Analysis of the impact of various gamification factors on the level of player satisfaction

Analiza wpływu różnych czynników grywalizacyjnych na poziom satysfakcji graczy

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Abstract

Nowadays, gamification factors have many applications outside the gaming market, including in science, trade and everyday life, which is referred to as gamification. Despite its widespread use, due to the number of factors that can be used, the scale of potential benefits is still unknown. Although the very concept of gamification refers to areas not related to games, its effectiveness prompts to examine the source from which it comes, and thus the impact of its individual factors on the games themselves. The following work examines the influence of various gamification factors on a player's playing time and satisfaction in order to find the factor that brings the greatest benefit. The research was carried out using a game specially created for this purpose and on the basis of the results of the survey presented to the players. The results show that the five selected gamification factors are the challenges and the badges awarded for them have the greatest impact on both examined metrics.

Keywords: gamification; immersion; player satisfaction

Streszczenie

Czynniki grywalizacyjne mają w obecnych czasach wiele zastosowań poza rynkiem gier, między innymi w nauce, handlu jak i w codziennym życiu, co określane jest mianem grywalizacji. Pomimo jej powszechnego wykorzystywania, z racji na liczbę możliwych do wykorzystania czynników, skala potencjalnych korzyści wciąż pozostaje nieznana. Choć samo pojęcie grywalizacji odnosi się do obszarów nie związanych z grami, jej skuteczność skłania do zbadania źródła z którego się wywodzi, a zatem wpływu poszczególnych jej czynników na same gry. Poniższa praca bada wpływ różnych czynników grywalizacyjnych na czas gry gracza oraz uzyskaną przez niego satysfakcję, w celu znalezienia czynnika przynoszącego największe korzyści. Badanie zostało wykonane przy pomocy specjalnie utworzonej w tym celu gry oraz na podstawie wyników ankiety przedstawionej graczom. Wyniki pokazują, że pięciu wybranych czynników grywalizacyjnych, to wyzwania oraz przyznawane za nie odznaki mają największy wpływ na obie badane metryki.

Słowa kluczowe: grywalizacja; immersja; satysfakcja gracza

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1. Introduction

Almost 50 years after the creation of the first video game (Pong, 1972), the gaming industry has gained immense popularity. In 2019 alone, it earned USD 148.8 billion and 8,290 new full-fledged titles appeared on the Steam platform. These numbers are definitely impressive and drive the further development of better and better technologies. However, such results also raise many new questions. Extensive research is still needed to understand the reason why players spend so much time at the computer, while other activities can tire them after a few moments, what exactly motivates or fascinates them, and of course how to use it in other areas.

Motivated by all these questions, scientists all over the world have been trying to understand how games affect the human mind. For this purpose, many metrics and terms have been defined, the most popular of which are the concepts of gamification and immersion.

The purpose of the study is to investigate which gamification factor has the greatest impact on game time and overall player satisfaction. Due to their wide application even outside the gaming market, the research results could be used in the development of gamification itself as it is the term used to describe the use of game mechanics in non-gaming situations. The study is based on surveys conducted on a selected research group and on the basis of information collected during gaming sessions. The obtained results can also be used by the developers to determine the aspects of the game that they should focus on the most. The aim of the study is to answer the following research questions:

1. Does the quality of the graphics extend the player's playing time?
2. Does the quality of the soundtrack extend the player's playing time?
3. Does the presence of a scoreboard extend a player's playing time?
4. Does the presence of player levels extend the player's playing time?
5. Does the presence of achievements and badges increase the player's playing time?

2. Literature review

Some gamification elements are so common that users are not even aware of their presence. Today it is normal that people get points for shopping [1] [2], awards for helping other users [3] or marks for knowledge [4], they have become natural. The use of various game mechanics and mechanisms in various industries other than gaming in order to increase commitment and motivation[5] is referred to as gamification. There has been a lot of research on this phenomenon and its impact on achieving the intended goals [6] [7], such as increasing sales results [3] or improving academic performance [8][9]. The vast majority shows that implementing gamification is definitely worthwhile. Despite its many possibilities, gamification is not a solution to every problem and requires careful planning in order to achieve the desired results. A very important element of the planning process is the correct selection of factors and methods that will have the greatest impact on a given recipient group [10] [11], and it has been proven that the effect may differ depending on age or gender [12]. The way of rewarding the user should also be carefully considered, in order to properly meet his needs [13]. One of the most important concepts of gamification is immersion. It describes the state in which the player focuses on the game to such an extent that feels as if the world created in it is real. This allows the player to distract from the real world, potentially extending their playtime and overall satisfaction. There are many factors that affect the level of game inertia. Sound plays an important role in this situation. Research [14] shows that in order to increase inertia, the music in the game should be liked by the player. Papers [15] [16] clarify this requirement, stating that a good soundtrack should not fit the player's preferences, but it should be of good quality and reflect the atmosphere of the game. Graphics also play a key role in gameplay. The research described in [17] proves that proper adherence to the psychology of colors can significantly increase player satisfaction. The fact whether the level was procedurally generated or created manually by a graphic artist also has a slight difference [18]. The results of the research in [19] show the positive impact of graphic realism, although on the basis of [20], it can be concluded that it is more important how well the whole combines into one style. Moreover, [20] apart from the graphic factor, it also shows the influence of an appropriate reaction to the user's actions in order to increase the sense of influence on the surrounding world in the game. It is also worth keeping the user at the right level of tension, depending on the type of game [21], so that he is properly focused on the game. The game should not be too difficult, which leads to excessive frustration, or too simple, which causes the player to feel bored. In [22], it was investigated how uncertainty influences player satisfaction, unfortunately, despite great expectations, the results of the research did not allow to find a significant influence on inertia.

3. Theoretical Background

The theoretical overview is based on two main concepts, gamification with focus on its factors and immersion. They have a key impact on the obtained results, therefore their knowledge is necessary to conduct an experiment.

3.1. Gamification factors

There are many gamification factors, and the frequency of their use is so great that they are often considered normal, an integral part of life today. The most common of them are probably *the points* awarded for the correct performance of activities in a gamified environment. They can bring benefits in the form of discounts, possibility of exchange for some awards or serve only as information for the customer about his activity or loyalty to a given brand. They are often linked to another factor, namely *the scoreboard*. Users are assigned ranks, places on the list, depending on the number of points obtained. Depending on the application, they can also inform about the awards won or serve to obtain satisfaction themselves. Usually, their main task is to motivate users to perform certain actions. This approach, however, depends largely on how competitive the group of entities is. A similar action is brought by the application of the mechanism of *achievements and badges* granted for their completion. However, this approach differs in that in the case of challenges, competition with other users is limited, and the personality type of the person receiving the challenges is more important. They are often scaled up to several difficulty levels, where the simplest ones are done quite quickly, while with the increase of the level, the required amount of work and time increases dramatically. While it is not required for simple tasks, it is worth using another factor, which is a progress bar, for long tasks. It allows you to increase your motivation by visually representing the progress of an achievement or experience required to move to the next level. *Levels* are a frequently used mechanism for determining when new content is unlocked and how users are divided according to their familiarity with the service. Therefore, it is worth making the new level mean something good for the user, worth the effort. Effort in this case refers to the tasks that are most often performed in order to gain a level. They are usually easier to perform than the aforementioned achievements, and they can also be repetitive. Additionally, in most cases, challenges are optional, while tasks can be imposed without the possibility of skipping them. A special case of tasks are group tasks, which refers to the last of the most important gamification factors, the cooperation of participants. This factor allows to tighten social ties, which leads to building a harmonious community of users. Such a community is usually positive about helping, increasing motivation and commitment.

3.2. Immersion

Immersion, often also called spatial presence, describes the state in which the user is absorbed by the environment presented to him to such an extent that he feels as if he were physically in this environment. As this is a very desirable behaviour, through numerous analyzes and studies, a number of issues that are worth paying special attention to have been developed. The first one of them is the game soundtrack. The key in this situation is to match the music to the atmosphere in the game. For example, racing games are often accompanied by strong, energetic music, while strategy games are usually endowed with calm music that allows the player to concentrate. It is also very common to adjust the music to the current events in the game, it is most visible in role-play games, where in moments of danger, the music changes drastically, thus signalling the current situation. In addition to the background music, there are many different sound elements that allow to enhance immersion. The rustle of leaves in the forest, the splash of water by the lake, or the sounds of nearby animals are just a few examples. It is also extremely important that the sounds delivered to the player at a given moment are sounds that are consistent with what the player expects. Sounds triggered by the player's actions, such as the creaking of a door opening or the sounds of footsteps while traveling, are also often included. In games that allow some form of conversation, or at least narration, the creator should also remember about the right choice of voice. The bored, sleepy tone of the narrator during the climactic scene will certainly be noticed by the player, thus bringing him out of the state of immersion. An inseparable part of designing immersive games is the process of choosing the graphic style. The game does not have to be photorealistic in order to provide the player with the best possible experience, but it does need to provide a consistent level of detail and style. The ultra realistic dragon model in a square game will undoubtedly grab the player's attention, thus destroying the overall gameplay experience. It is also worth paying attention to providing the player with the right perspective. In strategy games, the top view is the most common, while in action or role-play games, the view from the first or third person perspective dominates, with the possibility of changing these settings depending on the player's preferences. An important element is also providing a clear and legible interface, giving the player access to the most important information and a sense of control over current events. Of course, matching the sound and graphics is not enough if the goal is to provide the player with the greatest satisfaction. It is also necessary to take care of the gameplay itself. The game should consist of interesting tasks that allow the player to avoid monotony, preferably with different difficulty levels, so as to keep the player at the expected level of interest. This is possible thanks to a well-developed plot telling a story that can interest the player. Depending on the type of game, the plot is presented in text form or through all kinds of animations. Some game types also allow for ludonarrative behaviour. This allows the player to spend time in the game to perform other activities and tasks not directly related to the main story. This procedure allows the player to better master the game mechanics, understand the world presented to him and, in many situations, develop the character. By analyzing the above examples, one can easily see that there are many additional factors to consider when designing an immersive game. In addition to technological limitations, the design and the type of game itself also play an important role. For example, strategy games are usually characterized by high complexity and connections between various game mechanisms, which requires the player's constant attention and continuous decision-making. In turn, role-play games are distinguished by a high sense of development, with visible effects of work and commitment, thus motivating to continue the game. The factors that bring the player out of immersion are also important to discuss. The most obvious on this list are all kinds of errors and inconsistencies, overlapping models, distinctive textures, and stuttering characters. In addition, which is very easy to see especially in mobile games, there are too many ads that show up, which cannot be avoided.

4. Method

This chapter provides information about the game that is the basis for the research and describes the method of preparing and conducting the research, as well as the mechanisms influencing the quality of the obtained results.

4.1. The Game

The game was created by hand only for the purposes of research, using a ready-made, free template available on the Unity platform. As a genre, a tower defense game with a top view was selected. The main task of the player is to place the title towers in places intended for this purpose, so as to stop the waves of hostile objects moving along the marked route to the object referred to as the player base. A total of six levels have been prepared, the first of which was the base mode with no upgrades. Each of the other 5 modes was based on the base version and offered one of the possible improvements, which were:

- enhanced graphics,
- enhanced soundtrack,
- scoreboards,
- player levels,
- achievements with badges.

The game content was generated automatically with a gradually increasing difficulty level. An exemplary look of the game, presented in the mode with extended graphics, is shown in Figure 1.

Figure 1: Exemplary look of the game in mode with extended graphics.

4.2. Protocol

After agreeing to participate in the research, the participants were acquainted with the research topic and the game with its mechanisms. Then, they were presented with the research protocol and any questions were answered. After confirming the understanding of the research methodology, each participant received a link under which the game was posted. The next step was to choose a unique player name to be used in subsequent games and in the survey. After choosing the name, the player was able to play the game in the base version. The condition for the correct ending of the game was pressing a specific button visible after three minutes of the game or the player's defeat. After successfully completing a level, the player then had to wait 24 hours to continue research. This procedure was aimed at reducing the impact of the player's boredom with the game on the results obtained. For the time of research, the game was released on a free platform, so each participant could conduct next test at any time, taking into account the above-mentioned condition. Each player had the opportunity to play all of the modes, starting from the base mode and continuing with the next randomly selected level. After playing all possible levels, the respondent had to complete a questionnaire consisting of demographic questions and questions describing the satisfaction obtained by the player.

5. Discussion

5.1. Participants

A total of 768 players participated in the study. After verifying the correctness and completeness of the obtained data, 747 correct results were obtained. Due to the nature of the research, the research group consisted of people at least partially related to IT or games. The study involved 691 men and 56 women, mostly between the ages of 15 and 29. They were mainly students of IT technical schools, IT studies and people working as programmers of games or other applications. Each of the respondents regularly plays video games and 133 admitted playing at least 5 days a week. In terms of the duration of the game session, most responses focused on 4-6 hours or more. It is not possible to accurately determine the level of difficulty of the game expected by the players, as most of the respondents indicated that it depends on the game. When describing their type of player, almost half of the respondents described themselves as explorers, which, unfortunately, is not an ideal match for the type of game chosen for the research.

5.2. Play time analysis

The analysis of variance (ANOVA) was used to analyze the influence of gamification factors on the player's playing time. Its correct use requires meeting the assumptions of variance and normality. The first of them was checked using the Brown-Forsythe test (p = 0.00), indicating that the assumption of homogeneity of variance is met. Categorized normality plots were used to verify the normal distribution of the dependent variable. After confirming the assumptions, the ANOVA test was performed. The result of $p <= 0.00$ thus obtained means that the hypothesis of no difference is rejected and additional post-hoc tests can be performed. For this purpose, the Tukey test was selected, the results of which are presented in the figure 2.

Var1	{1} M=370.15	{2} M=920.16	{3} M=258.36	{4} M=812.71	{5} M=678.19	{6} M=969.90
1 {1}		0.000020	0.007133	0.000020	0.000020	0.000020
2 {2}	0.000020		0.000020	0.011354	0.000020	0.638102
3 {3}	0.007133	0.000020		0.000020	0.000020	0.000020
4 {4}	0.000020	0.011354	0.000020		0.000457	0.000036
5 {5}	0.000020	0.000020	0.000020	0.000457		0.000020
6 {6}	0.000020	0.638102	0.000020	0.000036	0.000020	

Tukey HSD test; Variable: Var2 (timescolumned.sta) Marked differences are significant at p < .05000

Figure 2: Tukey test result for play time.

It clearly shows the existence of differences between the base version and all the others. It is also worth paying attention to the lack of visible differences between the mode with extended graphics and challenges, which indicates a similar effect on the extension of the game time.

5.3. Satisfaction analysis

As in the case of time, the ANOVA test was chosen to analyze the satisfaction obtained by the players. The result of the Brown-Forsythe test (p = 0.00) and the normality of the dependent variable (an example of the normality chart shown in Figure 3) allowed for the correct performance of the test. The ANOVA result (p = 0.00) indicated the presence of differences between the versions, they are presented in figure 4 based on Tukey's test.
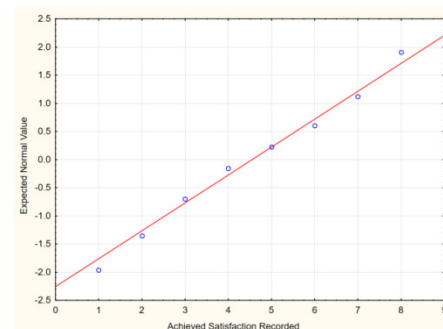

Figure 3: Normality chart for achieved satisfaction recorded in mode with extended graphics.

Figure 4: Tukey test result for player satisfaction.

The noted differences exist between all available game modes except the base version and the version with sound (p = 0.998). Considering the results received in the survey, according to players, these are the two least satisfactory modes.

5.4. Results summary

The answers to the research questions were based on a comparison with the results obtained for the base version of the game. This applies to both the average playing time (M = 370.15) and the average satisfaction obtained by the players (M = 4.5060). Table 1 also includes additional data from the research trials that may clear up some of the possible uncertainties. The number of towers purchased by the player may indicate interest in the game. Sold towers indicate a need for strategic thinking and planning. The number of improved towers allows to analyze the readability of the interface and the player's immersion level.

Table 1: Additional game data

Mode	Towers bought	Towers sold	Towers upgrades
Base	20.6364	3.8757	18.1056
Graphics	31.3917	5.4251	61.3610
Sound	12.7233	2.9198	2.3837
Scoreboard	31.5682	5.4559	53.1658
Player levels	29.7099	5.2313	41.3783
Achievements	34.0615	6.1163	66.5548

RQ1: Does the quality of the graphics extend the player's playing time?
RQ1 Summary: Graphics have a significant impact on the player's playing time (M = 969.90, p = 0.000020). Thus, more than a twofold increase in the obtained time was obtained. In addition, there was also a significant increase in the satisfaction obtained by players (M = 7.6078 p = 0.000020).
RQ2: Does the quality of the soundtrack extend the player's playing time?
RQ2 Summary: According to the test results, the use of sound also affects the player's playing time. In this case, however, it had a negative impact (M = 258.36, p = 0.007133). However, no significant effect on the satisfaction obtained by the players was noticed (M = 4.5489, p = 0.998947). In this case, the results of the additionally obtained data are interesting, in particular the number of upgrades made to the player's towers. Almost nine times lower results compared to the base version could indicate the lack of immersion in the player. One of the most likely reasons for this could be that the soundtrack does not match the player's [14] expectations and the atmosphere of the game.

RQ3: Does the presence of a scoreboard extend a player's playing time?
RQ3 Summary: The presence of the scoreboard had a significant impact on both the playing time (M = 812.71, p = 0.000020) and the satisfaction obtained by the players (M = 6.8046, p = 0.000020). This result may be surprising due to the fact that only 65 respondents described their type of player as Socializer.
RQ4: Does the presence of player levels extend the player's playing time?
RQ4 Summary: Introducing the possibility of player development by gaining new levels had a significant impact on increasing the players' playing time (M = 678.19, p = 0.000020) and on the satisfaction obtained from the game (M = 6.3655, p = 0.000020). When analysing additional data, it can also be noticed that the number of purchased and sold towers achieves results similar to other modes, where the game time was much longer. This may indicate an increase in the player's immersion by encouraging strategic thinking and constant interaction with the game.
RQ5: Does the presence of achievements and badges increase the player's playing time?
RQ5 Summary: The introduction of challenges and badges to the game had a significant impact on the player's playing time (M = 969.90, p = 000020) and on the satisfaction obtained by the players (M = 7.6068, p = 0.000020).

6. Conclusions

Starting with a summary of the results, in terms of their impact on the player's playing time, each of the prepared modes had a positive effect on extending the player's time, with the exception of the extended sound-track mode, which had a negative effect. Considering the satisfaction noted by players, the positive impact of all game modes can again be noticed, with the exception of the mode with the extended soundtrack, where there were no significant differences from the base version.

Due to the assumptions included in the protocol, allowing for the correct completion of the research session after three minutes of gameplay, the average game time in the base version (M = 370.15) turned out to be surprising. The values included in the additional data also allow to state that the players had no problems understanding the rules and the interface presented to them. This is important due to the presence of these factors in each of the other modes.

The use of improved graphics has been a huge success, with one of the highest average play times recorded. The results of the player satisfaction obtained in this way are weaker compared to other presented modes, but it was still an increase compared to the base version. The remaining results for this mode remain normal, showing no unexpected behaviour.

The mode with an extended soundtrack turned out to be a surprise, recording a similar satisfaction obtained by players with the game compared to the base mode, while achieving much worse results in terms of gameplay time. Worse results were also noted in this case for

all additional data, suggesting inappropriate selection of the soundtrack to the game's climate, resulting in problems with causing players to be immersed.

The results of the scoreboard mode also turned out to be unexpected. Despite the fact that the average game time is shorter than the mode with extended graphics or challenges, the statistics on the number of operations on towers, in particular their purchase, are similar. As this was one of the Operations that earned players points, this indicates player engagement as expected for this mode. The mode that allows the player to develop by acquiring levels and unlocking improvements turned out to be underestimated. It did not bring such a significant increase in the player's playing time as the other modes, but it had a large impact on the satisfaction obtained. This is most likely related to the greater difficulty of this mode, resulting from the need for strategic thinking and constant interaction with the game.

Despite the fact that only 155 people identified their player type as achiever, the achievements and badge mode scored the highest for game time, satisfaction, and each category from additional data. The challenges for this mode have been designed in such a way as to encourage the player to interact with the game as much as possible, gradually increasing the difficulty level and requirements.

In conclusion, the answer to the question of which of the gamification factors has the greatest impact on the player's game time and overall satisfaction obtained are the player's achievements and badges. This mode obtained the highest results in all possible categories. In order to extend the game time, it is also worth paying attention to the graphic style presented to the player and providing him with the opportunity to compete with other players based on the results obtained. Competition can also significantly increase the player's satisfaction with the game, and the ability for the player to develop and gain levels can work in a similar way. On the basis of the obtained results, it can be concluded that the soundtrack has the smallest, or even negative impact on the playing time, but it requires additional research due to the possibility of inappropriate matching of the sound to the game climate.

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