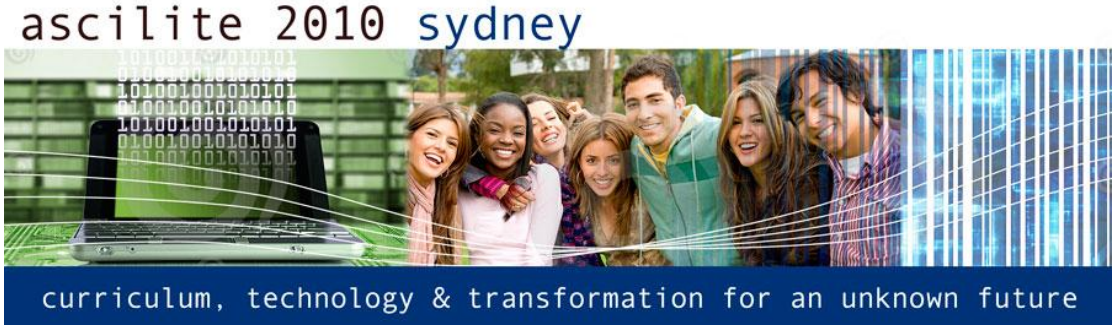

Children, engagement and enjoyment in digital narrative

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There have been many experiments being carried out in recent years by educators and designers in the digital narrative areas which engaged children progressively in the story environment in order to ensure that the experience is fun and enjoyable while maintaining the educational values (Robertson & Good, 2005). However, with the research and experiments in place, the demand is more focused on more engagement and enjoyment in children learning and digital playing environment. The intention of this study is to look into children's engagement and enjoyment in a 3D digital narrative environment and to find out their likes and dislikes based on their experience. This study focuses specifically on how children interact with the Quest Atlantis and seeks to identify participants' enjoyment level by applying the combination of Intrinsic Motivation Inventory (IMI) instrument (Ryan, 2006) and smileyometer (Read, MacFarlane, & Casey, 2002). Engagement was measured by time related factors as well as observation of each participant's facial expression. Data sources used in this study include questionnaire, interview content, observational notes, and time records while a mixed method of qualitative and quantitative approaches was employed for analyzing the data. Findings of this study showed that in general, there was a high level of enjoyment which demonstrates a fun environment in terms of interest, enjoyment, perceived competency and perceived choice. Perceived choice was reported positive with low degree of pressure and tension. The related time duration data also showed that there was a high-level of engagement among the participants of this study. Facial expression observed from the children supported the results from the time related analysis while interview responses provided some interesting points about their enjoyment features. In this paper, the implication for digital narrative design, engagement features, and IMI scale findings will be discussed.

Keywords: Digital narrative, engagement, enjoyment, children, interactivity

Introduction

Enjoyment and engagement are essential factors for playful learning activities (Malone, 1980; Montessori, 1965; Prensky, 2001, 2006) and they are both commonly discussed and evaluated in the study of interaction design with children (Druin, 2002). Fun and enjoyment support and strengthen learning and are reported helpful in children cognitive development (Clement, 1995; Veletsianos & Doering, 2010). Prensky (2001) indicated that a combination of different elements makes games more engaging. He stated that fun and enjoyment are the most important elements among many others. Likewise, it was also reported that the engagement of children in the learning activities are valuable in their learning (Read, MacFarlane, & Casey, 2002; Prensky, 2001).

Engagement and enjoyment in digital narrative

A narrative is composed of the unique sequence of events, mental states and occurrences that involves human beings as characters or actors (Bruner, 1990). It can be "real" or "imaginary" (Lambert, 2002, p. 11) and is used as a means of communication, often relating to our humanity in a story form. According to the story types, the combination of digital images, video, music, text, and voice to create stories are labeled as digital narrative. These types of narratives encompass the different kinds of personal stories that are important to us.

In several studies (Bers & Cassell, 1999; Lachs & William, 1998; Weis, Benmayor, O'Leary, & Eynon, 2002), it was found that children would be more engaged in the narrative process of telling stories when technology is used. In such case, they would also experience social benefits like increasing presentation skills, group dynamics and communication as well as building self-esteem through learning new skills. However, further studies found that there is still demand for study on children engagement and enjoyment in digital narratives (Kafai, 2001; Sedig, 2008).

Children's enjoyment and engagement

Several studies recommended that extending children's perceived enjoyment will enhance their intrinsic motivation and increases their participation in activities (Weiss,1987). Others indicated that enjoyment is positively related to a desire to remain engaged and participative (Scanlan, Stein, & Ravizza, 1989). The effort to increase intrinsic motivation has been widely accepted as a desirable educational practice because it will subsequently lead to long-term motivation, and continued participation (Ryan & Deci, 2000).

Ryan and Deci (2000) developed a model of enjoyment based on the self-determination theory (SDT), relating enjoyment to intrinsic motivation which signified a principal source of enjoyment. SDT investigates the people's inherent growth tendencies and innate psychological desires as basis for their self-motivation and personality integration, in addition to the conditions that encourage positive processes.

Ryan (2006) proposed the development of an intrinsic motivational inventory (IMI) tool based on the SDT theory. The revised IMI instrument employed in this study includes four subscales, which assesses participants' interest and enjoyment, perceived competence, felt pressure and tension, and perceived choice while performing a given activity. The interest and enjoyment subscales were considered as self-reported measure of intrinsic motivation. This approach has been utilized in other related studies on children engagement and enjoyment (Xie, Antle, & Motamedi, 2008) and could be an effective measure for assessing children's enjoyment of digital narratives.

At the basic level of computer based learning environment, Jones (1998, p. 205) described engagement as "the notion that the program makes the learner want to be there". This simple explanation illustrates an effective definition of engagement for learning and reflected its significances. It was found that learners with the mentality to "want to be there" would more likely be successful at building new knowledge during the activity than those without this mentality (Galarneau, 2005).

Method and approach

Research design and participants

A combination of descriptive and exploratory approach was employed to conduct this study. A pilot study was first utilized to select the most suitable digital narrative among Neverwinter Nights (2002), Samorost (2005) and Quest Atlantis. Three children aged from 8 to 10 years old were involved in the pilot test. Subjects' performance, feedback on the systems, wording of the questions and average completion time were all examined. The technical performance of the systems was also tested. The reported participants' engagement and enjoyment level in QA was significantly higher than the other two digital narratives. QA was consequently chosen for the main experiment and the issues that were faced in the pilot study were tuned in to the design of the main experiment.

Main study was designed to facilitate the collection of several forms of quantitative and qualitative data. Instruments used to collect required data in this research were questionnaires, interviews and observation of the participants. A total of 21 primary school Iranian children aged 8 to 12 years old participated in the main experiment. They were selected based on their accessibility and availability within the study time period as well as their parents' consent to the purpose of the study. Participants' Socioeconomic status (SES) varied from high to low SES but their native language was the same.

Quest Atlantis

Quest Atlantis (QA) is a unique digital narrative tool because it brings together the constructs of learning, gaming, play, situativity theory, and design research (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005). It is a 3D multiuser environment (MUVE) designed to immerse children in educational tasks. QA is designed as an immersive context which supports dramatic play and real-world inquiry. In the designed experience in QA, individuals are first-person players interacting in rich narratives. Children interacting with the worlds in QA were found to experienced learning, engagement, and fun. (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005; Gresalfi, Barab, Siyahhan, & Christensen, 2009).

QA is seen as being at the intersection of education, entertainment, and social commitment. However, instead of conceptualizing QA as just computer software or a computer game, it would be more accurate to describe it as a virtual environment designed to support an online community as well as multiple face-to-face community. The QA story line and its virtual worlds make it an enriched digital narrative (Barab, Dodge, Tuzun, et al., 2007). On top of that, the assigned educational tasks may vary based on the participants' level of education and the offered curriculum. QA utilizes a computer-generated, online 3D world that is accessible to multiple users in real time. The 3D world gives students the freedom to choose either first or third person view. Users can interact with each other as well as game characters using their avatars and the real time chat function. They can also create a virtual personality by selecting their own character role with individualized hair and skin color. In this research participants worked on a quest to determine who is the winner of the mayor election in Ander city (Math World). They had to learn basic statistics and interact with the game avatars to be able to make the right decision with enough evidences.

Instruments and settings

This research applied the usability evaluation guideline as suggested by Hanna et al.(1999). The smileyometer (Read et al., 2002) was the instrument used to measure enjoyment and fun. This tool was designed based on a 1 to 5 Likert scale, where pictorial representations of different kinds of happy faces were used to depict the diverse level of satisfaction as shown in Figure 1. This study also applied the four subscales of Intrinsic Motivation Inventory (IMI) (Ryan, 2006). In the questionnaire, there were seven questions related to the Interest and Enjoyment subscale, five questions related to the Perceived Competence subscales, five questions related to the Perceived Choice subscale, and five questions related to the Pressure and Tension subscale. The validities of these four subscales have been established across a variety of tasks, conditions and settings (Ryan, 2006).

Figure 1: Smileyometer Scale

Hanna, Risden, and Alexander (1997) recommended considering children's observed facial expressions as engagement indicators rather than their answers to questionnaires. Read, MacFarlane, and Casey (2002) suggested a similar method of observation to measure the participants engagement. However, when the study is related to children, it is hard to determine their real engagement level solely through observation on their behavioral or facial expression because they are too subjective and hence make this validation difficult. This study employed both time related data (Xie, et al., 2008) and facial expression observations (Hanna, et al., 1997) to measure the participants' engagement level. The first completion time, off-task time and subsequent play time that each participant spent during their

interaction with QA were measured to investigate the engagement level with the assumption that the more time they spend on the assigned task, the more engaged they are. Apart from that, facial expressions such as yawning, being distracted, etc. were considered as other criteria to measure the engagement.

A pre-questionnaire was designed to gather the participants' demographic information, their preference for games and their experience with computers. A post-questionnaire data was collected to analyze the subjects' enjoyment level. A time-related data was also collected to evaluate the participants' engagement level. The post-questionnaire, based on a modified version of the four subscales of the IMI (Ryan, 2006), was given to the participants after the play session. A five-point rating scale based on the Smileyometer was employed as a substitute of the seven-point Likert scale in the IMI questionnaires. IMI questionnaires have been validated for collecting children's subjective ratings (Read et al., 2002; Xie, et al., 2008). The 22 item IMI scale used in this study showed an acceptable reliability co-efficient of alpha ($\alpha = 0.82$).

Other than the subjective observation of facial expression and behavior engagement of the participants, measuring their engagement level was mainly based on the time they spent on the tasks. An in-depth interview session was also conducted and recorded in order to gather more data about their experience in the digital environment as well as their fun and enjoyment level throughout their work with the selected digital narrative.

Data collection

Data was collected at the Imam Khomeini Iranian Primary School (Marefat) in Malaysia during a one-week period in fall 2009. The entire duration of every session for each subject was between 35-40 minutes. At the beginning of each session, the participants were given a brief orientation. Each participant was given a chance to briefly introduce him or herself by name. Then, they proceeded with a verbally administered pre-questionnaire. After that, participants were given an explanation on task implementation and were then asked to complete the quest. At the start of the play sessions, the facilitators would demonstrate how to use the mouse and navigation keys to move the character, as well as how to make it run and move around. Participants were allowed to ask questions before starting the activities and were also given time to practice and explore on their own. They were then instructed to spend a total of 20 minutes to work on their quest where they could stop playing at any time. Once the participants gave the indication that they are ready, the facilitators would then leave them to work on the quest on their own and would start recording their time and observing their process. Figure 2 shows two participants working on the given quests. During the entire allocated period, the time recorded were based on: time spent exploring and navigating through the artifact to figure out the problem in their selected story, subsequent playtime (if they spend more time repeating their work) and off-task time (if they left for other activities). The facilitators were always on stand-by and were available in case the participants needed to ask questions while dealing with the digital narrative. When the twenty-minute play session ended, participants were asked to complete a post-questionnaire, which was verbally administered by the facilitators. The session ended with a closing recorded interview in which participants were asked about their impressions and preferences over the quest and what they liked or disliked about it.

Figure 2: Participants playing with the Quest Atlantis game

Results and analysis

Demographic analysis of collected data indicated that among the 21 primary school children who participated in the study, 57% of them were boys and 43% were girls but all of them were attending the same school. The students' age was between 8 to 12 years old among which 66.7% were 9 to 10 years old. The pre-questionnaire showed that 100% of all participants had played a computer game before, and all of them knew how to use the mouse and navigation keys. 90.5% of the participants indicated they really like to play computer games. 9.5% of children used computers at least a few times a week at their homes or at school, 9.5% used computers at least once a month and 81% indicated that they used the computers every day. None of the children had played the digital narrative used in this study before.

Enjoyment and IMI results

Descriptive analysis of these four subscales is presented in Table 1.

Table 1: Descriptive analysis of four IMI subscale

IMI Subscale	N	Mean	Median	S.D.	S.Error
Interest & Enjoyment	21	3.94	4.14	0.405	0.088
Perceive Competence	21	4.48	4.80	0.538	0.117
Perceived Choice	21	4.54	4.80	0.486	0.106
Pressure & Tension	21	1.47	1.40	0.421	0.092

Participants' responses to the four IMI scale was reported high as depicted in Table 2 below.

Table 2: Respondent IMI subscale results (R = Reverse)

Interest and enjoyment statements	1	2	3	4	5	Mean	S.D
While I was working on this task I was thinking about how much I enjoyed it.	0 (0%)	0 (0%)	0 (0%)	6 (28.6%)	15 (71.4%)	4.71	0.463
I found my playing of this quest to be very interesting.	0 (0%)	0 (0%)	0 (4.8%)	8 (38.1%)	12 (57.1%)	4.52	0.602
Doing this quest was fun.	0 (0%)	0 (0%)	1 (4.8%)	6 (28.6%)	14 (66.7%)	4.62	0.590
I enjoyed doing this quest very much.	0 (0%)	0 (0%)	4 (19%)	3 (14.3%)	14 (66.7%)	4.48	0.814
I thought the quest was very boring. (R)	0 (0%)	0 (0%)	2 (9.5%)	7 (33.3%)	12 (57.1%)	4.48	0.680
I thought doing this quest was very interesting.	0 (0%)	0 (0%)	1 (4.8%)	6 (28.6%)	14 (66.7%)	4.62	0.590
I would describe this quest as very enjoyable.	0 (0%)	0 (0%)	2 (9.5%)	4 (19%)	15 (71.4%)	4.62	0.669
Perceived competence statements							
I think I am pretty good at solving this quest.	0 (0%)	0 (0%)	1 (4.8%)	8 (38.1%)	12 (57.1%)	4.52	0.602
I think I did pretty well at this quest, compared to others.	0 (0%)	0 (0%)	1 (4.8%)	10 (47.6%)	10 (47.6%)	4.43	0.598
I am satisfied with my performance at this quest.	1 (4.8%)	1 (4.8%)	1 (4.8%)	3 (14.3%)	15 (71.4%)	4.43	1.121
I felt pretty skilled at the game.	0 (0%)	1 (4.8%)	1 (4.8%)	7 (33.3%)	12 (57.1%)	4.43	0.811
After working at this quest for awhile, I felt pretty competent.	0 (0%)	0 (0%)	1 (4.8%)	7 (33.3%)	12 (61.9%)	4.57	0.598
Perceived choice statements							
I felt that it was my choice to do this quest.	0 (0%)	0 (0%)	0 (0%)	4 (26.7%)	13 (73.3%)	4.43	0.811

I didn't really have a choice about doing the quest.(R)	0 (0%)	0 (0%)	0 (0%)	6 (28.6%)	15 (71.4%)	4.71	0.463
I felt like I was doing what I wanted to do while I was working on the quest.	0 (4.8%)	0 (0%)	2 (9.5%)	6 (28.6%)	13 (61.9%)	4.52	0.680
I felt like I had to do this quest.(R)	0 (0%)	0 (4.8%)	2 (9.5%)	6 (28.6%)	13 (61.9%)	4.52	0.680
I did this quest because I had no choice.(R)	0 (0%)	0 (0%)	0 (4.8%)	10 (47.6%)	11 (52.4%)	4.52	0.512
Pressure and tension statements							
I did not feel at all nervous about doing this game.(R)	15 (71.4%)	4 (19%)	1 (4.8%)	0 (19%)	1 (4.8%)	1.48	0.981
I felt tense while doing the quest.	15 (71.4%)	6 (28.6%)	0 (0%)	0 (0%)	0 (0%)	1.29	0.463
I felt relaxed while doing this quest. (R)	11 (52.4%)	8 (38.1%)	1 (4.8%)	1 (4.8%)	0 (0%)	1.62	0.805
I was anxious while solving this quest.	12 (57.1%)	7 (33.3%)	2 (9.5%)	0 (0%)	0 (0%)	1.52	0.680
I felt pressured while doing this quest.	14 (66.7%)	6 (28.6%)	1 (4.8%)	0 (0%)	0 (0%)	1.43	0.764

Engagement results

Four time-related measures which are total playtime, time for first completion, off-task time and subsequent playtime were used to measure engagement. The time-log data based on the 21 participants showed that on average, the total time for first completion was 10.45 minutes. However, all players except one continued playing for the entire 20 minutes allocated to them. One participant stopped playing 30 seconds before the time was up. The mean number of repeating the game by participants was 1.8. Figure 3 graphically depicts the relative amount of time that subjects spent on the first and subsequent tasks across the 20 minutes given.

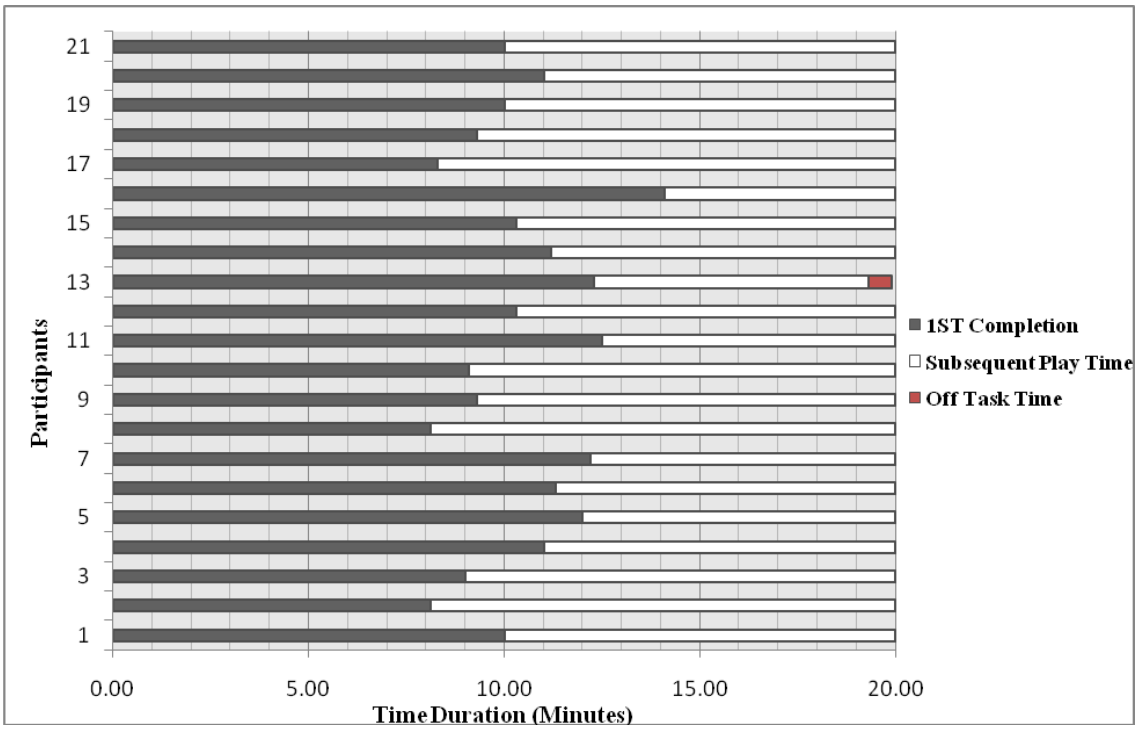

Figure 3: Participants' engagement result

Qualitative results

Hanna et al. (1999) suggested that in children usability testing, observational notes can be recorded to identify any sign of boredom resulting from children's interaction with the tested digital narrative. The observation results did not indicate any signs of yawns or frowns in this study. This study showed that 100% of the users continued to play even after they completed their task for the first time. All the participants completed their task at least once, while 81% completed the task more than once. Participants were eager to talk and interact with the game characters. Many of the participants commented that the quests were fun and enjoyable while they also liked the illustration style and the 3D environment of the examined digital narrative. About 50% of them commented that there was nothing that they disliked about the quest. They found the game challenging but they liked it because they were able to complete it within the allocated time. Several participants commented that they were concerned about the time they had spent and how much time were left to solve the quest during the play. Interview results which demonstrate the participants' likes and dislikes are presented in Table 3.

Table 3: Participants' feedback on their experience with Quest Atlantis

Likes	Talking to game characters, Being able to explore the environment, Having control over my character and environment, 3D design of the characters, Ability to edit their character's appearance, Music and pictures, Being challenging, Helping people solve their problems, game sounds, water splash sound when swimming, Movement of everything in the environment, Being able to create the story, Being able to hang out with new people, Being able to work with camera, Being able to virtually dance, jump, Swim and run
Dislikes	The need for translation, The tasks being complicated, Time limitation, Not having a very wide choice for Character's cloth, Only having the option of reading and typing the conversations (with the characters) instead of speaking them, Having too many icons to click, Lack of action theme, preferring a more action game and "The lion didn't bite me"

Discussion and conclusion

The sample population formed a relatively homogeneous group in terms of demographic variables including age, educational level, native language, user's competence on mouse control, and computer game experience. The perceived choice result upholds some past research findings that if children are allowed to participate in freely chosen activities for the sake of participating in the activity, their perceived enjoyment will increase. However, having the choice opportunity does not necessarily constitute motivational enhancement (Mandigo et al., 2000). Design researchers - when designing a study for children - should facilitate appropriate scenarios in which choice can be optimized.

Subjects commented that even though the quest was challenging they still enjoyed it because they could finish the task within the allocated time. This finding is in line with the previous researches arguing that when children are optimally challenged while participating in a task, they are more likely to experience enjoyment and be interested in the activity (Danner & Lonky, 1981; Salen & Zimmerman, 2003). Such challenging activities will enhance children competence and increases their intrinsic motivation (Mandigo et al., 2000). Hence understanding the relative importance of game challenge and interactivity is worthwhile; as most researchers agree that an enjoyable game, balances challenge and the possibility of winning (Salen & Zimmerman, 2003).

Observational results confirmed the findings from several research studies, that more effective learning can be achieved when children determine what is "going on in their own heads" (Bruner, 1973) during their individual experience. Danner and Lonky (1981) indicated that when children are interested in a specific activity; they are willing to spend more time on the task. This confirmed the viewpoints of most children's playful learning activities. But according to a study by Dix (2003), this could be separated from the fun factor in some cases. However, this research divided the analysis between enjoyment and engagement. The dynamic interrelationship between enjoyment and engagement would definitely be worth investigating in future studies. It was also found that children preferred getting help from the facilitator and game characters while working on quests. These features can reduce the task challenges which on the other hand are sometimes required in learning to be effective. For children this may mean better support for their tasks, but hopefully not at the expense of losing the focus of learning.

The other important finding from this study is related to the difference of repeated play times on the tasks. The mean number of the frequency of repeating a task was 1.8 which showed that most of the participants were eager to complete the task more than once. This finding seems to suggest that interaction with the tasks might benefit young users in achieving problem solving skills by affecting their level of engagement which is in line with results of Veletsianos and Doering (2010) study.

Most of the participants (85.7%) expressed their satisfaction in the participatory form of the examined digital narrative. For example, one of them indicated that: "*I like the way everybody can talk to me in the game and I'm a member of their city now. I'm the one who makes the decision. I can save their world with my action.*" These findings follow Murray's (1997) suggestions about properties of new media which are procedural and participatory. It also supports the sense of agency as well as the encyclopedic properties of the digital narrative.

The virtual environment of the digital narrative and the richness of the media is another favorable interesting factor which was mentioned by many participants. These findings are in line with McMillan's (2002) recommendations about participant's preferences on the use of senses in the artifacts which increases their engagement and enjoyment. However, designers must be cautious not to overuse this element.

In summary, this study puts an important step forward by applying modern digital narrative and virtual learning environments to evaluate school-aged children's enjoyment and engagement on a playful learning task. This study can contribute significantly to the existing body of digital narrative design knowledge for children. However, there are still many aspects and factors that can be discussed and further explored. The researchers hope that this study can guide the development of future interactive digital narrative artifacts for children in an optimal way. Multimedia developers also can create more practical, valuable and innovative narrative systems for children in the future.

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