Playfulness and Openness: Reflections on the Design of Learning Technologies

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Abstract. What does it mean to design a playful learning tool? What is needed for a learning tool to be perceived by potential users as playful? These questions emerged reflecting on a Participatory Design process aimed at enhancing museum-learning practice from the perspective of primary school children. Different forms of emergent interactions were evident, both during museum visits and while testing a low-fidelity prototype. Deeper reflections on the meaning of enhancing learning through play from a user's individual perspective was assessed. In this respect, openness and multimodality were evaluated intertwined with design of playful learning tools to enrich non-formal learning and to allow support for individual needs.

Keywords: non-formal learning, playfulness, open-ended design, multimodality, emergent interaction, learning technologies.

1 Introduction

Museums are currently facing a challenging innovation process, including a re-shaping of their role as learning practices. Related work has dealt with this challenge from different angles; from an institutional perspective [1] or from the visitors' perspective considering new design solutions to enhance museum as learning practices [2]. According to our study, mono-directional forms of communication of historical processes during guided tours still appear unexplored. These forms of transferring knowledge result in static interactions between children and adults, and to superficial understanding of abstract historical concepts. Primary school children (age 10) experience museums as an "adults-mediated" activity, in which adults are in control and where children and museum guides do not talk much to each other. The children are often depicted as a pleasant audience, as their behaviour is generally polite, somehow influenced by their school training. Therefore, a Participatory Design (PD) study has been conducted with a group of children (age 10), in order to investigate how museum-learning practice could be enhanced from the children's perspective.

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The aim of the PD process was to develop a new playful learning tool, involving a group of 10 years old children as co-designers. Observations conducted during visits in the museum and co-design workshops revealed how children may have different individual needs, in relation to play and to experiencing the museum. Some children tend to prefer more social situations, in which they can talk, laugh and eventually be physically active together with others. Others may choose quiet and solitary experiences, to enjoy by themselves or just together with a few friends.

Based on these findings, a reflection was conducted in relation to what makes a learning tool playful and engaging, from the individual perspective of the learners and their individual needs. It is argued that playfulness should be intended as an intertwining of openness and multimodality, to facilitate different user experiences.

2 Related Work

The field of technologies related to learning and more specifically to the museum context has become incredibly wide. However, some main tendencies can be identified and considered for inspirations when it comes to designing new technologies for museums. The first technological solutions for museums were interactive kiosks showing video audio media about the museum exhibition [2].

Generally, technologies proposed for museum contexts focus on providing visitors with interactive alternative access to information. The aim of this research is to provide visitors with an exciting museum experience, to allow them to learn more about the exhibition, to have fun during their visit, and to motivate them to come again. Many researchers have specifically focused on young audiences (children and teenagers), proposing computer-augmented installations to make their museum experience more fun [3, 4, 5]. Some of these works simply intend to leverage on young people's interest for computer games [4, 5], while others refer more or less explicitly to Prensky's theory about digital natives [3]. According to Prensky [6] young people have been deeply affected by continuous exposure to digital media since a very young age, and accordingly, developed different preferences regarding learning and fun. For example, they prefer a learning-by-doing approach to reading and education, and "random access" to information instead of being guided step by step by adults [6]. Based on these considerations, Prensky proposes a "computer-based" approach to learning, in which young learners may acquire knowledge by playing a computer game [6].

Researchers active in the field of developing technologies generally follow the same approach. Studies such as [3] explicitly refer to Prensky as a source of inspiration in their attempt to bridge teenagers' everyday interests with museums to elicit in them a motivation to visit museums. In order to achieve their goal, Dindler and his colleagues ran a series of participatory workshops which allowed them to find out that in some cases teenagers were not interest to the past itself, but it could be made more interesting by constructing parallels between the past and their own everyday [3]. Other researchers in the same field do not explicitly refer to such theories, but still seem to adopt digital technologies to add elements of fun and play. In the case of the Life Tree interactive table, at the Museum of Natural History in Berlin the researchers intended to provide a more engaging access to information about the different species displayed in the museum [4]. The result is an interactive multi-touch surface; a series of popping-up

bubbles allows the users to navigate among different information. Tests conducted in the museum revealed that people developed playful gesture interactions, as they experimented how to touch the surface, for instance by tapping with one or more fingers simultaneously, or even with flat hands [4].

A study conducted by Hall and Bannon [5] about ubiquitous computing within museum space, refers specifically to primary school children and proposes to hide technology to focus on interaction in itself. A new setting was created for the Hunt Museum in Limerick, through a participatory process and tested during an exhibition. An interactive environment was proposed in which children could interact with RFID-augmented copies of the collection items. In this way, they could leave their feedback about the exhibition by talking to a phone and listen to others' activating a radio [5]. Finally, systems such as Kurio introduce play more explicitly, intended as a way to support learning by doing and social interaction [5]. Kurio was designed to enrich families' museum tours, introducing a form of shared-problem solving activity. Families are supposed to pretend they are time travelers, stranded in a different time, and gather information about the current time to be able to come back [7]. Interestingly, this system seems to transform museum tour into a sort of apprenticeship, in which children and adults cooperate together in shared problem solving activities [8].

These works are inspiring and provide new directions to museum innovation. However, a gap was identified in the fact that such works do not discuss guided tours, which are the most common modality for children when they visit museums. Moreover, such approaches, as well as the installations provided by museums, aim at providing an immersive sensorial impressions of the past from a synchronic perspective, neglecting somehow the diachronic perspective, dealing with historical processes. Hence, issues related to guided tours practice and the diachronic perspective constitute the main focus of this study.

3 Methods and Background

The context for our research is *Ribes Vikinger*, the Viking Museum in Ribe, in Southwestern Jutland, Denmark. This museum was chosen because it has a mission in spreading knowledge related to local history to a wide audience, moreover, it displays a small but precious collection of artifacts, dated more or less from Prehistory to the Renaissance, with a special emphasis to Viking and Middle Ages.

In order to gain more meaningful and child-centred knowledge, a Participatory Design process was organized with an after school institution, involving a group of 25 children (10 years of age), in designing a playful learning tool for museums. Several activities have been conducted within the PD process; the children were interviewed about their previous museum experience and asked to carry out a few tasks, such as writing the name of the last museum they visited and detail an adjective to describe it. Furthermore, they should comment on pictures showing artifacts displayed in Ribe. The children were also invited to visit the museum; data collected during this visit were analyzed qualitatively and compared with data from observations conducted during a guided tour with a group of pupils (age 10). Afterwards the children participated in four co-design workshops, in which they had to design and test low-fidelity prototypes of the game. During such workshops and museum visits, individual

needs were identified in relation to play and museum experience, which constituted a framework for the reflections presented in this study.

4 Emergent Play and Museum Experience. Design of Micro-Culture and Observational Data

The aim of this study was to investigate how to transpose complex historical processes, specifically urban development through time, into playful interactions, to enhance learning and engagement in museums. Special attention was dedicated to guided tours, as they represent the typical way children experience museum. Moreover, board games, objects-mediated form of play, seemed to offer an interesting framework to enhance social interaction and to provide an experiential/tangible grounding to historical processes. Games such as Monopoly or Risk provided interesting sources of inspiration. Board games practice is a form of social interaction mediated by material objects [9], in which players engage in a peer, face to face, based communication. Moreover, the players often start a theatrical improvisation, staging the game situation and teasing each other, as it was all for real [10]. The material configuration of the games seems to play a central role in eliciting this particular interaction, as the board is placed at a lower level than the players' gaze, defining a circular interaction space with the players sitting around it. Hence players are supposed to place tangibles on the board and in some cases, like in Monopoly, to exchange them with each other. In this way the game play has a natural affordance for eye contact and social interaction, as the players look at each other through the game, then while acting on the tangibles they enter into a closer contact and in that moment a particular form of emergent interaction may occur as the players start staging the game situation [10].

This social dynamics match communication of historical processes, allowing the players to experience how a certain process may unfold through time and what would be the implications for the people involved. However, board games have usually a complicated system of rules that must be learnt before starting to play. Our game intended to be more unstructured and leverage on material affordance of a gaming board and tangibles.

The outcome of this process is *Micro-Culture*, a mixed reality setting composed by a tabletop surface, showing a simulated territory consisting of a population and a set of tangibles, representing infrastructures to be placed on the territory, such as bridges or streets. The Micro-Culture game is based on a biological metaphor with experiments and observations of bacterial cultures. A low-fidelity prototype has been developed and tested twice; a working prototype is currently under development.

The technical set up includes a webcam and a computer. The game is implemented in Python and with ReacTIVision, a system including a set of markers and software to develop tangible interfaces[1]. The markers are placed on Micro-Culture tangibles, so that they can be traced and recognize by a webcam and through the software. In this

[1] http://reactivision.sourceforge.net/

way, the simulation and population can be programmed to respond to the tangibles and provide direct feedback to players' actions. For instance, if a player places a bridge on a river, the bridge will appear in the simulation and people may start crossing it.

However, interviews, observations in museums and testing of a low-fidelity prototype showed that children had individual needs to express themselves, both in relation to the museum experience and related to play and playing. Comparisons between observations conducted with a group attending a guided tour and with the group of co-designers during a free tour, revealed different forms of emergent interaction. During the guided tour the children were very quiet, they tended to split into small subgroups, some followed more constantly the guide while others, usually on the back of the main group, moved around and whispered to each other. Other children did not seem to be part of a specific group, but looked at things by themselves. Children participating to the free tour manifested similar tendencies: some actively explored the exhibition space, chatting lively and almost running. Other children preferred a more quiet fruition of the space, walking quietly, talking and laughing at each other, at times even asking questions to us. Finally some children liked to be alone, for example, a girl liked to sit by herself in a niche and when she was asked if she liked the museum, she mentioned that she especially liked the space because "it is silent and I can be alone with my thoughts" (Figure 1).

Testing with the prototype showed a similar differentiation. Some children set up their "settlement" by placing a few tangibles and then started to play as expected; they interpreted the setting as a board game or a role-play game platform. Hence they acted as they were "landlords", competing with each other to conquer the other player's land. They also introduced tanks, a float, and soldiers as new tangibles for the game. Especially girls, considered the game as a design tool, which meant that they spent most of their time in creating their own settlements and in making new tangibles, specifically shops for the market place, animals and farms, ships. Afterward some children from the designer group started to play with the "landlords" group and seemed to enjoy a war-like game (Figure 2).

Fig. 1. Solitary and social museum experience

An interesting interplay emerged when this mixed group of players agreed that they wanted to play the game together. However, one designer girl expressed the desire to have everything ready before playing and she spent a lot of time in settling everything up with another girl. The landlord group asked repeatedly if they were ready and even took initiative attacking their piece of land so that they could play. The designer girl did not appreciate this and she stated: "Stop, I am not ready yet!"

Fig. 2. Emergent play: designing and engaging

Despite the small size of the cardboard board the children managed to arrange different groups playing differently. Interestingly, the mixed group and some individuals expressed forms of so called playful play, defined by Sutton-Smith [11] as a particular form of play in which creative players may define rules for others' play. This happened during the game a few times. The mixed group created tangibles and dynamics related to the tangibles for their play. Two female designers spent their time in making tangibles and playing dynamics related to such tangibles, and then they placed them on the board for the others to play with. Moreover, during a co-design workshop, a girl created a whole narrative framework, in which the player had to go through a quest, in the end a fight with Kraken should have taken place, and if the player survived then he/she would be able to access the Valhalla, otherwise he/she would die and be buried in a cemetery.

Considering these different forms of interaction expressed by the children, a concern emerged in terms of defining the meaning of designing a playful learning tool. In other words, what would be the characteristic of a learning tool to be perceived as playful by different individuals?

5 Playfulness, Openness and Multimodality

Reflections conducted on observational data from Participatory Design and museum visits informed that certain play dynamics might not be appealing for all learners.

Furthermore, considering the communication mode used to convey meanings related to historical processes, it seems as they primarily are based on a verbal mode of communication. This may happen because of the sequential nature of historical processes, as confirmed by interviews conducted with museum practitioners. We propose more tangible and playful communication modes to support understanding of historical processes.

The creation of a playful tool promotes a deeper investigation about how to enrich the current interaction style. Playful and fun experiences were targeted. This means that the children were engaged through different choices of action. The choice in how to do things was in this case closely related to having fun [12, 13, 14]. In this way, the learning tool provided a basis for evolution of playful experiences where the children could find their own ways for interacting.

In this sense it is being claimed that a playful learning tool should be characterized by openness, in the sense that its material affordance should easily support different forms of emergent interaction. This challenge requires multiple opportunities for manipulation and forms of play integrated in an open-ended model for learning [15].

To achieve such openness, the concept of multimodality appears as closely interconnected benefiting from the insight that children have different orientations to modes, specific preferences for temporal or spatial, image or speech, bodily movement [16, 17]. Multimodality combines these different modes providing a framework allowing different forms of sensorial explorations and openness in the form of extended forms and choice of interaction mode.

The board game configuration, Micro-Culture, facilitated social and object-mediated interaction. The absence of specific rules, which are typical in board games, allowed the children to decide for themselves, they could decide to engage with others in cooperative play but also to create some space for themselves and their imaginary world, or even to shift from one modality to another. The relatively small size of the board seemed not to hinder the co-existence of subgroups and their play dynamics. However, it may have created a few issues, for instance social players tended to occupy most of the space, while solitary players were using very little areas of the board. Probably a larger surface, such as a projection on the floor, may have provided a better affordance.

Social interaction is supported basically by hiding the technology and by coupling input and output, players' actions and the simulation responses, on the same playing surface, so that the system is not disrupting players' attention from establishing eye-contact and from the learning content. Audio effects could support tangible interaction and visual animated simulations in order to make the whole simulation even richer and more engaging.

6 Conclusion and Future Work

This study presented reflections about the meaning and implication of designing learning related technologies. The discussion is based on data collected during a one year Participatory Design process, aimed at exploring ways to enhance museum-learning practice from the perspective of primary school children. A group of 25 children, 10 years old, were involved in designing a new learning technology, aimed at enriching learning of historical processes and also social interaction between children and their guides when attending museum tours.

Reflecting on related work and data from the study, we propose a perspective in which playfulness regarding learning related technology should fit individual values of play. During our PD process it was noticed that children expressed distinctive individual needs regarding museum experience and play. Hence our original project was re-shaped to create space for users' needs. In this sense, playfulness is interpreted as strictly interrelated to openness and multimodality, to provide support for richer and more self-driven interaction forms.

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