
The Engagement Factors in Gameplay : Predictability and Difficulty

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1. Introduction

Games are one of the most engaging things in the world. What makes game like game and what makes game engaging? Many game reviewers use five factors to evaluate the expected engaging level of the game : graphics, sound, gameplay, value, and reviewer's tilt. Among them, in my opinion, the most important factor is the gameplay.

What is the process of the gameplay?
1) Motivations – there is something which makes people to start to play for the first time, or again.
2) Given situations – once the game starts, it will give players certain situations to which players should react.
3) Controls or reactions – players should control what they can control in the game against the situations.
4) Responses or rewards – the game will be affected by players actions and show the responses to the players' actions or give rewards to them. These given situations, controls, and reactions or rewards process are looping during the game play.
5) Final achievements – at the end of the game, it will show the final results of the players which can be another motivation to play the game again to get the better results.

In these processes, I focused on the given situations, which draw controls from users, and rewards. Especially, I assumed that predictable levels and difficult levels are important factors in these steps. Thus, I designed the experiment to find how these factors in these steps would affect to game players.

2. Experiment

I designed the experiment to know the effects of three factors in the game: predictability of rewards, predictability of given situations, and difficulty. Experiment participants were asked to play several games which were basically same but different in detail parameters. Participants played all the games and were examined their engagement levels and surveyed the reason why they were engaged or bored by certain games.

1) The Games

The games have very simple rules. Stars and bombs are falling down from the sky, and the character of players should receive all the stars and avoid the bombs. This type of games was chosen because it contained all the processes of the gameplay, it was very easy to play even in the first time, it was proven as engaging game type by other similar games, it did not require too much time to play, and it was very easy to modulate the parameters of the game.

You can see the games and the basic information about the games in **http://mimosa.snu.ac.kr/~ence/game/game.html**.

The games are divided by three categories, and each category contains three or five kinds of games.

- Predictability of rewards – scores and life bonuses
1) Game 1-1 : a standard game. Fixed rewards – one point for one star, one life bonus for ten points.
2) Game 1-2 : random rewards 1 – 0~2 points for one star, and randomly occurred life bonuses.
3) Game 1-3 : random rewards 2 – 0~2 points for one star, and 0~2 life bonuses for ten points.

- Predictability of given situations – patterns of falling stars
1) Game 2-1 : a standard game. Fixed patterns – red stars fall down with sine waves, pink stars fall down straightly, and orange stars fall diagonally.
2) Game 2-2 : random patterns 1 – stars often change their directions randomly.
3) Game 2-3 : random patterns 2 – stars often change their colors, patterns, directions, and continuity; they even stop in the air for random time.

- Difficulty of given situations
1) Game 3-1 : the easiest game. Rare falling stars with only one pattern, pink stars falling down straightly and bombs.
2) Game 3-2 : a little bit easy game. Falling stars with two patterns, pink and orange stars, and bombs.
3) Game 3-3 : a standard game. Three patterns and bombs.
4) Game 3-4 : a difficult game. Very frequent falling stars and bombs.
5) Game 3-5 : as difficult as the game 3-4, but give a lot of life bonuses to players; one life bonus for each three points.

2) Skin Conductivity Sensing

A galvactivator is a device for measuring the skin conductivity of people's hands. More detail information about galvactivators can be found in **http://www.media.mit.edu/galvactivator/**. I used a galvactivator which was connected to a computer through an ADC converter. Participants wore a galvactivator on their left hands, and played the game with their right hand. For making the contact between a skin and a galvactivator stable, soaked paper tissues were used between them and participants were requested not to move their left hands.

3) Survey

After playing all the games in each category, participants were asked about the games they played.

1) Did you recognize the differences between the games above?
2) What is your comment on the whole games?
3) Which game was your favorite? and why?
4) Which game was the worst? and why?
5) Could you arrange the order of your preference about the games you played?

4) Participants

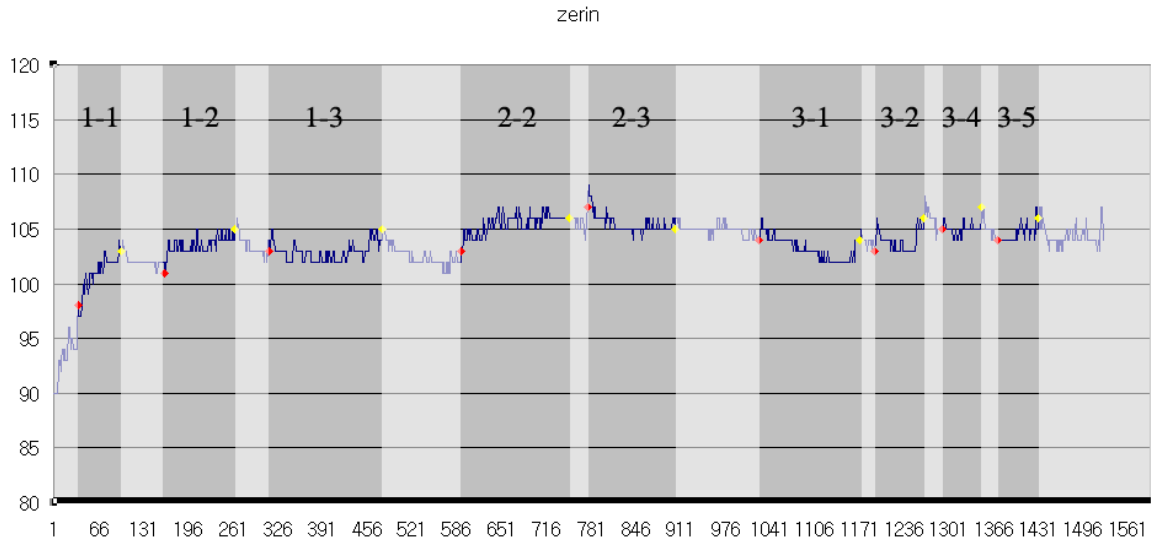
Total 8 players
- Gender : 3 females, 5 males
- Game Familiarity : 3 beginners, 3 middle-level game players, 2 high-level game players
- Examination : 3 persons - survey only, 5 persons - survey and skin conductivity sensing.

3. Results

1) Skin Conductivity Results

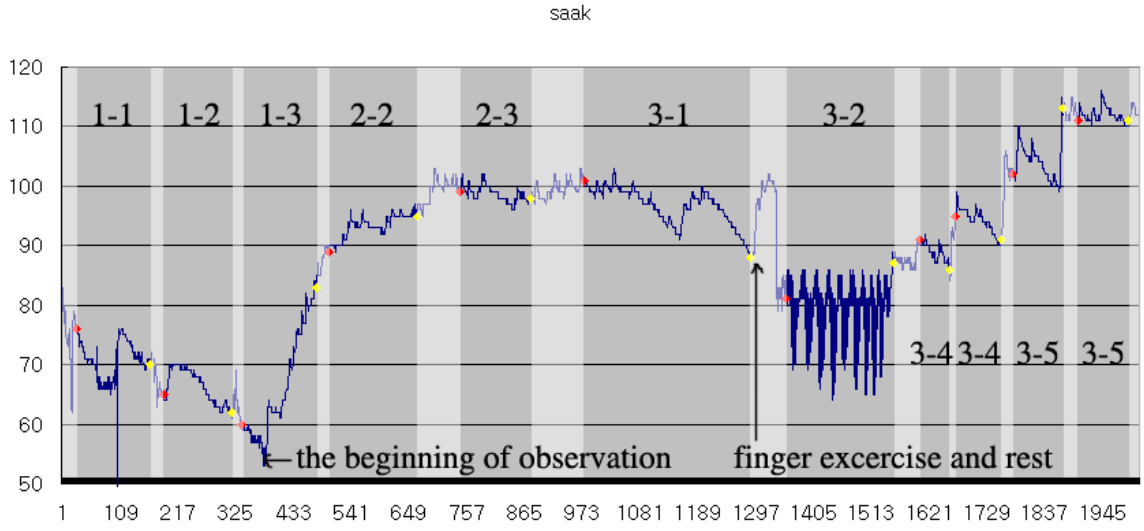
Red points mean the start points of each game and yellow points mean the end points(dieing points) of each game.
Although skin conductivity could indicate the excitement of users, it is also sensitive to other factors such as nervosity and body temperature. Thus, we have to concern other factors when we see the graph. For examples, the rising lines at the beginning of the experiment are shown in almost every graphs, and they don't mean the first game was interesting to play but the participants becomes nervous because of the fact the experiments were started.

A female beginner gamer.



This graph shows a skin conductivity level of a female beginner gamer while she was playing all the games.
The first rising line when she was playing the game 1-1 should be ignored by the reason written above.
Except that, this graph shows that she was excited when she played the game 1-2 and 2-2, and she was bored when she played the game 2-3, 3-1. The meaning of this tendency will be discussed later, in the survey result discussion sections.
One interesting thing we can find in this graph is that people become more excited when they start to play a new game and when they die. Usually, you can find the peaks overlapped with yellow points which mean dieing points.

A male middle-level gamer.



This graph shows a skin conductivity level of a male middle-level gamer while he was playing all the games.

There are three factors which have to be explained before we analyze his graph.
In this case, his experiment was suspended and resumed from the first game again. We can see that he lost his interesting in playing games at the beginning of the experiment because he played the same games again. At around time 350, his line rises rapidly. At this point, I started

to observe him, and it made him nervous. At around time 1300, his line rises rapidly and drops rapidly. At this point, he complained the pain of his fingers, so he had a time to do finger excercises and rest with taking off his galvactivator for a while.

The interesting things we can find in his graph are the lines when he was playing the game 3 series. After he played the game 3-4, he wanted to play the game again to get better score, and his line rises rapidly. The same tendency is also found when he played a very similar game, the game 3-5. As he repeated to play the similar games again and again, his skin conductivity level keep increasing. It throws the research question about whether repeated tries of playing game could increase the excitement level of players.

2) Survey Results

1) Predictability of Rewards

- Beginners
"I didn't care. Actually, I couldn't see the numbers."
"I didn't recognize it while I was playing. Just, because there were falling stars, I kept moving."
"I like the game 1-3 (the game with random score and random life bonus policy) because of serendipity."
Preference : not clear but 1-3 (the game with random policy)

- Middle-level game players
"I didn't care."
"I prefer the game 1-1 (the predictable game). Getting more points is good, but when I couldn't get my point or bonus when I expected to, it was annoying."
Preference : not clear but 1-1 (the predictable game)

- High-level game players
"I was even angry while I was playing the random games because rewards for my playing was so dubious. Even if I got more bonuses, it was annoying."
"The best was the first one (no randomness game) because I could expect exactly what I could get or lose and prepare the next situation."
Preference : best - 1-1 (the predictable game), worst - 1-2 (the random game)

- Discussion
Beginners tend not to concern about scores, points, lives, and any other numbers. They do not care about the predictability or unpredictability under the same probability. Even, some of them prefer unpredictable rewards because of the probability of getting more rewards than they expected.
High-level gamers, who concern about scores, are sensitive to fair and predictable rewards. Because they play the game with calculating the next situation, they obviously prefer the predictable rewards. Especially, they prefer consistency of when they can get rewards to consistency of how much rewards they can get.

2) Predictability of Patterns

- Beginners
"It is really interesting to play the game 2-3 because it is challenging!"
"The game 2-2 is exciting, but the game 2-3 irritates me especially those stop things."
"The game 2-2 and 2-3 are good, but for those stopping or going-up-and-down stars are irritating. I think it might be because they are not continuous."
Preference : 2-2 (the random games) except vertical-random patterns

- Middle-level game players
"It (the game 2-3) makes me angry."
"Even though I feel vexed while I was playing the game 2-3, I like it."
Preference : 2-2 or 2-3 (the random games) except vertical-random patterns

- High-level game players
"The stopping stars ruin all of my prediction and preparation. They made me miss even other normal stars!"
"It (the game 2-3) is not a game, but a lottery."
Preference : best - 2-1 (the predictable game), worst - 2-3 (the random game)

- Discussion
All participants said that they could enjoy the horizontal random patterns but they were irritated or even angry with stopping or going-up-and-down patterns, although their irritated levels were different by their levels of playing games.
Considering the result of skin conductivity, the game 2-2 seemed acceptably unpredictable and exciting, but the game 2-3 seemed too unpredictable to be enjoyed.

Most people tend to prefer "acceptable" unpredictable patterns. In this case, the least constraint of patterns to be acceptable is that stars should be falling down consistently in expectable time. It might be because they cannot control their characters vertically, or because it is related with time. It is an interesting research question to be done that where is the line between the acceptable patterns and unacceptable patterns.
Beginners tend to be more acceptable to unpredictable patterns and high-level gamers, who want to play with a plan to get high scores, obviously hate unacceptable unpredictable patterns.

3) Difficulty

"It is self-torture to play the game 3-1."
"I will eat the next bomb.." (during playing the game 3-1)
"The game 3-4 was too difficult for me, but I enjoyed the game 3-5."
"It (the game 3-5) is exciting because there are lots of things to eat and lots of things to lose."
"It (the game 3-5) was best because it gave me a lot of rewards."

Preference
Best : 3-5 (the most difficult game with lots of rewards)
Worst : 3-1 (the easiest game)

- Discussion
Appropriate difficulty is needed. Too easy game was not preferred by anyone, and someone regarded it as self-torture. It is also shown at the skin conductivity graphs. Most people gave up to play the game more and chose to kill their characters by themselves. The most difficult game in the offered games was preferred by everyone. But before we conclude "the more difficult, the better," there should be experiments with more difficult games, because in this experiment we used just one difficult game.

Another interesting point is that people said their favorites were the game 3-5 (the difficult game with lots of rewards) but they chose the game 3-4 (the difficult game) as a game they wanted to play again. It means two things: people feel more interested with more rewards even if the games are same, and the game which is most interesting and the game which is wanted to play again could be different.

4) The Best Game and the Worst Game

- Beginners and middle-level gamers
Best : Game 2-2 or 2-3 – the games with random patterns. (But participants said that they didn't like the vertical random patterns in those games.)
Worst : Game 3-1 - the easist and slowest game

- High-level gamers
Best : Game 3-5 – the difficult game with lots of rewards
Want to play again : Game 3-4 – the difficult game
Worst : Game 3-1 - the easist and slowest game

4. Conclusions and Remaining Questions

1) Beginners VS High-level Gamers

In the preference of predictability, there is an obvious difference between high-level gamers and beginners. High-level gamers tend to prefer predictable games while beginners tend to be more acceptable to unpredictable games.

In rewards, beginners usually do not care about the predictability of rewards, but high-level gamers are very sensitive to the predictability of rewards.

In patterns, although most of them do not like the patterns which are unpredictable beyond the acceptable boundary, the responses for the unacceptable unpredictability were different. Beginners shows more acceptance to too unpredictable patterns than high-level gamers.

2) an Acceptable Boundary of Unpredictable Patterns

In these games, people liked the horizontal random patterns of falling stars while they do not like and even hate the vertical random patterns. It might be because the vertical random patterns make the time inconsistency. Participants were irritated when they were waiting without knowing until when they have to wait.

Two things could be infered. The first one is that time unpredictability might be the line between acceptable and unacceptable patterns. The other one is that the line between what people can control and what people cannot control might be the boundary, because in this game people can control their character horizontally but cannot vertically. Because people more hated the stopping stars than the going-up-and-down stars even though both patterns are vertical random patterns, it seems more convincing that the boundary is more related with time inconsistency, because people can infer the expected time with the going-up-and-down stars, but cannot guess with the stopping stars.

3) Difficulty

The difficult is better than the easy. A too easy game is not acceptable to any user, and even regarded as self-torture, not a game, while challenging game is preferred and chosen as a game which players want to play again. Thus, we can infer that challenging difficulty is one of the engagement factors.

One more interesting question is that, if we assume that the engagement includes the desire to do the thing again and again, this experiment showed that the most interesting game and the most engaging game could be different.

4) Repeated Tries

The skin conductivity level graph shows that skin conductivity gets increased when players try to play the same game again and again to get better scores. Although this phenomenon is not researched in this project, it is a very interesting fact which could be an answer key for solving the addictiveness of games.