

Investigating the Impact of Design Processes on Children

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ABSTRACT

While there is a wealth of information about children's technology and the design processes used to create it, there is a dearth of information regarding how the children who participate in these design processes may be affected by their participation. In this paper, we motivate why studying this impact is important and look at the foundation provided by past research that touches on this topic. We conclude by briefly proposing methods appropriate for studying the impact of the design process on the children involved.

Categories and Subject Descriptors

D.2.10 [Software Engineering]: Design - Methodologies.

General Terms

Design, Human Factors

Keywords

Children, design processes, Cooperative Inquiry

INTRODUCTION

Human-Computer Interaction (HCI) as a field is, and has historically been, interdisciplinary [9]. Ours is a field composed of not only computer scientists and engineers, but also of educators and psychologists. However, we often overlook the "human" side and focus rather on the "computer" side – researching the technology we create. When we consider the "humans" in human computer interaction, we are most frequently interested in end users; however, we often overlook the impact upon those humans involved in the design process through participatory design.

As a unique set of users, children have been involved in the design of new technology for years. Publications on children having input into technology design processes first appeared in the late 1960's and early 1970's [2]. The main purpose for including children in a technology design process is to create better children's technologies. Whether children are testing a product that has already been

released, or helping to brainstorm ideas for a new technology, the focus of our research is nearly always to create better technology for children.

While designing quality technology for children is certainly an appropriate goal for design teams, there is another rich area within the design process that should be considered for study. This is the impact of participation in a technology design process on the children involved. It is incumbent upon us as researchers to ensure that the impact of being a part of such a design process is, at the very least, not harmful to children, and, more hopefully, has a positive impact upon them.

As we move forward in the 21st century, technology for children continues to proliferate and become more ubiquitous. As such it is likely that the number of children world-wide who are involved in technology design processes will increase. Ethically, it is the responsibility of researchers involved in technology design with children to ensure that the children involved are participating in a positive experience. The goal of the research we propose is to investigate the impacts of technology design process participation on children.



Figure 1. Children involved as technology design partners work over extended periods of time with adults in order to create innovative technology

CHILDREN IN THE DESIGN PROCESS

There are many ways in which children can participate in technology design processes. One way to categorize this participation is through Druin's levels of involvement [2]. Testers and users are the least involved roles. In both cases, children are working with technology that has been designed by adults for use by children. Informants and

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design partners work together with adults to design technology. The main difference is that informants are called upon at various times during the design process when their input is necessary, while design partners (see Figure 1) are equal stakeholders throughout the design process. An additional manner for children to be involved in design processes is through bonded design [8] which utilizes many of the same techniques as design partnering, while at a slightly less intense level of involvement.

While there is the potential to study children at all levels of involvement in the technology design process, it is likely that design processes which have the most substantial impact on children would be those involving children which require greater commitment. Thus, we feel it is most appropriate to first consider children who are involved in technology design processes as informants or design partners, or those involved in bonded design.

RELATED RESEARCH

Research in technology for children tends to focus on the resultant technology, not the children involved in the design process. Within HCI there is research which explores design processes; however, these works often do not explore the impact that the process has on its participants, and rather focus on the process itself. In papers that report on the process used to design technology, there are some which informally report benefits to children involved as design partners in technology design processes, such as [3, 4, 6, 13]. The discussion of impacts on children in the design process in these papers tends to be secondary to the discussion of the design methods or process itself.

The impacts reported on child design partners are nearly universally positive, including children being empowered, feeling challenged, increases in communication, collaboration, confidence and problem solving skills, and learning about technology. When one considers the requirements of being a child design partner – working with others, effectively communicating ideas, and creating new technology, these findings are unsurprising. Large [8] found similar benefits to children involved in bonded design processes, including children having fun and learning about technology.

As might be expected due to the incidental nature of these reports, most of the data is gathered informally and through non-standardized means. Most data collection on this phenomenon has been through self-report of the children and informal observation of the children by the adults on the team [3, 4, 6, 13]. These methods are appropriate in initial and informal investigations and as additions to existing research, as they were in these studies.

There are far fewer studies of informants which mention the effects of working in a technology design process on children. There are a few which make some suggestions, including that children involved in informant design may see increases in communication or be confident and creative [16, 17]. The passing mention of effects on

informants implies that they may exist and that we are interested in this potential. One paper, [12], discusses at length the benefits to teenage informants with behavioral challenges, including increased engagement and a feeling of pride.

There are related areas in which the impacts on children involved with technology design have been more specifically studied than as has been done for involvement in a technology design process. For example, Garzotto [5] examined benefits to children involved in Experience Design, and Kafai has long discussed the benefits to children who participate as Software Designers [7]. Rode et al. [14] have also found potential benefits to including design partnering in classrooms as a way to convey curricular materials. The distinction of this current call is to study intimately over the long-term children involved in technology design processes such as those who are design partners, informants, or participants in bonded design.

Literature shows us that while children are involved in technology design processes, we are not studying the impact that it can have on them. We further know that researchers are at least somewhat interested in these impacts, as many incidentally report the effect they see of the design process on children. Having determined that we should study the impact technology design processes can have on children, the question becomes *how* to do so.

PROPOSED METHODS OF INQUIRY

As suggested by Lazar et al. [9], there are many appropriate ways to undertake research in HCI. The strongest results will come from using many different methods to study the same phenomenon, with many different researchers, in different locations and settings, studying the phenomenon. It is our hope that researchers in many disparate locations will take up this work, whether they are working with children as design partners, informants, or in bonded design. In this section, we present considerations that must be addressed when investigating the impact of design processes on children, as well as briefly offering ideas for appropriate methods for study.

Initial Considerations

It would be ideal to study children who are involved in pre-existing design work. That is, one should not artificially create a technology design team for the sole purpose of studying the effects of participation in a technology design process on the children. Research should also ideally be done on teams that are interdisciplinary. We suggest that a researcher trained in education, psychology, child development, or a related field should be included on teams investigating how design processes impact children. The main focus of the setting where this research takes place should continue to be technology design. If the focus changes to studying the children, it necessarily changes the experience. This research should be conducted in parallel to the other research performed by the design teams.

The Potential of Quantitative Methods

The experience of being a child technology designer is complex – there are problem solving, collaboration, communication, and many other skills and talents to negotiate. Researchers in methods contend that the best way to study such complex processes may be through qualitative means [10, 15].

Measuring the impacts of technology design process participation on children with a pre-test, post-test approach is inappropriate as an initial foray into investigation. As the design processes in which children participate are long-term, it would be nearly impossible to control all other aspects of a child’s experiences, i.e., at home and in school, for the duration of the technology design process. These confounding variables would necessarily cloud quantitative data, thus rendering it less valuable. Qualitative methods allow researchers describe and explain phenomenon over the long-term, taking into account intervening variables.

Additionally, it would be difficult to find appropriate quantitative measurement tools to use in initial explorations. As we do not yet know what the impacts of participating in a technology design process on children may be, it would be difficult to find or craft a tool that appropriately pinpoints and measures the salient data. For early studies, more qualitative approaches, provide richer, descriptive data, and therefore are more appropriate.

Qualitative Methods

Within qualitative research, there are many different methods that can be employed. Three of them, case studies, interviews, and ethnographies, may be particularly appropriate for studying children participating in a technology design process. Researchers should consider each in turn, and given the research circumstances, decide which is best for their specific team.

Table 1 provides a quick reference to facilitate choosing a design method while shaping the design question. Researchers should think about who their participants will be, and the kinds of data they are comfortable collecting. Also, the amount of time a researcher is willing to commit to the study is a consideration.

Case Study

Case studies allow for the in-depth description of real-life

scenarios [9]. The context for study should be wherever the designing takes place – be it in a university or corporate lab, a school, or elsewhere. Case studies allow the researcher to choose to study either one child, or a group of children or unit. Called a “bounded system” [1], this allows the researcher to determine the best way to define the participants in the study.

Within a case study, many types of data can be gathered. Using many sources allows for triangulation of data, which strengthens the findings [11]. Within a case study, observations, artifact analysis, informal questioning, and many other types of data collection may occur concurrently. The particular techniques that a researcher(s) decides to use should be determined by the resources, both physical and temporal, the team has.

Interviews

While interviews can be included as data collection in other types of study, it is possible to use exclusively interviews as a method of study. When used as a stand-alone method, it is important to ensure that each participant is given the opportunity to speak exhaustively. Attention must be given to the structure of the interviews and wording of questions, as well as to who is interviewed. There are many stakeholders in technology design processes who might be interviewed, including child and adult design partners, and the parents of child design partners.

In determining what the interview questions should be the researcher(s) should bear in mind they should encourage the participant to speak to the topic at hand while remaining open-ended enough to allow freedom of expression [10]. Interviewers should also remain flexible in questioning. Interview studies do not require the same degree of sameness that quantitative testing scenarios do, and therefore researchers should be prepared to follow interesting tangents that participants take which might inform the research question. Researchers should consider when and where to interviews should occur, along with the length of the interviews. For initial forays into interview studies, researchers at different locations will need to create their own interview questions. We can look to research that has used informal self-reports to delve into this phenomenon to indicate good starting points [3, 4].

Table 1. Overview of proposed methods for studying children in the design process. Bolded words indicate the salient or unique features of each method.

Method	Time required	Participants	Data Collection
Case Study	Varying, depending on how the case is bounded	One child Children	Observations Artifact Analysis Informal Discussions
Interview	Less time than case study or ethnography	Children Parents Adult design partners	Interviews
Ethnography	Lengthy, in order to allow time to investigate culture	Children Adults design partners	Observations Artifact Analysis Informal Observation

Ethnographies

Ethnography is quite similar to case study [9], but tends to be very rich and in-depth, and possibly even more exploratory in nature. Ethnographies often focus on a culture [15], and aspects of a culture such as behaviors and shared activities [1]. An external researcher could undertake an ethnography given significant time and devotion to the project.

A researcher undertaking an ethnographic study of a technology design process would focus on the “culture” of the design process, and would therefore look at issues such as context, behaviors, and relationships. Data collection methods for ethnographies are likely to be similar to those used in a case study, including observations. Given the focus on culture, ethnographers are more likely than those employing case studies to use artifact analysis.

Drawbacks to Qualitative Methods

While we suggest the most appropriate manner in which to study children in the design process is through qualitative measures, there are drawbacks to this approach. Qualitative research is “messy”. The analysis process is time-consuming, and requires a researcher with the ability to be open to new and unexpected insights. Qualitative researchers, especially those involved in case studies or ethnographies, need to make a long-term commitment to their completion. These issues can make qualitative research unattractive to some – but the payoffs, in rich description, surprising findings, and in-depth understandings, are worth the work.

CURRENT AND FUTURE WORK

We believe that using participant observation with currently existing design teams through qualitative methods can lead to a better understanding of the impacts technology design processes can have on children. In incidental ways, our community has been investigating this phenomenon for years. The call now is to apply these questions in an intentional manner.

Using a case study method which involves multiple forms of data collection including interviews, participant observation, and artifact analysis, a study is underway which investigates the cognitive and social experiences of child design partners over the course of a year. Early data analysis indicates that there are indeed many ways in which children who participate in design partnering are impacted by the process, including indicators in the areas of communication, collaboration, and problem solving.

It is our hope that this research will provide new insights to those interested in further investigating how our young design partners are impacted through their participation on technology design teams. We know that children involved in design processes are helping to create better technology for tomorrow. It’s time to ensure as a community that we are also helping them to live a better today.

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