

Conceptual Model of Game Aesthetics for Perceived Learning in Narrative Games

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Abstract— Narrative games may offer reasoning on players' behaviour or make-believe on players' personation as a pursuit to achieve specific goals. One of the goals is probably the intention to instil learning, which subconsciously provides information on the content of the game. However, there is a lack of studies on the contribution of game aesthetics towards player's perceived learning. By means of expert review, this article reports on a conceptual model of game aesthetics towards perceived learning and the degree of importance of each attribute in perceived learning. Findings reveal that all experts agreed on the contribution of game aesthetics towards perceived learning. In addition, the expert recommends three other factors that may contribute to learning: player's motivation, learning content, and gameplay. Future work will continue to design and develop the game prototype and to investigate the relationship between game aesthetics and perceived learning.

Keywords— game aesthetics; perceived learning; narrative games

I. INTRODUCTION

There are games that tell stories of adventure and role-playing games thus created various game styles. This so-called narrative game is being discussed among ludologists and narrativists to provide a consensus on the degree of demand between the game itself versus the story that shapes the game [1]. Both narrative games and the ordinary game may offer a similar experience in terms of gameplay and game mechanism. However, narrative games have story or narration which eventually builds players' character in such game. Narrative games are also able to provide make-believe character on players' personation in achieving game goals. Apart from story and narration, game aesthetics is also anticipated to contribute to perceived learning in narrative games. There are four major factors that may contribute to perceived learning: the target audience (player) [2], [3]; the ability to relate stories and gameplay (interaction) [4], [5]; game aesthetics; and the learning context of a game. Previous studies focus on aesthetics in game design for engaging players [6], [7]. However, there is a lack of studies on to what extent game aesthetics may contribute to perceived learning in narrative games.

Previous narrative game studies mainly focus on the architecture and life-like characters of games such as the theory of contemporary architecture, to create spatial

narrative games [8]; an artificial intelligence character, which is also called as non-playing character [9]; the narrative time and space [10]; and the combination of storytelling, game and learning context to build exciting, adaptive and intelligent learning environments [11]. There are also guides for school children to develop narrative games based on existing three-dimensional (3D) storytelling software [12].

Game elements are now embedded into classroom education where the term gamification is then coined [47], [56], [58]. On the other hand, games also used for not only entertainment but for more critical tasks which are then associated to the term serious games [54], [59]. Among critical tasks which have been developed using serious games are in virtual heritage projects [51], attention assessment for cerebral palsy [55], in tourism [56], in retraining cognition for elderly [57], in educating domestic energy consumption [58], and nutrition education for children [61]. There is also an attempt to apply game aesthetics using machine learning [53]. Thanks to its interactivity and visual communication ability, digital games are currently considered as new media in transmitting cultural information [50].

Unlike other computer software and systems which promote usability to users, games probably best to offer its visual aesthetics – which is referred here as game aesthetics

– to engage players. Apart from [52], that looks into game aesthetics from the perspective of generative art, this study, on the other hand, attempts to identify the attributes of game aesthetics and to determine the degree of importance of game aesthetics towards perceived learning in narrative games.

A. Game Aesthetics

Game aesthetics may represent game appeal such as beauty, elegance, realism, art [13]-[16]. It may also include other aspects of game user experience (UX) such as emotion, pleasure (satisfaction), forgiving, sociability, fun, and gameplay [6], [13], [14]. We offer, on the other hand, game aesthetics definition as visual aesthetics' attributes such as sound, text, and image which may contribute to some degree of importance towards perceived learning.

According to [15], there are difficulties to produce universal aesthetic guidelines in interactive design due to the variety of products or artefacts in which oftentimes possess unique purpose and use contexts. It is nevertheless impossible to provide one universal guidelines especially for game makers with exact game aesthetics for each and every narrative game due to differences in styles and variety of features. For example, some narrative games might need to offer more texts like those in the visual novel [18], [19], but there are narrative games that can stand without any text as in The Binding of Isaac game series and the Angry Birds game series. Table 1 further explains the operational definition of game aesthetics used in this study. Each operational definition is concluded from previous studies as discussed in [18].

TABLE I
OPERATIONAL DEFINITION OF GAME AESTHETICS

Game Aesthetics	Operational Definition
Text	Text represents any kind of readable/written attribute; such as text in dialogue, menu, and button.
Image	Image represents an external form of the environment view within the narrative game.
Visual Perspective	Visual Perspective represents first- or third-person game perspective for the gameplay view.
Music	Music represents the background music of the narrative game.
Sound Effect	Sound Effect represents the sound produced by something within the narrative game (other than music and voice). For example the sound effect of button clicking, waterfall, and birds.
Voice	Voice represent the non-playing character's voice within the narrative game.
Color	Color represents all the colors that applied in the narrative game environment.
Graphic	Graphic is any kind of visual representation of an item that perceived and described in a very clear way. Some of them also defined as a symbolic of an icon. For example, the button used, or the arrow mark on each pickable object for a player to interact with.
Layout	Layout represents the placement of text and visual attributes of narrative game menus and dialogues.
Shape	Shape represents one of art element in a distinct 2D space.

Form	Form represents one of art element in a distinct 3D space.
Texture	Texture represents the consistency, appearance, and feel of a substance or a surface; which applied on every 3D object in the narrative game.

Table 1 depicts that game aesthetics may include text [19]–[22], image [22]–[25], visual perspective [26], music [24], [27]–[29], sound effect [24], [27], [30], voice [21], [24], [27], [31], colour [19]–[21], [27], [32]–[34], graphic [19], [22], [35], layout [19], [20], [33], [36], shape [20], [21], [34], form [21], [33] and texture [21]. Further description on these attributes of game aesthetics are available in [18]. Narrative games normally use game aesthetics as depicted in Fig. 1 to engage players. As far as cultural games are concerned, its attempt may lead to players' perceived cultural learning which eventually provide low level of understanding on the content and context of such cultural game.



Fig. 1 Narrative game on Chinese culture of dragon boat festival

Fig. 1 illustrates game aesthetics which have been used in narrative games to provide the ambience of Chinese culture. It shows text is used to provide an introduction to the scene while the graphic is used to display functional button. Layout for introduction text is located halfway bottom, and the text is placed next to the character to denote the speech is made by the elderly. Color, shape, form, and texture are blended in such a way to impress the player and hence be engaged into the game.

B. Perceived learning

Learning is a process that starts through interpretation and perception or perceiving of the differences between the environment and people. Meanwhile, the process of feedback stimulates various and continuous levels of perceptive and cognitive interaction, as information or interpreted data converted into knowledge. Perceived learning refers to player perception towards learning using the content of narrative games. It is acknowledged that there are other terms associated with learning in games such as learnability and situated learning. Learnability is the ability to learn how to play a particular game with less effort required. On the other hand, situated learning is associated with a particular context that surrounds learning content. As such while playing, information or knowledge of that context would probably be transferred to players through both narration and gameplay.

As for this study, we focus on to what extent player would learn from the content which represented by game aesthetics. The attributes of game aesthetics are identified and outlined to determine its degree of importance for perceived learning in narrative games.

C. Relationship Between Game Aesthetics and Perceived Learning

Aesthetics in narrative games may be defined as the feeling of games which somehow relates to players' emotion, game appeal, interactions flow, interaction design, smooth appearance of game content [18], [37]. Each of these aesthetics-related definitions towards game development is contributing towards game UX. Thus, the relationship of all identified game aesthetics towards perceived learning are illustrated in Fig. 1.

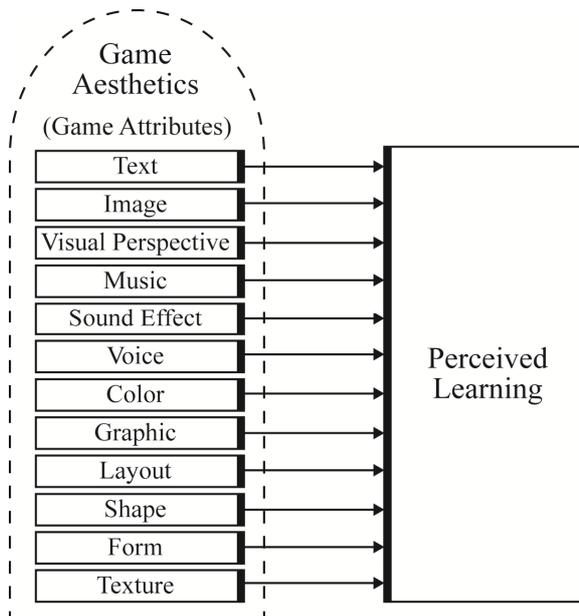


Fig. 2 Initial conceptual model of game aesthetics for perceived learning in narrative game

Fig. 1 suggests that game aesthetics contributes to some degree of learning from the perspective of a player. According to [38], the process of arousal or emotion is mainly based on the learning, activation, and also human's memory or experience. This means that learning could be perceived by the player through their prior knowledge, by recalling their other past memories and experiences. It is anticipated that if the player cannot distinguish between real and virtual environment while playing the game, the chances to instill learning are greater. Due to prior knowledge, one may quickly absorb and perceive learning better.

On the other hand, the previous study reveals an important role of aesthetics in the user interface and visual content and explores the importance and relationship of aesthetics and visual content towards online learning [39]. It is proven that by applying aesthetics to the user interface and visual content during online course development, not only on the course content and visual appearance could be improved, but also the process of students' interaction and reaction during the learning session. In addition, [40] defines the role of aesthetics in the user interface and visual

elements while exploring the importance of developed application in a web-based learning environment. Both studies prevail good relationship between aesthetics of user interface regarding color, image, and layout in an online environment and learning.

II. MATERIAL AND METHOD

Expert review was conducted in order to validate the identified game aesthetics and also to review the proposed conceptual model. The pool of experts is selected based on their public profiles. The outlined criteria for the experts are those who have working experience in game industry or computer science and its related fields such as multimedia and interactive media; and those who have been teaching and/or researching in these fields for at least five years.

Six experts are involved in this study, and their demographic is demonstrated as in Table 2. Their expertise is in the domain of multimedia especially in game design and/or computer science related areas. One expert has 27 years of experience in related field, four have 10 to 15 years of experience, and one is below 10 years. All of them is affiliated with teaching institutions, and one is also active in game production.

TABLE II
LIST OF EXPERTS AND THEIR EXPERTISE

Expert (E)	Expertise	Affiliation	Experiences (Years)
E1	Multimedia (Game Design)	Lecturer	7
E2	Multimedia (Game Design)	Lecturer, Game Art Director	15
E3	Computer Science	Senior Lecturer	10
E4	Multimedia (Game Design)	Senior Lecturer	10
E5	Interactive Media	Senior Lecturer	10
E6	Interactive Media	Senior Lecturer	27

The instrument for the expert review includes an operational definition of narrative games and game aesthetics, an initial conceptual model with justifications and expert personal details. There are three sections namely Section A, B, and C which they need to fulfill. Section A is intended to determine the degree of importance of each identified game aesthetics for perceived learning. The expert needs to choose in due diligence whether the listed game aesthetics are very important, somewhat important, and not important. Section B is to seek experts' justification upon their options as well as to seek their opinion on the operational definitions given to each game aesthetics. They must give a short answer to each attribute of game aesthetics. Section C is to gauge experts' recommendation on the proposed conceptual model along with additional comments or other recommendations. Experts must tick to the option either Yes or No All to indicate whether the terms used are easy to understand as well as whether relationships, connections and flows between attributes and perceived learning in conceptual model are logical. Data collection

took more than six weeks due to the experts' busy schedule. Data collected for the review is then analyzed using descriptive analysis and content analysis.

III. RESULTS AND DISCUSSION

A. Game Aesthetics and their Degree of Importance

Table 3 illustrates the results of the expert review on game aesthetics rating according to the frequency of responses. The consensus has been made by experts that image is the most important attribute in narrative games for perceived learning. This is because the process of interpreting image for perceived learning is not arbitrary. The process of interpreting the image is a reflection of an effort to build a simple structure that eventually makes sense to the player [41].

Text, visual perspective, color, graphic, and layout are rated very important, but there is also one expert opted for somewhat important. Most narrative games are using text in order to narrate the story. Meanwhile, in narrative games, the player(s) will achieve the educational goals through playing and reading the game story. Many previous studies related to learning in (written-text) narrative shows that text may contribute to emotion [42]; in connecting ideas as well as to differentiate an important and unimportant content [43]; and to provide instructions for reading and provide awareness during reading [44] prior to analyzing the holistic meaning of the content.

TABLE III
FREQUENCY OF RESPONSES ON GAME AESTHETICS FOR PERCEIVED LEARNING IN NARRATIVE GAMES

Game Aesthetics	Very Important	Somewhat Important	Not Important
Image	6	-	-
Text	5	1	-
Visual Perspective	5	1	-
Color	5	1	-
Graphic	5	1	-
Layout	5	1	-
Sound Effect	3	3	-
Voice	4	1	1
Music	3	2	1
Shape	3	2	1
Form	3	2	1
Texture	3	2	1

Visual perspective is where players can visually view the story with their own eyes, either through first-person perspective or third-person perspective. The first-person perspective is a view where the game world is experienced and perceived from the viewpoint of the controlled avatar. Meanwhile, third-person perspective provides an overview of a player who follows the main character of the game closely. Previous studies found that first-person perspective

can greatly increase players' arousal compared to a third-person game perspective [38].

Color may provide attraction from the user to play a game, thus enhance the user learning process from not relevant to relevant. It may also change the user perception and emotion [38]. However, color is probably not so important when it comes to player perceived learning.

Graphic can be in the form of image or text or both such as player life bar, game map, and even button. Graphic does not represent a picture of real objects such as an image of animals, flowers, and humans. However, it provides an abstract yet meaningful form. There is a lack of studies on the relationship between game aesthetics of graphic and learning. However, it is contributed to game UX. The graphic can be produced in the form of graphic image and vector. Graphic image is normally a detailed texture which is much easier to produce, but it might be heavier than vector form. Meanwhile, the vector is established in terms of scalability: the main function of zooming feature, where it is an additional advantage in interaction and providing usability of simulation and animation process.

Layout determines the placement of text and other visual attributes which later create a complete user interface. Good layout must at least consider these components, which also reflect well on narrative game development, such as item size on the screen must have a similar aspect ratio, consistency use of space, and intended reading sequence of displaying information must be synchronized [45].

Meanwhile, five elements which are music, voice, shape, form, and texture were rated as not important for perceived learning in games. It means that these five elements may or may not be used to convey learning in games. For example, E6 disagreed that music and voice are important for perceived learning. E6 claimed that "unless music or voice is part of the cultural content than music may not a very important feature". E6 also suggested that if music or voice is part of the cultural content, then it will become an important feature. However, the availability of music or voice in games must provide users the ability to turn it on or off.

The function of texture is not only to tell the look or feel of a surface on any substance, but also to provide realism. For example, the 3D realism could be achieved by either imitating the objects from the real world using shape and form or mapping real-world texture [26].

Above all, experts agreed that game aesthetics depend on the nature of the narrative game itself, such as its learning objective, learning content, learning outcome, target audience, game theme, genre, and how the game should be played.

On the other hand, both E1 and E2 agreed that attributes of game aesthetics are important in contributing to perceived learning because, as E2 claimed, "it can make player invested their time and effort into the game. However, this does not mean that perceived learning are included in their investment".

In brief, experts agree that game aesthetics can contribute towards perceived learning. However, the capability of game aesthetics in contributing perceived learning in narrative games depends on other factors. Recommendations from

experts on these factors are available in the subsequent section.

B. Recommendations

Based on experts' opinion, the biggest reason the player does not want to learn is that they do not have the illusion of choice, which are control and exploration. The control means players' ability in controlling their character. Meanwhile, exploration is the players' ability to explore things and trigger any event system in the game world. Although those two factors may not directly relate to game aesthetics and perceived learning, they may eventually enrich players' game experience.

During the interview, E3, E4, and E6 suggested further clarification must be stated in the operational definition of game aesthetics, especially on graphic, shape, and form as these terms are literally similar and somewhat overlapping to each other. To overcome such confusion, as suggested by E6, a visual example of each should have been accompanied with those operational definitions.

Apart from that, the operational definition of each game aesthetics must be added in the conceptual model. The list should then be simplified by dividing game aesthetics into two categories, Primary and Secondary game aesthetics. Primary includes text, image, and visual perspective which can be considered as basic needs of game aesthetics while Secondary is a combination of Primary game aesthetics which includes shape, form, and texture. These recommendations are considered in the revision of the conceptual model.

C. Revised Conceptual Model

Based on the feedback and recommendations from expert review, a revised conceptual model on the contributions of game aesthetics to perceived learning is developed as in Fig. 2.

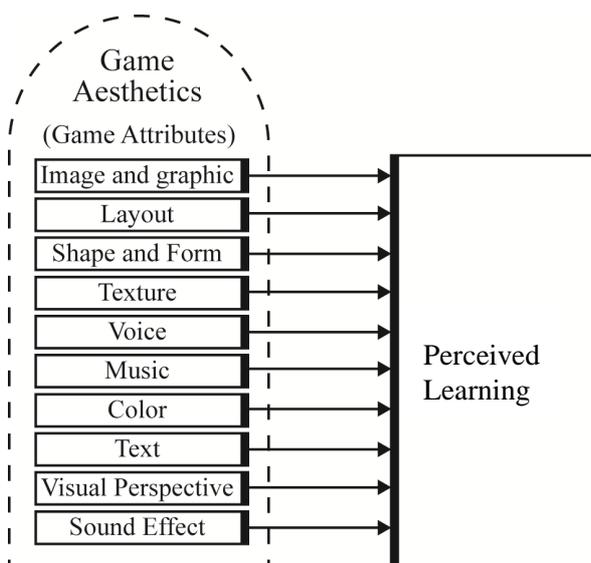


Fig. 3 Revised conceptual model of games aesthetics and perceived learning

Fig. 2 suggests that the terms image and graphic should be in the same cluster as they denote the visual space of the

game. Shape and form are also combined as the terms are interchangeably used, and they are likely to appear together. As similar to the findings of [15], it is difficult to measure whether each of game aesthetics is equally contributed to perceived learning in narrative games. This is probably due to various purposes and use contexts. Typical use contexts are types or genre of games, different target player, aesthetics, theme, and content. However, all experts agreed that the proposed conceptual model is sufficient to denote game aesthetics for perceived learning.

In addition, experts have also agreed that the contribution of the proposed conceptual model is understandable. However, one expert argues that there are other factors may also influence perceived learning. Those factors which were mentioned by both E2 and E4 are as follows.

- Player's motivation – It is what motivates the player to play the game, such as player's emotion, first impression, perception, past experience, et cetera.
- Learning content – It constitutes the content within the narrative games. This also includes the theme of the narrative games.
- Gameplay – It is the specific interaction style in which of the player interact with the narrative games, which also can be assumed as a part of game rules and game features.

Thus, the holistic conceptual model of game aesthetics towards perceived learning which considering these factors is illustrated as in Fig. 3.

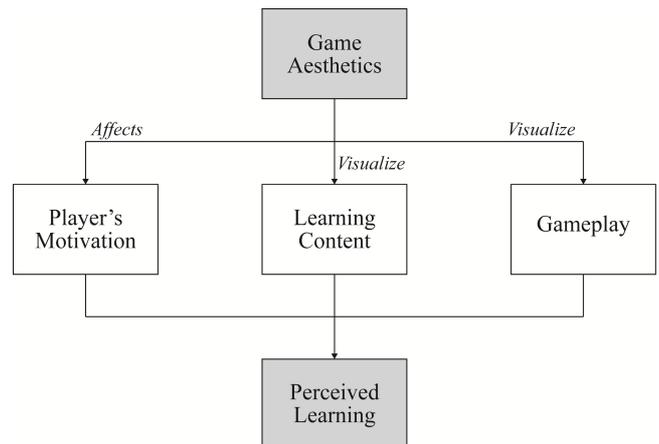


Fig. 4 Contributing factors in narrative games for perceived learning

Fig. 3 shall serve as the first layer of the conceptual model as it covers critical factors in narrative games for perceived learning. It shows that apart from game aesthetics which serve as the second layer of the conceptual model, there are other factors which would act as contributing factors to perceived learning. In other words, it is not possible to exclude other factors while evaluating game aesthetics for perceived learning. This supports similar work which reveals that these features are highly correlated in most games, so it is difficult to assign credit to particular features when they are implemented in conjunction with many other features [59]. Thus, as this study would focus on evaluating game aesthetics for perceived learning during later stages, it must consider developing the narrative game which would meet the expectation of players. The challenge is to be able to

meet requirements of the first layer while at the same time trying to focus on the second layer.

IV. CONCLUSION

This article has identified twelve game aesthetics which are related to players' perceived learning. It reported findings from an expert review of the proposed conceptual model of game aesthetics for perceived learning in narrative games. Experts were selected from a various background such as academicians from multimedia, computer science and interactive media; and also a game practitioner. Seven game aesthetics are found important to be included in narrative games for perceived learning while five are considered not important for perceived learning. Rearranging game aesthetics according to the expert review has resulted into two layers of a conceptual model: (i) the first layer which constitutes the overview of factors contributing towards perceived learning, and (ii) the second layer focuses on game aesthetics only.

Future work is to proceed with the design and development of the narrative game which incorporates game aesthetics and to further investigate the relationship between game aesthetics and perceived learning through the recruitment of game players. Typical game development methodology comprises of pre-production, production, and post-production [48], [49]. In addition, the game development may consider the adoption of Design Science Paradigm [46] to ensure meaningful games.

Above all, the outcome of this study would then benefit game developers as well as players. Game developers would have guidelines to make meaningful games. On the other hand, players may visualize learning content and overall gameplay which would increase players' motivation. The blend of these factors would eventually lead to perceived learning. Findings of this study may assist future developers in making meaningful games through the lenses of players.

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