User-centered Entertainment Factors for Platform Transformation and GameDevelopment

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Abstract: This paper explores the entertainment environment that focuses on platform transformation based on the respond of the user's demand. Improvement factor has been introduced to identify the key concept that was related to the perceived enjoyment. A player model was analyzed based on the perspective of user psychology. Scale-Rating questionnaires were distributed and collected which then analyzed based on the model to determine the improvement factors that largely effects different gaming platforms. The two-tailed t-test was also conducted to clarify the significant difference of each platform based on the improvement factors. The result found that the gaming platform can be trans- formed in the future based on specific improvement factor. While the findings may have limitations, it clarifies the effectiveness of improvement factors towards a better understanding of the entertainment space for both game platforms and contents which potentially drive future development and improvement of in-game community and industry.

Keywords: *Platform transformation, improvement factors, game entertainment, player model*

1 Introduction

As the recent year, the game technology both hardware and software is making progress rapidly and ubiquitous. Platform transformation and game development technology al- low user for thrilling sensations in terms of entertainment experience. The latest direction takes advantage of technical improvements and offers high performance. Researchers and psychologists have begun to investigate the factors that drives the entertainment experience of playing these games [2, 5]. Game diversity has also increased in terms of the existing elements sports that are being incorporated and transferred into the virtual game environments. Given the increasing applications of digital technology in traditional sports, critics can mention that the worlds of virtual and non-virtual sports are approaching and merging [12].

We considered evolution of this gaming entertainment experience over the years, many ongoing changes year by year nowadays it becomes almost casual game and launches in portable platforms. Earlier mobile game researches have mainly focused on implementation and development in sense of developer perspective. Additionally, while intrinsic factors are often considered important in affecting gameplay, little re- search has attempted to understand their kinds of characteristics that reach satisfaction of users [1]. Based on the assumption, developers should focus on demands of customers in how to improve gaming experience. Consequently, users can drive the direction of future gaming experience. To fill these gaps, our study focus on the role of improvement factor as a driver of mobile game's continued use, and the antecedents of perceived enjoyment [1, 6]. Therefore, this research studies the concept of improvement factor for gaming experience and wider entertainment space towards user perspective. The two

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re- search questions are accordingly as follows: Which platform/entertaining environment will be dominated in the near future, and how does the entertainment/playing trend change in the near future?

This paper is organized as follows. Section 2 introduces the related works and re- search question with hypotheses. Section 3 provides the entertainment improvement factor definition. Section 4 describes the methodology of this study based on player model. The results and analysis are shown and discussed in Section 5. Finally, Section 6 gives concluding remarks and considerations for future work.

2 Related works and background

2.1 Deftnition and element of play

Nowadays, there are many definitions and interpretation on the play. Some researchers have introduced traditional and modern concept and significance interpretation in various domains [1, 4, 6, 7, 12]. Psychologists interpreted 'play' as an area of interest and considered as a valuable cultural transference, they define play as a domain that is within society. Any play and game can take place in and outside of our physical reality with limitation of the medium and rule keeping within the domain [10].

The definition of play and games have elaborated on the key factor, based on the assumption that enjoyment as the vital of an entertaining experienced. [20] identified 27 fun factors based on a comprehensive literature review and a content analysis of 60 professional game reviews. They proposed Big Five [12, 15] in game enjoyment (i.e., technology, game design, aesthetic, entertainment experience, and narrativity) and three threshold perspectives for element of play (i.e., playability, enjoyability, and fun boosting factors).

The most importance in motivation of playing is that a player voluntarily enters to play without frustration and boredom [15]. Definition of play will change the quality of the activity and experience. In addition, play has a repetitive nature: If the play is enjoyable, then it provides high redundancy of the enjoy experience. Therefore, element of play consists of voluntary and repetitive activity, provide a unique combination of features that are also essential to development game contents and platforms [1, 6].

2.2 Perceived enjoyment

Enjoyment is defined as the intrinsic experience of using entertainment technology which is based on reward and pleasure to users [1]. The role of perceived enjoyment is driving the continuous using games. Most studies have focused on the drivers of the initial acceptance of the games, and the users' continuance behaviors have been mostly ignored. Some paper examined the effect of factors on intention to continue playing, and some relevant research [6, 7, 12] showed the adoption of factor to quantify the social interaction and entertainment contribution in the view of developers and players. This concept has been promoted repeatedly and became to be essential driver for identifying important game design. Perceived enjoyment can help identify and predict the direction of platform transition. As such, the drivers to perceived enjoyment model is investigated.

2.3 Psychological modeling analysis

There have been several studies of player modeling in human computer interaction field [17]. These models use to analyze distinguish player types, how players behave and how players react to software [16]. The main goal is improving entertainment of the game and identifying players' behavior. Psychological models describe the mentality and then predict behavior patterns. It is essentially model to identify emotion of players and their preferences that manifest themselves in the game with specific expression [14]. Thus, the functionality of the model can increase entertainment value while decrease the frustration value on player intrinsic experience (verified by player). The attitude of player towards a game is an important issue that many game companies concern, [14] have investigated which factors contribute to the intention of online game community. According to [15], since uncertainty of player is difficult to predict, Flow theory can describe how the way of player feel and provide amount of complexity and challenge in the game.

2.4 Today trends and evolution changes in game industries

The twenty-first century games are so much more complex and richer than first generation. Modern games can hardly be compared with the first generation of electronic games [2]. The diversity of games has also increased dramatically in terms of the existing elements sports that are being incorporated and transferred into the virtual game environments [4]. This not only relates to the simulation of well-known sport, but also includes aspects of human and computer interaction being part of a game. Given the increasing applications of digital technology in traditional sports, the development of the mobile content industry has been supported by such as portability (mobility), accessibility (generality), and convenience (simplicity) [11]. Interactivity is also one of the recent trend that has been introduced to every domain not except in mobile game such as Pokemon Go!, virtual reality (VR) games, augmented reality game (AR) games, and etc.

For platform issue, Nintendo Switch is now highly successful new hybrid console and also considered very interesting by the developer's community. However, few developers are already working on games for this console as shown in Fig.1. In case of smartphone, considering the huge installed base and the relatively low effort involved in making smartphone games, it is reasonable that developers try to carry on that opportunity. Not only easy implementation dominates the way of today trend, but also the accessibility of user and gaming experience affect to game company in sense of customer acquisition. Our study will mainly focus on five different platforms: board games (fun games), home console, smartphone, hybrid console, and VR and AR.

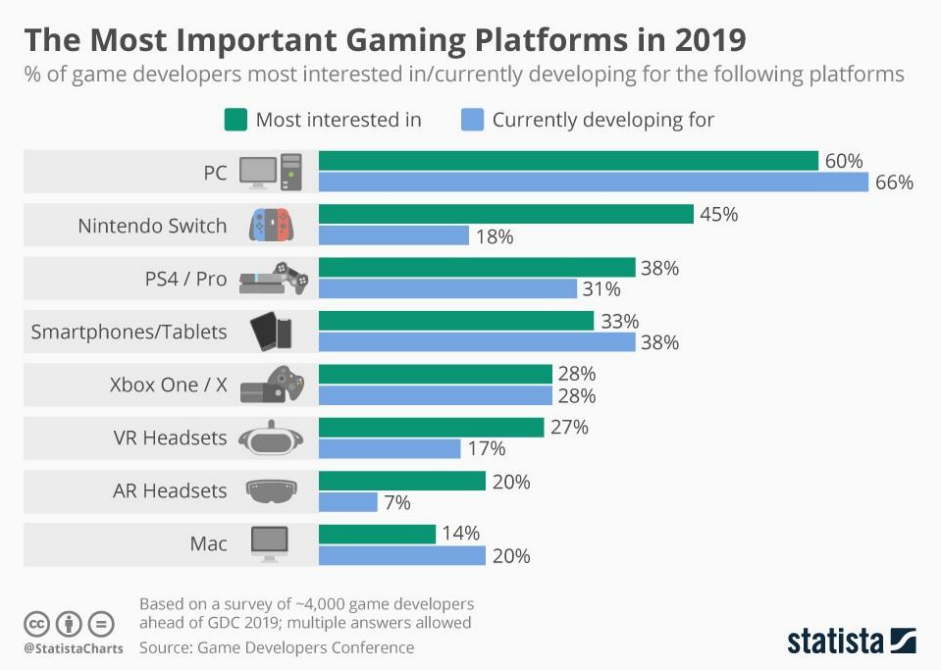

Fig. 1. Illustration of gaming platforms are currently get- ting the most support from game developers in 2018 [13].

3 Improvement factors for entertainment space

Perceived enjoyment consists of five factors as design aesthetics, ease of usability, interactivity, variety/novelty, and challenge [1]. In entertainment aspect, there are only interactivity, variety, and challenge. The main reason is that users can directly feel these intrinsic factor with common understanding. While perceptual factors need high under- standing which is provided by developers. The definition of each factor are described as following below.

3.1 Interactivity

Interactivity is one of the most important factor that response and activate the inter- action between player and game. Most descriptions are typically defined as how system respond and provide real experience for user [1], when user feel great practical situation and positive impact during in-game period. In point of developers, they evaluate as providing positive impact on the users' gaming experience by facilitating the casualness.

3.2 Variety

Variety or novelty can be referred as the extension for the system and gaming experience. Users always need to meet variety during in-game period. Thus, the term variety or novelty refer to the aspects of system attributes that users perceived surprising and unfamiliar [c1]. To maintain users' enjoyment, variety in system will increase the users' interest towards the game.

3.3 Challenge

Challenge is defined as the sense of user face against positively situation and capability to use individual skill including stochastic decision and outcome [1]. Challenge is of great relevance in gaming context, typically presents the difficulty of the game. The user is likely to lose interest in the game if the challenge is too easy. On the other hand, if it is too hard, the user might be frustrated and boredom.

4 Assessment Methodology

In this section, a scale-rating questionnaire was proposed in order to survey and collect data, statistical analysis can be conducted to test our hypotheses.

4.1 Questionnaire and data collection

Questionnaire has been used to gather importance of improvement factors among plat- form based on users. Coming up 15 questions in total which each question (See in Appendix) consisted of a pairwise comparison of three improvement factors. For each question, the respondents were asked to mark the relative importance of those factors and categorization. The questions were developed in Likert-scale items (1 to 5) for each factor to describe users' attitude regarding a subject. The resolution of the scale range is to include possibility to provide neutral answer. 350 respondents can be anyone and intentionally game player or entertainment relative person. Half of respondents are in 15-22 age range, and separated group of respondents every 7 years because of users' personality changes [14], as shown in Fig.2. The validity and meaningful of data are describe in discussion part.

4.2 Analysis of player Model for perceiving and improving enjoyment

The dimensional focus of perceived enjoyment consists of interactivity, variety, and challenge. These three factors are not independent, but they uniquely combine together to improve enjoyment and perceive by player.

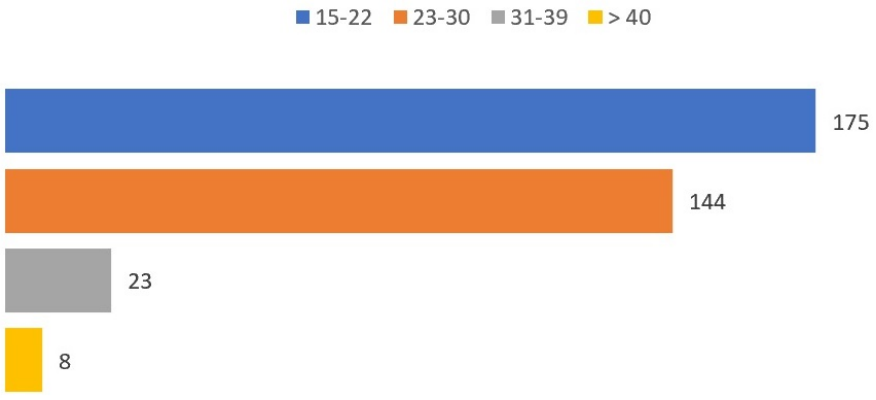

Fig. 2. The number of respondents and age range in questionnaire.

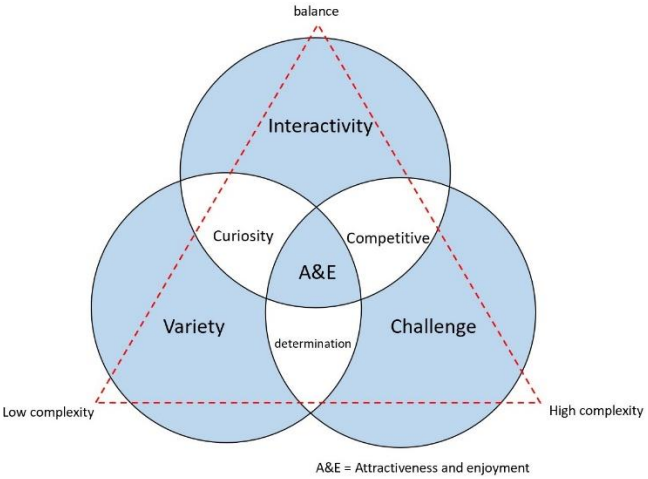

Fig. 3. Player Model for perceive and improve enjoyment.

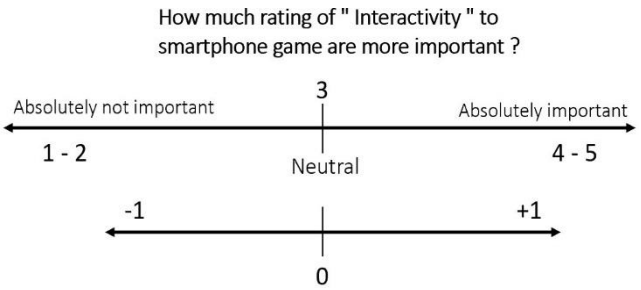

Fig. 4. Sample question and simplification from Likert-scale to positive-negative scale.

The model for improvement factor in Fig.3 showed that variety, interactivity, and challenge are defined as low, balance, high complexity respectively. The intersection points are curiosity, competitive, determination, and finally attractiveness and enjoyment [1, 5] which are the player's feeling, emotion, and state when they reach at that equilibrium. The data collected were reduced into three columns–positive (+1), neutral (0), negative (-1) in order to easily identify the general trends. Fig.4 showed the sample question and simplification Likert-scale into positive-negative scale. The score values were grouped into 1-2 score value as a negative set, 4-5 score value as a positive set, and others as the neutral set. The reliability test is conducted using the t-test to compare the mean scores of two or more groups of significant differences. The significance p-value was set at 0.05 in this analysis (Fig.5).

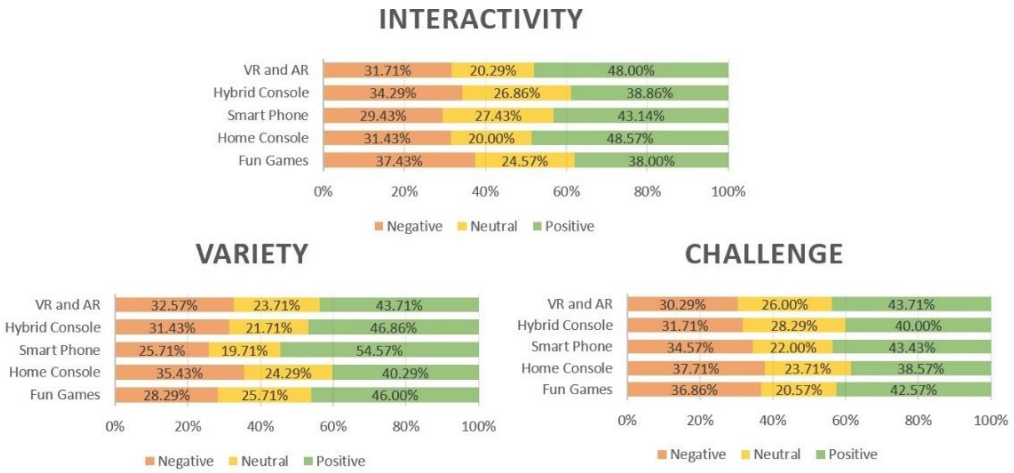

Fig. 5. Relationship of improvement factors among game platforms.

Fig.5 shows the general questionnaire that distributed for 350 respondents. This questionnaire was analyzed among three improvement factor and used Likert-scale from 1 (absolutely not important) to 5 (absolutely important) score.

5 Discussion

5.1 Survey results and interpretation of improvement factors

This study investigates the improvement factors that are perceived as important in platform transition and observe the game contents changes based on user perspective. To see more clearly, the scale from Likert-scale was derived into a positive-negative scale to identify the percentage ratio of the respondents results for each platform (Fig.5). 54.57% in variety is the highest in smartphone platform followed by hybrid console and fun games. Interactivity is strongly fit for home console and VR platform, which accounted for 48.57% and 48%, respectively. However, for the challenge factor, the percentage ratio for each platform were in close proximity between one another where home console is the lowest one.

Using t-test analysis, each platform was compared by testing a hypothesis based on improvement factors which resulted into 30 hypotheses. The expected score from the respondents were used for comparing platform demand for each factor. Table 1, 2 and 3 showed the result of both the t-test and the p-value for each hypothesis classified based on the factor of interactivity, variety, and challenge, respectively.

Table 1. The result of t-test and p-value for interactivity factor.

	Hypotheses	**t**	**p**
Interactivity	Fun games - Home console	−1.69	0.05
	Fun games - Smartphone	−1.98	0.02
	Fun games - Hybrid console	−0.20	0.42
	Fun games - VR	−2.83	0.00
	Home console - Smartphone	−0.26	0.40
	Home console - Hybrid console	1.52	0.07
	Home console - VR	−1.19	0.12
	Smartphone - Hybrid console	1.81	0.04
	Smartphone - VR	−0.96	0.17
	Hybrid console – VR	−2.68	0.00

Table 2. The result of t-test and p-value for variety factor.

	Hypotheses	t	p
Variety	Fun games - Home console	1.69	0.05
	Fun games - Smartphone	−2.10	0.02
	Fun games - Hybrid console	0.60	0.27
	Fun games - VR	0.67	0.25
	Home console - Smartphone	−3.84	0.00
	Home console - Hybrid console	−1.09	0.14
	Home console - VR	−0.98	0.16
	Smartphone - Hybrid console	2.72	0.00
	Smartphone - VR	2.74	0.00
	Hybrid console - VR	0.08	0.47

Table 3. The result of t-test and p-value for challenge factor.

	Hypotheses	t	p
Challenge	Fun games - Home console	1.10	0.14
	Fun games - Smartphone	−1.08	0.14
	Fun games - Hybrid console	−0.42	0.34
	Fun games - VR	−1.32	0.09
	Home console - Smartphone	−2.25	0.01
	Home console - Hybrid console	−1.59	0.06
	Home console - VR	−2.50	0.01
	Smartphone - Hybrid console	0.70	0.24
	Smartphone - VR	−0.26	0.40
	Hybrid console –VR	−0.96	0.17

The result for interactivity term regarded home console, smartphone, and VR plat- form are significantly different to other platforms. For example, the hypothesis of importance of interactivity between fun games and VR platform has t = -2.83 which minus sign means expected score of interactivity in VR platform is more than fun games, and p = 0.00 which is less than 0.05 means the difference is significant. Other hypotheses which are fun games - home console (t = -1.69, p = 0.05), fun games - smartphone (t = -1.98, p = 0.02), smartphone - hybrid console (t = 1.81, p = 0.04), and hybrid console and VR (t = -2.68, p = 0.00) have been proved by significance level p = 0.05.

For variety factor, smartphone is the dominant that need variety to improve entertainment aspects. p value showed the absolutely difference among other platforms. Variety in smartphone platform is more important than hybrid console (t = 2.72, p = 0.00). In order to support and improve gaming experience in smartphone platform, variety is rich important in view of users. Other hypotheses which are fun games - home console (t = 1.69, p = 0.05), fun games - smartphone (t = -2.10, p = 0.02), home console - smartphone (t = -3.84, p = 0.00), and smartphone and VR (t = 2.74, p = 0.00) have been proved by significance level p = 0.05.

The proximity of challenge factor was analyzed between home console and other platforms. only two hypotheses are significant different which home console - smart- phone ($t = -2.25$, $p = 0.01$) and home console - VR platform ($t = -2.50$, $p = 0.01$). Corresponding to users point of view, they do not need higher challenge for home con- sole than enjoyment, otherwise need challenge to reduce boredom in game contents.

5.2 The next generation of platform and game contents: ubiquitous and hybrid

By investigating and studying the history of the way of Nintendo developed various game platforms (Table 4), a good example of the future trend can be examined. Nintendo usually has platform transition cycle every 5-7 years due to hype cycle of technology. Most game companies begin with the home console which high interactivity. However, the progress of support technologies drives development of game platform in both sense of aesthetic and cognitive. Nintendo had developed Virtual Boy in 1995 that is the prototype of virtual reality nowadays. They also released the first portable console Game Boy in 1989 which got highly famous and still ongoing development until Nintendo 3DS in 2011. Portable console is the motivation that many game companies started launching game to mobile platform and smartphone due to more ubiquitous and more accessible.

Table 4. Timeline for Nintendo game platforms [21].

Platform	Year	Type
Nintendo Entertainment System (NES)	1983	Home Console
Game Boy	1989	Portable Console
Virtual Boy	1995	Virtual platform
Nintendo 64	1996	Home Console
Game Boy Advanced	2001	Portable Console
Ninterndo DS	2004	Portable Console
Wii	2006	Home Console
Nintendo 3DS	2011	Portable Console
Wii U	2012	Home Console
Nintendo Switch	2017	Hybrid Console

The level of improvement factors for those platforms should be improved in game industry, Nintendo release Wii in 2006 that drives the profit in the company. It can be inferred that interactivity is the main concern in home console, and Wii can respond to players in such direction by providing positive impact on practical gaming experience. For example, many sports in real world are implemented in platform so that players can enjoy sport without going outside. Even though Wii U is not successful for earning revenue, but Nintendo applied this idea into Nintendo Switch which is the first hybrid console to make more variety and interactivity for players.

Recently, it can observe that Nintendo Switch (combination of Wii and Nintendo DS series) had improved impact to players by providing interesting gaming experience and better flexibility. This justifies our findings on platform transformation as a primary concern with respect to the variety and interactivity factors. From our study context on entertainment platform, next generation platform would be a device that allows accessibility which reduce border between reality and virtual world based on the traditional play and sport. Additionally, new platform will also capitalize the improvement factors for creating a new playing style and a new playing experience which maximizes user entertainment and enjoyment.

6 Conclusion

In this study, improvement factors were established using perceived enjoyment model [1] to understand and predict the next generation platform for users. Then, the relationship among improvement factors was described in user-centered entertainment model. The proposed model was justified using questionnaire and statistical analysis. It was found that home console, smartphone, and VR platform need high interactivity in playing style. However, smartphone needs more variety to enjoy and satisfy in short game length. Furthermore, VR platform needs challenge to make users feel more interesting and more competitive. Further generalization of the model to other domains (such as platform transformation of education [18, 19], business, and social network) may be an interesting direction to investigate. Since this study focused on users, the findings may be limited and ex- posed to bias. In addition, respondents might have different preferences and acquiring data in the psychological sense is difficult to analyze quantitatively. Thus, future study should be conducted to specific respondents and exposed to specific purposes.

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