagement

The purpose of the study was to determine the effect adding a random factor to a video game rewards system would have on player engagement. In order to test this two versions of a simple game were used where the only difference was that in one game players could choose rewards while in the other players were assigned rewards at random; the aim with this was to eliminate as many factors that might affect player engagement.

The study did not prove any remarkable differences between the two versions of the game when it came to participant level of engagement, though most participants still seemed to favour the selective version of the game (version A). When participants were asked to rate various aspects such as engagement on a 5 point scale there weren't many significant differences however when asked directly which version of the game they preferred a majority of participants answered that they preferred the selective version. Participants were also asked to motivate why they prefer the version they chose and based on these answers participants seemed to prefer the selective version because it gave them a more balanced level of difficulty as well as greater freedom in choosing how to play the game. This was also in line with the 5 point scale question which concerned player autonomy where the selective version got a significantly higher score on autonomy. This is to say that the non-random version got an on average more positive reception by participants and this seemed to be largely connected to participant perceived autonomy and level of difficulty.

On questions pertaining to what formed the basis of the study participants' level of engagement, the results indicated that the selective version of the game was also slightly more intrinsically motivating. Looking at the correlation matrix, intrinsic motivation was found as one of the aspects with the strongest correlation to player engagement. Overall the study suggests that there are some similarities in the results to those presented in [14] in that the selective version of the game has scored higher on overall engagement, albeit with different types of video games.

5.2 Method and limitations

5.2.1 The Game

The prototype game that was created for this study was made only to conduct a direct comparison between a random versus a non-random reward system where rewards are granted in between levels. If the rewards were instead provided as direct pickups during actual gameplay, the results might have differed. Also, tying into the reward system categorization; the game only focused on comparing an item-based reward system and not the various other types of reward system presented in the background. The prototype game also did not tap into the social aspect listed as one of the central reasons as to why people find video games engaging [5] and thus we cannot present any results as to what the impact of random rewards in video games are in social settings.

It should also be noted that the rewards themselves had a direct impact on gameplay and this was also the main reason as to why the players found them rewarding. By comparison some rewards systems found in video games have value without affecting gameplay. One example of this would be through the aforementioned social aspects which is the case with some leaderboards. Another example is how players might find value in collecting certain game items even though they don't affect gameplay. As discussed most participants expressed a preference for version A of the game and their reasoning seemed largely connected to how the rewards affected gameplay. While the effect on gameplay is in a way connected to the random and non randomness of the two versions of the rewards system it is not necessarily a part of it. This is to say that using a rewards system that did not impact gameplay or one that had other external value aspects might have given a different result.

The rewards themselves were also awarded in a predictable way, which would mean that the game has not tapped into the concept brought up in [4]; that intrinsic and extrinsic motivation can become addictive when rewards are handed out as a surprise. It can therefore be stated that the additive effect of extrinsic and intrinsic motivation ought not to be relevant with the reward systems used for the game and compared for this study.

During the process of conducting this study, the covid-19 pandemic was still ongoing and, as such, the study needed to take place remotely. This was not a major obstacle but did have an effect in that the testing environment for playing the game could not be standardized. The variation in hardware used by the study participants when playing the game may as such have had an impact on the overall level of engagement if the hardware was limited or in any way interfered with the game.

5.2.2 The questionnaire

The questions included in the questionnaire were centered around measuring player engagement as well as various motivational aspects such as intrinsic and extrinsic motivation theory[5] and

self determination theory (SDT) [4]. One potential flaw in the study is that the terminology for some of the words used in the questionnaire were never strictly defined. For example, while the study was conducted based on engagement being defined as “the level of continuation desire or the motivation to proceed experienced in-game over a sustained period of time” [7] this was never forwarded to the study participants in the question itself. As a consequence, it is possible that the participants had varying definitions of the word “engagement” when answering the question. The overall level of engagement could however instead be captured through the questions relating to the level of motivation to proceed the player had after the first as well as the last level of the game.

A final important note regarding the study was that no questions relating to the previous experience or self perceived skill level were asked to the study participants. The game was created to be completable by as many people as possible within the target group (students at kth) while still offering some level of challenge. Nevertheless, three people were unable to complete all levels on each version of the game. Asking questions relating to previous experience or skill might have given interesting insight as to how these aspects affected player engagement or motivation.

5.3 Future research

Even though this study has implied that random rewards can lead to a negative impact on player engagement, an important aspect that has completely been left out of this study is the effect of audiovisual feedback on the player engagement. Various types of rewards in video game settings are often presented to the player alongside various sources of feedback. This is particularly true when it comes to randomized rewards which are often presented to players alongside audiovisual feedback that share many similarities with the feedback effects used in slot machines or other forms of gambling[11]. A few examples of successful games containing this would be games with rewards such as the “cases” used in Counter Strike: Global offensive (Valve software, 2012) or pickup rewards found in Mario Kart 8 (Nintendo, 2014). An interesting topic of research could potentially be to delve into how these audiovisual feedback effects are used in video games and how they impact the engagement or preferences of a player.

Another interesting area for further research relates to when the allocation of rewards is randomized as opposed to the rewards themselves. In [15], the authors investigate how random scheduled interval times between an action being taken and a reward being given can affect the forming of habits. This area could also be tied into the video game area, comparing how randomizing rewards over different timed intervals may affect the creation of habits with the player.

6. CONCLUSION

The aim of this study was to investigate the effect of random rewards systems within a video game setting and its effects on player engagement. This being in comparison to rewards systems that can be said to be completely non random. The result indicated that given two nearly identical games, one with a randomized rewards system and one with a non random reward system, players seemed to prefer the non random version. The reason for this seemed to be how the different versions affected various aspects of gameplay. Notably the non-random version was generally seen as giving players greater autonomy in how they played the game as well as a more balanced level of difficulty.

That said, when it came to engagement there wasn't any significant difference between the versions.

While this seemed to suggest that random rewards systems lack any impact on engagement yet have an overall negative impact on players' perception of the game. It is however also important to note that the result also indicated that the preference for the non random version in large part came down to how it affected gameplay. Because of this the result might not be applicable to rewards systems that differ significantly from the one used in the study.

This study could be relevant to any developer or designer considering how to structure an item based reward system as it indicates that a selective based item reward system might gain a more positive reception with those playing the game. This study might also prove useful as a prelude to other research going more in-depth investigating how various forms of feedback may affect player preference more towards randomized or selective rewards.

7. ACKNOWLEDGEMENTS

We would like to thank everyone who participated in this study by trying out the game and answering the questionnaire. We would also like to thank everyone in our peer-reviewing group as well as our supervisor for giving guidance throughout the study.

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Instruktioner för utförande av studie, Grupp [A]

Hej och tack för att du deltar i vår studie; Nedan följer instruktioner för vad du ska göra (**obs läs igenom hela dokumentet**). Du kan utföra studien när det passar dig men du ska göra hela studien vid ett tillfälle. **Deadline för att göra studien är fredag 9/4**; men gör det gärna innan dess.

Studien innebär att du kommer att få spela två versioner av ett enkelt datorspel byggt i Unity; versionerna av spelet benämns [version A] och [version B]. Spelet består av ett antal nivåer som du ska spela igenom och spelet kommer att avslutas efter sista nivån. Du ska helst spela igenom alla nivåer men om du fastnar någonstans så är kravet bara att du spelar i minst 10 minuter. Vilken version du ska spela först beror på vilken grupp du tillhör där grupp A ska spela version [A] först och grupp B ska spela version [B] först. Du kan se vilken grupp du tillhör i början av detta dokument. Vilken version som är vilken framgår av filnamnet (t.ex. Test-Game_Ver-A för MAC eller KexGameA/KexGameB för Windows eller Linux).

Efter att du spelat båda versionerna av spelet kommer du att få svara på en enkät med frågor om din spelupplevelse. Se detaljerade instruktioner nedan.

Om du har några frågor kan du höra av dig till amodee@kth.se.

Du har blivit tilldelad grupp [A]

1. Spela version [A] av spelet; nedladdningslänk för Windows, Mac och Linux hittar du nedan. Spela spelet i minst 10 minuter eller tills du klarat av hela spelet (alla banor) från början till slut.
2. Spela version [B] av spelet; nedladdningslänk för Windows, Mac och Linux hittar du nedan. Spela spelet i minst 10 minuter eller tills du klarat av hela spelet (alla banor) från början till slut.
3. Fyll i enkäten: <https://forms.gle/g1iK2NXHPxw4DsPk7>

Nedladdningslänkar

Windows:

Version A:

<https://drive.google.com/file/d/1-MxmfFIJ7WVHqCmjblNY6Ph6QACLh5Zb/view?usp=sharing>

Version B:

https://drive.google.com/file/d/1sZ74W4hGtMg110jfy54TJVX_6cga5KgP/view?usp=sharing

Mac:

Version A:

<https://drive.google.com/file/d/1TUVUNec5huyWWxEa9-7II3cMwyr1Wlzm/view?usp=sharing>

Version B:

https://drive.google.com/file/d/14DLD3vCBQ-MjCfKyolnBRD24CXyG5j_e/view?usp=sharing

Linux:






Version A:

<https://drive.google.com/file/d/1GoAtbgEUbA93mYotVZ5Ue5HVYfMgCEKN/view?usp=sharing>

Version B:

https://drive.google.com/file/d/1tmwWP2kl_hpqE2SLONa1g812h2ieqEyK/view?usp=sharing

Nedladdningarna går till zip filer. För att kunna spela spelet så måste du extrahera innehållet i zip filen, därefter startar du spelet genom att köra spel filen (se bild)

Namn	Senast ändrad	Typ	Storlek
 KexjobbTestGame_Data	2021-03-28 12:39	Filmapp	
 MonoBleedingEdge	2021-03-28 12:39	Filmapp	
 KexjobbTestGame	2021-01-21 00:37	Program	627 kB
 UnityCrashHandler32	2021-01-21 00:32	Program	1 044 kB
 UnityPlayer.dll	2021-01-21 00:38	Programtillägg	21 434 kB

Volym varning! Spelet har musik som börjar spela direkt och det rekommenderas att du inte startar spelet med maxvolym på datorn!

Buggar kan förekomma. Om du stöter på en bugg som hindrar dig från att göra studien så kan du skicka ett mejl, om det är lätt att fixa så kan vi skicka en patchad version till dig så fort vi fixat till det.

Spelet stängs automatiskt när du klarat den sista banan. Annars kan du stänga av spelet genom aktivitetshanterare/genväg på tangentbordet.

Instruktion till spelet

Komponenter

- Spelaren ; blått klot
- Red zones ; Röda block, vid beröring så tappar spelaren ett liv.
- Red wall ; bred röd zon som rör sig över hela banan
- Green zone ; rör för att klara banan

Tangentbord input

- UP / W
- Down / S
- Left / A
- Right / D
- Space; jump powerup

Power ups

- jump ; låter dig hoppa två gånger (Space)

- Destroy 3 red zones ; låter dig förstöra 3 röda block
- Destroy 3 walls; låter dig förstöra 3 väggar (svart-gula)
- 2 Bonus Lives ; låter dig överleva 2 kollisioner med röda zoner
- Slow down red zones ; minskar hur snabbt röda block rör sig
- Slow down red wall ; ger dig längre tid att klara banan
- Phase through walls ; låter dig passera genom väggar

Powerups som har ett visst antal användningar (förstör x antal väggar, få 2 bonus liv) kan bäras över till nästa bana. Om du t.ex klarar av en bana med 2 bonus liv kvar så kommer du att få dessa bonus liv på banan efter men bara tills du startar om (då kommer du ej att få tillbaka dem)

Instruktioner för utförande av studie, Grupp [B]

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Efter att du spelat båda versionerna av spelet kommer du att få svara på en enkät med frågor om din spelupplevelse. Se detaljerade instruktioner nedan.

Om du har några frågor kan du höra av dig till amodee@kth.se.

Du har blivit tilldelad grupp [B]

1. Spela version [B] av spelet; nedladdningslänk för Windows, Mac och Linux hittar du nedan. Spela spelet i minst 10 minuter eller tills du klarat av hela spelet (alla banor) från början till slut.
2. Spela version [A] av spelet; nedladdningslänk för Windows, Mac och Linux hittar du nedan. Spela spelet i minst 10 minuter eller tills du klarat av hela spelet (alla banor) från början till slut.
3. Fyll i enkäten: <https://forms.gle/g1iK2NXHPxw4DsPk7>

Nedladdningslänkar

Windows:

Version A:

<https://drive.google.com/file/d/1-MxmfFIJ7WVHqCmjblNY6Ph6QACLh5Zb/view?usp=sharing>

Version B:

https://drive.google.com/file/d/1sZ74W4hGtMg110jfy54TJVX_6cga5KgP/view?usp=sharing

Mac:

Version A:

<https://drive.google.com/file/d/1TUVUNec5huyWWxEa9-7II3cMwyr1Wlzm/view?usp=sharing>

Version B:

https://drive.google.com/file/d/14DLD3vCBQ-MjCfKyolnBRD24CXyG5j_e/view?usp=sharing

Linux:






Version A:

<https://drive.google.com/file/d/1GoAtbgEUbA93mYotVZ5Ue5HVYfMgCEKN/view?usp=sharing>

Version B:

https://drive.google.com/file/d/1tmwWP2kl_hpqE2SLONa1g812h2ieqEyK/view?usp=sharing

Nedladdningarna går till zip filer. För att kunna spela spelet så måste du extrahera innehållet i zip filen, därefter startar du spelet genom att köra spel filen (se bild)

Namn	Senast ändrad	Typ	Storlek
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- UP / W
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- Destroy 3 walls; låter dig förstöra 3 väggar (svart-gula)
- 2 Bonus Lives ; låter dig överleva 2 kollisioner med röda zoner
- Slow down red zones ; minskar hur snabbt röda block rör sig
- Slow down red wall ; ger dig längre tid att klara banan
- Phase through walls ; låter dig passera genom väggar

Powerups som har ett visst antal användningar (förstör x antal väggar, få 2 bonus liv) kan bäras över till nästa bana. Om du t.ex klarar av en bana med 2 bonus liv kvar så kommer du att få dessa bonus liv på banan efter men bara tills du startar om (då kommer du ej att få tillbaka dem)

Reward systems in video games

I detta formulär kommer du att få svara på ett antal frågor om hur du upplevt de två versioner av spelet som du precis fått spela.

Du svarar anonymt och ingen information som kan användas för att identifiera enskilda individer kommer att tas med i rapporten.

Om du har några frågor eller funderingar kan du höra av dig till amodee@kth.se.

Tack för att du är med i studien!

***Obligatorisk**

1. Vilken grupp tillhörde du; det vill säga vilken version av spelet du spelat först *

Markera endast en oval.

Grupp A

Grupp B

Version A

Nedan följer ett antal frågor om version A av spelet

2. Uppskatta ungefär hur lång tid det tog att spela igenom version A av spelet; svara i minuter (t.ex. 10 min) *

3. Spelade du klart hela spelet? *

Markera endast en oval.

Ja

Nej

8. Hur motiverad att fortsätta spela var du under sista banan (level 7) *

Markera endast en oval.

	1	2	3	4	5	
Inte alls motiverad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Mycket motiverad

9. Hur utmanande upplevde du att den här versionen av spelet var? *

Markera endast en oval.

	1	2	3	4	5	
Väldigt lätt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Väldigt svårt

10. Hur fri att spela spelet som du ville kände du att du var? *

Markera endast en oval.

	1	2	3	4	5	
Inte alls fri	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Helt fri

11. Stod någon bana ut som svårare? I så fall; Vad hade detta för effekt på din motivation att fortsätta? *

12. Medans du spelade spelet, vad skulle du säga att din motivation var mest grundad i? Att klara av spelet för att bli klar med studien eller var spelet i sig motiverande *

Markera endast en oval.

1 2 3 4 5

Endast att bli klar med studien Endast för att spelet i sig var motiverande

13. Hur upplevde du att möjligheten att välja belöning/powerup inför varje bana påverkade ditt engagemang? *

Markera endast en oval.

- Det minskade mitt engagemang
 Det ökade mitt engagemang
 Varken eller

Version B

Nedan följer ett antal frågor om version B av spelet

14. Uppskatta ungefär hur lång tid det tog att spela igenom version A av spelet; svara i minuter (t.ex. 10 min) *

15. Spelade du klart hela spelet? *

Markera endast en oval.

- Ja
 Nej

20. Hur motiverad att fortsätta spela var du under sista banan (level 7) *

Markera endast en oval.

	1	2	3	4	5	
Inte alls motiverad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Mycket motiverad

21. Hur utmanande upplevde du att den här versionen av spelet var? *

Markera endast en oval.

	1	2	3	4	5	
Väldigt lätt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Väldigt svårt

22. Hur fri att spela spelet som du ville kände du att du var? *

Markera endast en oval.

	1	2	3	4	5	
Inte alls fri	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Helt fri

23. Stod någon bana ut som svårare? I så fall; Vad hade detta för effekt på din motivation att fortsätta? *

24. Hur upplevde du att slumpmässigt bli tilldelad belöning/powerup inför varje bana påverkade ditt engagemang? *

Markera alla som gäller.

- Det minskade mitt engagemang
- Det ökade mitt engagemang
- Varken eller

25. Medans du spelade spelet, vad skulle du säga att din motivation var mest grundad i? Att klara av spelet för att bli klar med studien eller var spelet i sig motiverande *

Markera endast en oval.

	1	2	3	4	5	
Endast att bli klar med studien	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Endast för att spelet i sig var motiverande

Jämförelse mellan version
A och version B

Nedan följer ett antal frågor där du ska jämföra din upplevelse av de båda versioner (A och B) av spelet

26. Vilken version tyckte du best om? *

Markera endast en oval.

- Version A
- Version B

27. Varför tyckte du den versionen var bättre? *

28. Om du skulle spela igenom spelet flera gånger, vilken av versionerna skulle du föredra?

Markera endast en oval.

Version A

Version B

Personlig information

29. Kön *

Markera endast en oval.

Man

Kvinna

Annat / vill ej uppge

30. Ålder

31. Jag godkänner att mina svar sparas och används i studiens syfte *

Markera alla som gäller.

Ja

Det här innehållet har varken skapats eller godkänts av Google.

Google Formulär

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