Weighting Play and Learning in Interaction

Andrea Conci
Dept. of Information Engineering And Computer Science
University of Trento, Italy
Via Sommarive, 5 38123 Povo (TN)
andrea.conci.1@unitn.it

Cristina Core
Dept. of Information Engineering And Computer Science
University of Trento, Italy
Via Sommarive, 5 38123 Povo (TN)
cristina.core@unitn.it

Fabio Morreale
Dept. of Information Engineering And Computer Science
University of Trento, Italy
Via Sommarive, 5 38123 Povo (TN)
morreale@disi.unitn.it

Categories and Subject Descriptors
D.5.2 [**User Interfaces**]: Evaluation/Methodology.

General Terms
Design, Human Factors.

Keywords
Play, learning, interactive systems, interaction design, game design.

1. INTRODUCTION
Pedagogical theories suggest that *learn* and *play* often happen to overlap [9]. When approaching a new game, one needs to go through a learning process, which is itself part of the enjoyment [3]. On the other way around, should the objective of interaction be learning, ludic and playful activities are needed to keep the user engaged [1]. In this paper we reflect upon our experience with the design of interactive systems where play and learning interweave. Specifically, we propose four case studies, equally distributed in the computer game and in the musical domains:

1. *OHR*, an enigma-based computer game operated via tangible interaction;
2. *Skies of Manawak*, a cognitive training computer game;
3. *The Music Room*, an interactive installation for music composition;
4. *Kids orchestra*, an interactive system for educating preschool children to music.

Each case study is briefly introduced and the implications for the topic of the paper are discussed.

CHItaly'15, September 28–30, 2015, Rome, Italy.

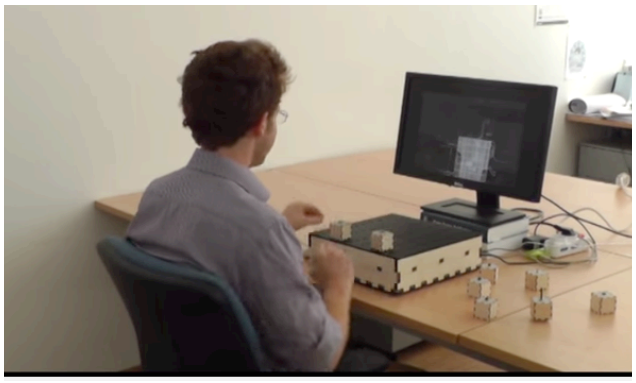
2. OHR


Figure 1. User testing OHR puzzle game.

OHR[1] (fig. 1) is a platform and puzzle computer game designed to explore the possible benefits of using tangible user interfaces [4]. The game narrative follows the adventure of Spark, the main character, who encounters a series of riddles that need to be solved to proceed in the game. In order to solve riddles the player needs to complete simple electronic circuits using the Radiant[2], a tangible user interface that was specifically designed for this game[1]. An experimental study, that involved 29 participants (20 males and 9 females) aged between 20 and 47, confirmed that players tend to prefer tangible over touch-screen interaction [5]. The data, which were collected from questionnaires, short semi-structured interviews, and video recordings, showed that tangible interaction positively affects the user experience. The favourable reaction of the players was partially due to the possibility of solving the riddles using multiple solutions. As a consequence, learning all the electronic concepts that are included in the game is not necessary. When progressing in the game, the player indeed acquires new knowledge at each new solved riddle but this is not mandatory to enjoy the game.

3. SKIES OF MANAWAK

[1] http://youtu.be/0Gh0tuTHAXk

Figure 2. Skies of Manawak participatory design second workshop.

Skies of Manawak is an adventure computer game for training cognitive processes of children between 8 and 12 years old. This project is grounded on existing research on exercises for cognitive training that are commonly used to help people overcome learning disabilities. The whole game follows a cognitive training learning plan by integrating the characteristics and mechanics of a number of exercises, which are based on cognitive training requirements. The gameplay is a continuous game experience in which the exercises are embedded into the story thus they are not plainly manifested. These choices allow children to experience *Skies of Manawak* as an actual game rather than a therapeutic session. The design process followed a participatory design approach in which approximately 60 children and two cognitive scientists were directly involved during several workshop sessions. The children respectively participated to three different laboratories: the first laboratory comprised 26 children aged between 9 and 10 years old, the second laboratory comprised 8 children aged between 8 and 10 years old (fig. 2), the third laboratory comprised 20 children aged between 11 and 13 years old. The children contributed to the definition of the ludic characteristics, the aesthetics and the narrative of the game: they were consulted about their aesthetic preferences and were asked to envision appealing characteristics of the game they would like to play. The cognitive scientists contributed to the design of the exercises and were directly involved in the decision-making process shaping the design of the game: their direct involvement made sure to balance the achievement of neurocognitive goals with a pleasant user experience.

4. THE MUSIC ROOM

Figure 3. Two children inside the music room.

The Music Room[2] (fig. 3) is an interactive installation designed to offer the experience of music making to a large population of visitors, independently of their musical competence [7]. Visitors in pairs actively compose a musical score by moving throughout a room. The music is automatically generated by an algorithmic composer [6] and users can control the emotional character of music following an interaction paradigm based on the metaphor of intimacy: the more proximal the visitors are, the more positive the music; the faster they move, the louder and faster the music. *The Music Room* was evaluated using a triangulation of different research methodologies, including field observations, video and log-data analysis, online questionnaires, and interviews. The results highlighted a strong positive engagement with the installation [8]: people immersed in the experience and deeply enjoyed it. Their engagement arose from a full range of different playful behaviour (e.g. dancing, jumping, pirouetting, and enacting) and intimate behaviours (e.g. hugging, kissing, and mimicking declarations of love), which evidenced that visitors appropriated the installation giving it their personal interpretation. This appropriation was favoured by the lack of clear objectives of the interaction. Also, independently of the goals that the visitors set themselves, the learning activity for this installation proved being functional to let them fully plunge into the playful experience.

5. KIDS ORCHESTRA

Figure 4. Children performing inside the adapted version of the music room.

A new version of *The Music Room* was designed to sensitise preschool children (3 to 6 years old) to music creativity (fig. 4). The requirements for this new version of the installation were defined through a series of focus groups and meetings with pedagogues, music experts, teachers, and parents. Furthermore, a tagesmutter organization specialized in *Gordon Music Learning Theory* [2] was continuously involved in the design process. According to the collected requirements, a low fidelity video-prototype was developed and evaluated with three preschool children - two females (5 and 7 years old) and one male (5 years old). The final version of the system is composed of three sequential steps, which are meant to gradually involve the children in the learning process. In the first step, the children are guided by a researcher to learn how to understand the differences among three couples of parameters: legato vs. staccato, forte vs. piano, and fast vs. slow. Once acquainted with these couples of

[2]http://youtu.be/OSEvfjVivlw

parameters, in the second step, the children learn to manipulate these sounds by means of body movements. In the third step, a narrative element is introduced: each child plays a role of a story and moves accordingly to recreate a melody that fits the story. In *Kids Orchestra* the explicit goal is to educate children on music creation, but this learning task is achieved by playful and social activities.

6. DISCUSSION

These case studies allowed us to identify how learning and play interact when games are designed with a focus on learning or play (Table I). *OHR* and *The Music Room* are focused on providing an engaging experience to their users, and this is partially accomplished due to the lack of predefined learning paths, which fosters users to identify their own meanings. Here, the learning process is characterized by "trial and error" explorations, and previous knowledge in music or electronic is not necessary. In these cases, players can learn game mechanics and metaphors (example: switch button to turn on and off something), and pursue active listening of music. On the contrary, in *Kids orchestra* and *Skies of Manawak* the learning path is incremental and the interaction is driven by learning goals. In these cases, the players have to follow a predetermined learning schema.

Table I. Learning and play in *OHR*, *The music room*, *Skies of Manawak*, *Kids orchestra* case studies.

Hedonic goals	*OHR* **Main objective:** UX (playfulness) **Minor objective:** learn electrical concepts	*The music room* **Main objective:** UX (engagement) **Minor objective:** learn musical concepts
Learning goals	*Skies of Manawak* **Main objective:** cognitive training **Minor objective:** UX (playfulness)	*Kids Orchestra* **Main objective:** learn musical concepts **Minor objective:** UX (playfulness)

Figure 1 highlights the amount of knowledge a user needs to accumulate through learning. In figure 1a (*Skies of Manawak* and *Kids orchestra*) the user needs to go through learning processes such that he reaches the required amount of knowledge to advance in the games. In the other cases (*The Music Room* and *OHR*), fig. 1b, the required level of knowledge is lower: the player does not need to go through learning processes and acquire new knowledge.

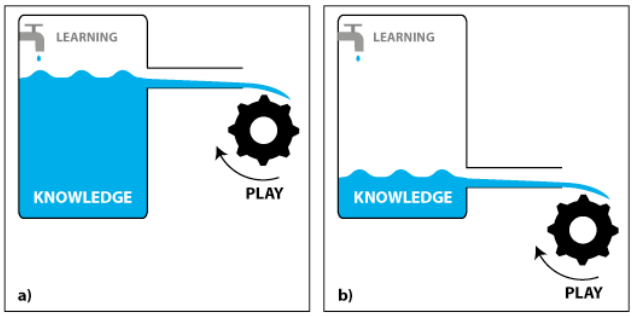


Figure 3a and 1b: the model on the left schematises learning and play processes involvement in Skies of Manawak and Kids Orchestra; the model on the right schematise learning and play processes involvement in OHR and The music room case studies.

In both cases, a level of knowledge which is higher than the minimum required can help the user in better controlling the systems. We reflect that an open-ended interaction seems more suitable when designing playful and engaging systems, while task-oriented approaches seem to fit better learning oriented systems.

7. REFERENCES

[1] Csikszentmihalyi, M. (1991). Flow: The psychology of optimal experience (Vol. 41). New York: Harper Perennial.

[2] Gordon, E. (2003). A music learning theory for newborn and young children: Gia Publications.

[3] Jackson, D. W., & Angelino, H. R. (1974). Play as learning. Theory into Practice, 13(4), 317-323.

[4] Menestrina, Z., Bianchi, M., Siesser, A., Masu, R., & Conci, A. (2014, October). OHR. In Proceedings of the first ACM SIGCHI annual symposium on Computer-human interaction in play (pp. 355-358). ACM.

[5] Menestrina, Z., Conci, A., Siesser, A., Masu, R., Bianchi, M., De Angeli, A. (2016). Tangible and Graphical Game Interfaces: An Experimental Comparison, book chapter accepted for publication."Games User Research: A Case Study Approach", CRC Press/Taylor & Francis.

[6] Morreale, F., Masu, R., & De Angeli, A. (2013). Robin: an algorithmic composer for interactive scenarios. In Proceedings of Sound and Music Computing, SMC, 10th.

[7] Morreale, F., De Angeli, A., Masu, R., Rota, P., & Conci, N. (2014). Collaborative creativity: The Music Room. Personal and Ubiquitous Computing, 18(5), 1187-1199.

[8] Morreale, F., De Angeli, A. (2015). Evaluating Visitor Experiences with Interactive Art. In Proceedings of CHItaly 2015.

[9] Schell, J. (2014). The Art of Game Design: A book of lenses. CRC Press.