

<http://www.ftsm.ukm.my/apjitm>

Asia-Pacific Journal of Information Technology and Multimedia

Jurnal Teknologi Maklumat dan Multimedia Asia-Pasifik

Vol. 7 No. 2-2, December 2018: 1 - 11

e-ISSN: 2289-2192

ANALYSIS OF REALM OF VALOR AND ITS BUSINESS MODEL ON PC AND MOBILE PLATFORM COMPARISON

PUNYAWEE ANUNPATTANA

MOHD NOR AKMAL KHALID

UMI KALSOM YUSOF

HIROYUKI IIDA

ABSTRACT

This paper explores the attractiveness and sophistication of Realm of Valor (ROV) using game refinement theory and analyzes its business model by gamification. ROV is one of the most attractive and popular MOBA games in mobile platform. It is free-to-play (F2P) game which is the most popular business model for mobile platform. The result shows that ROV has game refinement value in sophisticated zone that implies entertainment and competitiveness experiences. Moreover, the results are used to make a comparison of platform transformation of MOBA genre which causes from quick time battle characteristics. We also present the result of evolution skin revenue essentially increase over the year due to number of mobile users. Finally, ROV is one of the best examples in monetization while introducing suitable characteristics for the mobile platform such that players can feel entertainment and excitement.

Keywords: Game refinement theory; MOBA; Realm of Valor (ROV); Gamification; Evolution skin; Arcana system.

INTRODUCTION

A rapid development of the Internet has increased the popularization of the mobile Internet application. This includes games, videos, animations, social media and other mobile technology. Availability of mobile Internet in the daily life of people in this information age had profoundly changed their entertainment medium. There are much ongoing development in multiplayer online battle arena (MOBA) game industry such as League of Legend, Heroes of The Storms, Vainglory and so on (Furini, 2007; Pinchot, Paullet, & Rota, 2011; Resources & Irs, 2007), and there are many ongoing researches to identify how sophisticated and evolution terminology of this type of game. As the interpretation result of this research (Xiong & Iida, 2015; Xiong, Zuo, & Iida, 2017; Zuo, Xiong, & Iida, 2017a), MOBA game on PC has own characteristics with high competitiveness and macro mechanism. Game company has been trying to improve infrastructure and rules of the game (Lazzaro, 2004; Zichermann & Cunningham, 2011). Observed point of each MOBA game is different, some of that has very stable (fit for beginner player), and some of that has very stochastic (more competitive) (Zuo et al., 2017a).

Realm of Valor (ROV), one of example popular MOBA games on mobile phone, particularly needs to integrate essential characteristics suitable for positioning itself among other MOBA games that are well-established and demanding (Resources & Irs, 2007). In addition, the game developers should define the development direction and business model of the game from the offset together with responding to players' experience (Furini, 2007). The core focus of this study is on the platform transformation of a popularly developed MOBA game and understand the monetization direction for mobile phone platform.

To achieve good positioning for ROV in the MOBA game platform, a gamification tool is utilized to explore and analyze the key elements in ROV's competitive and entertainment experiences. Gamification can be defined as the tools applied to the various game elements to increase the user experience and engagement (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011; Zichermann & Cunningham, 2011). Most business models have implemented gamification to keep customer retention while increasing the customer satisfaction. However, most businesses prefer customer retention than acquisition as it is difficult to obtain newcomers. This would only be possible by improving the customer retention strategy and the game itself (Deterding et al., 2011). The development of technology changes preferences of users and developers. Most users today have both smartphone and PC, however, due to their high portability and continuous connectivity, smartphones users are strongly replaced with PC users. Our essential interest is to know the reason why mobile games have increased in popularity in recent years. This motivation implies our research question on how MOBA genre game could work well and succeed on mobile platform as well as on PC platform either gameplay or business model.

This paper is organized as follows. Overview and business model of mobile MOBA on ROV are presented in Section 2. Section 3 provides the fundamental ideas of the game refinement theory, including our approach to the application on ROV. Experimental results and discussion are given in Section 4. Finally, Section 5 concludes the study.

AN OVERVIEW OF ROV

GAME CHARACTERISTICS OF ROV

Realm of Valor (ROV) or globally known as Arena of Valor (AOV) is a smartphone MOBA game of 5 versus 5, released on iOS and Android platform by Tencent Games. ROV was originally developed from League of Legends (LOL) (Arena of Valor Guide, 2018). ROV has over 80 million and 200 million of daily and monthly active players respectively, which is the world's most popular and downloaded app globally, while becoming one of the highest grossing games in mainland China and Asia.

Given the incredible success of League of Legends (LOL) and Defense of the Ancients (DOTA) on PC platform, MOBAs mainly require a critical mass of players in order to have a short match waiting times and gain competitive experience for each player (Xiong et al., 2017). However, there is a number of differences made to the game to make it more accessible for mobile users. The key point corresponding to our research question is that ROV has own characteristics of short game period and easy controller for the mobile platform and aims to provide entertainment not only for children but also for every group of people. Bringing MOBA to the mobile platform is the best way to implement ubiquitous for game industry. It is a highly competitive game played by two teams: Blue and Red team, each consisting of five players (has 10 heroes in the game). The main goal is trying to destroy the opponent's tower/ancient located in the opponent's base. Due to the implementation of the mobile platform, ROV is True 5 versus 5 MOBA with 3 battle lanes with quick battle time per game (approximately 15 to 20 minutes). The battle contains minions which are computer controlled characters that automatically spawn at the base and make their way towards the enemy's base along the three lanes (Zichermann & Cunningham, 2011).

MONETIZATION MODEL OF ROV

ROV is a Free-to-Play (F2P) game which can be downloaded, installed and played for free. However, the basic concept of every business has to consider how to make the profit as much as possible from the customer (Alha, Koskinen, Paavilainen, & Hamari, 2014). An F2P game should include an option for the player or the user to spend their own money to get in-game

purchasable items and privileges (Pöllänen, 2014). MOBA games usually provide the F2P model and require players or users spending for in-app purchasable items which do not affect the gameplay and for privileges same as points and tiers systems (Baghbaniyazdi & Ferdosara, 2017; Stolyarchuk, 2016; Zuo, Xiong, & Iida, 2017b). Common examples can be categorized into two types of items: functional and decorative.

Functional items: This type of items help boost the heroes and directly affect the win-rate and balance of the gameplay. In ROV, players are able to play a trial hero weekly. However, if the players need to get a permanent hero, they need to purchase with real money. Alternatively, the heroes can also be purchased with virtual currency. In addition, there is a temporary boost item that helps players increase virtual money and the player’s experience point. Moreover, ROV provides one feature that formed diversity in the gameplay styles. This feature strengthens the initial abilities of the characters and can be adapted in each type of the character called “Arcana system” as shown in Figure 1.



FIGURE 1. Screenshot of Arcana system of ROV

Decorative items: This type of items do not affect the gameplay, but they will increase the in-game money rate and the experience point of the player (not heroes). They are solely for appearances (known as skin) in ROV, and players have an option to purchase with real money or from lucky draw. Tencent Games has partnered with DC Comics, one of the largest and oldest American comic book companies that produce iconic hero characters in order to create special heroes and skins (Arena of Valor Guide, 2018). Moreover, there is an evolution skin where a player can experience special animation, effect, and sound according to the tiers system. Players have to accumulate the total evolution points to obtain evolution skins of higher tiers. Also, the evolution skin of each tier comes with their own privileges, as shown in Figure 2.



FIGURE 2. Screenshot of Evolution skin features of ROV

TOURNAMENTS AND PRIZE POOL

There was an official tournament in 2017 organized by Tencent Games, which was the first major tournament as Arena of Valor International Championship (AIC 2017) in Seoul, South Korea in November 2017. This competition has awarded a total prize value of an incredible \$500,000 (V.Butalov, 2017).

In 2018, there will be Arena of Valor World Cup 2018 (AWC 2018) in Los Angeles, United States of America. Garena, the organizer of this competition, has stated that the tournament's prize pool has been set at total over \$550,000. This breaks the previous world record by AOV set during the AIC 2017. The prize will be awarded to teams and players for various accomplishments in the tournament. Table 1 shows the major tournaments. They are significant signs for e-sport prize pool of mobile game platform, increasing year by year. Recently, AIC 2018 has been hosted by Vietnam and Thailand, which has broken the record by total prize over \$650,000 (Arena of Valor Guide, 2018).

TABLE 1. Total Prize Pool for the Tournaments

Tournament	Total Prize Pool
AIC 2017	\$500,000
ROV Major League 2017	\$150,000
ROV Pro League Season 1 2018	\$160,000
ROV Pro League Season 2 2018	\$200,000
AWC 2018	\$550,000
AIC 2018	\$650,000

METHODOLOGY

In this section we first give a brief sketch of the basic idea of game refinement theory (Section 3.1) and apply them to the game progress of the ROV (Section 3.2 and Section 3.3), as well as its business model (Section 3.4).

GAME REFINEMENT THEORY

A general model of game refinement was proposed based on the concept of game progress and game information progress (Pratama, Purwarianti, & Iida, 2014). It bridges the gap between board games and sports games. In this study's context, the "game progress" is twofold. On one end, the game progress refers to the game speed or scoring rate. On another, the game progress is the progress of the game's information that focuses on the game outcome. Game information progress presents the degree of certainty of game's results in time or in steps. Having full information of the game progress, i.e. after its conclusion, the game progress $x(t)$ will be given as a linear function of time t with $0 \leq t \leq t_k$ as shown in Equation (1).

$$x(t) = \frac{x(t_k)}{t_k} t. \quad (1)$$

However, the game information progress given by Equation (1) is unknown during the in-game period. The presence of uncertainty during the game, often until the final moments of a game, reasonably renders the game progress to be exponential (Pratama et al., 2014; Xiong & Iida, 2015). Hence, a realistic model of the game information progress is given by Equation (2).

$$x(t) = x(t_k) \left(\frac{t}{t_k}\right)^n. \quad (2)$$

In Equation (2), n stands for a constant parameter which is given based on the perspective of an observer of the considered game. Then acceleration of game information progress is obtained by deriving Equation (2) twice. Solving it at $t = t_k$, we have Equation (3).

$$x''(t_k) = \frac{x(t_k)}{(t_k)^n} t^{n-2} n(n-1) = \frac{x(t_k)}{(t_k)^2} n(n-1). \quad (3)$$

It is assumed in the current model that game information progress in any type of game is encoded and transported in our brains. We do not yet know about the physics of information flow within the brain, but it is likely that the acceleration of information progress is subjected to the forces and laws of physics. Therefore, we expect that the larger the value $\frac{x(t_k)}{(t_k)^2}$ is, the more the game becomes exciting, due in part to the uncertainty of game outcome. Thus, we use its root square, $\frac{\sqrt{x(t_k)}}{t_k}$, as a game refinement measure for the game under consideration. We call it R value for short as shown in Equation (4).

$$R = \frac{\sqrt{x(t_k)}}{t_k}. \quad (4)$$

In sport domains such as soccer and basketball, the game refinement measure R was calculated by $R = \frac{\sqrt{G}}{T}$ where G and T stand for the average successful scores per game and the average average number of total shoot attempts respectively. The values G and T correspond to $x(t_k)$ and t_k in the previous discussion.

We show the results of DOTA 2 and LOL, which are MOBA PC games in Table 2. Except for LOL, sophisticated games have R values which we recognize as a *zone value* ($0.07 \leq R \leq 0.08$). This range indicates the degree of game sophistication where players may feel the same level of engagement or excitement regardless of different type of games. Higher R value than the zone value infers that the game progress is faster than others. This implies that LOL is able to attract beginners who prefer to play MOBA for entertainment purpose (Takeuchi, Ramadan, & Iida, 2014; Xiong & Iida, 2015).

TABLE 2. Measures of game refinement for sports and popular MOBA game (adapted from (Xiong, Zuo, & Iida, 2014; Xiong et al., 2017; Zuo et al., 2017a))

Sports	G	T	R
Basketball	36.38	82.01	0.073
Soccer	2.64	22	0.073
DOTA2	54.0	94.3	0.078
LOL	37.65	44.26	0.138

GAME PROGRESS MODEL OF ROV SCORING INFORMATION PROGRESS

In this section, the ROV is analyzed using the game refinement measure to determine its game progress model. ROV is a game with complex game information that requires the adoption of suitable information that readily available during the in-game period to represent its progression. This study focuses on the killing progress (inclusive of kills/deaths/assists) because this is the only scoring information that both sides of the competing teams know during the in-game period and no other information is readily available. ROV is similar to a sports domain where there are no limits to score in the game. With this idea, we construct a functional game progress model with a focus on the average number of successful kill per game called G and average of total number of attempt (or assist) per game called T as shown

in Equation (5).

$$R = \frac{\sqrt{\text{average number of succesful kill per game}}}{\text{average total number of attempt per game}}. \quad (5)$$

GAME PROGRESS MODEL OF ROV ARCANA SYSTEM

The Arcana progression system in ROV is very similar to the Rune system in LOL and DOTA 2. Heroes can equip arcanas that strengthen their initial abilities. New arcana slots are unlocked every time the player levels up, and the player can also gain access to multiple arcana pages. There are only 54 arcanas in the game, but players can make a combination of 66 arcanas in a maximum of 30 slots for each arcana page. They can only use virtual in-game money earned after the game ended to purchase a new arcana from the shop. Based on this information, the game progress model is constructed based on the ROV's Archana system. The R value can be obtained by considering the number of available arcana slots for each arcana page (30 slots) and the total number of arcanas in the game (54 and 66 arcanas), as shown in Equation (6).

$$R = \frac{\sqrt{\text{number of available Arcana slot(s) for each page}}}{\text{total number of Arcanas in the game}}. \quad (6)$$

GAME PROGRESS MODEL OF ROV EVOLUTION SKIN MONETIZATION

This study focuses on the decorative items called the skin. There are just only three heroes in the game that contains evolution skins, which make them the most pick heroes. Players can purchase these heroes at an affordable cost. However, the company can generate incomes through strategically released contents at a higher cost in responding to the demands of customers. As such, every player is given the freedom to decide whether to spend real money to get a uniquely designed evolution skin or not.

The evolution skin is originally made up from in-game tiers system called as the evolution level. The maximum level is 5, which consists of a unique effect, sound, animation, and appearances. We assume that a player must gain 360 evolution points to level up from the initial Level 1, where such point can be purchased using real money through the *evolution element*. A single evolution element can vary between 10, 20 or 50 points, respectively. In addition, since the opportunity to get a higher point is less possible, it is assumed for this study that each evolution element can only get 10 points. The game progress of this model is figured out by the ratio of the cost of evolution elements obtained over the accumulated cost as shown in Equation (7). Table 3 shows the relationship between required evolution score, number of elements and accumulated price in each level. Since the price of the evolution elements is worth \$1 each, the accumulated price can be computed based on their respective level.

$$R = \frac{\sqrt{\text{cost of elements obtained}}}{\text{total or accumulated cost}}. \quad (7)$$

TABLE 3. The relationship between the required evolution points, accumulated price of each tier/level and privileges.

Level	Require Point	Accumulated Cost	Privilege
1	360	\$36	New ability effect
2	500	\$86	Appearances
3	760	\$162	New skill effect
4	1140	\$276	Special animation
5	1500	\$426	Special sound

ANALYSIS AND DISCUSSION

Analyzing and discussing the application of game refinement theory, the significance of ROV in MOBA game is determined (Section 4.1) and effectiveness of its monetization model in the context of F2P games is highlighted (Section 4.2).

Is ROV a big deal in the mobile MOBA domain?

To apply the game refinement metrics to the ROV game, we collect the game data from AIC 2017, ROV Major League Playoffs Knockout Round, and ROV Pro League Season 1 (Grand Final). For this purpose, we download all the match replays in order to calculate the R values. Table 4 shows the R value for each match and the average R value of these tournaments. We can see that the R values gradually reduce to the range of *zone values* that signifies the sophisticated and exciting of the match. As we have mentioned above, it is developed from LOL and the platform transformation should be a crucial concern of the company. Mobile MOBA requires a quick time battle to feel excited in short time. The R value observed indicates the change of game refinement measures (Table 4) which corresponds to the increases excitement where the influence on the R value is more likely to resemble DOTA 2 (Zuo et al., 2017a). Therefore, ROV is a well-designed game with a good balance between entertainment and competitiveness, which is suited for both individual-based and competition-based play, compared to its original counterpart on PC (LOL). Thus, we can observe that R value has decreased from only entertainment purpose to a more competitive purpose after 2017. A similar trend can be expected for ROV where it would become more popular in the future.

TABLE 4. Measures of game refinement for ROV

Tournaments	G	T	R
AIC 2017	24.0	53.86	0.091
ROV Major League 2017	25.57	58.0	0.087
ROV Pro League Season 1 2018	25.3	62.95	0.079

TABLE 5. R value of ROV's Arcana system

Version	Number of slots	Total Arcanas	R
2016 - 2017	30	54	0.101
2017 - Present	30	66	0.083

For the Arcana progression system, the results of the R value are given in Table 5. Decreasing of R value is caused by an increasing number of arcanas. The R value converges to the sophisticated *zone value* where the player can feel excited. Since each player can make different arcana combinations and utilize various strategies, this accelerates entertainment in the game itself. While it does not affect the gameplay experience, it does provides possibilities for exploring various dimensions of playing styles.

Moreover, a short game period provides the best balance to the mobile game platform in term of competition. This is because a shorter game period provides excitement and competitiveness for both beginners and interested parties to play. The trade-off between two platforms (PC and mobile) is commonly based on the development of technology, many game industries will introduce modern mobile games with such high performance and new entertainment playing style that correspond to how technology and innovation changes in the future.

Table 6 shows the trade-off between the PC and mobile platform comparison. It is the reasons behind developer perspective, since mobile platform is dominant in convenience, design, game length and specification. However, PC can provide a game with higher performance and complexity (Li & Counts, 2007), users can experience excitement without the need for understanding the complexity of the game on a mobile platform. Many game industries trendily begin to penetrate the huge market with easy to implementation, developing, launching and make an impression to their customers' experiences.

TABLE 6. Trade-off between mobile and PC platform comparison

	Mobile	PC
Game length	Short (5-15 mins)	Long (15-30 mins)
Technology	Supportive	
Convenience	More	Less
Design/Implementation	Easy – Moderate	Moderate – Difficult
Specification Requirement	Less	More
Special Features	Various	

In May 2018, Asian E-Sport Federation has announced that ROV is one of the e-sport games including in the 18th Asian Game: Jakarta Palembang Game 2018 as category of mobile MOBA. This is a significant trending sign in the mobile game platform and e-sport competition. Furthermore, Tencent Games is bringing this game to Nintendo Switch in Winter 2018. The MOBA console is a good idea and suitable for a portable console which becomes the motivation for the future study of the MOBA game on the console platform.

ROV's Monetization model based on F2P towards success

In general, ROV does not have a high monetization value from the players' base due to their extremely competitive nature. Cosmetic items are the main source of revenue since they have no effect on the gameplay. Although heroes are also one of the revenue sources, we focus only on the F2P concept that does not influence the ROV gameplay.

Table 7 tabulated as the resulting *R* values which varies between the tier/level of the evolution skin. If players decided to pay real money, they will be excited for the first time because the player has obtained the privileges of the first tiers. When the player reaches higher tiers/levels, the *R* value decreases because the distance (i.e. the evolution point) is wider, so players have to spend too much and feel less excited. When reaching Level 3 and Level 4, players already have a skill effect, animation and appearance that are unique; adequate for the player to experience satisfaction at this tier/level without spending real money.

TABLE 7. *R* value of ROV monetization model

Level	Items	Accumulated Items	Accumulated Price	<i>R</i>
1	36	36	\$36	0.1667
2	50	86	\$86	0.1078
3	76	162	\$162	0.0786
4	114	276	\$276	0.0602
5	150	426	\$426	0.0485

Additionally, it can be observed in Figure 3 where the approximate revenue of the ROV gradually increases since 2016. The main source comes from in-game cosmetics and purchasable items. Tencent Games focuses on marketing target which mainly penetrates in China and distributes another enhanced business strategy around the world. It is important to note that the market continues to evolve and grow as the adoption and development of smartphone increases. This is a significant sign that the F2P model of ROV acquires higher revenue because of a very specific genre of MOBA business model that focuses on the mobile

platform. It is not a Pay-to-Win monetization model which can ruin player experience because of the imbalance caused by the heroes that cannot be played for free. Instead, the company is confident that players will be able to understand and accept everything whilst ready to pay for the privileges that they offer. The influence of the F2P model is suited for MOBA game where it makes the players felt more familiar at the beginning of the game and provides a lasting fan base of the mobile game.

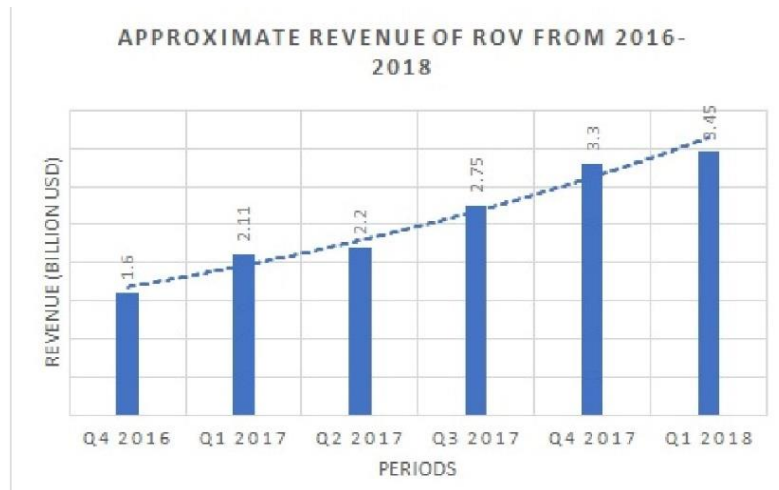


FIGURE 3. An approximate global revenue of ROV from 2016 to 2018

CONCLUDING REMARKS

In this paper, we have analyzed ROV and its platform transformation by applying a game refinement measure as well as studying its business model using gamification. The results indicate that ROV is in the sophisticated *zone value* of the game refinement measure which has converged within 0.07-0.08. Based on this, ROV can be said as a well-designed with a good balance between competitiveness and entertainment where the zone value implies skillful play with quick time battle per game. In addition, the reduction of game length on the mobile platform does not affect the excitement of the game but increases player satisfaction. This factor has strongly influenced the industry development standards of ROV and mobile game development. Most mobile phone users usually prefer a stochastic game experience due to their competitiveness. However, the introduction to the arcana system in ROV helps cater to a new entertainment experience without affecting player gameplay. Players do not feel imbalance but instead, they can formulate and experience multiple varieties of playing styles. Therefore, the mobile platform transformation tries to concise the system into the suitable design when compared to the PC platform whilst designing new prototype characteristics to get player satisfaction in different point of view. In fact, a number of opportunities can be expected in the near future on both the PC platform and mobile platform, depending on the technology development and support. It means that players can enjoy high-quality gaming contents in any device used.

The direction of Tencent Games is to maximize customer retention within the Asian market before distributing it around the world where ROV has continually been improved throughout the years. The concept of F2P has been incorporated into the mobile platform because of the number of mobile users' increases every year, as well as a high number of active users of ROV, compared to the MOBA game on a PC platform. ROV has a specific monetization model, such as utilization of the evolution skin. The *R* value of the evolution skin for Level 3 and Level 4 tier is nearly within the sophisticated *zone value*. Hence, a company can get the revenue of approximately \$200 per player, if either the company

improves the R value or the players are willingly to pay for the privileges on this tier.

Further works can be done by comprehensively analyzing all the working elements of the mobile platform to increase the precision of the game refinement theory. Also, analyzing from the social aspect of players' interaction in term of learning or toxicity among one another using force in mind theory would be another potential field of exploration.

REFERENCES

- Alha, K., Koskinen, E., Paavilainen, J., & Hamari, J. 2014. Free-to-Play Games : Professionals ' Perspectives. In *Proceedings of Nordic Digra 2014 Gotland, Sweden*, 1–14.
- Arena of Valor (Guide). <https://samurai-gamers.com/arena-of-valor/> [31 March 2018].
- Baghbaniyazdi, S., & Ferdosara, H. 2017. The Most Successful Business Model of Mobile Applications: A Comparative Analysis of Six Iranian Mobile Games. *Journal of Software*, 12(4), 201–211. <https://doi.org/10.17706/jsw.12.3.201-211>.
- Bornemark, O. 2013. Success Factors for E-Sport Games. *Uscs*, 1–18. Retrieved from <http://www8.cs.umu.se/research/uminf/reports/2013/001/part1.pdf>
- Butalov, V. 2018. Arena of Valor: mobile version of League of Legends. <https://medium.com/@vadimbutalov/arena-of-valor-mobile-version-of-league-of-legends-9db53224b594> [30 December 2017].
- Deterding, S., Sicart, M., Nacke, L., O'Hara, K., & Dixon, D. 2011. Gamification. Using Game-design Elements in Non-gaming Contexts. In *CHI '11 Extended Abstracts on Human Factors in Computing Systems* (pp. 2425–2428). New York, NY, USA: ACM. <https://doi.org/10.1145/1979742.1979575>.
- Furini, M. 2007. Mobile Games: What to expect in the Near Future. *Proceedings of the 8th International Conference on Intelligent Games and Simulation (GAMEON'2007)*, 93–95.
- Ho, C., & Wu, T. (2012). Factors Affecting Intent to Purchase Virtual Goods in Online Games. *International Journal of Engineering Business Management*, 10, 204–212.
- Lazzaro, N. 2004. Why We Play Games: Four Keys to More Emotion Without Story. *Game Developer Conference (GDC)*, 1–8. <https://doi.org/10.1111/j.1464-410X.2004.04896.x>.
- Li, K. A., & Counts, S. 2007. Exploring social interactions and attributes of casual multiplayer mobile gaming. *Proceedings of the 4th International Conference on Mobile Technology, Applications, and Systems and the 1st International Symposium on Computer Human Interaction in Mobile Technology*, 07, 696–703.
- Pinchot, J., Paillet, K., & Rota, D. 2011. How mobile technology is changing our culture. *Journal of Information Systems Applied...*, 4(1), 39–48. Retrieved from <http://jisar.org/2011-4/N1/JISARv4n1p39.html> [10 June 2018].
- Pöllänen, T. I. (2014). The influence of cognitive skills and team cohesion on player performance in Multiplayer Online Battle Arena. Retrieved from <http://www.web-psychometrics.com/images/LoL.pdf> [10 June 2018].
- Pratama Sutiono, A., Purwarianti, A., & Iida, H. 2014. A Mathematical Model of Game Refinement. In *International Conference on Intelligent Technologies for Interactive Entertainment*, pp. 148–151. Springer.
- Resources, I., & Irs, S. 2007. Research on Mobile Phone Culture. *Culture*, (February), 403–406.
- Takeuchi, J., Ramadan, R., & Iida, H. 2014. Game refinement theory and its application to volleyball. *Information Processing Society of Japan*, 2014:1–6.
- Wikipedia: Wikipedia Arena of Valor (AOV). <https://en.wikipedia.org/wiki/Arena-of-Valor> [21 January 2018].
- Xiong, S., & Iida, H. 2015. Attractiveness of real time strategy games. *Computer Science and Information Systems*, 12(4), 1217–1234. <https://doi.org/10.2298/CSIS141101054X>.
- Xiong, S., Zuo, L., & Iida, H. 2014. Quantifying Engagement of Electronic Sports Game. *2014 2Nd International Conference on Social Sciences Research (Ssr 2014), Pt 1*, 5(1), 37–42. <https://doi.org/10.5729/asbs.vol5.37>.
- Xiong S., Zuo L., Iida H. 2017. Possible Interpretations for Game Refinement Measure. In: Munekata N., Kunita I., Hoshino J. (eds) *Entertainment Computing – ICEC 2017. Lecture Notes in*

Computer Science, vol 10507, pp.322-334. Springer, Cham.
Zichermann, G., & Cunningham, C.2011. *Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps* (1st ed.). Sebastopol: O'Reilly Media, Inc.
Zuo, L., Xiong, S., & Iida, H. 2017a. *An Analysis of DOTA2 Using Game Refinement Measure*.
<https://doi.org/10.1007/978-3-319-66715-7>. [5 May 2018]
Zuo, L., Xiong, S., & Iida, H. 2017b. An Analysis of Hotel Loyalty Program with A Focus on the Tiers and Points System, (November). <https://doi.org/10.1109/ICSAI.2017.8248345>. [5 May 2018]

Punyawee Anunpattana

Mohd Nor Akmal Khalid

Hiroyuki Iida

Japan Advanced Institute of Science and Technology

1-1 Asahidai, Nomi, Ishikawa 923-1292 Japan

punyawee.anunpattana@gmail.com, akmal@jaist.ac.jp, iida@jaist.ac.jp

Umi Kalsom Yusof

School of Computer Sciences

Universiti Sains Malaysia, Pulau Pinang, Malaysia.

umiyusof@usm.my

Received: 11 August 2018

Accepted: 12 October 2018

Published: 4 January 2019