Designing for Children
- With focus on 'Play + Learn'

Design for the Youngest

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Abstract: The broad theme of this article is the process of adapting the methods and techniques used in human centered design and participatory design to design for young children (0-12 years of age). The case study that prompted this research is the one of developing conceptual design for the first large-scale children's museum in Oslo, Norway. The museum is of hands on, experience type. From the start, children's museums are institutions designed with children in mind, but to what degree and how they include children in the design process is still not clear, especially with children of this particular age group. Specifically, we consider the role of technology in the children's museum whose main focus is on young children and how can children themselves participate in the design of the experience they will have in the museum.
We have chosen to conduct both qualitative and process-oriented work in order to start getting the grasp of the question. A course in Interaction Design has been used as aid in research – students have been offered a possibility to work on range of projects involving children and technology, in the children's museum setting.

Key words: co-design with children, participatory design, interaction design

1. Introduction

Children's museums are the fastest growing segment of the larger museum field. They are institutions that are not object-centered, but rather experience-centered. Gyroscope Inc. (Gyroscope, 2006) points out that museums in general are going through a transition, trying to incorporate technologies that would enhance the user's experience of the visit:
… museums of every discipline—art, science, and history—and from every corner of the globe are responding with efforts to use new technologies to engage visitors in new and different ways. From providing visitors with handheld devices to instantly access more information about a work of art to using cards tagged with RFID chips to automatically create a personal website based on the visitors' interests, museums are experimenting

with ways these new technologies can enhance the visitor experience on site and at home." (Samis, 2001) and (Sayre, 2005) speak of the same trends.

For children's museums the issue of the presence of technology is even more pressing and relevant. These institutions are designed for children born in the digital era, children whose lives unfold naturally around technology. The huge discussion of whether technology should be part of the museum experience will not be considered here. Experts from various fields have differing opinions on this topic. Children's museums are conceived as places that offer both learning and play. They are places that are inspiring and creative, challenging children's minds and expanding their views of the world we live in. As technology is a part of everyday life, it is natural to examine the degree to which it helps or impedes fulfillment of these goals. We hope to demonstrate that children's museums have larger potential to meet these goals, if children are allowed to participate in designing their experience with technology in the museum.

The author of this article has been put in the fortunate or unfortunate situation of being the technologist associated with the Oslo Children's Museum project. Fortunate part has to do with abundance of technological tools and toys, allowing for ever changing new exhibitions that attract and offer new possibilities for the use and reuse of the latest most interesting, easily changeable, pliable, adaptable interactions (both between humans and technology and as digital mediators for human to human interactions). The unfortunate part has to do with somewhat uncharted territory of knowing how to choose the best set of approaches to the design, what kind of collective knowledge will lead to eventual fulfilment of the institution's high goals and create a lasting bond between the museum and the community and museum and children in particular. Being an interaction designer, the following question unfolded naturally: how adaptable are the methods and techniques used in human - centered design and participatory design to design for young children (0-12 years of age)? Can children contribute in a meaningful way in the planning and designing process that would also lead to a better understanding of how to use the technology in the future children's museum in Oslo, Norway? Can the Scandinavian tradition of user participation be modified to this user group in ways that would give meaningful results and contribute to the design and the experience that children will have at the museum?

We have chosen to conduct both qualitative and process-oriented work in order to start getting the grasp of the question. A course in Interaction Design has been used as an aid in research over the period of three years. Students have been offered the possibility to work on range of projects involving children and technology, in the children's museum setting. Twenty one projects have been conducted, covering a range of applications that may be

placed into four categories: navigation through museum, entertainment, learning through play and web based applications bringing the museum experience home. Students on all projects were required to include children in the design process. Some have used them only to evaluate their design, some to inform the design, but some are now trying to go further and include children as informants to design and co-designers. We still lack consistent methods and techniques adapted to the specific setting we have, as well as experience in working with children in the spirit of co-designing, though happily, some initial steps will be presented in this paper.

2. Background
2.1 Children and technology
Many inspiring books and articles are found in the literature addressing children and play involving technology; see for example (Laurel, 2004), (Barab, 2009), (Ackermann, 2009) and (Buckingham, 2007). Buckingham's message is that young people need to be given a new form of digital literacy that is both critical and creative. The creativity part has become to a large degree appropriated by the field of interaction design (in the scientific community). The problem is that, although the field of interaction design has a strong focus on the users, children and young adolescents are very rarely included in the design process of the technology that is intended for their use.

One of the pioneers, who started to write about involvement of children in the design process, is Allison Druin. Her four books, (Druin, 1996), (Druin, 1998), (Druin, 2000), (Druin, 2009) as well as the article presented at CHI (Druin, 1999) have been groundbreaking in establishing methods for working with children in the design process (cooperative enquiry) as well as documenting the merits of including the children in the process.

In (Druin, 2002) Druin writes: *In the Human-Computer Interaction community, we have a short but rich history of developing shared paths for communication between diverse users and technologists. However, this history of shared communication is even shorter and less developed for our children as users, testers, informants, and partners in the technology design process. With the emergence of children as an important new consumer group of technology (Heller, 1998), it is critical that we support children in ways that are useful, effective, and meaningful for their needs. With this in mind, we need to question how we can build new technologies that respect children for their ability to challenge themselves and question the world around them. We need to understand how we can create new technologies that offer children control of a world where they are so often not in control."*

2.2 The role of children in the design process

In the same article (Druin, 2002), Druin describes in detail the four roles children may have in the design process: user, tester, informant to design and design partner. She gives historical background for each role and, challenges with it and the impact a child in the role may have on technology. Here, we just briefly describe these roles.

User would be a child observed, video taped or similar, while using the product. The goal would be to see what impact the product has on a child. Tester is a child who would participate in user testing during the design process (typically testing prototypes). A child becomes a design informant if he/she contributes with something in the design process (researchers may, for example ask for some prototypes, sketches or simply observe the child using similar existing products). Design partner would be a child who is part of the entire design process, in the role similar to the role of informant, but spanning the whole design experience.

It is in this context, as well as that of (Druin, 1999) and (Druin and Fast, 2002), that we will look at what role children have had in the various projects related to Oslo Children's Museum.

3. Case study: learning about working with children

3.1 Interaction Design projects, 2007

In the fall of 2007 we used the Children's museum project as the case study in the HCI course at the University of Oslo for the first time. Students taking the course were seniors and a smaller number of graduate students. The children's museum project was one of several possible projects to choose from. Projects (HCI projects, 2007) that had to do with Children's Museum were: The Musical Steps, Personalization of the Children's Museum, Interaction Device, Distribuert audiovisuelt system for museer (Virtual Mirror), Our World, Verdensrom (Universe) and Visual Telephony (two of them are submitted in Norwegain language, but the rest of them are available in English). The students of this year were not told explicitly when and how to involve users, nor has the work of Druin (and more specifically, roles that children can play in the design process) been presented to students. All teaching was done from the first edition of Interaction Design book (Preece, 2007).

Careful review of children's engagement in the project revels that children have been used in more traditional roles of users and testers. None of the groups went further than

that. However, some experiences recorded in their projects are worthwhile mentioning: Students from Musical Steps group (Figure 1), final report: *"Our group is working on the idea of a musical steps installation. The idea is to have sensors in a room, so that when triggered, they will play a sound. To form a prototype we firstly conducted observations of the user group, and got in contact with Oslo Barnemuseum. They were eager to follow our project, and were able to provide a test group for our prototype. Based on the data from the observations connected with our idea, we constructed a pilot. We executed the pilot on a small group of volunteer children. This was prior to our prototype test with the test group, with the intention of improving our prototype further before the prototype was tested. These preliminary tasks showed to aid us greatly in constructing a well-defined and beneficial test run of our prototype. The test of the prototype was very successful, with plenty of happy kids, and with our goals for the prototype achieved. Although it was limited due to budget, it shows a great potential."*

Figure 1. Children testing the Musical Steps prototype

Students from Our World group (Figure 2), final report: *"Designing for children is not easy. They think, interpret, and react to situations differently than adults. Understanding how children are reacting to different kinds of aspects to our simulator will be very important. Also, understanding how they are playing and learning new things will be necessary to design a good product."*

Figure 2. Prototype that Our World group has made

3.2 Interaction Design projects, 2008

In 2008 (HCI, 2008) there are six new projects involving children. Those are Interaction Poster, Console 1 and Console 2, Augmented shadows, Dinosaur and Color Pot. This time, students were encouraged to start involving children as early in the process as possible. Still, nothing was presented explicitly about methodologies of working with children. That children can have a more active role in the design process was not mentioned that year either. Without making any judgement about the quality of projects themselves, it may be noticed that the involvement of children in these projects is stronger than the year before.

Students from Color Pot group, final report: *"We tried to get them to just step on a few of the colours, to see if they got more interested in the mixing when it was clearer with just two colours. They seemed to enjoy this very much, but it was still the jumping and dancing that was interesting, and not the screen in the same amount. What the girls were missing to make it even more fun was music, so when they asked for that after a while, we started the CD player that was in the room. The CD was in very poor shape, and the music was full of hickups. This didn't seem to bother the girls, as they were having fun anyway. After some time, the program which displayed the colours stopped working, and the beamer just showed the coding. We thought that this was a good time to punctuate our test, but we weren't allowed to do so by the girls, so we had to start the program again, and let them keep on for a while longer until our time ran out and we had to pack up and leave."* This last group has received a new input that they did not initially consider, that is to add the music to their colour mixing. This input was not solicited by them as researchers; they still used children as testers only. But they experienced how children's input could be valuable to their project. A step from here to asking the children for ideas and input is a small one.

Students from Console 2 group, final report: *"Our overall responses to the concepts we have introduced to the children have been that they find it both appealing and captivating, but there is a definite threshold for many of the children regarding the exploration of its functions. Our solution to this has been to introduce an adult facilitator to demonstrate some of the initial functions. Based on this most of the children had no trouble exploring it further, and especially the multi-user experiences were immediately favoured. We also saw several occurrences and experiences feedback that confirmed initial documentation with regards to gender regarding the male need to achieve and the female preferences to social functions. It is also sad that we were unable to explore how our functions might be adopted and adjusted to physically and mentally challenged children.*

For a possible future it has become obvious to us that we would need to introduce participatory design methods to both confirm our ideas and as a source for new ones." The last sentence explicitly states that students would like to give the larger and more active role to children in their design process.

Figure 3. Children testing Augmented Shadows

Students from Augmented Shadows group (Figure 3), final report: *"We observed the children and we interviewed them. We took videos and pictures. Observations for a field study are usually analysed by experts to extract interesting information from what happened. For instance, it would be very interesting to ask child psychology specialists what they think of our observations."* And another quote from the same group: *"Having the opportunity to work with children was a very interesting experience."*

3.3 Interaction Design projects, 2009

This year is somewhat different. These projects are not finished at the time of this submission, but they are still relevant, since this was the first year where part of the teaching at the very beginning was to bring attention to different roles children can have in the process. Students were made aware of the relevant work of Druin (Druin, 2009), (Druin et.al, 2001), (Montemayor, 2002), (Druin, 2002) (Taxen et al, 2001) and (Gelderblom, 2009).

There were 10 groups of students this year that chose to work with children. One of the groups has dissipated, so there are 9 projects being conducted at this time that involve children (there are only 3 projects in different areas). The projects are (HCI,2009): Interactive Art, Children's Search on Web, Virtual Window, The World of Garbage, Children's World, Health Awareness, Save the Planet!, eBook Reader and Interactive Guest Book.

Students were advised to make contact with children before they actually had any firm idea of what they want to do and talk to them about it. Not all of the groups have followed this advice, but for the ones that did, something interesting happened: students took children more seriously. Children, most of them from one specific school and class (fourth grade), have seen several different projects and participated in them repeated times. Their desire to participate has been increasing, and they with more enthusiasm and curiosity meet the groups to see "what has happened since the last time". One group of students was working with children aged 4-5. They have had three visits to the child care center the children are attending, and worked with the same group of kids. Children have, with each visit, become more interested and eager to interact with students.

"I had no idea that this could be such an enriching experience" said one of the students from this year's class. The authors cooperation with students has increased, cooperation between different groups has also changed towards more frequent interaction.

Students from Children's search on Web group (Figure 4), midterm report: "Some of the drawing shows us how the children imagined their interaction with the computer to be richer than today."

Figure 4: Children were asked to sketch how they envision their interaction with the computer

Students from Virtual Window group (Figure 5), midterm report: *"We really felt we got more out of the session than we anticipated. First of all, the concept was readily accepted; we got the impression that the children considered the concept of a virtual window as fun and enchanting. The kids came with many suggestions and even some new ones during the brainstorming sessions. The Plexiglas window proved a great toy and it was evident that the simple concept of interacting through a window was considered fun."*

Figure 5: Students prototyping and brainstorming together with children

Students from The World of Garbage group (Figure 6), midterm report: *"The kids made it clear that they wanted to choose among a great deal of alternative characteristics of characters boy/girl, human/cartoon, different kinds of look, different voices, and so on. Maybe the best suggestion was a character made out of garbage which was given human behaviour. The children also came up with ideas that they could come up with their own "garbage songs" and make the character sing the songs, so as you can see the children's fantasy has practically no limits."*

Figure 6: Students awaiting the group of children for brainstorming session

Students from eBook Reader group (Figure 7), midterm report: *"Utilizing the methodology of Contextual Inquiry (CI), where the data gathering is in the users own environment (Druin, Bederson, Boltman, Miura, and Platt 1999), and Participatory Design (PD) where we asked direct questions about designs, we had the children showing us how they would physically select a book they would want to read, and tell us why. This showed us what properties the children consider when deciding on a new book to read. Then we had the children using their imagination and draw how they picture selection of books on a*

minicomputer (see Figure 6). Afterwards we let them interact with eBook readers (Iliad) we had brought with us. Finally we asked them to do another drawing of how an eBook reader would look if the children themselves had designed it. This is what Allison Druin in her paper «The Role of Children in the Design of New Technology» calls using the children as informants."

Figure 7: A child's drawing of the interface: how to select a book on eBook reader

To summarize briefly, there is a visible progress in the manner of working with children over the past three years. The more one experiences children's evolving role in the design process, the more one sees it's potential. Even though we are just now exploring mixing of ideas (Guha et al, 2004) and contextual enquiry (Druin, 1999) more consciously through the teaching and project work with children, there is no doubt that it is worthwhile to do so. The opportunities in the field of interaction design for children are huge, and their inclusion as design partners is an interesting and rewarding direction to take, in particular in regards to the development of children's museum.

4. Conclusions

It is important to remember that in designing for children, children can be included if one chooses to do so. There are difficulties, but also enormous benefits from using this approach. In the traditional design of children's museum, children are merely present as users, sometimes testers. All the project work that we have done, has established for us that involving children as much as possible, ultimately partnering with children in the design process, is the right direction to take. By involving children in the design process, one can gain precious knowledge about how children learn, what they need and what they want. And we can give them in return satisfaction and growth from participating in the process and last, but not least, a true bond to the museum (I have been part of creating this).

Acknowledgement

References

Gyroscope, Inc. (2006) Museums in Transition: Emerging Technologies as Tools for Free-Choice Learning [Online PDF]. Available at

<http://www.gyroscopeinc.com/News/articles/MuseumsInTransition.pdf> [Accessed 11 November 2009]

Samis, P. (2001) Points of Departure: Integrating Technology into the Galleries of Tomorrow. International Cultural Heritage Informatics Meeting, 2001. Available at <http://www.archimuse.com/ichim2001/abstracts/prg_115000640.html> [Accessed 11 November 2009]

Sayre, S. (2005) Multimedia that Matters: Gallery-based Technology and the Museum Visitor. First Monday, Peer- Reviewed Journal on the Internet 10, number 5. Available at <http://www.firstmonday.org/issues/issue10_5/sayre/index.html> [Accessed 11 November 2009]

Laurel, B. (2004) Design Research, Practice, and Principles for Digital Kids. Commissioned paper for the Macarthur Foundation [Online PDF]. Available at <http://www.exploratorium.edu/research/digitalkids/games.html> [Accessed 11 November 2009]

Barab S.A., (2009) Educational Games: Effective learning through (inter)action. Key note lecture, IDC 2009, Como, Italy

Ackermann E. K., Decortis F., Hourcade J. P. and Schelhowe H. (2009) Digital Technologies and Marginalized Youth: Reducing the Gap, IDC 2009, Como, Italy

Buckingham D., (2007) Beyond Technology: Children's Learning in the Age of Digital Culture, Polity Press

Druin., A. and Solomon C. (1996) Designing Multimedia Environments for Children, Wiley

Druin, A. (1998) The Design of Children's Technology Morgan Kaufmann Series in Interactive Technologies, Morgan Kaufmann

Druin, A. and Hendler, J. (2000) Robots for Kids: Exploring New Technologies for Learning (Interactive Technologies) Morgan Kaufmann

Druin, A. (2009) Mobile Technology for Children: Designing for Interaction and Learning , Morgan Kaufmann Series in Interactive Technologies, Morgan Kaufmann

Druin A., (2009) Dispelling Myths and Changing Minds: New challenges and opportunities in designing for and with the world's children, Key note lecture, IDC 2009, Como, Italy

Druin, A. (2002). The role of Children in the Design of New Technology. Behaviour and Information Technology, 21(1) 1-25.

Heller, S. (1998). The meaning of children in culture becomes a focal point for scholars. The Chronicle of Higher Education, p. A14-A16

Druin, A. and Fast, K. (2002). The Child as Learner, Critic, Inventor, and Technology Design Partner: An Analysis of Three Years of Swedish Student Journals. The International Journal for Technology and Design Education, 12(3), 189-213.

Druin, A. (1999). Cooperative inquiry: Developing new technologies for children with children. Proceedings of CHI'99, ACM Press.

HCI projects (2007). Available at <http://www.uio.no/studier/emner/matnat/ifi/INF3260/h07/ > [Accessed November 14 2009]

HCI projects (2008). Available at <http://www.uio.no/studier/emner/matnat/ifi/INF4260/h08/ > [Accessed November 14 2009]

Preece, J., Rogers, Y. and Sharp, H. (2007) Interaction Design: beyond human-computer interaction, 2nd Ed., Wiley

Druin, A., Bederson, B., Hourcade, J.P., Sherman, L., Revelle, G., Platner, M., and Weng, S. (2001). Designing a Digital Library for Young Children: An Intergenerational Partnership, Joint Conference on Digital Libraries (JCDL'01)

Montemayor, J., Druin, A., Farber, A., Sims, S., Churaman, W., & D'Amour, A. (2002). Physical programming: Designing tools for children to create physical interactive environments. Proceedings of CHI2002, ACM Press.

Taxen, G., Druin, A., Fast, C., & Kjellin, M (2001). KidStory: A Technology Design Partnership with Children. Behaviour and Information Technology, 20(2), 119-125.

Gelderblom H. and Kotzé P. (2009) Ten Design Lessons from the Literature on Child Development and Children's Use of Technology, IDC 2009, Como, Italy

HCI projects (2009). Available at <http://www.uio.no/studier/emner/matnat/ifi/INF4260/h09/ > [Accessed November 14 2009]

Guha, M. L., Druin, A., Chipman, G., Fails, J., Simms, S., & Farber, A. (2004). Mixing Ideas: A new technique for working with young children as design partners. In Proceedings of Interaction Design and Children (IDC'2004). College Park, MD, pp. 35-42.