

Towards Game Engagement: Usability Evaluation of Digital Malaysian Traditional Games

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Abstract—Sustainable engagement in digital traditional games can preserve country’s cultural heritage. However, despite such importance, digital traditional games are far less popular than the digital contemporary games. This study investigates one dimension of user engagement by empirically evaluate their usability aspects. Three digital versions of Malaysian traditional games namely Dam Haji, Congkak and Gasing-X were chosen. Literature suggested that usability problems may affect user engagement in the game. In contemporary games, usability is one of the attributes that promotes attractiveness which later leads to engagement. To date, little is known whether usability is also deemed critical for users to become engaged to traditional games. Usability helps in verifying the requirements, successes and functionality of the games which are missing. Evaluation involved 50 respondents who are IT and domain experts, using the instrument that was adopted from Jakob Nielsen’s usability evaluation principles. The instrument consists of 17 heuristic component protocols based on interface design. The results revealed several usability issues with current digital Malaysian traditional games including aesthetic and minimalist design, error prevention, help and documentation and assessment, which should be given serious attention in the development of future digital Malaysian traditional games.

Index Terms—Game Engagement; Digitization of Traditional Games; Usability Evaluation; Heuristic Evaluation.

I. INTRODUCTION

Digital technology has transformed games into another form which has made them more accessible to users via mobile devices. Today’s digital games are widely and freely available on Google Play Store and Apps Store. Most of these games are contemporary games which have impressive interface design with minimum technical requirements which made them easy to be used. Combination of attractive interface, challenge, fantasy and curiosity of contemporary games makes users engaged to it [1].

Traditional games are of no exception from being influenced by the advances in digital technology. Traditional games have been acknowledged as part of country’s cultural heritage and therefore, attempts to digitize traditional games are mainly driven by the need to preserve cultural heritage. There is a growing concern that traditional games, in its existing forms, will finally be forgotten by younger generation or the so-called techno-savvy generation [2]. In respond to this need, Malaysia through the National Heritage Department is taking various steps to preserve its traditional games such as

Congkak, Dam Kapit, Gasing-X, Dam Haji, Ceper and Snake and Ladders, one is by digitizing the games. Figure 1 shows the interface of digital Congkak, Gasing-X and Dam Haji apps which are now available for free from Google Play Store. Digital Congkak and Dam Haji were developed by Lipandes Studios while Gasing-X was developed by Magic X. At time these games were last updated in 2014 and 2013, their download rate was 1183, 3402 and 578 respectively.

Digital Congkak by Lipandes Studios uses the combination of Mancala algorithm and Congkak playing rules [3]. Another version of digital Congkak that uses Neural Network (NN) and Min-Max algorithm can be found in [3]. NN is used to make a better predictor for the winning move while Min-Max algorithm finds the best possible move. The application runs perfectly after several testing but obviously needs improvement in GUI aspect.

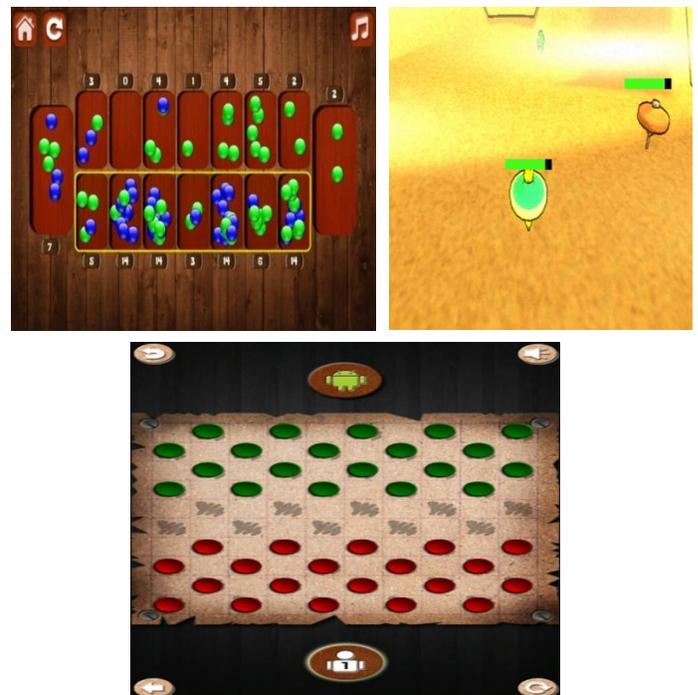


Figure 1: Digital Malaysian Traditional Games – Congkak (top left), Gasing-X (top right) and Dam Haji (bottom)

Gasing-X promotes one of the Gasing type, i.e. *GasingPangkah*. Traditionally, Gasing is played by many players. In Gasing-X, a player will spin his spinning top in the

arena or a circle in his attempt to knock the spinning top that belongs to the opponents out of the arena. The last spinning top that stand still in the arena wins the stage and move to another stage.

Dam Haji is a two-player board game and one of the checkers or draught variations. It is the most popular digital Malaysian traditional game among the three. While playing this game the players use their intellectual and search skill in making the decision to make a move in every step. Like other checker games, Dam Haji also has many possibilities that human needs to understand, and player with the best strategy will win the game. Unlike other checker games, the King can move forward and backward on the check board. In [4], Min-Max algorithm is used to check whether the movement made by checkers and Haji is valid or not.

Despite their importance to cultural heritage, digital traditional games are far less popular than digital contemporary games. Taking example of one most popular game from both genres, i.e. Candy Crush Saga (contemporary game) and Dam Haji (traditional game), their download rate shows a significant difference. Candy Crunch Saga has been downloaded for 14,422,527 times, while Dam Haji has only been downloaded for 8,725 times (as recorded on 6th April 2016). The statistics shows how contemporary version is more popular among users than the traditional version. This could due to many factors. In contemporary games, usability is one of the attributes that promotes attractiveness; when users are attracted to the game they become engaged to it. To date, little is known whether usability is also deemed critical for users to become engaged to traditional games. Digital Malaysian traditional games are still lacking in the aspects of interaction and GUI compared to other countries' traditional games such as Mahjong, Sudoku and Table Tennis [3].

In light of this, a study has been conducted to evaluate usability of digital traditional games. Three digital Malaysian traditional games (i.e. Congkak, Dam Haji and Gasing-X) were evaluated. The experience gained from the study is presented and discussed in this paper. Section 2 provides the background on usability and games engagement. Section 3 discusses the usability evaluation with emphasis on heuristic evaluation method. The methodology for evaluating usability is discussed in Section 4. Experimental results is presented in Section 5, while Section 6 provides the concluding remarks.

II. USABILITY AND GAME ENGAGEMENT

Good games must be engaging. Successful games have remarkable capability to draw people in [19], glue them to the game [20] and make them want to keep playing [21]. Games, like any other computer applications, expose an interface between user and the application itself. Since interaction is mediated through the interface, usability is essential for the quality of user experience during playing [5]. Usability is defined in the ISO 9241-11 as the extent of which a product can be used by the specified user to achieve the specified goal with efficiency, effectiveness and satisfaction in the term of the context that it is used [6]. Usability is an important part of successful in games because to get users engaged to the game, it must increase the popularity by setting up the game and make the game experience fluent [7]. Meanwhile engagement

is defined as something that attracts and holds users' attention [8]. Therefore, game engagement can be viewed as a dimension of usability that is influenced by the user's first impression of the application and enjoyment from using it [9]. Hence, for the traditional games to stand out of the crowd and make gamers engaged to it, one must also consider usability as one of the key aspect when developing the games. With regard to competition of the product in the so-called aggressive market, gamers usually prefer games which are usable to them. As emphasized in [10], games, although they are doing very well on the market, they would do better if they are more usable. Recently, some contemporary games suffer from usability issue. For example, the character in the 2005 release Shadowgrounds was criticized for moving too slow in some parts of the game. A game named Halo also suffers from poor usability especially in terms of tutorial and weapon control [11].

Figure 2 illustrates one of the existing game engagement models [12] which highlights usability as one of the eight factors that have been identified as factors that are able to maximise the impact of user engagement in mobile-based augmented reality games (MARG). Perceived usability contributes to both attraction and maintaining user engagement towards the application. Besides usability, researcher [13] also identified four other aspects that lead to engagement, i.e. challenge, fantasy, curiosity and control. Others discovered many other aspects which were used to develop various user engagement models. Yet, discussion in aspects other than usability is beyond the scope of this paper.

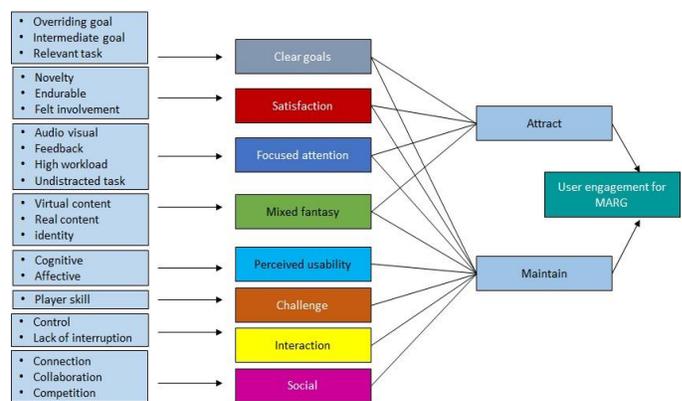


Figure 2: Conceptual model of user engagement for mobile-based augmented reality games [12]

III. USABILITY EVALUATION

Usability evaluation is the process of evaluating a product to see, from users' point of view, whether it is easy to use, meets their acceptance and overall acceptability [6]. It also helps in verifying the requirements, successes and functionality the product is still lacking [14]. In games, usability problems are either uncovered using usability inspection techniques, where experts review the interface, or using play testing, where people play a functional prototype to identify design flaws [15]. Interface design, interactivity design and technical issues are among the attributes commonly used in usability evaluation.

There are many factors in usability to evaluate. Clanton, in [6], summarized the attributes for usability evaluation into three areas which are game interface, game mechanics and game play. The game interface is about the interaction of the player and the game via controller such as keyboard, touch screen and joystick; game mechanics is about the combination of programming and animation while game play is about the process of the games. Game mechanics is one of the aspects that are tested by game companies for Quality Assurance (QA) to ensure no broken games or bugs in the programming aspect. Furthermore, player's log-on time at gaming site could be increased if the developers consider four critical design features during design, i.e. customer loyalty, flow, personal interaction and social interaction [14]. Microsoft Game Studio Playtest Group conducted usability test on 70 games involving more than 10,000 participants. Result shows that one of the terms used in difficulty preset created usability problem to most players. The term was then renamed during redesign and it solved the problem completely [11].

Heuristic is often used in usability evaluation as an evaluation tool [5,7]. Heuristics are defined as a set of usability principles. Heuristic-based evaluation method has a number of advantages over user-based evaluation. One is due to the low operating cost; at the same time it is also effective in detecting specific and fine-grained design defects [16]. The principles in heuristic evaluations is where a small set of the evaluators examine the user interface of the product, they judge its compliance against the selected heuristics. Since the evaluators are not using the system or program to perform the task, it is possible to perform the heuristic evaluation of the user interfaces that is only in the hard copy. It is suitable for evaluating products at the early stage in product development.

Heuristic evaluation emphasizes on knowledge of usability principles. The quality of the result is a key issue in judging the experience and knowledge of the evaluators. However, when multiple evaluators define usability problems, their subjective view can also lead to disagreement in defining usability problems [17].

IV. METHODOLOGY

The usability evaluation of Congkak, Dam Haji and Gasing-X involved three phases, i.e. planning and analysis, heuristic evaluation and data analysis.

A. Planning and analysis

Four main activities conducted in this phase are domain analysis, usability analysis, component analysis and game selection. Digital traditional game is chosen as the domain for the study. Several games were studied. Based on popularity, three were chosen which are Congkak, Dam Haji and Gasing-X.

B. Heuristic evaluation

Two main activities involved in this phase: (1) instrument preparation and (2) data collection. For instrument preparation, the study adopted the refined heuristic instruments developed by Jakob Nielsen in 1995. It is a widely used protocol for heuristic evaluation of any type of software which is based on factors related to instructional design. The

instrument consists of three main heuristic components in evaluating usability, i.e. technical, interface design and interactivity. The total of 17 usability heuristics were used as shown in Table 1.

Table. 1
Usability Heuristics (H)

H	Description
1	Visibility of system status
2	Match between system and real world
3	User control and freedom
4	Consistency and standards
5	Error Prevention
6	Recognition rather than recall
7	Flexibility and efficiency of use
8	Aesthetic and minimalist design
9	Helps users recognize, diagnose & recover from errors
10	Help and documentation
11	Interactivity
12	Message design
13	Assessment
14	Performance support tools
15	Learning Managements
16	Feedback
17	Content

Data were collected from 50 respondents at various range of age. The lowest range is age below 20 and the highest is 51 and above. These respondents are from different background including IT executives (32%), game developers (20%), programmer (16%), software engineers (12%) and others (20%). Invitation emails were sent to the respondents to participate by answering the online web-based questionnaire and we managed to get 100% of it returned and answered.

C. Data analysis

Data of the 17 usability heuristics were analyzed using SPSS 16.0. Mean and standard deviation were used in analyzing the data. The following section discusses the results of this study.

V. DISCUSSION

A comparison of means scores and standard deviation (SD) between the three games are as shown in Table 2 and 3 respectively. The analysis in graphical format can be found in [18].

The overall mean for Dam Haji is 2.37 in which H6 (recognition rather than recall) and H7 (flexibility and efficiency of use) scored the highest. This indicates that Dam Haji is at the average in terms of its heuristic components. It also indicates that Dam Haji is a usable game, however it needs improvement for some components that achieved minimum scores, i.e. H5 (error prevention), H8 (aesthetic and minimalist design), H10 (help and documentation) and H16 (feedback). The overall mean for Gasing-X is 2.50. The highest score is H7 (flexibility and efficiency of use) and H17 (content), showing that Gasing-X is also at the average in terms of its heuristic components. Similar to Dam Haji, future development of this game also needs improvement on some heuristic components such as H2 (match between system and real world), H8 (aesthetic and minimalist design) and H13 (assessments).

Table 2
Mean for Dam Haji, Gasing-X and Congkak

Heuristic	Dam Haji	Gasing-X	Congkak
H1	2.96	2.84	2.86
H2	2.12	1.82	2.32
H3	2.86	2.76	2.84
H4	2.44	2.42	2.46
H5	0.52	2.46	1.32
H6	3.00	2.90	2.96
H7	3.00	2.94	3.00
H8	1.14	1.72	1.66
H9	2.94	2.82	1.78
H10	0.82	2.72	1.34
H11	2.82	2.52	2.64
H12	2.78	2.54	2.72
H13	2.96	1.32	1.42
H14	2.84	2.68	2.71
H15	2.96	2.72	2.78
H16	1.36	2.34	2.26
H17	2.80	2.94	2.82
Overall	2.37	2.50	2.35

The overall mean for Congkak is 2.35. The highest heuristic component is H7 (flexibility and efficiency of use). In general, it can be concluded that this game is usable to play. However, in order to encourage better engagement, some heuristic components need to be improved. These are H5 (error preventions), H8 (aesthetic and minimalist design), H9 (helps user recognize, diagnose and recover from errors), H10 (helps and documentations) and H13 (assessments). Respondents suggested that helps of the games should be improved.

Table 3
Standard Deviation for Dam Haji, Gasing-X and Congkak

Heuristic	Dam Haji	Gasing-X	Congkak
H1	0.20	0.51	0.45
H2	1.21	0.90	0.82
H3	0.50	0.60	0.47
H4	1.11	0.86	0.84
H5	1.07	0.88	0.68
H6	0.00	0.42	0.28
H7	0.00	0.31	0.00
H8	1.40	0.90	0.87
H9	0.24	0.56	0.95
H10	1.30	0.64	0.72
H11	0.63	0.83	0.72
H12	0.65	0.81	0.67
H13	0.20	0.65	0.78
H14	0.51	0.71	0.68
H15	0.28	0.70	0.62
H16	0.69	0.90	0.92
H17	0.57	0.90	0.52
Overall	0.62	0.71	0.65

Table 3 shows the SD value for each usability heuristic for each game. Overall, the distribution of responses are quite

wide, given the score for Dam Haji, Gasing X and Congkak are 0.62, 0.71 and 0.65 respectively.

The highest SD for Dam Haji is 1.40 for H8, showing there is a wide disagreement between the respondents in aesthetic and minimalist design aspect. The zero SD value for H6 and H7 consistent with the mean score; all respondents agree that Dam Haji does not rely on user’s memory and also the interface must be easy to navigate and should not require too much effort on user’s side. For Gasing-X, the highest SD is 0.90 (H2, H8, H16 and H17) while for Congkak, the highest SD is 0.95 (H9). The lowest SD for both games is H7, with the value 0.31 and 0 respectively.

Table 4 shows seven major usability issues that have been uncovered from this study. The aesthetic and minimalist design issue appears to be the issue in all the three games, which means all games are lacking of beauty and tidiness. Issues such as error prevention help and documentation and assessment appear in two out of the three games.

Table 4
Usability Issues in Digital Malaysian Traditional Games

Heuristic	Dam Haji	Gasing-X	Congkak
H2		/	
H5	/		/
H8	/	/	/
H9			/
H10	/		/
H13		/	/
H16	/		

VI. CONCLUSION

Based on the results presented above, it can be concluded that the selected games are usable but some of the usability aspects need to be improved in order to promote better engagement of the games. The most concerned issue is aesthetic and minimalist design, while error prevention, help and documentation and assessment are also important. Developers of digital Malaysian traditional games should pay more attention to enhance the beauty and tidiness of the games while at the same time avoid user from making a mistake by eliminating any interface element that cause confusion or lead to an error. Furthermore, help and documentation is still deemed necessary, even though it is better if user can use the apps without referring to any documentation.

Future works might consider involving gamers and players in evaluating the usability of the games. Future works can also consider the evaluation of other engagement factors towards measuring how engaged the gamers on digitized Malaysian traditional games.

REFERENCES

- [1] T. W. Malone, "Heuristics for designing enjoyable user interfaces: lessons from computer games," in *Human Factors in Computer Systems*, J. C. Thomas & M. L. Schneider, Eds. New Jersey: Abex Publishing Corporation, 1984.
- [2] A. Putra, S. Anuwar, N. Akma and A. Fahmi, "Re-creation of Malaysian traditional game namely 'Baling Selipar': a critical review," *International Journal of Science Environment*, pp. 2084-2089, 2014.
- [3] N. ChePa, A. Alwi, A. Mohamed Din and M. Safwan, "The application of Neural Network and Min-Max algorithm in digital congkak," in

- Proc. of the 4th International Conference on Computing and Informatics (ICOICI 2013)*, Kuching, Malaysia, 2013.
- [4] M. F. Rosli, "The development of the Dam Haji traditional game using Java," *Final Project Report*, http://library.utm.edu.my/index2.php?option=com_docman&task=doc_view&gid=4329&Itemid=113, 2015.
- [5] A. Ferbretti and F. Garzotto, "Does usability affect engagement in long-term user experience?," <https://s3.amazonaws.com/febretpository/UsabilityInGames/FerbrettiGarzotto.pdf>, 2015.
- [6] S. Laitinen, "Better games through usability and testing," *Gamasutra*. http://www.gamasutra.com/features/20050623/laitinen_01.shtml, 2005.
- [7] D. Pinelle, N. Wong and T. Stach, "Heuristic evaluation for games: usability principles for video games." in *Proc. of SIGCHI Conference on Human Factors in Computing Systems*, 2008, pp. 1453-1462. <http://dx.doi.org/10.1145/1357054.1357282>
- [8] P. Chapman, *Models of Engagement: Intrinsically Motivated Interaction with Multimedia Learning Software*. University of Waterloo: MSC Thesis, 1997.
- [9] W. Quesenbery, "Dimensions of usability," in *Content and Complexity: Information Design in Technical Communications*, M. Albers & B. Mazur, Eds. 2008, pp. 81-102.
- [10] R. J. Pagulayan, K. Keeker, D. Wixon, R. Romero and T. Fuller, "User-centered design in games," in *Handbook for Human-Computer Interaction in Interactive Systems*, J. Jacko A. Sears, Eds. Erlbaum, 2003, pp. 883-906.
- [11] A. H. Jorgensen, "Marrying HCI/usability and computer games: a preliminary look," <https://pdfs.semanticscholar.org/b3a8/5a063096df741d00de320d027f389608650b.pdf>, 2015.
- [12] D. Permadi and A. Rafi, "Developing a conceptual model of user engagement for mobile-based augmented reality games," *Jurnal Teknologi*, vol. 77, no. 29, pp. 9-13, 2015, eISSN 2180-372.
- [13] T. W. Malone, "What makes things fun to learn? a study of intrinsically motivating computer games," *Technical Report CIS-7*, Palo Alto, CA: Xerox PARC, 1980.
- [14] C. Dongseong and K. Jinwoo, "Why people continue to play online games: in search of critical design factors to increase customer loyalty to online content," *CyberPsychology & Behavior*, vol. 7, no. 1, pp. 11-24, 2008.
- [15] S. Y. Wong and N. A. Mat Zin, "Usability evaluation for History educational games," http://www2.dc.ufscar.br/~elis_hernandes/phdproposal/systematicmappings/Q5.1/ACMfiles/436/Yue, 2015.
- [16] J. Nielsen and R. L. Molich, *Usability Inspection Methods*. John Wiley and Sons., 1994.
- [17] J. Nielsen, "Characteristics of usability problem found by heuristic evaluation," http://www.useit.com/paers/heuristics/usability_problems.html, 2011.
- [18] N. ChePa, N.A. Abu Bakar and A. Mohd, "Usability evaluation of digital Malaysian traditional games," *Jurnal Teknologi*, vol. 77, no. 29, pp. 85-90, 2015, eISSN 2180-372.
- [19] C. Jennet, A. L. Cox, P. Cairns, S. Dhoparee, A. Epps., T. Tijs and A. Walton, "Measuring and defining the experience of immersion in games," *International Journal of Human-Computer Studies*, vol. 66, no. 9, pp. 641-661, 2008.
- [20] S. Rigby and R. Ryan, *Glued to games: how video games draw us in and hold us spell bound*. California: ABC-CLIO, 2011.
- [21] E. Brown and P. Cairns, "A grounded investigation of game immersion," *Extended Abstracts of the 2004 Conference on Human Factors in Computing Systems*, pp. 1297-1300, 2004