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Generating game immersion features for immersive game selection

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Abstract
Immersion is an essential component of the modern digital game. Immersion is the required component that should be included in the digital game. The modern game whose success within the game industry indeed has included immersion as a component. Although digital games have been introduced for many years, immersion games have been known very little. Regarding the intensive study about user immersion, there still needs to be more knowledge about game immersion. First, game designers, developers, and gamers need help understanding whether their game is immersive. There needs to be knowledgeable regarding how to evaluate their game, whether immersive or not, and this process requires expert knowledge. Second, game designers currently rely on speculative interpretation to evaluate their games because there is no method to examine whether the game is immersive. Therefore, this study proposes a method to evaluate whether the game is immersive. This method has emerged as knowledge and recommendation that can quickly assist game designers, game developers, and gamers in evaluating whether a game is immersive. First, this research conducts a literature review to categorize the game immersion features. Second, this study proposes an effective method that can analyze and recommends whether a game is immersive or not. Finally, this study reveals that the finding could be used as a recommendation for the other immersive technology platforms.

Keywords: Game Immersion Features; The Digital Game; Game Immersion Selection.

Introduction

With the rapid growth of the digital game industry, there is an increasing demand for higher digital game quality. Many game developers have been focusing on increasing their game quality to meet these demands. Evaluation ways have been developed to improve the quality of digital games, such as through the study of user experience (UX) [1,2] and the study of game design [3]. User experience (UX) has been the primary concern about experience quality and has been investigated in digital games for many years. However, due to intensive user experience (UX) studies, the researcher has reported that this area needs more exploration [4]. A recent study has introduced the concept of user immersion as an essential component that leads to a game being successful in the game industry. Several studies have argued that user immersion is one factor of a successful digital game [5,6]. While the growing research on user immersion, many researchers stated that there needs to be more knowledge regarding how to examine a game, whether it is immersive or not [7]. Therefore, based on this problem, this study's objective is to propose a method to evaluate whether a game is immersive. This method is presented as knowledge and recommendation that can quickly help game designers, game developers, and gamers choose and evaluate whether a game is immersive.

In general, immersion is used to describe feeling "being in an environment system" that offering stimulus and experience. In general, the term was used in virtual reality and the digital games field. While this term has been widely implemented, there is lack of clarity regarding the definition of immersion. On the one hand, the researcher has defined immersion as objective features of a virtual environment or system that deliver a sense of immersion to the sense of human [8]. On the other hand, the researcher argued that immersion is the human psychological response indicated by feeling oneself interacting with an environment that supplies stimuli and experiences [9]. While the definition of user immersion has been critically argued among several authors, user immersion has been successfully implemented in several areas such as healthcare prevention and rehabilitation [10], education [11], simulation of construction safety [12], and tourism [13]. Finally, despite a slightly different definition of immersion

among researchers, this paper argues that immersion can be described as a feeling of part of a virtual environment that is influenced by stimulus components of the experience

Method

A. Finding the Immersion Game Features

This study has identified three fundamental approaches used when investigating user immersion. Researchers examined the digital game's specific components that impact user immersion in three components: input/output, content, and multiplayer. Input/output describes the game as a particularly input/output component as a stimulus for an immersion experience. Content represents the specific component in a digital game that influences immersion experiences, such as game rules and gameplay. Multiplayer describes one user's interaction with another user in the game that shares interaction and influence on user immersion (e.g., competition with another player). For instance, in the input/output component, the authors have investigated how screen size impacts user immersion when playing the game. In the component of contents, the challenge has been examined as an essential immersive factor [15]. Finally, in the multiplayer component, the researchers have found that social entities or competition with another user impact user immersion [16]. This study has identified several game immersion features successfully implemented in the previous study. The review collected eight components of digital games. **Table 1** presents the list of components, and **Table 2** presents each component's description.

Table 1 The immersion features

	The Features	**Literatures**
Input/output	Game Control Technology	[17]
	Avatar	[18]
	Graphical Realism	[19]
	Music/Sound	[20]
	Display Technology	[21]
Content	Rewards	[22]
	Game Difficulty/Level	[23]
Multiplayer	Social Entities	[24]

Table 2 Description of the features

The Descriptions of Features	
Gesture Controller - Player using their gesture controlling the game	Rewards - The form of reward for a player when performing specific actions
Avatar - Visual representations of players characters	Game Difficulty/Level - The tasks in the player progression that require to solve
Graphical Realism - The quality of graphical representation of the game	Social Entities - The occurrence of enemy/computer/friend in the game
Music/Sound - Voice or instrumental sounds	
Display - The button command to do something in the game	

B. Game Selection Method

First, this study is classified into several game platforms and a case study of the game. This game is used as the output of the immersive game selection. **Table 3** shows six-game platform types and the game as a case study of this paper. Thus, in this step, the game designers, game developers, and gamers can choose several games that he or she wants to know whether it is immersive or not.

Table 3 Game platform and game

Games	**Game Platform**
Skyrama	Web Browser
Kinect Adventure	Xbox One/360
Serious Sam VR: The Last Hope	VR Headset
FIFA 2018	PS4/Pro
Adventures of Pip	Personal Computer
Super Mario Odyssey	Nintendo Switch

Second, this paper has developed the multi-criteria decision system based on the Analytical Hierarchy Process (AHP) method [25]. The AHP method uses hierarchical structures to measure complex decision problems. Third, this study has defined three main criteria for immersive game selection: game control technology, display technology, and immersion features. There are sub-criteria for every criterion. There are three sub-criteria for the game control technology: mouse and keyboard controller, joystick controller, and motion controller. There are also three sub-criteria for the display technology: flat-screen display, VR Headset, and LCD TV HD. For the immersion features, there are six sub-criteria: rewards, social entities, avatars, game difficulty, music/sound, and graphical realism. The user develops all these criteria or designs, and they are based on the user's preference. The proposed method works based on the used criteria designed based on their preference. This study has developed hierarchical structures of AHP in Appendix 1. Level 1 and level 2 are the levels for evaluation of the game. Level 0 is the level for deciding which game is immersive or not and presenting the results in the form of ranking.

C. Discovery AHP for Games Immersive Selection

The AHP method is implemented to identify the most appropriate game immersive concerning the users' parameters (e.g., game developers, game designers, gamers). Generally, the AHP method includes five levels of process: defining the problem, establishing a pairwise comparison matrix, normalizing the pairwise comparison matrix, examining the consistency ratio and consistency index, and finalising the decision problem **Figure 1**.

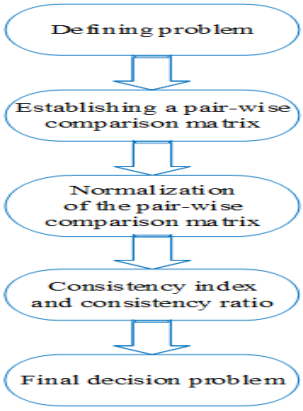

Figure 1. AHP Level

1). Defining the Problem

The problem structure divides decision-making into a hierarchy from the top to the bottom levels. In Appendix 1, the problem's goal is placed at level 0 for decision (game immersive selection). Level 1 consists of the main criteria, and level 2 contains the sub-criteria used to evaluate the game selection.

2). Starting A Pairwise Comparison Matrix of the Criteria

The second level includes a pairwise comparison matrix. The user or decision-maker (e.g., game developers, game designers, gamers) examines the weight to pairs of each hierarchy level using the Saaty scale **Table 4**.

Table 4. The Saaty's scale for comparison [26]

Intensity of importance	Definition	Description
1	Equal importance	Equal judgment
3	Moderate importance	The judgment slightly prefers over another
5	Essential importance	The judgment strongly over another
7	Very strong importance	The judgment is strongly preferred over another
9	Extreme importance	The judgment is highest possible over another
2,4,6,8	Intermediate values	An intermediate value between the two judgments

At this level, the elements are compared pairwise toward a specific element in the higher level. The goal is to obtain the grade of relative rank among elements. In this way, the decision-maker can use their

interpretation and experience, which element is possible over another. The comparison of the two elements is presented as follows

$$A_{i,j} = \frac{W_i}{W_j} i, j = 1,2,3, \dots, n \quad (1)$$

Where $\boldsymbol{A_{i,j}}$ explains the weight of the pairwise comparison of the element $\boldsymbol{e_i}$ and $\boldsymbol{e_j}$. W_i and W_j explains the relative weights for all elements.

3). Standardization of The Pairwise Comparison Matrix

Regarding the output of the comparison matrix, the eigenvector is obtained. The eigenvector explains the level of relative rank among the elements. Furthermore, the maximum eigenvalue also is obtained. This eigenvalue is applied to examine the strength of consistency between comparisons. The method is presented as follows:

$$AW = nW \quad (2)$$

The priority of criteria is approximated by calculating the principal eigenvector W (normalized vector) of matrix A. The maximum eigenvalue λ_{max} matches the order of the number, and it shows as follows:

$$AW = \lambda_{max} W \quad (3)$$

Using normalization solution, the relative weight $Wi, W = 1, 2, 3, \dots, n$, can be obtained using the formula as follows:

$$\lambda_{max} = \left(\frac{1}{n}\right)\left(\frac{W\prime_1}{W\prime_1} + \frac{W\prime_2}{W\prime_2} + \cdots + \frac{W\prime_n}{W\prime_n}\right) \quad (4)$$

$$\mathbf{W' = AW} \quad (5)$$

4). Consistency index and consistency ratio

This level is applied to examine the consistency of the matrix. The Consistency index (CI) calculates as follows:

$$CI = \frac{\lambda_{max}}{(n-1)} \quad (6)$$

If the consistency index ≤ 0.1, the consistency level is satisfied. Further, consistency ratio (CR) is also performed to check the precision of comparisons. It is used to calculate the consistency of the judgments to all matrices and is presented as follows:

$$CR = \frac{CI}{RI} \quad (7)$$

If the consistency ratio ≤ 0.1, the evaluation within the matrix is appropriate. For each matrix, a random index (RI) is used as a reference and is presented in **Table 5**.

Table 5 The values of RI [26]

N	RI
1	0.0
2	0.0
3	0.58
4	0.90
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49

5). Final decision

At this level, all elements (criteria, sub-criteria, and their weights) are calculated to choose the optimal solution for the decision problem (in this case, immersive game selection).

Results and Discussion

This section presents the implementation of the AHP method dedicated to game immersive selection. The hierarchical structure was divided into three levels: First, level 0 explains the primary goal, "selection of game immersive." Second, level 1 includes "game control technology, display technology, and immersion features." Third, in level 2, there are sub-criteria linked to each criterion of level 1. There are three sub-criteria for the game control technology: mouse and keyboard controller, joystick controller, and motion controller. There are also three sub-criteria for the display technology: flat-screen display, VR Headset, and LCD TV HD. For the immersion features, there are six sub-criteria: rewards, social entities, avatars, game difficulty, music/sound, and graphical realism (detail in Appendix 1). After the hierarchical structure has been implemented, this study calculates the pairwise comparison matrix for all levels of criteria in a hierarchical structure.

A. Pairwise comparison of level 1

The matrix of pairwise comparison of level 1 includes "*game control technology*, *display technology,* and *immersion features*" (**Table 6**).

Table 6. The first level of attributes comparison

Goal	Game control technology	Display technology	Immersion features	Weight
Game control technology	1	1/3	1/5	0.11
Display technology	3	1	1/3	0.26
Immersion features	5	3	1	0.63

$$\lambda_{max} = 3.05; CI = 0.027; CR = 0.04 < 0.1$$

In table 6, the decision-makers give their preference value for every criterion (e.g., the preference values 3 of field criterion to display technology, meaning that the display technology is moderately more important than game control technology). The immersion features were essential than game control technology, and immersion features were moderately important than display technology. Finally, in the Consistency Ratio value, the evaluation showed that the matrix is acceptable (CR=0.04<0.1).

B. Pairwise comparison sub-level of game control technology

There are three types of game control technology: mouse and keyboard controller, joystick controller, motion controller in the sub-criteria of game control technology. The pairwise comparison matrix is shown in **Table 7**. The decision-makers give the preference value.

Table 7. The Sub-level game control technology comparison

	Mouse and Keyboard Controller	Joystick Controller	Weight
Mouse and Keyboard Controller	1.00	0.33	0.08
Joystick Controller	3.00	1.00	0.19
Motion Controller	7.00	5.00	0.72

$$\lambda_{max} = 3.11; CI = 0.057; CR = 0.09 < 0.1$$

C. Pairwise comparison sub-level of game control technology

There are three components: flat screen display, VR Headset, and LCD TV HD in the sub-criteria of game display technology. The pairwise comparison matrix is shown in **Table 8**. The decision-makers give the preference value.

Table 8. Sublevel display technology comparison

	Flat Screen Display	VR Headset	LCD TV HD	Weight
Flat Screen Display	1.00	0.33	0.20	

	Flat Screen Display	VR Headset	LCD TV HD	Weight
				0.11
VR Headset	3.00	1.00	0.33	0.26
LCD TV HD	5.00	3.00	1.00	0.63

$$\lambda_{max} = 3.05; CI = 0.027; CR = 0.04 < 0.1$$

D. Pairwise comparison sub-level of immersion features

In the sub-criteria of immersion features, there are six components: rewards, social entities, avatars, game difficulty, music/sound, and graphical realism. The pairwise comparison matrix is shown in **Table 9**. The decision-makers give the preference value. Regarding the limitation of the table, only the local weight is presented.

Table 9. The Sublevel display immersion features

	Weight
Rewards	0.03
Social Entities	0.06
Avatars	0.11
Game Difficulty	0.16
Music/Sound	0.25
Graphical Realism	0.39

$$\lambda_{max} = 6.51; CI = 0.10; CR = 0.08 < 0.1$$

E. Pairwise comparison of alternatives

Table 10. The local weight of the sub-criterion mouse and keyboard controller

	Local Weight
Skyrama	0.11
Kinect Adventure	0.21
Serious Sam VR: The Last Hope	0.21
FIFA 2018	0.21
Adventures of Pip	0.08
Super Mario Odyssey	0.16

$$\lambda_{max} = 6.39; CI = 0.07; CR = 0.06 < 0.1$$

Table 11. The local weight of the sub-criterion joystick controller

	Local Weight
Skyrama	0.09
Kinect Adventure	0.19
Serious Sam VR: The Last Hope	0.32
FIFA 2018	0.15
Adventures of Pip	0.13
Super Mario Odyssey	0.13

$$\lambda_{max} = 6.28; CI = 0.05; CR = 0.04 < 0.1$$

Table 12. The local weight of the sub-criterion motion controller

	Local Weight
Skyrama	0.08
Kinect Adventure	0.39
Serious Sam VR: The Last Hope	0.28
FIFA 2018	0.08
Adventures of Pip	0.08
Super Mario Odyssey	0.08

$$\lambda_{max} = 6.04; CI = 0.008; CR = 0.006 < 0.1$$

Table 13. The local weight of the sub-criterion flat-screen display

	Local Weight
Skyrama	0.16
Kinect Adventure	0.22
Serious Sam VR: The Last Hope	0.22
FIFA 2018	0.22
Adventures of Pip	0.09
Super Mario Odyssey	0.09

$$\lambda_{max} = 6.2; CI = 0.04; CR = 0.035 < 0.1$$

Table 14. The local weight of the sub-criterion VR headset

	Local Weight
Skyrama	0.08
Kinect Adventure	0.08
Serious Sam VR: The Last Hope	0.58
FIFA 2018	0.08
Adventures of Pip	0.08
Super Mario Odyssey	0.08

$$\lambda_{max} = 6.0; CI = 0; CR = 0 < 0.1$$

Table 15. The local weight of the sub-criterion LCD TV HD

	Local Weight
Skyrama	0.18
Kinect Adventure	0.26
Serious Sam VR: The Last Hope	0.07
FIFA 2018	0.21
Adventures of Pip	0.21
Super Mario Odyssey	0.07

$$\lambda_{max} = 6.16; CI = 0.032; CR = 0.02 < 0.1$$

Table 16. The local weight of the sub-criterion rewards

	Local Weight
Skyrama	0.19
Kinect Adventure	0.19
Serious Sam VR: The Last Hope	0.19
FIFA 2018	0.10
Adventures of Pip	0.16
Super Mario Odyssey	0.16

$$\lambda_{max} = 6.22; CI = 0.04; CR = 0.03 < 0.1$$

Table 17. The local weight of the sub-criterion social entities

	Local Weight
Skyrama	0.21
Kinect Adventure	0.21
Serious Sam VR: The Last Hope	0.21
FIFA 2018	0.21
Adventures of Pip	0.07
Super Mario Odyssey	0.07

$$\lambda_{max} = 6; CI = 0; CR = 0 < 0.1$$

Table 18. The local weight of the sub-criterion avatar

	Local Weight
Skyrama	0.06
Kinect Adventure	0.19
Serious Sam VR: The Last Hope	0.19
FIFA 2018	0.19
Adventures of Pip	0.19
Super Mario Odyssey	0.19

$$\lambda_{max} = 6; CI = 0; CR = 0 < 0.1$$

Table 19. The local weight of the sub-criterion game difficulty

	Local Weight
Skyrama	0.05
Kinect Adventure	0.18
Serious Sam VR: The Last Hope	0.20
FIFA 2018	0.20
Adventures of Pip	0.18
Super Mario Odyssey	0.20

$$\lambda_{max} = 6.04; CI = 0.009; CR = 0.007 < 0.1$$

Table 20. The local weight of the sub-criterion music/sound

	Local Weight
Skyrama	0.08
Kinect Adventure	0.31
Serious Sam VR: The Last Hope	0.31
FIFA 2018	0.10
Adventures of Pip	0.10
Super Mario Odyssey	0.10

$$\lambda_{max} = 6.06; CI = 0.012; CR = 0.01 < 0.1$$

Table 21. The local weight of the sub-criterion graphical realism

	Local Weight
Skyrama	0.07
Kinect Adventure	0.30
Serious Sam VR: The Last Hope	0.32
FIFA 2018	0.11
Adventures of Pip	0.10
Super Mario Odyssey	0.10

$$\lambda_{max} = 6.16; CI = 0.032; CR = 0.02 < 0.1$$

F. Result

In the final level, the global weights are calculated regarding each alternative. The results are presented in-game control technology, display technology, and immersion features criteria **Table 22**, **Table 23**, and **Table 24**. Finally, a summary of the immersive game selection is presented in **Table 25**.

Table 22. The global weight of game control technology

Games	Platforms	Global Weight	Rank
Kinect Adventure	Xbox One/360	0.334	1
Serious Sam VR: The Last Hope	VR Headset	0.279	2
FIFA 2018	PS4/Pro	0.109	3
Super Mario Odyssey	Nintendo Switch	0.099	4
Adventures of Pip	PC	0.092	5
Skyrama	Web Browser	0.088	6

Table 23. The global weight of display technology

Games	Platforms	Global Weight	Rank
Serious Sam VR: The Last Hope	VR Headset	0.219	1
Kinect Adventure	Xbox One/360	0.209	2
FIFA 2018	PS4/Pro	0.178	3
Adventures of Pip	PC	0.154	4
Skyrama	Web Browser	0.164	5
Super Mario Odyssey	Nintendo Switch	0.076	6

Table 24. The global weight of immersion features

Games	Platforms	Global Weight	Rank
Serious Sam VR: The Last Hope	VR Headset	0.275	1
Kinect Adventure	Xbox One/360	0.265	2
FIFA 2018	PS4/Pro	0.137	3
Super Mario Odyssey	Nintendo Switch	0.123	4
Adventures of Pip	PC	0.120	5
Skyrama	Web Browser	0.080	6

Table 25. The global weight of all comparison matrix

Games	Platforms	Global Weight	Rank
Serious Sam VR: The Last Hope	VR Headset	0.261	1
Kinect Adventure	Xbox One/360	0.258	2
FIFA 2018	PS4/Pro	0.144	3
Adventures of Pip	PC	0.129	4
Super Mario Odyssey	Nintendo Switch	0.108	5
Skyrama	Web Browser	0.100	6

The Kinect adventure game has obtained the first rank in the game control technology, followed by Serious Sam VR: The Last Hope (**Table 22**). Serious Sam VR: The Last Hope has obtained the first rank in the display technology, followed by the Kinect adventure game (**Table 23**). Serious Sam VR: The Last Hope has obtained the first rank in the immersion features, followed by the Kinect adventure game (**Table 24**). In summary of the immersive game selection, the application recommends the Serious Sam VR: The Last Hope with VR Headset game platform as the first rank. This game was identified as the best based on the total score and all criteria selection, followed by Kinect Adventure with Xbox 360 game platform (**Table 25**). According to the consistency ratio validation, the results were identified as reliable and consistent. Finally, this study develops a web application for immersive game selection. In this application, game designers, game developers, and gamers can input their games to evaluate and give their preference values. In the end, the application will give output to the recommendation of the game (see Appendix 2).

Conclusion

This study has presented a proposed method to evaluate whether a game is immersive. This method is presented as knowledge and recommendation that can quickly help game designers, game developers, and gamers choose and evaluate whether a game is immersive. The knowledge developed from this work could be used as a recommendation for game designers in evaluating immersive digital games and other immersive technologies. The limitation of this study is that it used several criteria for game immersion selection. This study argued that there is a need for an investigation to add more criteria for game immersion selection on the AHP method. This study has used limited criteria, "game control technology, display technology, and immersion features," for game immersion selection. This study identified many game immersion features that should be included in further studies, such as game story, game competition, and user interface. Future works should consider this limitation and suggestion

offered by this study. Future studies may benefit from examining different game types or other immersive technologies, such as virtual and augmented reality. Hopefully, our findings will inspire further studies to investigate immersive digital games in detail.

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References

[1] Caroux L, Isbister K, Le Bigot L, Vibert N. Player-video game interaction: A systematic review of current concepts. Comput Human Behav 2015;48:366–81. doi:10.1016/j.chb.2015.01.066.

[2] Boyle EA, Connolly TM, Hainey T, Boyle JM. Engagement in digital entertainment games: A systematic review. Comput Human Behav 2012;28:771–80. doi:10.1016/j.chb.2011.11.020.

[3] Mora A, Riera D, Arnedo-moreno J. A literature review of gami fi cation design frameworks. Proc 7th Int Conf Games Virtual Worlds Serious Appl 2015. doi:10.1109/VS-GAMES.2015.7295760.

[4] Gasselseder H-P. Dynamic music and immersion in the action-adventure an empirical investigation. Proc 9th Audio Most A Conf Interact With Sound - AM '14 2014:1–8. doi:10.1145/2636879.2636908.

[5] Brown E, Cairns P. A grounded investigation of game immersion. Ext Abstr 2004 Conf Hum Factors Comput Syst - CHI '04 2004:1297. doi:10.1145/985921.986048.

[6] Jennett C, Cox AL, Cairns P, Dhoparee S, Epps A, Tijs T, et al. Measuring and defining the experience of immersion in games. Int J Hum Comput Stud 2008;66:641–61. doi:10.1016/j.ijhcs.2008.04.004.

[7] Suh A, Prophet J. The State of Immersive Technology Research: A Literature Analysis. Comput Human Behav 2018;86:77–90. doi:10.1016/j.chb.2018.04.019.

[8] Slater M. Measuring Presence: A Response to the Witmer and Singer Presence Questionnaire. Presence Teleoperators Virtual Environ 1999;8:560–5. doi:10.1162/105474699566477.

[9] Witmer BG, Singer MJ. Measuring Presence in Virtual Environments: A Presence Questionnaire. Presence Teleoperators Virtual Environ 1998;7:225–40. doi:10.1162/105474698565686.

[10] Rose T, Nam CS, Chen KB. Immersion of virtual reality for rehabilitation - Review. Appl Ergon 2018;69:153–61. doi:10.1016/j.apergo.2018.01.009.

[11] Potkonjak V, Gardner M, Callaghan V, Mattila P, Guetl C, Petrović VM, et al. Virtual laboratories for education in science, technology, and engineering: A review. Comput Educ 2016;95:309–27. doi:10.1016/j.compedu.2016.02.002.

[12] Li X, Yi W, Chi HL, Wang X, Chan APC. A critical review of virtual and augmented reality (VR/AR) applications in construction safety. Autom Constr 2018;86:150–62. doi:10.1016/j.autcon.2017.11.003.

[13] Schott C. Virtual fieldtrips and climate change education for tourism students. J Hosp Leis Sport Tour Educ 2017;21:13–22. doi:10.1016/j.jhlste.2017.05.002.

[14] Hou J, Nam Y, Peng W, Lee KM. Effects of screen size, viewing angle, and players' immersion tendencies on game experience. Comput Human Behav 2012;28:617–23. doi:10.1016/j.chb.2011.11.007.

[15] Bastos AS, Gomes RF, dos Santos CC, Maia JGR. Assessing the Experience of Immersion in Electronic Games. 2017 19th Symp Virtual Augment Real 2017:146–54. doi:10.1109/SVR.2017.27.

[16] Park J, Kim S, Oh A. Analysis of the effect of Competition on player immersion and engagement in a mobile game. Conf Hum Factors Comput Syst - Proc 2017;Part F1276:2833–8. doi:10.1145/3027063.3053200.

[17] M P, N B-B, B VD, A N. Immersion in Movement-Based Interaction. Int Conf Intell Technol Interact Entertain 2009:169–80. doi:10.1007/978-3-642-02315-6_30.

[18] Ahmed I, Harjunen V, Jacucci G, Ravaja N. Total Immersion: Designing for Affective Symbiosis in a Virtual Reality Game with Haptics, Biosensors, and Emotive Agents 2017;9961:23–37. doi:10.1007/978-3-319-57753-1.

[19] Cutting J. Measuring Game Experience using Visual Distractors 2017:695–8.

[20] Cuny C, Fornerino M, Helme-Guizon A. Can music improve e-behavioral intentions by enhancing consumers' immersion and experience? Inf Manag 2015;52:1025–34. doi:10.1016/j.im.2015.07.009.

[21] Fairclough SH, Burns CG. Decomposing Immersion: Effects of Game Demand and Display Type on Auditory Evoked Potentials. CHI'13 Ext Abstr Hum Factors Comput Syst 2013:1095–100. doi:978-1-4503-1952-2/13/04.

[22] Alfadhli S, Alsumait A. Game-Based Learning Guidelines: Designing for Learning and Fun. 2015 Int Conf Comput Sci Comput Intell 2015:595–600. doi:10.1109/CSCI.2015.37.

[23] Qin H, Rau PLP, Salvendy G. Effects of different scenarios of game difficulty on player immersion. Interact Comput 2010;22:230–9. doi:10.1016/j.intcom.2009.12.004.

[24] Liszio S, Emmerich K, Masuch M. The influence of social entities in virtual reality games on player experience and immersion. Proc Int Conf Found Digit Games - FDG '17 2017:1–10. doi:10.1145/3102071.3102086.

[25] Saaty TL. Analytic hierarchy process. Encycl. Oper. Res. Manag. Sci., Springer; 2013, p. 52–64.

[26] Saaty TL. How to make a decision: The analytic hierarchy process. Eur J Oper Res 1990;48:9–26. doi:https://doi.org/10.1016/0377-2217(90)90057-I.