ABSTRACT

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| Title of Document: | ENABLING  GEOGRAPHICALLY DISTRIBUTED, INTERGENERATIONAL, CO-OPERATIVE DESIGN |
| | Gregory Walsh, Doctor of Philosophy, 2012 |
| Directed By: | Professor Allison Druin, College of Information Studies |

As more children's technologies are designed to be used with a global audience, new technologies need to be created to include more children's voices in the design process. However, working with those who that are geographically distributed as design partners is difficult because existing technologies do not support this  process, do not enable distributed design, or are not child-friendly. In this dissertation, I take a research-through-design approach to develop an online environment that enables geographically distributed, intergenerational co-operative design.

I began my research with participant-observations of in-person, co-located intergeneration co-operative design sessions that used Cooperative Inquiry techniques at the University of Maryland. I then analyzed those observations, determined a framework that occurs during in-person design sessions and developed a prototype online design environment based on that scaffolding.

With the initial prototype deployed to a geographic distributed, intergenerational co-design team, I employed Cooperative Inquiry to design new children's technologies with children. I iteratively developed the prototype environment over eight weeks to better support geographically distributed co-design. Adults and children participated in these design sessions and there was no significant difference between the children and adults in the number of design sessions in which they chose to participate.

After the design research on the prototype was complete, I interviewed the child participants who were in the online intergenerational design team to better understand their experiences. During the interviews, I found that the child participants had strong expectations of social interaction within the online design environment and were frustrated by the lack of seeing other participants online at the same time. In order to alleviate this problem, five of the participants involved their families in some way in the design process and created small, remote intergenerational design teams to compensate for the perceived shortcomings of the online environment.

I compared Online Kidsteam with in-person Kidsteam to evaluate if the online environment was successful in supporting geographically-distributed, intergeneration co-design. I found that although it was not the same in terms of the social aspects of in-person Kidsteam, it was successful in its ability to include more people in the design process.

ENABLING  GEOGRAPHICALLY DISTRIBUTED, INTERGENERATIONAL,
CO-OPERATIVE DESIGN


By


Gregory Walsh


Dissertation submitted to the Faculty of the Graduate School of the
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# Dedication

To Ann, Mary Jane, and Franklin—Thank You.

# Acknowledgements

This section is harder to write than I thought. I didn't know how I should organize it--should I arrange it by time or by people or just break into something similar to the Academy Awards and just list names with affiliations? I think I'll just go stream of consciousness and see where that gets me.

I want to thank my mother and father, Tom and Denise Walsh, for their love and support throughout my entire life. I also want to thank my mother- and father-in-law, Jerry and Kathy Marconi, for their overwhelming support of me to pursue a PhD. And my deepest thanks to my wife, Ann, for her unconditional love and support without which I know that I could not have completed this journey.

I can't imagine that many people want to thank their fifth-grade teachers in their dissertations, but there is no way that I could not thank them. Gloria Gaynor and Jeff Vermuth taught me that every child has something to say and has the right to be heard. It was my time with them as a fifth-grader, and later, as a high-schooler that made the work we do in Kidsteam seem so normal to me. I hope they know what great teachers they were to me.

I want to thank my advisor Allison Druin for her mentoring over the last four years. From the beginning, Allison treated me as a colleague-in-training and enabled me to find my academic path by working with me to help me identify the research topics that interest me. She has helped me realize my strengths and improve my deficiencies, making me a better academic. Allison has also been generous in her financial support through my time at the University of Maryland by connecting me with funding that moved my research forward. Finally, I want to acknowledge how

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# Chapter 1: Introduction

## *Scenario*

*It is the middle of July and the Human-Computer Interaction Lab's intergenerational co-design team is currently working on developing a new game to help young children learn to read. I ask the group to draw pictures to describe what kind of game we should build. There are five children and four adults who participate in the design session.*

*Robin, an adult, starts the design session by saying that she thinks that the game should be a board game. Another adult, Evan, adds that he thinks he should be able to hold his eReader over the game board to see hidden items that he can use in the game and draws the device over the board that Robin drew. Alice [1], a child designer, thinks that the game should involve reading to move around and reminds everyone to not make it hard.*

*Oscar, another child designer, draws an additional path on the board so that readers who want a new challenge can take a new path. Jason, an adult, wants players to be rewarded with cartoon characters while Amanda-Jane draws a test next to the game board because she thinks that the difficulty of the game should depend on how well you read. Richelle draws cards on the board that would contain parts of a story with missing words that players would have to identify to complete the story. Finally, Mason pulls several of the previous designs together and adds his and his brother's ideas. He draws a READ spot that when landed on, players need to read from a story they brought. If the*

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[1] The names of participants have been changed to protect their privacy.

*players have difficulty reading, they can use their mobile phone to read the words out*

*loud for them.*

This design session is very similar to many design sessions that have occurred during meetings of Kidsteam, the University of Maryland's Human-Computer Interaction Labs intergenerational co-design team. However, this real design session is unique because it took place over seven days with real participants in Maryland, Virginia, Utah, and California. It is just one example of design outcomes generated by the geographically distributed, asynchronous, intergenerational co-design environment that I co-designed, implemented, tested, and evaluated as part of this dissertation.

### *What is Co-Design*

In the mid-1970's, computer-based technologies were introduced into the workplace in Europe, and workers began to feel that they were losing control of their work environment. In order to democratize the technology development in the workplace, end-users were invited to be partners in the design of new technologies for them (Bodker, Ehn, Sjögren, & Sundblad, 2000; Kensing & Blomberg, 1998). "Cooperative Design", or "co-design", is the subset of participatory design that maintains the original ideals where expert designers work with the target audience to solve a problem. Participatory Design can include any activity with an end-user, but, co-design implies that the end-user is part of the design process. Cooperative Inquiry, a type of co-design, has been used in the design of children's technologies for over a decade. This method has adults and children work together as design partners to create low-tech prototypes (Druin, 1999) that are redesigned iteratively and usually increase in technological sophistication or focus at each iteration. Prototypes then receive feedback from the design team and the iterative

cycle continues. In this method, the intergenerational design team participates in the design of the technology throughout its life cycle as partners.

The University of Maryland's Human-Computer Interaction Lab (HCIL) has an intergenerational design team based in cooperative inquiry, known as "Kidsteam," which meets two-times a week for 90 minutes each session during the school year, and full days for 2 weeks over the summer. The team uses a variety of activities to communicate ideas, or techniques, to "low-tech prototype". They use art supplies, large pieces of paper, markers, and sticky notes to do their design work with such organizations as Microsoft, the U.S. National Park Service, Carnegie Hall, and Nickelodeon. These techniques have been instrumental in the designing numerous technologies for elementary-school-aged children, but three technologies in particular that have had a considerable number of users: the International Children's Digital Library (ICDL)("ICDL," n.d.), StoryKit (Quinn, 2009), and KidPad (Druin, Stewart, Proft, Bederson, & Hollan, 1997). The ICDL has had almost 6 million visitors, Storykit has had over a 340,000 users, and KidPad was used throughout UK and Swedish elementary schools as part of a European-Union funded initiative to develop the next generation of learning environments.

### *The Need for Research*

In order to involve more end-user voices into the design process, teams must use "distributed co-design" techniques. Currently, when an intergenerational design team would like to work with others in another location, distributed co-design is generally achieved with non-interactive media like paper and sticky notes physically sent via courier, or non-iterative, computer-based methods like e-mail. Distributed co-design is currently difficult because of the multiple individual idea streams that the distributed co-

design teams must manage such as text from an e-mail or graphics from an image file (Druin, Bederson, Rose, & Weeks, 2009). Besides the difficulty in organizing relevant media, distributed design teams need a way to see the iterations between versions and prevent versioning errors.

Some of these problems could be solved through the use of technologies that support computer supported cooperative work. Although tools currently exist for simultaneous co-work, such as online whiteboards and online writing tools, and can be extended for synchronous co-design, tools designed specifically for asynchronous co-design with children do not exist.

### *A Real World Problem*

A potential audience for a geographically distributed, co-design team is the students and facilitators of the Carnegie Hall Cultural Exchange program. In this program, students from New York, Mexico City, and New Delhi participate in activities in the classroom and in an online social network to learn more about culture through music. Each semester featured a live simulcast concert in which participating music artists from the respective country would perform and broadcast to the other country. Each location alternated between having an in-person performance and watching a live telecast of another performance at the other location. The staff provided opportunities for the audience to interact with the musicians and the students in the other countries.

Traditionally, the students in New York did not participate at the levels of their international counterparts. When asked questions, the students often just sat there and seemed to not enjoy the experience while participants in other countries seemed to be

more engaged and enjoyed the concert. Christopher Amos, Director of Educational Technology for the Weil Music Institute at Carnegie Hall wrote:

"Through our previous experience with the Cultural Exchange program, however, we also knew that it was challenging for students to have substantive dialogue with one another, or make meaningful contributions to the concert, when asked questions or otherwise "put on the spot" during concerts. As we planned for the 2009-10 season, we recognized a need for additional ways to provide structured experiences through which students could plan, create, prepare, and share their work for one another in the Cultural Exchange concerts." (Amos, 2011)

In the 2009-2010 school year, Carnegie Hall worked with student ambassadors, participating students chosen by their teachers, to help improve these semester-end concert experiences in the participant countries. Each location had co-design sessions; however, there was no interaction between locations except for the adult facilitators of Carnegie Hall who traveled between the countries.

Synchronous, co-located co-design sessions would be impractical with the students due to travel cost and time. Synchronous, distributed sessions, such as video conferencing, would be impractical between New York and New Delhi because of time-zone differences. The only solution to enable co-design in this scenario would be an asynchronous, distributed session. Unfortunately, tools and techniques that supported this were either not practical or did not exist in the 2009-2010 academic year.

This is a real-world problem that prohibits co-design from happening with geographically distributed audiences. In recent participatory design work with this

nationally recognized artistic institution, the ability to use traditional techniques with an international audience was prohibited by tools, location, and time. As the practice of Human-Computer Interaction has come to be a global experience, it is important to understand how to enable diverse users, young and old, to work with each other in order to solve complex problems. This lack of tools influenced my interest in distributed co-design and focuses my research.

### *Purpose*

The designs of children in areas not co-located with system builders, or who live in locations not easily accessed, are just as important and valid as children who are more easily accessed. There is a need for computer-mediated, asynchronous, intergenerational, participatory design tools. To accomplish this, a tool needs to support: users who are geographically distributed, elaboration between designs, and creative expression. In order to be useful for intergenerational design teams, these tools would also need to be child-friendly. Therefore, the features that an intergenerational, distributed co-design system must support are: creative expression, elaboration, geographic distribution, asynchronous participation and child-friendliness.

### *Children*

Although these technologies would be useful in general distributed co-design tools, my purpose is to understand them in the context of intergenerational design teams. The reason that I work with children is because I personally believe that many children's technologies designed by adults are not as good as they could be because children haven't systematically been included in the design team. Druin (2002, p. 2) wrote "[w]e need to understand how we can create new technologies that offer children control of a world

where they are so often not in control…The better we can understand children as people and users of new technologies, the better we can serve their needs".

Children are an important and interesting group with which to work. Children under the age of 14 experience the world differently than adults (Nardini, Bedford, & Mareschal, 2010). Children between the ages of 6 and 12 are considered pre-operational by Piaget and construct their reasoning through those experiences and perceptions (Gelman, Baillargeon, & others, 1983). This means that children between the ages of 7 and 12 years of age think (reason) in a way that adults cannot. They have insights to designing technology for children that adults would not.

Another important reason for working with children is their impact on the national economy. Today, children under 12 years of age spend $40 billion to $50 billion annually of their own money (Lappe, 2010; "Trillion-dollar kids," 2006). In 1960, children directly influenced about $5 billion of family spending but today directly influence over $350 billion (McNeal, 1998; "Trillion-dollar kids," 2006). Children have tremendous purchasing power in the United States and are an important aspect of the economy.

Finally, children and their interaction with technology is an important topic to Human-Computer Interaction academics and professionals. This importance is realized as a featured community within the Association for Computing Machinery's Special Interest Group on Computer Human Interaction (SIGCHI) and as a special interest group within the International Federation for Information Processing's Technical Committee on Human-Computer Interaction (TC13). There is an international conference for this subset called Interaction, Design, and Children and a journal named the International Journal of Child-Computer Interaction.

*Research Questions*

The following primary research questions (RQs) are the main focus of this dissertation research:

[RQ1] How can co-located, cooperative design with children be translated to an online distributed environment?

[RQ1A] What are the purpose and benefits of each stage of a cooperative inquiry design session?

[RQ1B] What features must be built into an online design environment to facilitate the purpose and benefits of each stage of a cooperative inquiry design session?

This question examines the transfer of the existing format of Kidsteam to be online. In order to answer this question, I analyzed the format of Kidsteam and break down each segment into time in process (first, second, third, etc), purpose (feed participants, elicit discussion, etc), perceived benefit to design process (increase energy levels, focus design space, etc), and participant-participant interactions (conversations, topics). I shaped the online environment to address the purposes and benefits of what the co-located Kidsteam provides. I examined the interactions that occur in co-located Kidsteam and identify how those types of interactions need to change in an online environment. This question is answered through observations of Kidsteam, and interviews with participants of the online environment.

[RQ2] What are the experiences of children as they participate as online design partners and how do those experiences influence their participation in an online asynchronous distributed co-design environment?

[RQ2A] What were the social and affective experiences of the children as they co-designed new technologies in an online, asynchronous design environment?

[RQ2B] How were those experiences shaped by their context as children?

[RQ2C] How did those experiences affect their participation in the online environment?

This question addresses the child-designers' feelings as they pertain to Online Kidsteam. This question takes into account how designing as part of Online Kidsteam makes them feel, what they liked, what they didn't like, what was hard, did they feel like members of a team, did they feel like they contributed to designing technology, and the favorite thing they designed. This question is answered through interviews with participants of Online Kidsteam and analysis of system logs.

[RQ3] What are the tools and technologies necessary to successfully support distributed co-design with children?

In this case, success refers to the ability for a design to be created in the same way that a design can be created within in-person design groups, not necessarily the success of the item designed by the group. This question is also informed by Q1 because the elements identified, their purposes, and the benefits derived from them require enabling

technologies. This question is answered through a design research approach in which the environment is iteratively developed and the problems are reframed.

## *Contributions*

The following contributions are made through this research:

### *Academic contributions*

[C1] The first version of a geographically distributed, asynchronous, intergenerational design environment is available for design research projects.

[C2] The experiences of an online, intergenerational design team are identified.

[C3] The distributed co-design technologies enable new kinds of co-located co-design techniques.

[C4] Support for high-tech prototyping in the traditionally low-tech prototype realm of participatory design.

[C5] New techniques for working and designing with children have been identified.

### *Broader Impact*

[C6] Underserved and hard-to-serve populations will be able to participate in the co-design process giving a voice to those who, frequently, cannot participate in the design process of technology.

[C7] International co-design projects between geographically distributed users will be possible.

*Definition of Terms*

Asynchronous – not happening at the same time.

Co-design:  cooperative or collaborative design; design that occurs between expert designers and members of the intended audience.

Co-located: design occurs in the same place.

Distributed:  design occurs in different places.

Bags of Stuff: large plastic bags containing art supplies used in the creation of low-tech prototypes.

Layered Elaboration – a paper-based prototyping technique in which users add layers of transparent material to iteratively design without destroying the original (Greg Walsh et al., 2010).


*Contents*

This dissertation is structured in seven parts:

- Introduction: The current section in which I introduced my topic, research questions, and contributions.

- Literature Review: This section contains a survey of literature around participatory design, low-tech prototyping techniques, computer supported cooperative work, distributed design, and asynchronous design.

- Research Methods: This section discusses the frameworks I used for my research, the quantitative and qualitative methods used for data collection and analysis, the technologies used in the research, the research schedule, and a

description of my pilot research.

- Intergenerational Design Session Findings: This section describes the process and protocols that our intergenerational design team follows and that I documented by observing the group as a non-participant in an afternoon Kidsteam design session.

- Online Kidsteam Environment Design Process: In this section, I detail the iterative design and development of the Online Kidsteam environment that occurred over an eight-week period.

- Participant Analysis Findings: This section discusses how the online environment was utilized by the intergeneration design team and the experiences that the children had within and outside of the environment.

- Discussion and Future Work: In this section, I discuss my findings and how they interoperate with each other to answer my research questions. I also describe how these findings influence my future work and the new questions I pose to research.

# Chapter 2: Literature Review

In this chapter, I will present a review of the literature. I will start with an introduction to participatory design and children's technologies, the growth in the literature over the years and a frequency analysis of participatory design literature within the last two decades. Then, I will present examples of projects created through co-design with children. Following that, I will explore existing co-design methods and techniques that have been utilized to develop design requirements with the target audience. This work motivates today's challenges with current co-design tools and their ability to be used as part of a distributed, intergenerational design team.

### *Participatory Design and Children*

To understand what co-design is, one must look at its history and how it has been used in the design process of technology. At its core, co-design is a subset of participatory design, an overarching methodology that involves end-users in the technology design process. In mid-1970's Germany and the Scandinavian countries, a feeling of loss was an important theme concerning democracy in the workplace (Kensing & Blomberg, 1998) and led to the seminal work of the UTOPIA project (Bodker et al., 2000). The UTOPIA project sought to give a voice to newspaper workers in Sweden in the design of new graphics workstations in the early 1980's. This project continued in the spirit of other democratizing projects in 1970's Scandinavia where researchers observed and helped trade unions influence the technologies used in the work place (Bodker et al., 2000).

Democratic Ideals

The idea of democracy is an important part of participatory design and co-design. As Muller and Kuhn (1993) point out, these projects focused on "participation" instead of "involvement". In this light, participatory design is more than just one of the many ways to gather requirements or preferred features lists—instead it is a way to recognize the end-user as an important (if not the most important) part of the system and to reframe the end-user as a colleague in the design of technology for that end-user. Today, participatory design methods and techniques could be described as extensions of the UTOPIA project, yet do not always achieve the democratic ideals of that project. Almost of all of these techniques are used in the design of new technologies.

"Cooperative Design", or "co-design", is the subset of participatory design where expert designers work with the target audience to solve a problem and attempt to rise to the early ideals of democratization. Projects are often labeled as "Participatory Design" if they include any activity with an end-user, but, co-design implies that the end-user is part of the design process. This subtle distinction is necessary because co-design implies that the user becomes involved in the design process early are not merely testers.

In a similar distinction, Druin (2002) outlined the roles that children can play in the participatory design of technology, from minimally involved to full partner: user, tester, informant, and design partner (See Figure 3). When children are users, they interact with the finished technology in a way that researchers can record and observe. When children act as testers, they interact with technology that has not been released so that researchers and designers can make changes before it is released into the public. As informants, researchers ask children to offer input at different stages of the design process

in order to guide the design and may considered the first role as co-designers. As design

partners, children are considered equal partners in the design process lifecycle.
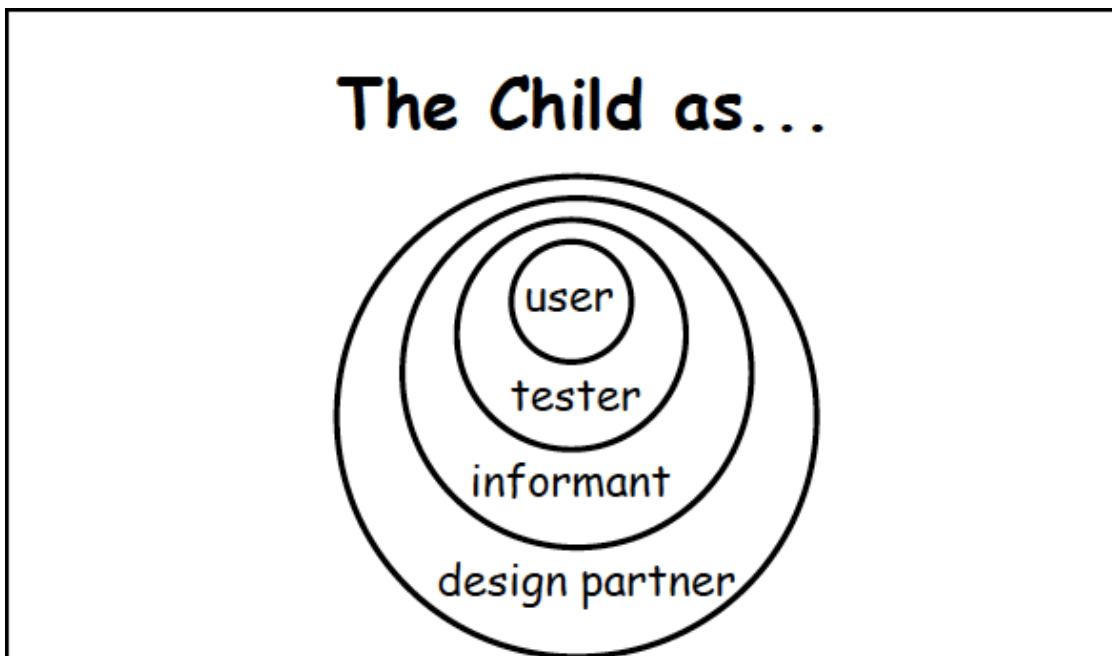


*Figure 1 – The roles of children in the design of new technology (Druin, 2002)*

Researchers have developed different methods for working with children in the

design of new technologies. Cooperative Inquiry, Bonded Design, Informant Design, and

MESS (Druin, 1999; Large et al., 2006; Read, 2010, 2010; Scaife & Rogers, 1999) are

popular methods used in the intergenerational co-design process.

Druin (2002) outlined the roles that children can play in the participatory design

of technology from minimally involved to full partner: user, tester, informant, and design

partner (See Figure 1). When children are users, they interact with the finished

technology in a way that researchers can record and observe. When children act as

testers, they interact with technology that has not been released so that researchers and

designers can make changes before it is released into the public.

As informants, researchers ask children to offer input at different stages of the design process in order to guide the design and may be considered the first role as co-designers. Informant design utilizes both hi-tech and low-tech prototyping techniques depending on the design problem and results desired. Philosophically, this method differs from previously mentioned methods in that it believes that researchers can choose the best stages of the design process for the involvement of children and only seek input during those stages. Informant design is intended to be a compromise between working with children as full partners, such as in Cooperative Inquiry, and adults designing technology with children in mind (Scaife, Rogers, Aldrich, & Davies, 1997)

Cooperative Inquiry has been used in the design of children's technologies for over a decade. This method builds on informant design by having adults and children work together as design partners to create low-tech prototypes (Druin, 1999). The prototypes are redesigned iteratively and usually increase in technological sophistication or focus at each iteration. Prototypes then receive feedback from the design team and the iterative cycle continues. In this methodology, the intergenerational design team participates in the design of the technology throughout its life cycle.

Benefit to Design and Participants

Cooperative Inquiry has been shown to create technologies for children that are positively received. After the previously mentioned Carnegie Hall project's completion, the organizers observed better audience engagement and participation than previous years and "we attribute this increase to the students' involvement in so many, and so wide a range of, aspects of each concert's planning and production" through co-design sessions as part of the cooperative inquiry method (Amos, 2011).

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Intergenerational co-design is not only positive for the products created through it, but can also be a positive experience for children who participate in it. Guha (2010) looked at the social and cognitive experiences of children who participated in an intergenerational co-design team through artifact analysis, observation, and interviews with child-participants and their caregivers. The data was used to identify and understand the experiences of the children. She found that the experiences fell into the following categories: relationships, enjoyment, confidence, communication, collaboration, skills, and content. The children's parents felt as though the experiences were positive because the children were being exposed to new topics and adults. Parents also though their children were more confident, outgoing, and technologically savvy after participating in an intergenerational co-design team.

Although this research was extremely enlightening, it only pertains to those children that participated in a co-located, intergenerational, co-design group. There is a still a need to look at the experiences of those children that participate in distributed co-design.

Academic Interest

Participatory design is also important to academia as its appearance in the literature has increased over the last 20 years. In a review of the frequency of literature appearing in *Google Scholar*, the *Web of Science*, and the *ACM Digital Library*, I found that there has been an increase in the number of publications mentioning participatory design in general. These publications either had "participatory design" in the meta-data or in the document. Using these three databases, I searched each for the term "participatory

design" and ordered the results by date, and took count of the results. The same scope (title, metadata, and body) was used for all three databases.

Searching returned more results year after year most years in the Google Scholar Database ($\beta$=106.6, $r^2$=.94) and the ACM Digital Library ($\beta$ =21.07, $r^2$=.76). Although the number of found articles varied year to year in the Web of Science, the general trend was positive ($\beta$=1.29, $r^2$=.70). See Figure 2 for a graphical representation. See Appendix A for search terms used and the results from those searches.
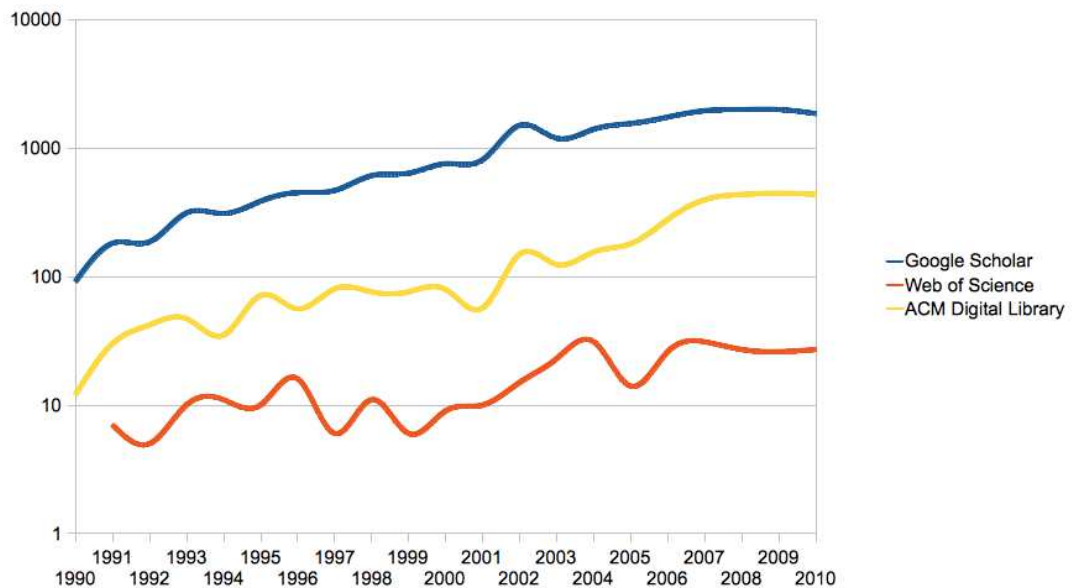


*Figure 2- Participatory Design's appearance in academic literature from 1990 through 2010 in three popular databases.*

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I performed an additional analysis using the same databases to determine the frequency of publications mentioning the design of children's technologies without participatory design (See Figure 3). Again, the general trends were similar; however, there was a great disparity between the databases in the number of publications contained. The Google Scholar Database ($\beta$=3445.87, r2=.82), Web of Science ($\beta$=3.49, r2=.87) and the ACM Digital Library ($\beta$=5.32, r2=.78) all showed year over year increases most years. The Google Scholar database reported the most articles (min=8140, max=70100). An interesting finding was that the ACM Digital Library did not have any publications found before 1994. This may be due to some conferences not being indexed until this time. See Appendix B for search terms and the results of those searches.

Finally, I did a search analysis to determine the frequency of publications mentioning children's technology and participatory design. The general trends were similar, however, there was almost no publications in the Web of Science (n=9). The Google Scholar Database ($\beta$=24.51, r2=.92) and the ACM Digital Library ($\beta$=4.85, r2=.76) both showed positive growth with most years showing year-over-year improvements (See Figure 4). See Appendix C for search terms and the results of those searches
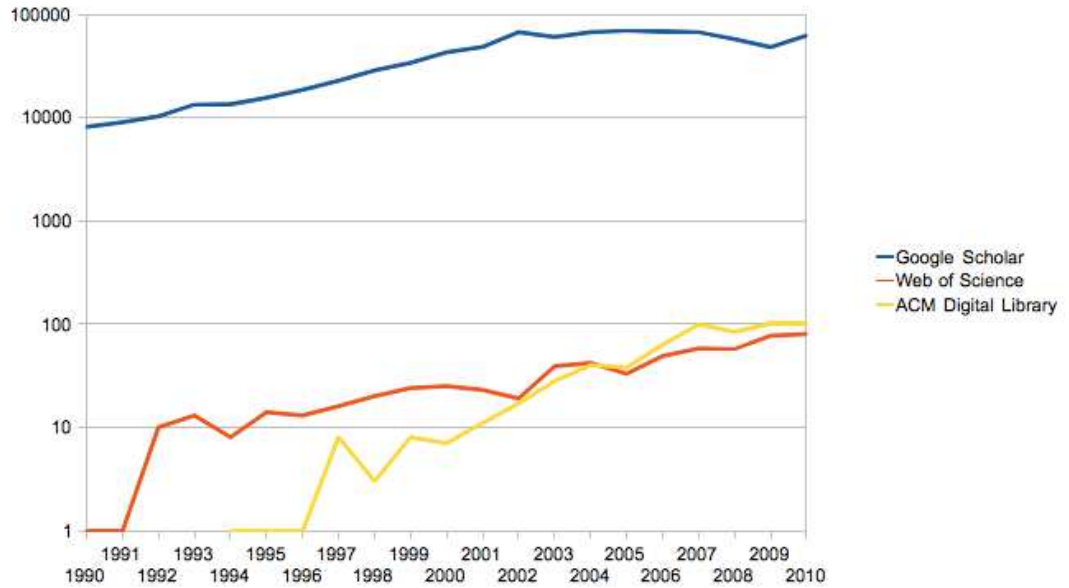
*Figure 3 – Children's technology design's appearance in academic literature*

*from 1990 through 2010 in three popular databases.*
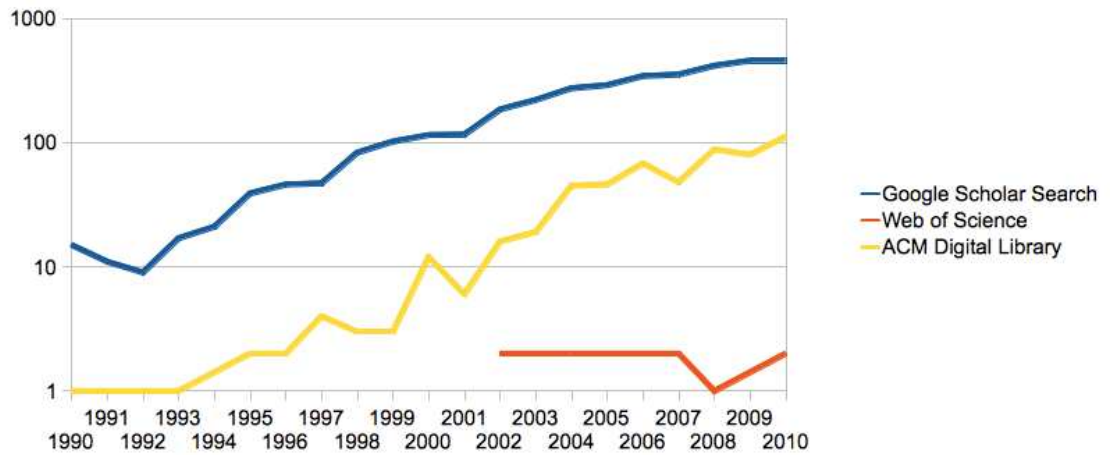


*Figure 4 - Children, technology and participatory design's appearance from 1990*

*through 2010 in three popular databases.*

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This analysis does show an increase in the frequency of participatory design and the increase of children's technology design in the literature but does not take into account if the literature is about the process of participatory design or the technology designed with participatory design techniques. Guha (2010) analyzed 90 pieces of literature involving children and participatory design to determine if the articles were about the design process, the technology created with the design process, or some combination of both. Figure 5 shows that, of the literature sampled, there was as much literature about process as there was about technology and technology and process combined.
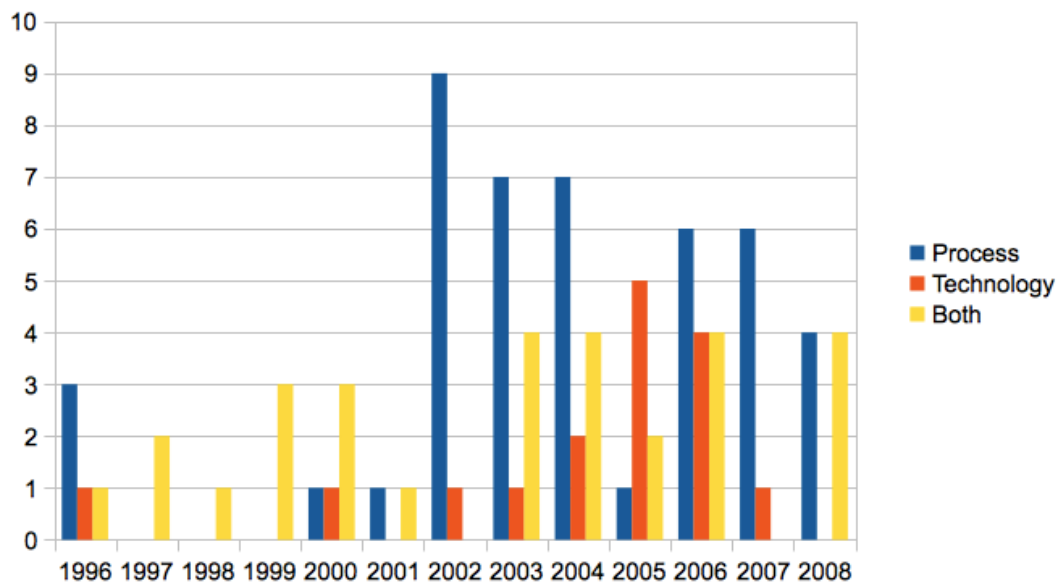


*Figure 5 - Analysis of Participatory Design Literature to determine if it discusses process, technology, or both.*

This analysis, as illustrated in Figure 4, combined with the increased frequency of publications concerning participatory design and concerning design with children, as illustrated in Figures 2 and 3 respectively, demonstrates that there is a growing body of scholarship in this area in not only the technology created with participatory design but the process as well.

### *ICDL: An Example of a Co-Designed Technology*

In order to better illustrate co-design, I present the International Children's Digital Library. I chose this example because of the large number of users the technology has had and the impact it has made. I will discuss the design process that the library went through, the outcomes from that process, and the subsequent technologies that have emerged from the library.

The mission of the International Children's Digital Library  is "to support the world's children in becoming effective members of the global community - who exhibit tolerance and respect for diverse cultures, languages and ideas -- by making the best in children's literature available online free of charge" ("ICDL - Mission," n.d.).  An international Kidsteam helped develop the ICDL through Cooperative Inquiry.

In the first version of the library, children were able to navigate the hierarchy of books but had trouble creating complex searches that relied on Boolean operators. Adults and children observed one another using existing technologies, created low-tech prototypes and evaluated and critiqued high-tech prototypes. The Kidsteam child designers interviewed other children, chose and designed the categories for the search, and designed and tested the interfaces for selecting books.

Kidsteam worked on the second revision by analyzing sketches, and developing low-tech prototypes for improvements. The designs were developed into high-tech prototypes and were tested for usability with another group of children and were found to be successful (Hutchinson, Bederson, & Druin, 2006).

As of May, 2012, the ICDL has had more than 6 million unique visitors. It has won numerous awards, such as the American Library Association's President's award for International Library Innovation in 2010 ("ICDL - Library News," n.d.) and a Digital Education Achievement Award in 2009 ("2009 Digital Education Achievement Award Winners Announced!," n.d.). The ICDL has been extended for use on such mobile devices as iPhones, iPod Touches, and iPads (Druin, Bederson, & Quinn, 2009).

One technology that has grown out of the ICDL is Storykit. Storykit was envisioned as a story editor for the ICDL so that readers could modify existing stories. It is an application for iOS devices (iPhone, iPod Touch) that enables adults and children to create multimedia stories. The application supports capturing, drawing, and inserting pictures, as well as recording audio and typing text. Cooperative design was used in the design and development of the app (Quinn, 2009). Kidsteam members were involved in the design from start to finish.

In early sessions, Kidsteam explored several applications on the iPhone to become familiar with it. Next, the members tried reading books on the device and were asked how they would write their own books. Sticky notes were used to capture the likes, dislikes, and design ideas from participants. These evaluations and ideas are sorted and grouped to identify common themes. The identified themes informed the building of low-tech prototypes for a "story-telling machine of the future."  The low-tech prototypes were

evolved and merged into a high-tech prototype which eventually was released as a free application.

StoryKit has gone on to be featured in Fall of 2010 in Apple's App Store as one of eight back-to-school apps for literacy. From its introduction in September 2009 until May 2012, StoryKit has been downloaded over 340,000 times and launched over 2,000,000 times (Bonsignore, 2012). Users have shared over 20,000 stories (Bonsignore, 2011) and enabled users to engage in "sense-making" in the world (Bonsignore, 2010).

### *Techniques and Methods used in Co-Design with Children*

Co-design relies on different types of techniques to facilitate the design process. Some techniques utilize something as simple as paper, while other techniques involve large workspaces and physical objects In this section, I will discuss different types of techniques and their relevance to a distributed co-design environment.

Researchers use *techniques* to "enable children and adults to work together to create innovative technology for children" (Guha et al., 2004). I define a technique as a creative endeavor between researchers and users that is meant to communicate design ideas and system requirements to a larger group. Techniques are often described as high-tech, which require sophisticated technology, or low-tech, which may require nothing more advanced than crayons and paper. There is often a need for modified or unique techniques when working with children, due to factors such as power dynamics between adults and children or the comfort level of the child (Druin, 2002).

Researchers have developed different methods for working with children in the design of new technologies. I define methods as a collection of techniques used in conjunction with a design philosophy. Cooperative Inquiry, Bonded Design, Informant

Design, and MESS (Druin, 1999; Large et al., 2006; Read, 2010, 2010; Scaife & Rogers, 1999) are popular methods used in the intergenerational co-design process. Methods and techniques both fall under the Participatory Design umbrella, as long as designers work with the end-user group at some point during the design process.

As previously mentioned, Druin (2002) outlined the roles that children can play in the participatory design of technology from minimally involved to full partner: user, tester, informant, and design partner. When children are users, they interact with the finished technology in a way that researchers can record and observe. When children act as testers, they interact with technology that has not been released so that researchers and designers can make changes before it is released into the public.

As informants, researchers ask children to offer input at different stages of the design process in order to guide the design and may be considered the first role as co-designers. Informant design utilizes both hi-tech and low-tech prototyping techniques depending on the design problem and results desired. Philosophically, this method differs from previously mentioned methods in that it believes that researchers can choose the best stages of the design process for the involvement of children and only seek input during those stages. Informant design is intended to be a compromise between working with children as full partners, such as in Cooperative Inquiry, and adults designing technology with children in mind (Scaife, Rogers, Aldrich, & Davies, 1997).

Cooperative Inquiry has been used in the design of children's technologies for over a decade. This method builds on informant design by having adults and children work together as design partners to create low-tech prototypes (Druin, 1999). The prototypes are redesigned iteratively and usually increase in technological sophistication

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or focus at each iteration. Prototypes then receive feedback from the design team and the iterative cycle continues. In this methodology, the intergenerational design team participates in the design of the technology throughout its life cycle.

Bonded Design (Large et al., 2006) is similar to Cooperative Inquiry, except that design partners work with researchers for shorter periods of time and the design projects are done in schools instead of a lab environment. This is done because the amount of time and resources required for a full-year of design partnering are often outside the means of design researchers. One philosophical difference of Bonded Design from Cooperative Inquiry is that all participants are also thought of as learners in addition to being designers.

The Mad Evaluation Session with Schoolchildren (MESS) day method used by the ChiCI group is mix of several techniques unified by the mission "to help children have technologies that are worthy of them; that support playfulness, that are fun to use, and are engaging and exciting" (Read, MacFarlane, Kelly, Mazzone, & Horton, 2006). This method relies heavily on evaluation and low-tech prototyping during MESS days. In this method, the research team works with a group of children to evaluate new technologies, participate in design sessions, and take part in research experiments (Read, 2010). This method is similar to Bonded Design, but has more of an emphasis on evaluation and fun.

All of these methods have relied on face-to-face design sessions for the majority of their work. Although none of the methods prohibit distributed co-design, the techniques used have required co-designers to be co-located (with the exception of the previous mentioned ICDL). These methods, in particular Cooperative Inquiry, have the

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ability to support distributed co-design through a modification of existing techniques and the creation of new techniques.

### *Food and Creativity*

Food is essential to the human body and it is suggested to provide snacks to participants in co-design sessions in order to maintain energy levels ("Usability First - Methods - Facilitated Brainstorming | Usability First," n.d.). Children have been shown to be more creative after eating a healthy meal (Wyon & Abrahamsson, 1997). This is important for designers who wish to include end-users in their design process in order help the participants reach their full potential, especially children who may "think and behave better" after eating ("National School Lunch Program," n.d.).

### *Low-fidelity Prototyping*

The use of paper as a medium in Participatory Design is popular through the use of low-fidelity, paper prototypes (Snyder, 2003). Paper prototyping provides user feedback early in the design process. Paper prototypes can be as simple as storyboards, or more complex requiring multiple researchers to imitate a computer. Paper prototyping can be effective because end-users are more likely to focus on content instead of appearance (Rettig, 1994).

Storyboards, originally used for film and television production design and later modified for interactive educational media (Orr, Golas, & Yao, 1994) are simply low-tech pictures either hand-drawn or created with layout software that represents what happens on each screen. Paper-based storyboards are static and communicate steps or screens while being limited in their ability to represent interaction.

More elaborate paper prototypes require several people to execute with a participant. In the design of a robot for ophthalmology (Go, Ito, & Kashiwagi, 2007), a team was made up of three researchers and one participant. One researcher acted as the leader and ran the session. One researcher acted as the computer and manipulated paper elements based on the input of the end-user. Finally, one researcher observed and took notes.

One of the earliest participatory design tools that leveraged paper-prototyping with new media was PICTIVE (Muller, 1991). PICTIVE combined low-tech prototyping materials with high-tech video recording. PICTIVE used a shared design surface and included a number of low-tech materials like labels, highlighters, colored pens, Post-it notes and pre-made icons. The video equipment recorded the design team working on the shared surface. The idea of "Plastic" is important to PICTIVE because items are made of plastic, plastic in the sense that designs are easily changed, and plastic as artificial because one can't confuse the prototype with a working system.

Similar to PICTIVE's shared physical space, the Cooperative Interactive Storyboarding Prototyping (CISP) (Madsen & Aiken, 1993) approach used a virtual space on the computer screen. The goal of CISP was to aid the researchers in designing a better VCR interface. The first iteration of the method started with asking users to perform a task with the lab's then-recently purchased VCR and having them describe what they were doing. The sessions were recorded but obstacles including occlusion of the camera and poor voice recording reduced the efficacy of the artifacts for research.

The second iteration of CISP was built with HyperCard. This iteration of the method used a palette of building blocks for people to develop user-interfaces on the

screen. The users could design a system on the screen that really controlled the connected VCR, test their system with other users and capture real-use data that was unavailable with only a video recording.

The previously mentioned techniques were similar in their shared workspaces; however, collaboration between users occurred in real-time (PICTIVE) or, more loosely defined, in a design-test-redesign method (CISP) and only occurred in the fixed-location of the tools. These tools required the designers to be in the same place at the same time.

### Elaboration during Design

Techniques used in intergenerational co-design often rely on elaboration between participants to create designs. These elaborated designs are the outputs from which common themes and future directions emerge.

One method that contains elements overcoming the limitations of the previously mentioned design techniques was the Group Elicitation Method (GEM) (Boy, 1997). This technique allowed domain experts to collaboratively solve a problem through brainstorming augmented with a decision support system. The second phase of the six-phase system is the most interesting in terms of low-tech prototyping.

In the second step, called viewpoints generation, participants write their ideas on large pieces of paper at different parts around a room. This is an iterative process where the experts write their own ideas and then move around to read others' ideas. In this process, participants critique each other's work as they go. As this cycle occurs, "participants start to write for the others instead of for themselves by adapting their own language to what they have just read" (Boy, 1997, p. 2).

Landauer and Prabhu (1998) described Dray's technique called BrainDraw. BrainDraw is a round-robin brainstorming activity done without critique. In this process, each designer draws an initial design at his or her own station. After a defined amount of time, the participants physically move to the next drawing station and continue the drawing at that station. The process continues until everyone feels as though they have worked with each idea. Each idea builds upon the previous idea in an iterative manner. At the end of the process, each station contains a drawn artifact representing ideas from multiple people. Another version of the technique has participants stay seated and the designs are moved to different stations.

Trying to enhance storyboards led to the development of Layered Elaboration (Greg Walsh et al., 2010), a new technique for co-design that the Kidsteam researchers developed. It generates design ideas through an iterative drawing process where each iteration leaves prior ideas intact while extending ideas in new and different directions. It does this through the use of over-head transparencies applied over a piece of paper that has a design on it. The over-head transparency is laid over the piece of paper and then the team members add to the design using markers specifically made for acetate.

The utility of this technique is the ability for several designers to contribute ideas in a non-destructive way. In a traditional low-tech prototyping session, when one designer adds an idea to another's design, that original design becomes permanently changed. For example, if one designer builds a model of an airplane with craft materials and another designer adds a piece to it, that original design has been changed and reverting back to its original form is often difficult or impossible. Likewise, when using paper to make designs, it is often impossible to go back to an original design after

someone else has drawn on it with marker. If the first designer uses paper and then each subsequent designer stacks a transparency on the drawing, the ability to "roll back" the changes becomes very easy. Co-designers may be more likely to contribute ideas if they do not feel like they are destroying another's work. Madsen and Aiken thought the "concept of iteration as a discovery process is the key to prototyping: each successive iteration brings the prototype one step closer to correctly representing the user needs…the concept of the role of the user changing from reviewer to codeveloper" (Madsen & Aiken, 1993, p. 57).Layered Elaboration has been used to develop a touchscreen-based, educational game called "Energy House" (Cruz-Cunha, 2012; Greg Walsh et al., 2010).

GEM, Brain Draw, and Layered Elaboration are relevant because all allow for iterative design in a round-robin like fashion. GEM allows participants to critique and fosters the creation of a shared language as they go while BrainDraw allows participants to build up and add to designs without a fear of critiquing. Layered Elaboration builds on these methods to enable users to design without destroying previous versions. Each one is described as having taken place in a fixed setting and each requires co-designers to be co-located. Participants would need to incur the cost of travel to be co-located or be willing to take extra time as the artifacts are shipped from location to location.

### *Computer Supported Cooperative Work*

Computer-supported Cooperative Work (CSCW) is "an endeavor to understand the nature and requirements of cooperative work with the objective of designing computer-based technologies for cooperative work arrangements" (Schmidt & Bannon, 1992). The CSCW conference describes itself as the venue for research pertaining to the technological and social aspects of technologies that support collaboration ("CSCW

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2013," n.d.). It is difficult to discuss distributed participatory design before understanding distributed design within a CSCW context.

Rodden and Blair (1991) describe that CSCW technologies take place over two dimensions: form of cooperation and geographical nature. The forms of cooperation deal with the temporal aspects of collaborative work as being synchronous, asynchronous, or mixed. In this case, synchronous means work is done at the same time and asynchronous means that work is done at different times by team members. The geographical nature dimension describes where the participants are in relation to each other. Rodden and Blair describe that team members can be co-located, virtually co-located, locally remote, and remote. These labels were created when there were greater technological limitations than today and the labels of virtually co-located and locally remote essentially mean the same thing today.

Saad and Maher (1996) investigated the role of CSCW in distributed design. They found that collaborative design required complex interactions and information than other types of collaborative work. The system they designed, MATE, not only showed visual representations of the design objects, but also included semantic representations of objects and provided a shared workspace that worked in tandem with a real-time video conferencing system for the distributed team members to collaborate. The system also enable designers to record video and audio about design artifacts.

Researchers have investigated the use of collaborative technologies through developing a tool call Slice and observing a geographically distributed team in the design of a rocket engine that cost less than traditional solutions (Rice, Majchrazak, & Malhotra, 2000). The Slice tool consisted of collaborative technologies included making entries and

commenting within an electronic notebook, electronic sketching through a whiteboard

drawing program, and graphic tools for taking snapshots of the computer screen.

Engineers were from three different companies and were able to accomplish this task

using less that 15% of their work schedules.

CSCW focuses on the tools to support group work. In projects like TeamSCOPE

(Jang, Steinfield, & Pfaff, 2002), researchers determined that a number of tools were

necessary to help create a centralized place for distributed teams to keep their designs.

TeamSCOPE used the following tools as part of a system that supported virtual design

teams: file manager, message board, calendar, activity summary, activity notification,

team member login status, team member usage information, and team site summary. This

tool was used by engineering students in distributed teams.

In all of these previously mentioned projects, the main users of the systems were

experts. These experts were engineers or professional designers whose jobs depended on

collaborating with other professionals. In terms of participatory design, the lack of

involvement of end-users is a shortcoming in this work. However, these projects are all

extremely important in the context of geographically distributed participatory design

because they set the stage for future projects and give insight into the types of

technologies and frameworks that would be necessary for distributed collaboration.

### *Geographically dispersed design teams*

As research becomes more global and collaborative, we need to consider what methods

and techniques for design support this audience. According to *The Record Project*,

including the target audience in a way that keeps to the spirit of participatory design is

becoming difficult ("RECORD□» Participatory design 2.0 – user involvement through

social media," n.d.). Involving a significant number of users is hampered by how distributed users of software have become. A developer only needs to release her software on a web site and have it available to a worldwide audience. As communities become more global, there is a need to use cooperative design techniques with geographically dispersed audiences. There are multiple considerations when working with a geographically dispersed design team including online prototyping, communication channels, and time zone considerations.

One project that attempts to make geographically dispersed, cooperative design work is the PICTIOL project (Farrell, Farrell, Mouzakis, Pilgrim, & Byrt, 2006). PICTIOL is based on and shares features with TelePICTIVE, (Miller, Smith, & Muller, 1992), an online version of the PICTIVE design technique. PICTIOL seeks to mimic PICTIVE with an online design space using predesigned shapes, "sticky notes", and some drawing tools. Like TelePICTIVE, PICTIOL allows users to design user interfaces in synchronous sessions. Both also break the users into distinct roles like manager, designer, developer and end-user.

In TelePICTIVE, users work on the screen at once. Once an object is placed and modified by one user, other users can modify it. If a user begins to modify an object, that object is locked to the user until they release it. PICTIOL, however, locks the entire screen when a participant is designing. Other participants can watch what is being done and all can participate in a discussion. TelePICTIVE has a similar User Info box to describe what all the participants are doing.

Another example of geographically dispersed, cooperative design can be seen in the design and development of the International Children's Digital Library (ICDL)

(Druin, Bederson, Rose, et al., 2009). For this international project, the design team leaders had to modify their traditional co-design techniques (e.g., sticky-noting, low-tech prototyping, and idea frequency analysis, or "Big Ideas") (Guha et al., 2004), to work with a geographically dispersed group.

For example, instead of sticky notes to denote likes, dislikes, and design ideas, a paper matrix was created for design partners to write those same thoughts and then send them back to the design leaders at the University of Maryland. Similarly, instead of low-tech prototyping with Bags of Stuff, bags of art supplies and found objects, children from geographically dispersed areas drew pictures on paper and mailed them back. Once a year, a lead team member would travel to the different countries to interview the children about their designs to get some insight (Druin, Bederson, Rose, et al., 2009).

In order to use co-design with a distributed audience, TelePICTIVE, PICTIOL, and the ICDL made compromises in order to succeed. Although TelePICTIVE and PICTIOL allow participants to design together, they require synchronous connectivity. Synchronous activities can become difficult when participants' local time zones are far apart. For example, if one participant is in London, while another participant is in Los Angeles, they are separated by over eight hours. That means that one participant's morning is another's evening and their window to collaborate is small.

The ICDL team ran into a different, yet important, challenge in distributed co-design. The quality of interaction between co-designers usually encountered was reduced because of communication media. The time to scan and email something, the cost to travel to a site, and the lack of iterations and elaboration by all parties in a timely manner could reduce the speed of development of the project.

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*Asynchronous design*

Tudor and Radford-Davenport (2005) developed four techniques to enable asynchronous collaborative design: the *hallway method*, the *rolling whiteboard method*, *design by appointment*, and the *electronic method*. The hallway method focused on a paper-based, centrally located prototype that participants could comment on and elaborate upon using common office supplies. The rolling whiteboard was similar but was moved from office to office in order to address management's time constraints while the design by appointment method allowed individuals to schedule time with the designers to comment on the paper prototypes. The electronic method utilized email to disseminate PowerPoint-based "paper" prototypes to a distributed user, collect that user's comments, send it back to the design team and then send it to a new participant.

In their current form, the hallway method, rolling whiteboard, and design by appointment do not lend themselves to geographically distributed design. The electronic method does support geographically distributed asynchronous design, however, the constant back and forth between participants and designers creates an overhead for organization because all iterations must be managed and organized by the co-design leaders. Also, this technique seems ideal for including participants as informants but not design partners because they are merely commenting on designs created by a design team and not as active partners.

Thus, what is needed is a technique that is usable by designers around the world when they are available, yet updates instantaneously, and manages the iterations between versions.

*Table 1- Comparison of existing tools and their usefulness in distributed, intergenerational co-design.*

| Tool Name | Creative Expression | Elaboration | Geographically distributed | Asynchronous | Child Friendly |
|---|---|---|---|---|---|
| Photoshop | Yes | No | No | No | No |
| PICTIVE | Yes | No | No | No | Yes |
| TelePICTIVE | Yes | No | Yes | No | No |
| Google Docs | Yes | Yes | Yes | Yes | No |
| Group Elicitation Method | Yes | Yes | No | Yes | No |
| PICTIOL | Yes | No | Yes | No | No |
| BrainDraw | Yes | Yes | No | Yes | No |
| Layered Elaboration | Yes | Yes | No | Yes | Yes |
| Cooperative Inquiry | Yes | Yes | No | No | Yes |
| Cooperative Inquiry (modified for ICDL) | Yes | No | Yes | Yes | Yes |
| Hallway Method | Yes | Yes | No | Yes | No |
| Rolling Whiteboard | Yes | Yes | No | Yes | No |
| Design by Appointment | Yes | No | No | Yes | No |
| Electronic Method | No | Yes | Yes | Yes | No |

*Comparing existing tools and their usefulness in distributed, intergenerational co-design.*

There are tools and techniques available today that have some of these characteristics as presented in Table 1. In the table, the following definitions are used:

*Creative Expression*: provides tools to participants in a way that encourages design.

*Elaboration*: the tool or technique inherently enables users to add to designs from other users without the need for separate technology (such as email).

*Geographically distributed*: the tool or technique supports multiple users in different physical locations.

*Asynchronous*: the tool or technique supports multiple-users to design together without requiring those designers to work at the same time and not with a separate technology (such as email).

*Child Friendly*: the tool or technique was designed with children in mind.

In order to address this need for a distributed co-design tool, I investigated the following items: translating cooperative design with children to an online distributed environment, the experiences of children as they participate as online design partners, and the tools and technologies necessary to successfully support distributed co-design with children.

# Chapter 3: Research Methods

This research is descriptive, as I looked at the phenomenon of distributed co-design. The research for this dissertation utilized a mixed-methods approach with an emphasis on qualitative research in order to provide a more thorough description. My overarching research philosophy was *research through design* in which knowledge was gained through a combination of design problems, prototypes and iterations as well as interviews and descriptive statistics. In this chapter, I will discuss my participants, the methods I used to collect data, the ways in which I analyzed the data, and the schedule. The Institutional Review Board has approved this research as an addendum to the existing Kidsteam research.

### *Design Research*

Horvath (2007) described three types of design research: research in design contexts, design inclusive research, and practice-based design research. In research in design contexts, scientific principles are applied toward design inquiries. Techniques from different scientific fields, such as psychology, information studies, or ergonomics are used in the generation of knowledge. In this context, the knowledge gained can lead to better insights and the development of new theories. In practice-based design research, an existing project is reflected upon and theory and knowledge are based upon that reflection.

Design inclusive research is a methodology framework in which design becomes a vehicle for research. The context is less theoretical than the research in design contexts methodology and seeks to create knowledge by generating prototypes. The goals and

contexts of this methodology are similar to Research through Design (Zimmerman, Forlizzi, & Evenson, 2007). With Research through Design, researchers design and build prototypes informed by outside disciplines, such as anthropology, ethnography and computer science in order to generate knowledge. Through iterating and critiquing, the problem is reframed. The outcomes of design by research include identifying a concrete problem and the ideal state as well as artifacts such as models, prototypes, process, and documentation.

Horvath describes three phases of design inclusive research: pre-design process, the embedded design process, and the creative action. In the pre-design process researchers aggregate knowledge and existing work to see how similar research has been conducted, critique existing solutions, define the research questions and develop hypothesis, set the goals of the design activities, and develop theories to solve the design problem. In the embedded design process, the researchers' goal is to develop concepts and methodologies, test those ideas via prototypes, and create better understanding of the situation. In the post-design process, the hypothesis is verified, the research methods are internally validated, the findings of research and artifacts are externally validated, and the knowledge is applied to other contexts.

One critique of the methodology is that the research goal of generating knowledge is usually an afterthought in existing Research through Design projects (Zimmerman, Stolterman, & Forlizzi, 2010). Instead, it was thought that researchers reflect on a design project and write about that in a way similar to Horvath's practice-based design research. To counter this, Zimmerman et al. found that the research community wanted a more

thorough rigor in the design process by having design researchers documenting the changes in problem framing and how those changes affected the design.

This style of research through design and design inclusive research is the framework that I followed to complete this research within the Cooperative Inquiry method.

### *Participants*

The research was broken up into two sessions: one six-week session where participants were at a place of their choosing and used the system as they wanted and one two-week session where the environment was used as a part of face-to-face Kidsteam "Camp". In the first session, there were 12 child participants with ages ranging from 7 to 11 (M= 8.92, N = 12, SD= 1.44) and 9 adult participants ranging in age from 20 to 48 (M=32, N =10, SD=8.63). There were six boys, six girls, seven female researchers, and three male researchers. In the second session, there were an additional three girls and two boys who participated (M =9.18, N = 17, SD=1.33).  See Table 2 for a list of the participants.

There were interviews with parents at the end of the summer session that took place during the final interview with each child. I was able to interview five of the seven parents. I was unable to interview two of the parents due to availability.

*Table 2 - Participant list*

| Name | Gender | Age | Role |
|---|---|---|---|
| Alice | F | 11 | Online Participant |
| Breanna | F | 7 | Online Participant |
| Samantha | F | 8 | Online Participant |

| | | | |
|---|---|---|---|
| Max | M | 7 | Online Participant<br><br>Camp Participant |
| Amanda-Jane | F | 10 | Online Participant |
| Bethany | F | 10 | Online Participant<br><br>Camp Participant |
| Selena | F | 7 | Online Participant<br><br>Camp Participant |
| Mason | M | 9 | Online Participant |
| Raoul | M | 8 | Online Participant<br><br>Camp Participant |
| Tomas | M | 10 | Online Participant |
| Hugh | M | 10 | Online Participant |
| Oscar | M | 10 | Online Participant |
| Clarissa | F | 10 | Camp Participant |
| Flynn | M | 8 | Camp Participant |
| Sirsha | F | 10 | Camp Participant |
| Ernesto | M | 11 | Camp Participant |
| Eliza | F | 9 | Camp Participant |
| Greg | M | 36 | Online Participant<br><br>Camp Participant |
| Jason | M | 32 | Online Participant<br><br>Camp Participant |
| Mona Leigh | F | 36 | Online Participant |

| | | | Camp Participant |
|---|---|---|---|
| Beth B. | F | 48 | Online Participant |
| | | | Camp Participant |
| Evan | M | 40 | Online Participant |
| | | | Camp Participant |
| Richelle | F | 30 | Online Participant |
| Robin | F | 20 | Online Participant |
| Asmi | F | 20 | Online Participant |
| Tammy | F | 31 | Online Participant |
| | | | Camp Participant |
| Beth F. | F | 27 | Online Participant |
| | | | Camp Participant |

### *Online Kidsteam*

My research goals are to identify the experiences of children who participate in an online, distributed, intergenerational co-design team as well as identify a process and develop technologies for distributed co-design. In order to generate that knowledge in the framework of design inclusive research and research through design, I created a web-based Online Kidsteam as my embedded prototype that was iteratively developed over an eight-week period. Instead of regular meeting times, Online Kidsteam members logged on to the website and participated in design sessions from when and where they wanted for the first six weeks and then in a mixed environment of lab and home.

In order to facilitate distributed design, several tools were made available and new tools were developed and refined through the research period based on the reframing of the problem as the research went on. The distributed design activities represented the co-located design experience at the beginning of the research and were iteratively modified and evolved as the experience unfolds. The original co-located, co-design team agenda was: snack time, circle time, design activity, and debriefing (Greg Walsh, 2010). The distributed co-design team had modified versions of these agenda items that replicated their core functions based on my initial understanding of them.

### *Technologies Used in the Environment*

Online Kidsteam required a suite of tools to enable participants to design in the distributed environment. I've used the four previously mentioned phases (snack time, circle time, design activity, and big ideas) as the original framework for the tools. The tools were built with a combination of Drupal, PHP, JavaScript, HTML, MySQL and Adobe Flex.

Drupal is a content management system for Web sites ("Drupal - Open Source CMS | drupal.org," n.d.). It has many built-in features to support sites with members: login and password management, profile pages, avatars, and roles. Additions, known as modules, are created by the community and allow for extended features like chat rooms and forums.

HTML is "the publishing language of the World Wide Web" ("W3C HTML Working Group," n.d.). It is a mark-up language that enables developers to display text, graphics, interactive elements, and forms in a Web browser. By itself, HTML offers limited opportunities for interactivity and is often paired with JavaScript.

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JavaScript is an interpreted language that operates in modern Web browsers (Flanagan, 2011). JavaScript is able to communicate with HTML elements to retrieve and set values. It is useful because it enables embedded objects to communicate with other objects on the Web page.

PHP is an embedded scripting language for Web development ("PHP: General Information - Manual," n.d.). Developers place code into the web page that is converted on the server side and returned as plain HTML. PHP is often used when developers want to extract or input information into a database. I have 12 years' experience with PHP and have found it to be powerful.

MySQL is an open source, structured query language compatible, relational database ("MySQL□:: The world's most popular open source database," n.d.). It is often used in conjunction with PHP as a database for Web-based applications. It can store text and binary objects and is well suited for this project.

Flex is an open source variant of Adobe Flash. Its language is similar to Java and was designed to aid in the development of Web-based applications. Conversely, Flash was designed as an animation tool. Flex is compiled into a Shockwave Flash File, or SWF, and embedded as an object within an HTML page. SWFs can communicate with HTML objects through JavaScript.

Utilizing the  AWave MP3 library for Adobe Flash, I was able to create a web-based application for recording audio. This functionality has traditionally been difficult in Web-based applications. With the addition of this component, I will be able to implement asynchronous notation through voice.

Because snack time is the least structured, a tool that functions similarly to group instant messenger was used. This enables design partners to asynchronously chat by leaving messages that are persistent. The tool was built with PHP, HTML, and MySQL. Circle time is similar to a discussion board, but because it is a more structured activity and works to set the tone of the design session, the tool will ask a specific question. The answers will be presented in a list alongside of the participant's avatar.

The design tool, DisCo, is built with Adobe Flex, HTML, PHP, JavaScript, and MySQL. The participants drawings are recorded in the database as sets that contain a start point, x and y coordinates, end point, line width, and color. This tool manages the iterations and elaborations between the participants. It has been designed in a modularly way so that changes to the techniques easily can be made.

*Empirical Research: Quantitative*

Data Collection

**Artifact Data**

The web application stores the artifact data in a table called "layers" in the MySQL database. The table has seven fields: identification (id), project id, user id, notes, data, time, and audio. The id field is a unique value that identifies the layer. The project id field is a relational field that references what week, or project, the layer is associated with. The user id field identifies the first author of the layer and subsequent authors are stored in a relationship table that connects all authors with a particular layer. The time field stores the time that the layer was saved by the user in the epoch time format. The audio field was added to store the URL of the recorded audio.

The notes and data fields store the majority of the information used in the tools. The notes field is a text field in which the layer's author describes the design created. The data field is a long-form text field in which the layer's graphical data is stored. The data is recorded as a matrix of text information that can be interpreted by the tool and re-rendered into graphics. The matrix is constructed in this format: [tool name,tool property 1, tool property 2…tool property *n*, epoch time]. This is the first ten lines of an example of a layer's data field in which the user drew a beach ball (See Appendix H for the complete dataset and Figure 6 for the graphical representation):

```
[circle,10,16711680,196.95,82.55,102.30000000000001,90.3,1309194197169,],
[brush,'null','null',253.05,84.75,1309194201227,],
[brush,'null','null',244.25,84.75,1309194201798,],
[brush,10,16711680,244.25,85.85,1309194201918,],
[brush,10,16711680,246.45,88.05,1309194201939,],
[brush,10,16711680,248.65,90.3,1309194201958,],
[brush,10,16711680,251.95,93.6,1309194201982,],
[brush,10,16711680,254.15,94.7,1309194202001,],
[brush,10,16711680,255.25,95.8,1309194202020,],
[brush,10,16711680,256.35,96.9,1309194202039,]…
```
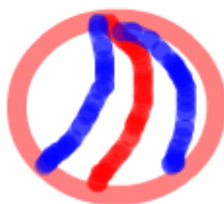


*Figure 6- Illustration of a beach ball*

In this example, the circle matrix denotes the following: [tool name, circle line width, circle color, circle x coordinate start, circle y coordinate start, circle x width, circle y width, time stamp]. The brush matrix represents the following: [tool name, brush width,

brush color, x coordinate, y coordinate, time stamp]. This data was used to answer

research questions 1 and 2.

**Logs**

The online tools that make up the distributed co-design environment write to log

files in order to better evaluate the usage patterns of the distributed co-designers. The

following data was recorded:

- User information

    o Login date and time

    o The participant's computer's unique Internet Protocol (IP)

address

- General usage history

    o Pages visited

    o Time page is accessed

- Tool usage

    o Project ID

    o Tools selected

    o Time tool is selected

The user information records the date and time the participants use the system.

This information is useful in seeing when co-designers chose to participate in the design

sessions. In instances where multiple links go to the same location, the system

differentiated what button the user clicked. This data was used to answer research questions 2 and 3.

Data Analysis

**Artifact Data**

The artifact data was analyzed with a custom PHP script. This script enabled me to pull data from the artifact database, and I was able to investigate the relationship between layers attempted and layers actually saved. This helped me corroborate the qualitative data.

**Logs**

The IP address of the participant's computer informed where the user had chosen to design from by using IP-Geolocation tools ("Geographical Location for IP address. | ip address to Country, City, Region lookup. | free ip to location service," n.d.). This IP address was also used in determining if the co-designer logged in from different locations.

The general usage information recorded the pages that users loaded in the distributed co-design environment. Each page made a log entry upon loading. This information allowed me to see the access times and types of pages that the users accessed.

### *Empirical Research: Qualitative*

Data Collection

**Observation**

In order to better understand the intergenerational co-design process, I stepped away from the role of participant and spent one session observing the in-person, co-

located intergenerational design time as an outsider. I have reviewed the process of co-located cooperative inquiry before (Greg Walsh, 2010) but never as an observer. I collected my data by writing a moment-by-moment synopsis of what I was observing combined with digital photographs. See Figure 7 for a photograph of my technical setup in order to best capture my observations. These observations were used to answer research question 1.



*Figure 7- A picture of my prototype observation capturing setup that combined a digital camera with text-based note taking.*

**Interviews, Questionnaire and Preference Survey**

There were semi-structured, open-ended interviews with the child participants that took place at two points in the research period: the mid-point and at the end. Some

participants were asked all of the questions at the same time due to their availability. All interviews were conducted with the internet-based voice tool Skype and recorded to an audio file. The interview at the mid-point asked participants about their experiences as members of Online Kidsteam (See Appendix C). There was a pre-survey about expectations. This survey used a Likert Scale modified for use by children (See Appendix D).

Along with the expectations pre-survey, there was a preference questionnaire (See Appendix E) about online tools in the second and fourth weeks of the research through web-based forms. The preference questionnaire investigated the participants' feelings about the tools being used through open ended questions.

At the end of the Online Kidsteam, there was a final interview with participants and their parents via Skype (See Appendices F & G). This final interview was loosely based on the instrument used by Guha (2010) and modified based on the mid-point interviews. One participant declined to be interviewed for the final session and I was unable to interview two parents due to availability.

Only the child participants and their parents were interviewed for this research because of my interest in the experience of children as distributed co-designers. I did interview several adult members at the mid-point but soon realized that it was difficult for them to express their experiences within the environment as participants and instead their feedback was more about the research and the research methods. Realizing that I needed to approach this project with an emphasis on intergenerational and not child-exclusive, I interviewed parents at the end of the research period to try and elicit their opinions of their own and their child's experiences with Online Kidsteam. The parents proved to be

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very forthcoming in their comments and criticisms of the research project. The data

gathered from the interviews contributed to answering research questions 1, 2, and 3.

**Artifact Analysis**

Participants' designs from within the environment were analyzed for content. The

system manages each person's contribution. The artifacts were examined for their

graphical appearance and their textual descriptions. This data was used to answer

research question 3.

Data Analysis

**Observation**

The observations produced text and photographic data. The data was combined to

create a narrative of my experiences of the in-person Kidsteam session.

**Interviews, Questionnaires, and Preference Surveys**

The interviews and surveys produced text and numerical data. The numerical data

was processed with statistical software and descriptive themes were identified. I used an

open coding system and developed codes as I analyzed the interviews in the style of

Grounded Theory (Strauss & Corbin, 1990). I transcribed the interviews into text by

using the open source tool Transcriber. My text analysis was completed within the open

source program Weft Qualitative Data Analysis. When I had completed one-third and

then two-thirds of all of the interviews, I performed a code-check with two adult

members of Online Kidsteam in order to see if my coding scheme made sense.

The data from the questionnaires was not analyzed because each iteration had less

three or less child respondents. Because of this, I included some of the same questions

into the second interviews in order to gain insight into the participants' feelings about

their usage and the environment.

**Artifact analysis**

The design process produced the following types of data: texts, graphics, and audio. The text data came from the text descriptions entered by the design partners to describe their designs which were captured as graphical data. The few pieces of audio were recordings of participants' descriptions of designs. In order to analyze these data elements, I extracted the main points of the design sessions to list the Big Ideas to solve the design problems I presented.

*Pilot Research*

Using the lessons learned from previous co-design methods, and trying to address the needs of a geographical distributed co-design audience, I designed and implemented a pilot research prototype (G. Walsh, 2010) by following a Research through Design approach. Research through Design is an emerging area of the Human-Computer Interaction field (Zimmerman et al., 2007). With research through design, researchers design and build prototypes informed by outside disciplines, in this case Cooperative Inquiry techniques and computer drawing tools. Through iterative development and evaluation, the problem is reframed. The outcomes of research through design include identifying a concrete problem and the ideal state as well as artifacts such as models, prototypes, process, and documentation. In this research, the artifacts included a prototype web-based software package to facilitate Layered Elaboration and support creative expression. The distributed co-design tool, *DisCo*, was designed to expand Layered Elaboration from a paper-based technique to an on-line environment. It enables co-designers to work asynchronously and manages iterations of designs.

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The first version of DisCo was designed to mimic the paper-based Layered Elaboration technique while adding a small number of features available only on the computer and necessary for distributed teams. The tool allowed users to add layers similarly to the acetate layers used in the paper-based technique.
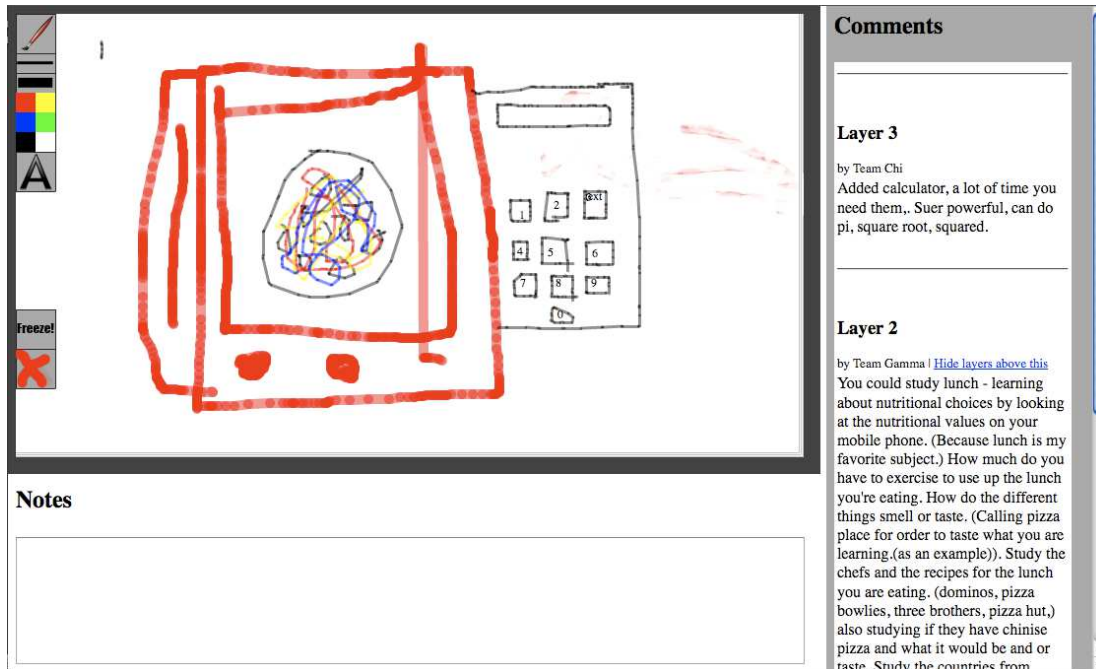


*Figure 8 – Screenshot of the first version of DisCo.*

The screen is divided into three parts: a canvas for drawing, a box for annotating the design, and a comments pane that displays the designers' annotations for their respective layer (See Figure 8). The canvas contained a paint brush for designers to draw, a color palette, a tool for adding text, a discard button, and a save button called "freeze" to mimic the verbal alert used in the paper-based version of the method. Designers were able to hide all the layers above a selected layer similar to removing a stack of

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transparencies from a paper-based design. It was built using Adobe Flex, Pre-hypertext Processor (PHP), JavaScript, and a MySQL database.

In order to assist another research project, the first prototype was used by Kidsteam to design a mobile user interface for: doing homework, hanging out with friends, doing classwork, going on vacation, and watching television. Each child-member of Kidsteam was paired with an adult and was assigned a computer and team name (See Figure 9). Four of the teams were in the Human-Computer Interaction Lab, and the remaining two were in the College of Information Studies' student computer lab across the hall. Each team was assigned a team identifier and one of the topics. They were then given ten minutes to create a design. I reminded the groups to annotate their design in the Notes area and press "Freeze" when done. This was repeated twice and then the groups critiqued the DisCo tool.
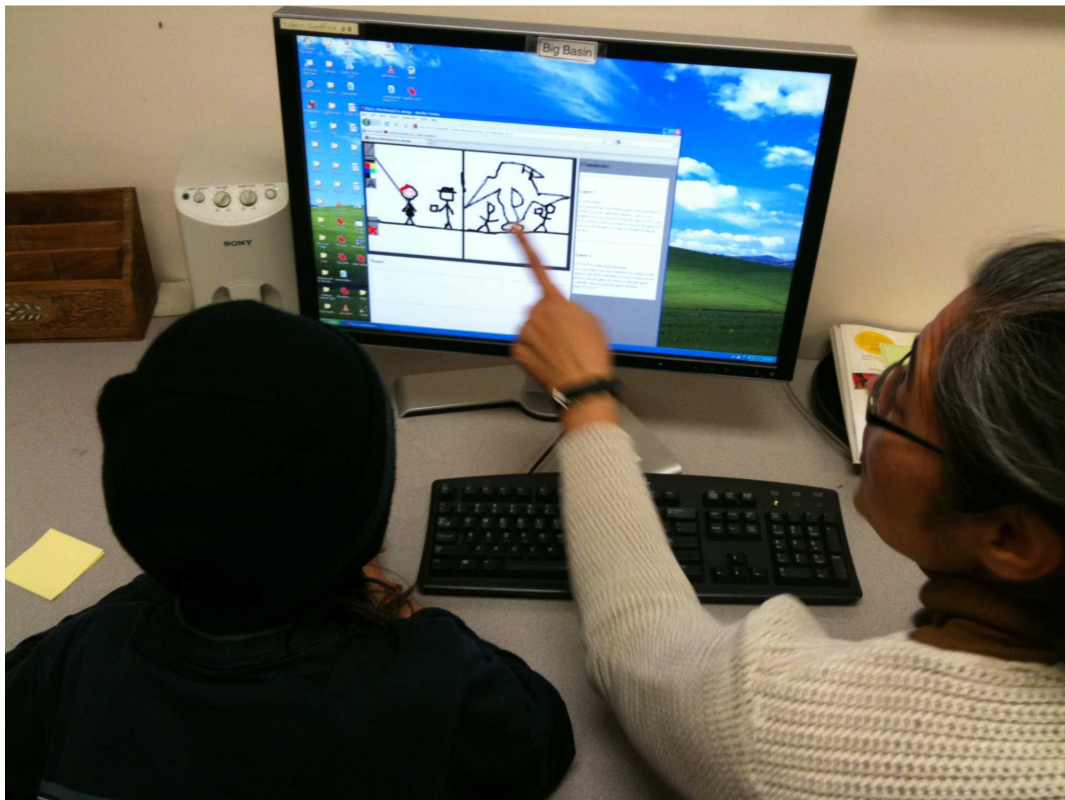


*Figure 9- Design partners work with the DisCo tool*

Using the feedback and design ideas from this session, I was able to identify the shortcomings of this initial prototype: the lack of drawing tools, no undo function, and designs that hindered communication between designers. These problems were fixed and another design session took place and the groups each worked on three designs. Another critiquing session took place at the end.

The second version of DisCo used the same underlying technology (Flex, PHP, MySQL database) but I added more tools to the canvas and rewrote the comments tracker (See Figure 10). Although the group had many suggestions in the initial design session, changes were made based on prioritizing the needs of a distributed co-design tool: people who are geographically dispersed, elaboration between design partners, and creative expression. These criteria were used in deciding how to modify the tool.

I added an undo function to address the most popular design suggestion (See Figure 10, Area A). This feature is important because it supports creative expression by helping to prevent the user from being frustrated from having to delete and restart the design when a mistake is made. Similarly, I modified the Clear All button to give feedback with a roll-over, changed its icon, and moved it away from the save button (See Figure 10, Area D). Again, this supports creative expression through a reduction in frustration.
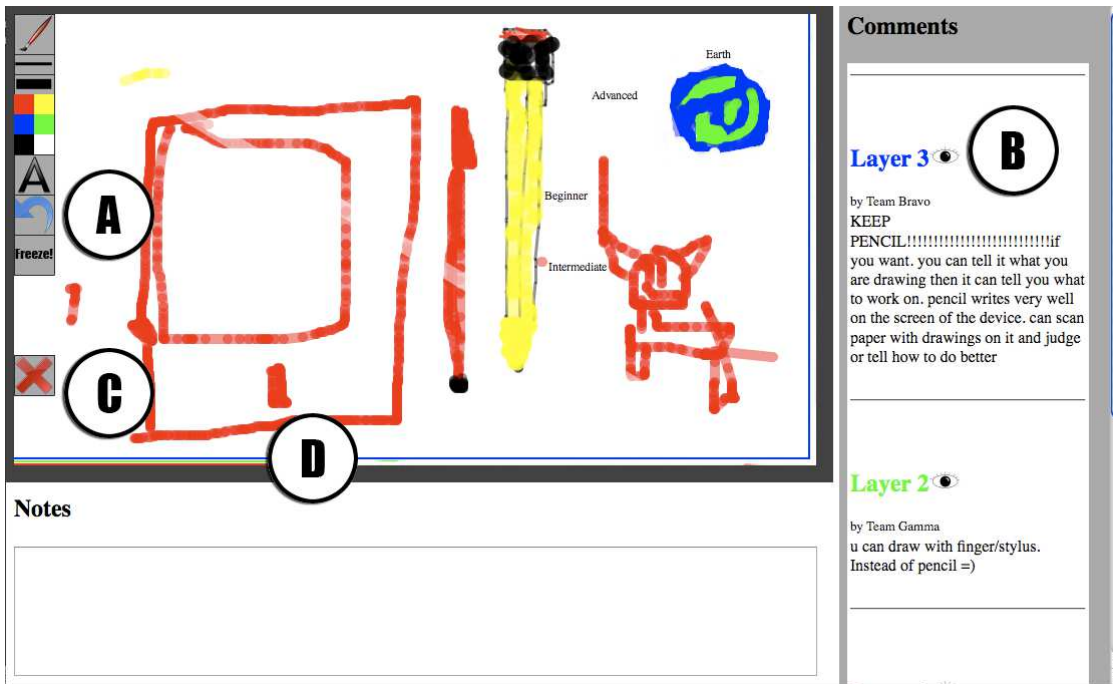
*Figure 10 – Screenshot of the second version of DisCo.*

The layer visualization functions were modified to include a hide and show function activated by an eye icon. When the layer was visible, the eye was open and when invisible, it was shut (See Figure 10, Area B). This is now similar to Adobe Photoshop's (*Adobe Photoshop*, n.d.) and the GNU Image Manipulation Program's (*The GNU Image Manipulation Tool*, n.d.) hide/show convention. This aids the tool in supporting collaboration as the design's previous designers may not be easily accessible to ask questions of in a geographically distributed environment. This change is also important because it supports elaboration by helping the user associate the design notes left by previous designers with the corresponding graphic layer.

Additionally, when a designer rolls over a layer's "eye", that layer stays at full visibility while the other layers faded back to 25% transparency. The faded layers' eye icons also fade back as well. This continues to address the suggestion for better layer

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visualization. Similar to the hide/show functionality, it is important because it also promotes elaboration by helping designers identify design notes with the corresponding graphic layer.

Each layer was given a color. The layer's name was written in that color in the annotation section. The layer's outline on the drawing canvas was drawn in that color (See Figure 10, Area C). This, too, addresses the suggestion for better layer visualization. Like the previously mentioned eye icons, this change enhances the software because it supports the elaboration process by more explicitly identifying which layers are being described by the design notes.

The second session was one week after the first session. In order to explore what the design partners could do with the tool, I asked each of the children to come up with a problem that could be solved with technology and use DisCo to design the solution. They wanted to solve the following problems: a device that helps you learn to draw, a device that automatically does your hair, a device that helps you not be hungry in class, a device that helps prevent bullying, a device that physically helps you read a book, and a device that helps you play video games.

Much like the previous session's discussion, all of the design partners (adults and children) met to discuss the design ideas. The collected ideas were grouped into the following categories: layers, undo, textbox problems, interface, drawing tools, and colors.

The ideas that had to do with layers and undo were actually positive comments that reinforced what worked well. One designer liked the color-coding of the layers. Three of the five comments said that they liked the eye feature. Likewise, one designer liked the new undo feature enough to comment on it. This demonstrates that the changes

regarding layers and undo helped support geographically distributed users, elaboration, and creative expression in a design environment.

Interestingly, the remaining design ideas had largely to do with those things that limited creative expression. Design ideas regarding the textbox were due to a bug in the software that prevented an empty text box from being cleared in the undo. Also, one designer wanted the text box to accurately appear where he clicked. That is how the system works but it seems as if he wanted the text *characters* to appear where clicked instead of the text *box* appearing where he clicked.

For the design ideas regarding the interface that would improve creative expression, one participant said that some things they drew didn't appear after saving. Someone else wanted a smaller comment area so the drawing area was bigger. Ideas about interface that could improve elaboration include reworking the colored layers as some participants did not like them, most of the designers did not notice them, and one adult thought they were much too subtle. One user suggested to change the name of the area labeled "Notes" to match "Comments". One design partner wanted an exit button in case you didn't want to edit but you wanted to leave the screen. I think this suggestion would be valuable because it could help users in a distributed environment by not requiring them to keep working when they need to stop and help creative expression by not requiring the user to rush through a design.

More ideas to improve creative expression were raised during discussion regarding drawing tools. The ideas were interesting because they wanted more ways to add graphics. Like the first session, the designers wanted to load images from the Internet and use a shapes palette "especially straight lines". New tools to foster creative

expression were discussed such as adding more line sizes, an eraser and more colors. The design partners also had the idea to make the mouse cursor indicative of the tool and color selected which would support both creative expression and aid in elaboration.

A third version of the prototype was created for use in the design process of a game that teaches financial literacy to children. The game was originally designed as a board game and the creators wanted to move it to a computer-based environment. This version of the tool saw the addition of an oval tool, a straight-line tool and new brush sizes. This version also saw the addition of a rudimentary version control system that locked the design while being edited by another user. See Figure 11 for a picture of the interface.
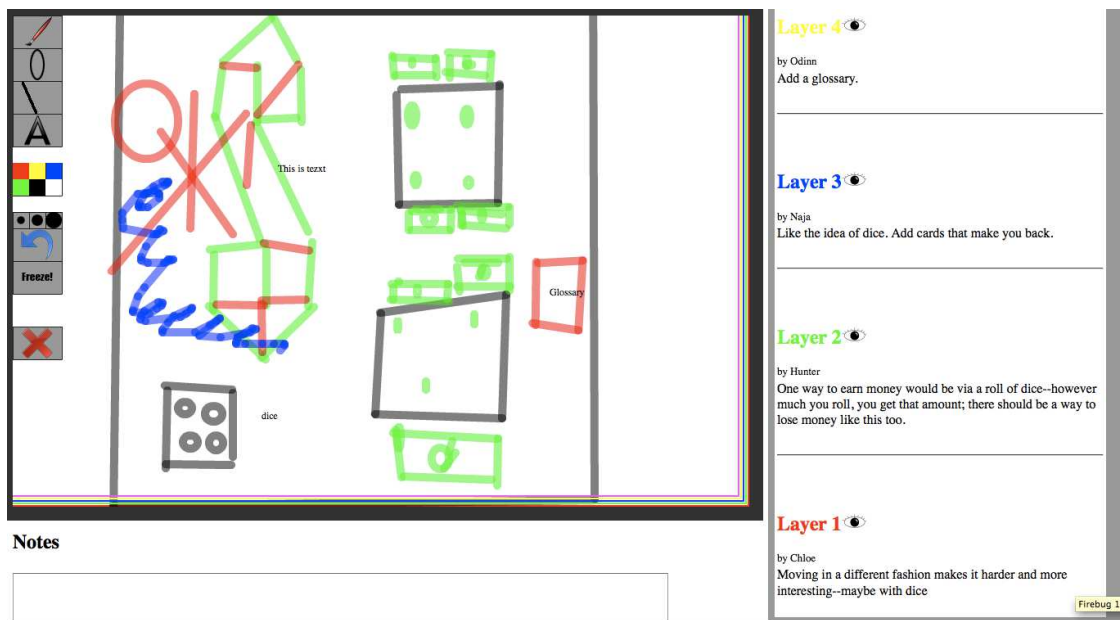


*Figure 11 - Screenshot of the third version of the Distributed Co-design tool, DisCo.*

At the end of the pilot study, I came to the conclusion that although the drawing tool could still be improved, the main shortcoming of this tool was its isolation from a

larger system. It would not function on its own to facilitate distributed co-design. The missing element was an environment that could allow the tool to function as part of distributed environment that provided the scaffolding that I had been providing through in-person instructions and other face-to-face activities. *This "missing system", as well as the needed modifications to the design tool, has been the inspiration for my dissertation research.*

### *Role of the Researcher*

My role in this project was lead researcher. I led the development of new paper-based techniques that led to computer-based prototypes which led to Online Kidsteam. I recruited the adult and child participants through my contacts with Face-to-face Kidsteam and completed all of the necessary research paperwork.

Once Online Kidsteam began, I prepared the environment weekly by creating new content to support the design challenges. At the end of each week, I would review the artifacts and messages that I received and would modify the environment through existing tools or programming custom software.

I was responsible for scheduling the mid- and end-interviews with participants. I recorded each interview and transcribed it to text. After the interviews were transcribed, I created an open coding scheme by analyzing the documents. During this analysis, I scheduled code checks with colleagues.

Before becoming a researcher, my field of study and practice was instructional and interactive technologies. I practiced for 10 years as a professional designing interactive educational media for adults and children. During that time, I also created web-based entertainment software for children.

During this research, I participated in different capacities: as a design partner, facilitator, and researcher. Although I would have liked to have taken a completely positivist stance on this research, that would have been impossible. Instead, I adopted a post-modern viewpoint that I cannot be entirely unbiased and, instead, embrace my roles in this research as lens in which I can take a phenomenological approach to describing the experiences of the participants and the technologies that need to be developed.

*Limitations*

Although I think this is the right methodological approach to this research, I understand that there are some limitations. The co-design method employed throughout the research period was Cooperative Inquiry. In cooperative inquiry, children and adults work as partners in the design of new technologies for children with children. Because this method was used as the basis for the online tools and techniques, other methods described in the literature review that are used to gather requirements for children's technologies, such as informant design or MESS, may not work with the online environment without heavy modification.

The time frame for this research was eight weeks in the summer of 2011. Of the eight weeks, six of those weeks tried to replicate the in-person Kidsteam experience within the online environment and two of the weeks tried to augment in-person Kidsteam with Online Kidsteam. This time period was relatively short compared to other cooperative inquiry instantiations. In-person Kidsteam takes place twice a week over one academic school year. The shorter time frame for Online Kidsteam was necessary to enable participation in the summer and to not interfere with in-person Kidsteam's schedule.

Ten of the twelve child participants of Online Kidsteam had participated in in-person Kidsteam at one point in time. This was necessary to work within the time frame available. It may skew the findings that participants missed real-time interactions with other Kidsteam members as almost all had met each other in-person within the last two years. Being familiar with the Kidsteam model and being a co-designer may cause the design environment to not be applicable and approachable to all children without modification and tutorials.

### *Schedule*

An addendum to the existing intergenerational design team IRB was submitted to the Institutional Review Board in April, 2011 and was approved in May, 2011. The majority of data collection occurred over six weeks from June 22nd through the Summer Kidsteam Orientation camp that begins on August 1st. During Kidsteam Summer Camp, there were two design activities that contributed to the research.

Analysis occurred throughout the data-gathering period. The interview regarding tools happened for most of the child participants in the middle of the data-gathering period. The second interview happened shortly after Kidsteam Summer Camp and involved parents if they were available.

Writing occurred through the Fall 2011 and Spring 2012 semesters.

# Chapter 4: Face-to-Face Kidsteam

In this chapter, I present the findings of my intergenerational design team observations. I stepped out of my role as a participant in the co-located, intergenerational design team to observe the complete process of a design session. I used these observations as the basis for the design of an online design tool that enables intergenerational design in the same way as co-located design but has additional support for distributed audiences.

### *Co-Design Session*

In order to better understand the intergenerational co-design process, I stepped away from the role of participant and spent one session observing the in-person, co-located intergenerational design time as a non-participant. I have reviewed the process of co-located cooperative inquiry before (Greg Walsh, 2010) but never as an observer. The session was the Tuesday after the Thanksgiving holiday and the outside design partner that the team worked with was the United States National Park Service (NPS).  The design session began at 4:00 PM at the Human-Computer Interaction Lab at the University of Maryland. The Human-Computer Interaction Lab is located on the second floor of the Robert Lee Hornbake Library's South Wing. This session was indicative of a typical co-design session based on my experiences as a participant.

When the children arrive to Kidsteam, they are dropped off by their parents or other caregivers behind the library. Ten minutes before the children are expected to arrive, two adult researchers go down to the drop off point and wait for the child participants. Some parents engage in conversation during this time or simply wave. After

all of the expected children arrive, they are escorted up to the lab. Escorting the children to and from their parents ensures a safe environment in which to design.

As with every Kidsteam design session, the activity began with a snack. The original reason for snack time was to keep the participants (children and adults) from getting too tired in the afternoons (See Figure 12). However, my observations are that Snack Time has evolved from being about food to being a way for the children and adults to bond and adjust to the new power dynamics, or lack thereof, that will take continue to be in effect as the design session gets under way.

That day, snack time took approximately twenty minutes. There were multiple topics discussed during snack time including pie, glass cleaner, my presence as an observer, a lost toy and Mickey Mouse. There was very little talk of what we would be designing that day. In fact, most of the discussions were the kinds that people would have with their friends and not necessarily indicative of children and adult conversations.

*Figure 12 - An example of Snack Time. In this photograph, adult and child design partners partake in a pre-design session snack.*

The traditional power dynamic of adult and child did emerge during the snack time when one child participant lost her toy. In that case, one adult participant immediately took on the role of nurturing authority to help settle the girl down. This was the exception during this observation as the rest of the conversations were intergenerational, unstructured, and equal. Snack time may have been created for a very practical purpose, nutrition, but has evolved into a very social and team-building activity that allows the group to feel comfortable and safe in their design ideas.

After snack time, the group moved from the large conference table in the lab to the floor for circle time (See Figure 13). Circle time is an activity where a "Question of the Day" is asked to the whole group and each design participant takes turns to introduce

themselves by telling their name, their age, how long they have been with Kidsteam, and

answers the "Question of the Day." Disclosing ages is another way that children and

adults can eliminate the traditional power structure that is present in most of society.

The "Question of the Day" is used as a way to get the group thinking about a

particular topic and on this day, the question was "What do you think about when you

think about wilderness?" This question was directly related to the later design session.



*Figure 13- An example of Circle Time. The design team sits together to answer the question of the day and begin to think about the day's design challenge.*

An important part of circle time is that instead of only talking to the group, it

seemed to be more conversational. After someone introduced themselves, another

participant may ask a clarifying question about their answers. The protocol of raising

hands is not used in circle time and instead, the participants are encouraged to talk and

discuss. After all child participants and partners from the NPS, two adult members who were leading the session led a discussion about wilderness and the definition of wilderness by tying back what people said in the circle and involving all in the conversation. They began to set the stage for the day's later design session. My observation is that circle time is more than just a way to introduce the group and let them know what will be happening in that design session. Instead, I believe that circle time's semi-structured nature focuses the design partners to think about the design session's domain.

The third part of the session was the design activity (See Figure 14). Now that the larger group knew what the day's domain was and had been focused through circle time, the design partners were ready to tackle the problem of showing children the wilderness if they can't get to the wilderness themselves through the development of low-fidelity prototypes. The larger group was divided into three smaller groups: one group comprised of boy participants and two groups each with a pair of girls. At least two adults were assigned to each of the smaller groups and the art supplies for building were distributed to the three groups. I embedded into the group with the two boys, one graduate researcher and one undergraduate researcher. This entire portion took approximately 25 minutes.

In the ideal situation, the group would instantly coalesce, however, that was not the case that day. Each of the child participants had their own idea and the graduate researcher talked through the ideas and helped them focus while contributing ideas himself. After 10 minutes, the group was still discussing ideas and slowly building.

At 13 minutes, the day's lead walked around and gave more building supplies to the group. The noise in the lab was getting louder as the groups discussed and increased

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their activity. At 15 minutes, the graduate researcher was asking both Max and Fred questions about their designs. At this point, it seemed as if one adult began working with one child and the other adult worked with the other. Another member of a group, Sandy, came over to this group to look for a certain piece of art supply.



*Figure 14- This is an example Design Time. In this picture, adults and children are working together to design a low-tech prototype with art supplies.*

At 20 minutes, the lab was very quiet as the groups were constructing their low-fidelity prototypes. At this point, a five minute warning was given by Mona Leigh. The work in all of the groups began to slow down as finishing touches were put on the prototypes. At this point, Fred put the mask on that he built. The group left to meet back at the circle but is called back to clean up.

The final portion of this design session is the group debriefing, also known as the "Big Ideas" session (See Figure 15). After the larger group reassembles in the discussion

area, Mona Leigh asked each group to present their ideas to the group. As each group

presented the designs, Mona Leigh wrote the groups' individual ideas on the white board

(See Figure 16). In all of the groups, the children did the presenting with some kind of

help from the adults either as a co-presenter or just to offer clarifying comments. After all

of the groups have presented, Mona Leigh identified similarities between the ideas as

well as each groups' unique ideas. Other adults offered their observation of similarities.

When the Big Ideas session was over, the children were able to have free time on the

computers in the lab before they had to leave at 5:30PM.



*Figure 15- In this photograph, one group is presenting their designs during the Big Ideas phase.*

After the children left, the adults briefly met about the day's design session. Several of the adults made references back to previous projects that the group worked on and compared the ideas.

Although it seems obvious that the design portion of the session is where the majority of ideas come from, I believe that it is not as valuable as a session without the presentations. The presentations capture the essential ideas of each design and begin to make connections between the groups to identify what is important to the designers. The low-fidelity prototypes are useless without the rich description that occurs during these group presentations because the features of the designed technology or the subtle differences between groups may not be apparent in a sculpture made of art supplies. The presentations need to be accomplished in the same session as the one in which the prototypes are developed. As long as the ideas are captured, the Big Ideas portion can be done at a later time.

*Figure 16 - An adult member of Kidsteam is capturing the ideas generated during the small-group presentations.*
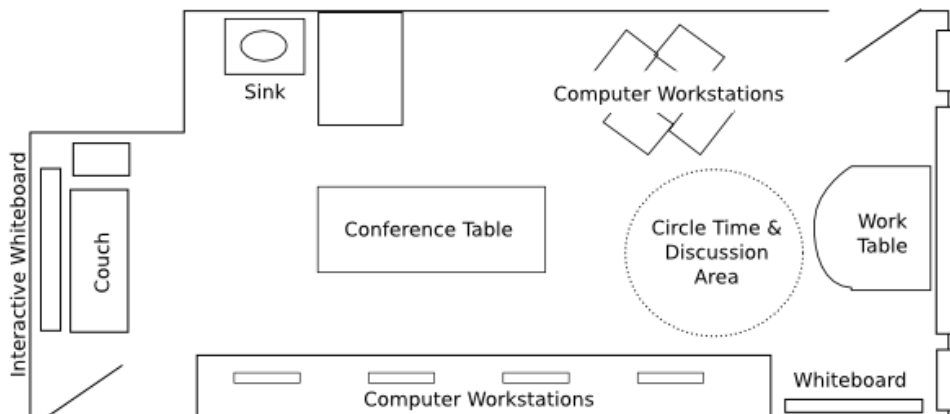


*Figure 17- Floor plan of the Human-Computer Interaction Lab*

Kidsteam is the instantiation of Cooperative Inquiry in a co-located environment; an instantiation of Cooperative Inquiry for a geographically distributed environment needs to be developed. Based on these observations, the phases of an intergenerational co-design session achieve the following goals: eliminating traditional power dynamics, nurturing a safe space through social interaction, focusing the conversation with scaffolding, enabling creative expression through techniques, capturing ideas to be used later, and facilitating creative discourse. In turn, an online, asynchronous system that enables geographically distributed co-design would also need to achieve these goals.

In this chapter, I discussed my observations of an in-person, co-located, intergenerational design team session indicative of other co-design sessions that I have participated in. The session was broken into several smaller segments: Snack Time, Circle Time, Design Time, and Big Ideas. Each of these segments focused the discussions from broad conversational topics to specific design ideas aimed at solving the design challenge presented by the National Park Service. In the next chapter, I examine how these segments and their affordances were transferred to an online environment and how that online environment was iteratively developed over eight weeks.

# Chapter 5: Online Kidsteam Design Process

In this chapter, I present the evolution of the distributed co-design environment. The segments of the environment were originally based on the segments of the in-person, co-located, intergenerational design sessions that take place as part of Kidsteam. The tool used for creative expression was a previous version of the DisCo tool developed during the pilot research for this dissertation.

### *Week 1*

The first version of the environment was a combination of the last version of DisCo and the Drupal content management system. The design challenge for the week was to create the vacation of the future.

In the first few days, I received email from one adult participant that the environment did not work in Google Chrome. The adult participant was able to contact me because he himself had an email address. I thought that the child participants might not have email accounts and would need to ask a parent to email me which could cause a delay in responding. In order to give the participants an outlet for feedback about problems they were having and not requiring email, I implemented a "Something went wrong" button that enabled the users to explain what happened. When they filled out the form, I received an email detailing the problem and who sent it. Of course, this only solved the problem of communicating with me and not with them. Some kind of internal messaging system needed to be implemented in order to communicate directly to the participants without email.

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Another concerning email came in from a child participant that said she lost work even though she saved it. Others were having a problem that the system wasn't allowing users to design because it kept displaying that the drawing areas were busy. By analyzing the use logs, I discovered that people were clicking the save button but then apparently were closing the browser before the data was actually saved. This required a change in the backend to prevent this scenario from happening.

One adult participant wanted to know who was part of the network. A new dynamic page needed to be created in order to list the participants and their avatars. Another adult participant felt that there should be a home button within the top level navigation. One child participant wanted a time and date attached to each snack time posting so people knew when they were posted. Another adult participant suggested adding pictures to snack time so it seemed more personal. Finally, a child participant wanted the ability to privately chat with other participants in snack time.

One family of participants exhibited interesting behavior by communicating with one another in real-time in the Snack Time module while co-located. The sisters sat around their table at home and interacted with the site and each other in the environment.

Reframing the Problem

At the end of Week 1, the participants wanted social interactions in ways that I didn't anticipate. The addition of avatars and a list of participants were necessary to create a sense of presence that was lacking in the online environment. Also, making the environment more child-friendly through the formatting of time and date could go a long way to making the tools easier to use.

Ideas from Week 1:

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- In-environment messaging

- Improved back-end workflow to prevent lost data and lock outs

- Reformat the time and date in snack time postings

- Add avatars to the snack time module

- List of participants

- Improved navigation

- Improved tools for co-located design from one computer.

### *Week 2*

In order to address the ideas from Week 1, I modified the Snack Time area to be more conducive to conversation and more accessible by children. In order to simulate a conversation, I placed each commenter's avatar next to their Snack time chat. This gives the impression that that particular user is "saying" those things. Second, I modified the format of the comment's time label. The time now contains the month, day, and time of day that the comment was written (See Figure 18).
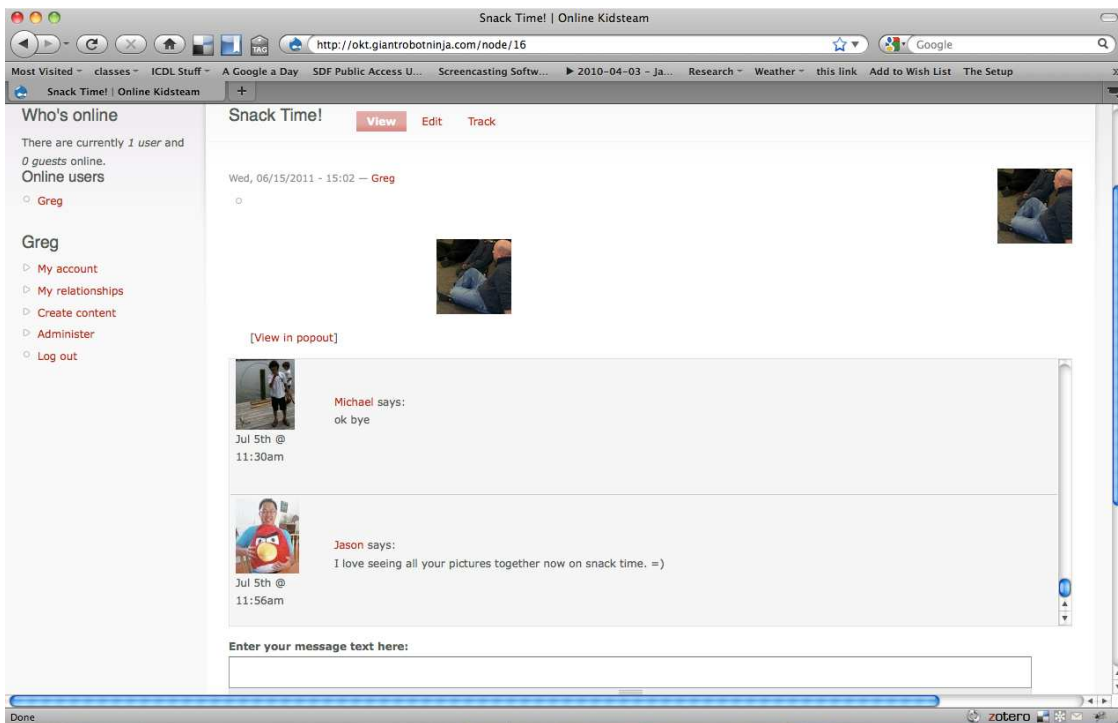
*Figure 18- Example of Snack Time tool with avatars. The avatars were added to create a sense of presence.*

The design challenge for Week 2 was to design a photography site for children. In order to clearly distinguish that the site had new content, I changed the colors of the background from blue to dark red. I implemented the list of participants and a Home button per the feedback received in the first week. Based on feedback received in the initial design of DisCo, I was able to add the ability to upload photos. I also reconfigured the tool bar so that like-functions were together and eliminated the "erase all" button as there was now an exit button (See Figure 19).
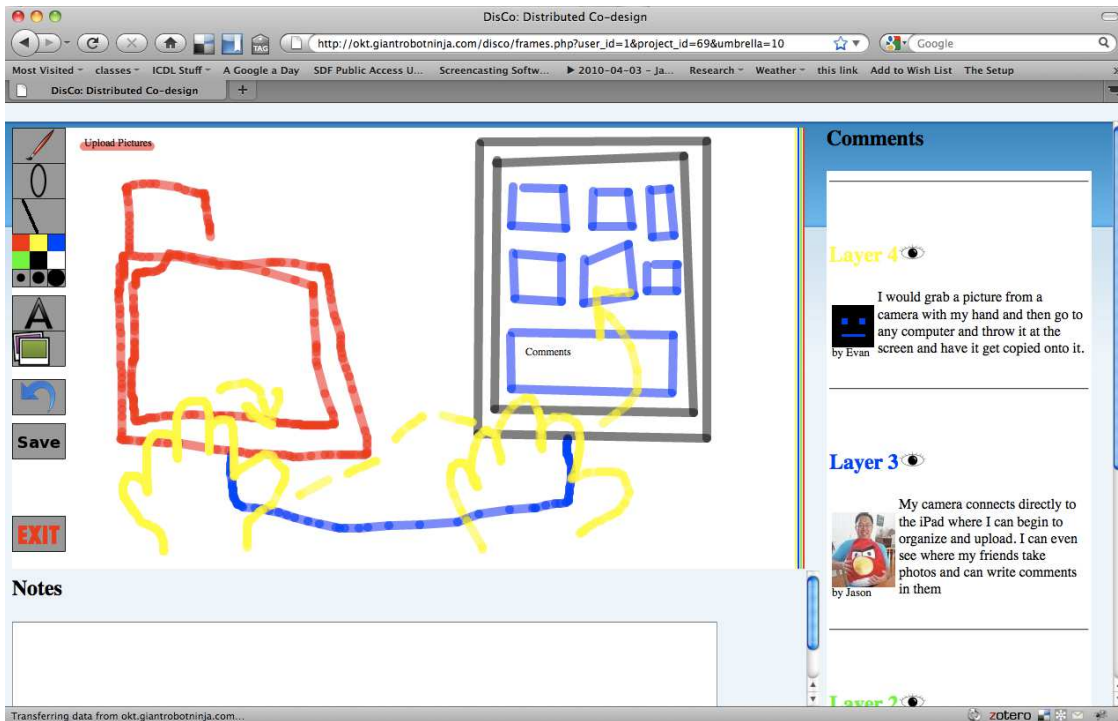
*Figure 19- An example of the new drawing tools implemented for Week 2.*

Several parents contacted me to let me know that the screen was too big for small laptops. Due to the non-scaling nature of DisCo, the tool was being cut off on small laptops such as the MacBook Air and the Intel Classmate PC.

In the previous week, I noticed that only one of the child participants actually added to the design before an adult. In order to investigate this observation, I asked the adults to not participate in the design sessions for the first few days and, consequently, had no child participants add their designs. I asked the adults to then participate and two of the children added their ideas to several of the designs. The lack of participation in the design area was contrasting to the participation in the snack time and circle time areas. This led me to believe that I needed to create some kind of motivation for the participants.

I was asked by one of the child participants if there was a way to privately chat with another participant instead of in the open in Snack Time. His idea was a way to message other people without it appearing in the Snack Time timeline.

Reframing the Problem

Designers were not participating in a way that I had hoped for. New functionality needed to be added in order to help motivate the child-design partners to participate in the design sessions. Also, the environment needed to be scaled down in order to enable smaller laptops to be able to access the design tools as a few of the participants had smaller scaled laptops.

Ideas from Week 2:

- Functionality to increase motivation

- Ability to directly message

*Week 3*

In order to increase motivation, I utilized a Drupal module as part of the environment that gives points for various actions on the site. The design activities would give the most points through custom functionality and the most popular activity, snack time, would give no points. There would be two rewards: the top point earner would be congratulated on the home page and any participant would be able to directly message another member if he or she scored a certain amount of points.

In week 3, I received emails from parents about the environment. Both suggested that typing is extremely difficult for younger participants and the parents were typing for the children. The parents also mentioned that the activities were too abstract for their

younger children. One parent stated that his child thought it wasn't as fun as the face-to-face Kidsteam because it was asynchronous and another parent thought the entire site relied too heavily on words and suggested using pictures and video for instructions. Although, I had used videos in weeks one and two, I did not use them in week three.
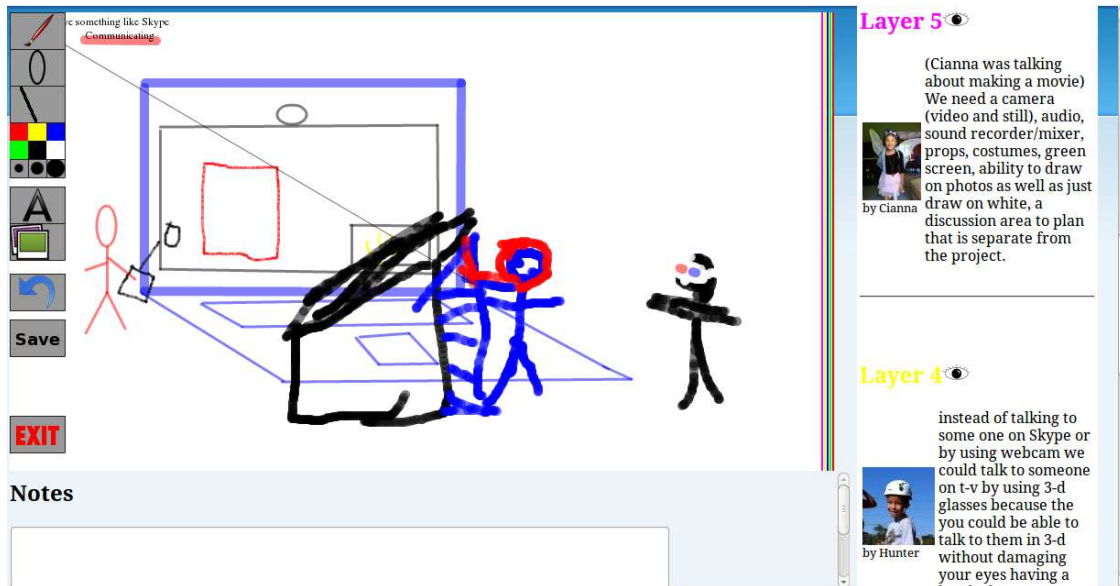


*Figure 20- Design of technologies to help Kidsteam communicate while online.*

The topic for week three was helping to design Online Kidsteam to better suit participants. The design challenge was broken up into three sub-challenges: tools to help participants communicate while designing (See Figure 20), tools to design with, and tools to help participants develop new technologies instead of merely designing them.

Most of the ideas for communicating with other participants while designing were focused on synchronous communication. There were suggestions for both audio and visual communication, as well as the novel idea of using three-dimensional technologies to communicate with other participants through their television. One participant did think about the problem of communicating with other participants asynchronously. In her design, there would be a space separate from the design area that participants could use to

plan and discuss their ideas before adding them to the main design area. I found this

suggestion interesting because the design area is intended to act as a work area to

describe and iterate on ideas. This is not unlike my previous finding that children are less

forgiving of what they create with a computer than what they build with arts supplies.
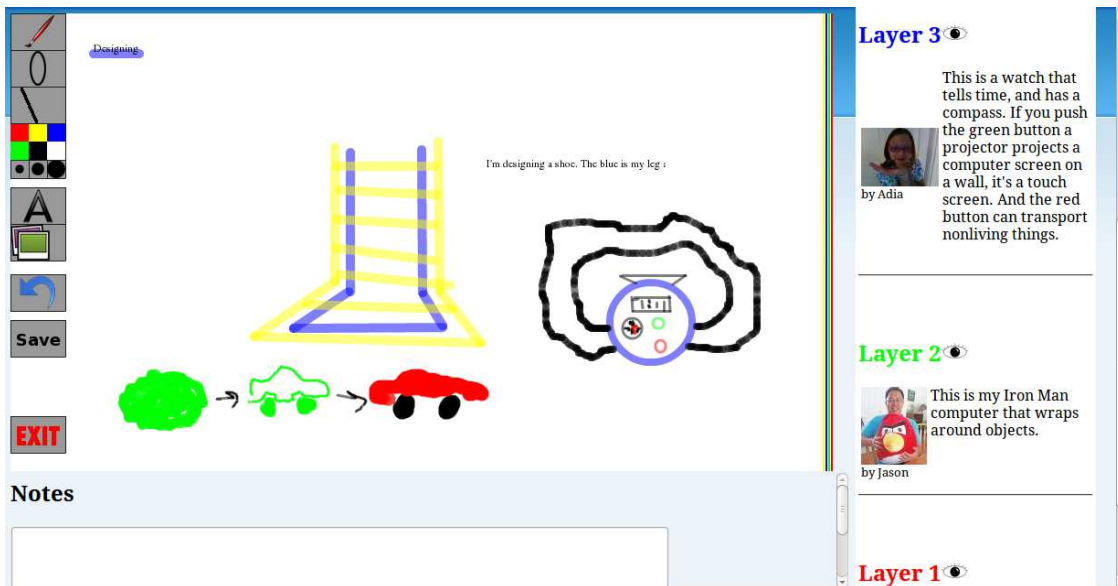


*Figure 21- An screenshot showing the outcomes from the Week 3. In this picture, computer elements are super-imposed over physical objects.*

The ideas for new ways to design centered on improvements and novel interaction

design. One participant wanted three-dimensional images to appear over real objects

while designing. For example, when designing a new shoe, the designer could overlay the

mock-up over his real foot. Another participant wanted a projector and touchscreen

interface, while another participant wanted clay that could be shaped into objects on the

screen and then a finished version would appear.

The ideas for building new technology were as diverse as the previous sub-

challenges. In an idea related to the modeling clay interface, the same participant wanted

the design environment to enable the designers to print out the design with a three-

dimensional printer. One participant simply wanted to extend working together to building and not just designing (See Figure 22). Interestingly, another participant did not "want to program. I just want to play." In this case, the idea of actually bringing the design to fruition was less appealing than designing.



*Figure 22- The low-fidelity prototype that demonstrates how Online Kidsteam participants could build new technologies together. The representation of the two children was described as "We can build them together."*

Reframing the Problem

Because this week was self-reflective on the design environment, there were many ideas generated to improve the Online Kidsteam experience for participants including the ideas generated through analysis of the parental communications:

- The need for audio in the design session

- The need for a motivator and explicit instructions for the children through video

- Incorporating live communication

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- Developing a scratch pad functionality to enable refining designs before placing them into the main design area to enable more create expression

- Bringing three-dimensional design tools and interaction to the design area

- Reducing ambiguity in the design challenges in order to reduce confusion from the participants

*Week 4*

In week 4, the design team returned to designing new technologies for children. The topic of the week was to design a video game that could help young children learn to read. The three sub-tasks were: What kind of game, characters, and stories. In order to address the problem without the design challenges being too abstract, I posed the first design sub-task as a question.

In this week, I added the ability for participants to record audio. In order to simplify the design and make it easier for all to use, I added a large Flash-based, audio recording tool in the shape of a red button to the area where the designers write about their ideas (See Figure 23). The designers spoke their ideas into a microphone and the system captured, encoded the audio into an MP3, and uploaded the audio file to the server. The system would require designers to write in the text box or record audio to describe their contribution.

Comments

Choose your partner... [ ▲▼ ]
Add This Partner

**Layer 9** 👁

Mine is a mix of Evan and Matthew's. You can't read Matthews idea because he had trouble saving. You have a reading board game, with READ spaces on the board. This prototype has 3 READ spaces, but the real game will have at least 10 READ spaces across the board. So you roll a dice to move and if you land on a READ you have to read from a story that you brought to the game. Everyone brings a story because everyone reads at different levels. If you are reading well your phone will show you shortcuts to go across the board. If you need help reading there is a help button on the phone that will read for you. You have to use the phone camera to take a picture of the page of the words that you need help on.

by Michael

Write your design ideas here or click the big red button to record your audio.

**Notes**

*Figure 23- The designs for a game to teach young children to read. Note the large red button used to begin recording audio.*

When another designer came to the design area after someone recorded audio, the timeline of comments would display a standard play button instead of text. In order to demonstrate this, I made an audio recording for each sub-task describing the activity (See Figure 24).



**Layer 1** 👁

Click the button below to hear the design challenge.

by Greg

*Figure 24- An example of an audio file used in the comment timeline.*

In order to address the design idea of using video as instruction and as a motivator, I recorded a video in which I recapped the last week's design idea and then

described what the group would be doing this week. I described the background on the challenge and announced last week's high scorer. In the video, I also gave instructions on how to use the play and record buttons and reminded the group about the points.

There were some problems with the audio tool during this week and subsequent weeks. In order to record audio through Flash (actually, through any browser-based applet), the user must have their microphone correctly configured and grant the applet, in this case the Flash-file, permission to access the recording capabilities. This posed two problems that required some skill: configuring audio equipment settings and accessing Flash's permission tool.

For the laptop users, there was little problem with configuring the audio settings as a microphone is often included. However, for those using machines without built-in microphones, the hardware and software set-up was sometimes difficult. Even if the participant had set up the hardware correctly, the software needed to be configured to work. There was at least one participant who tried to record but was unable to and the audio file attached in the comment section was blank.

The second problem was giving Flash permission to use the audio device on the computer. The maker of Flash, Adobe, uses a browser-based configuration tool to grant permissions. When a Flash applet encounters code that asks for permission to access the microphone, a small dialog box is presented to the end-user with several radio buttons to choose how to proceed (See Figure 25). In the version of Flash that was prevalent during this research, there was a bug in the player that prevented this dialog box from working correctly. Instead, the users needed to visit Adobe's Web site and manually add the domain name of Online Kidsteam to their local software in order to work properly. This

was a complicated task that was difficult for most users. Either because of these problems or for other reasons, only one participant used the audio recording tool this week.



*Figure 25- Dialog box asking for permission to use the participant's microphone to record audio.*

Unfortunately, these problems will persist with the tool until new technologies replace older ones due to security concerns by Flash's developer. For example, the Hypertext Mark-up Language version 5 (HTML5) includes specifications for recording audio directly in the browser without the need for additional software.

Another problem that occurred this week was that one participant was unable to add his design ideas to the environment because of computer trouble. In order to express his ideas, he wrote them in his journal. The journal area of the environment was intended for participants to write about design challenges and their experiences on the site.

During this week, I was able to interview one family about their experience with Online Kidsteam. Besides interviewing the three children, I briefly interviewed their father as well, who gave me some insight into their participation. He felt that he saw a big difference in participation between his youngest and oldest—the oldest wanted to participate and actively did so while the youngest did not without prompting. Also, he felt as though the first designer into the environment was "privileged" because he or she was starting with a blank slate.

Participation increased from the previous week. As usual, I sent an email to all participants (or a participant's parent) letting them know the activity had changed as well as highlighting the activity for the week.

Reframing the Problem

I felt as though a new dimension came into being that I hadn't thought of for this project and that was technical ability. In face-to-face Kidsteam, younger children worked with older children or adults to complete the design tasks but in an online environment, younger participants were at a disadvantage if trying to accomplish the design challenges independently.

Design ideas from Week 4

- Simplify audio recording steps for all ages

- Address the issue of the first user being "privileged"

*Week 5*

In week 5, the design team had two unique challenges. The first design challenge used the current state of the DisCo tool to express their likes, dislikes and design ideas of the low-fidelity prototype I created based on the group's designs (See Figure 26). The second challenge was to play with a reconfigured DisCo that utilized graphics of three-dimensional found objects to mimic the tools and objects available in the low-tech prototyping activity called Bags of Stuff (See Figure 27).
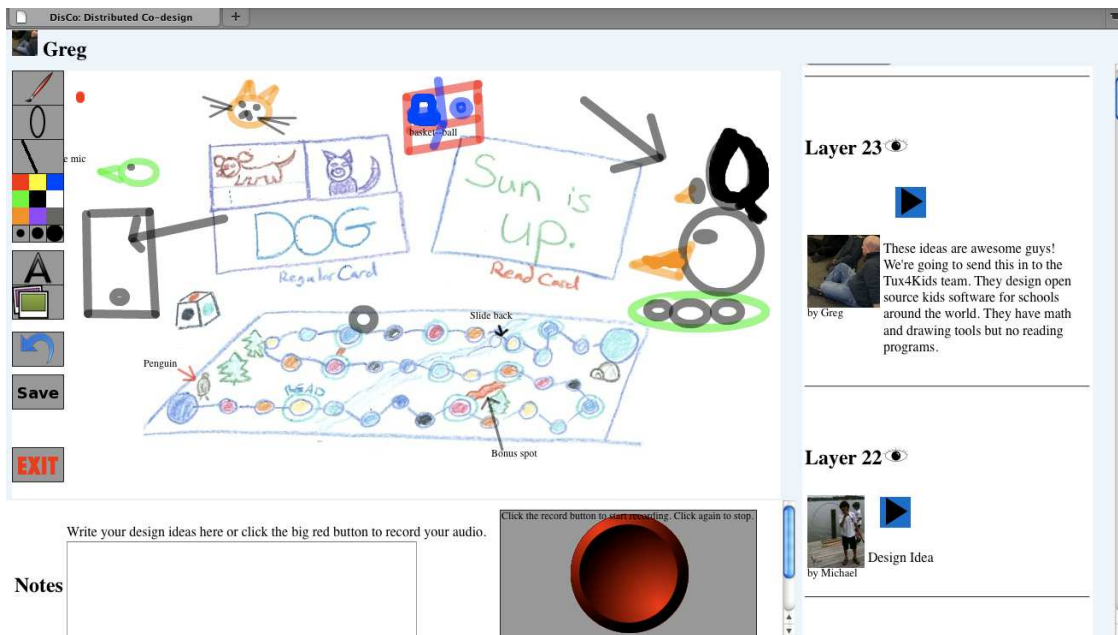
*Figure 26- This image shows the low-tech prototype used to solicit Likes, Dislikes, and Design Ideas about a reading game for young children.*

In order to continue with the iterative design of the reading game, I used the design ideas from the previous week's design session to create a drawing of the game with a text description using actual paper, pencils, and crayons. Then, I took a digital photo of those drawings and inserted them into the DisCo canvas using the photo tool.

Because I wanted to continue the design process, I chose to ask the design team for likes, dislikes, and design ideas about the mocked-up game. This is a different design task than the previous weeks because the team was being asked to generate ideas and feedback while having more constraints than previous design sessions. This activity is often used by in-person Kidsteam once the team feels they have a good understanding of the design requirements and wants to move the process forward. In the in-person activity, the design partners write one like, dislike, or design idea on a sticky note and placed on a surface. A member of the design team organizes the sticky notes into general commonalities.

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This functionality needed to be implemented in the design tool but I knew that through instructions and protocol, I would be able to accomplish the same goals with the existing DisCo tool. In order to replicate the discreet nature of comments, I asked the design team to only put one thought into the note section and to preface the comment with the words "like", "dislike", or "design idea". I removed the version locking functionality from the design tool so that multiple people could be operating at once. This also enabled participants to easily post multiple comments easily by simply clicking the Back button in their browsers. Ideally, the system should update each designer's screen every few seconds so they can see what others are doing at that moment.

The participants did this and there were 20 comments from 12 different participants. Some of the participants wrote their design ideas but then drew something to augment the mock-up. This is interesting because there is no equivalent functionality to that when performing this activity in a face-to-face session with paper materials. Usually, the design member who organizes the ideas may ask the author of a design idea what he or she meant in order to clarify. Instead, this tool allows designers to augment the designs they are evaluating and critiquing.

Although this tool worked well, there were problems that needed to be addressed in future revisions. The back and forth required to make multiple comments was tedious and there was no way to easily manipulate the likes, dislikes and design ideas into like groups for analysis.

The second design task that the team participated in was using the prototype "e-bags of stuff". In this prototype, I added the ability to place toilet paper tubes and cotton balls into the design, in addition to all the tools currently available. I also asked the

design team to play with it and provide feedback on how it could be more like the "Bags of Stuff" activity used in face-to-face Kidsteam. The design team made the suggestion to make the items rotate and to add more items to the palette.

Based on previous feedback, I implemented a design vault. The design vault gives access to all of the previous projects that the team worked on and organizes those projects by week. Another feature added during this week was user icons, or badges, that appear next to participants' names in Circle time and on their profiles if they meet certain criteria. The first badge implemented was an award for scoring the most design points in a week.

Reframing the Problem

This was the first week in which environment needed to be more than just an extension of Layered Elaboration and instead move into a new direction to accomplish a new design task. It was also an example of how this environment can exceed instead of mimic the paper-based methods on which it is based.

Design ideas from Week 5

- Create specific functionality for capturing likes, dislikes, and design ideas

- Create functionality for visualizing the likes, dislikes, and design ideas

- Add more objects to the e-Bags of Stuff

- Add more control to the elements in e-bags of Stuff

- Allow system to update the design space while someone else is editing.

*Week 6*

Week six was the last week for Online Kidsteam to function as exclusively asynchronous and geographically distributed. The final week's design activity was to look at an iterative version of the e-Bags of Stuff tool and to design improvements using the updated tool.

Based on the previous design ideas, the new tool included additional design elements. I added squares of virtual construction paper, pipe cleaners, and popsicle sticks to the toilet paper rolls and cotton balls (See Figure 27). The pipe cleaners and popsicle sticks were each available in four different angles: 0-180, 45-225, 90-270, 135-315. When a designer used the pipe cleaner tool, the system randomly chose one of three colors. The previously existing DisCo features were also available.
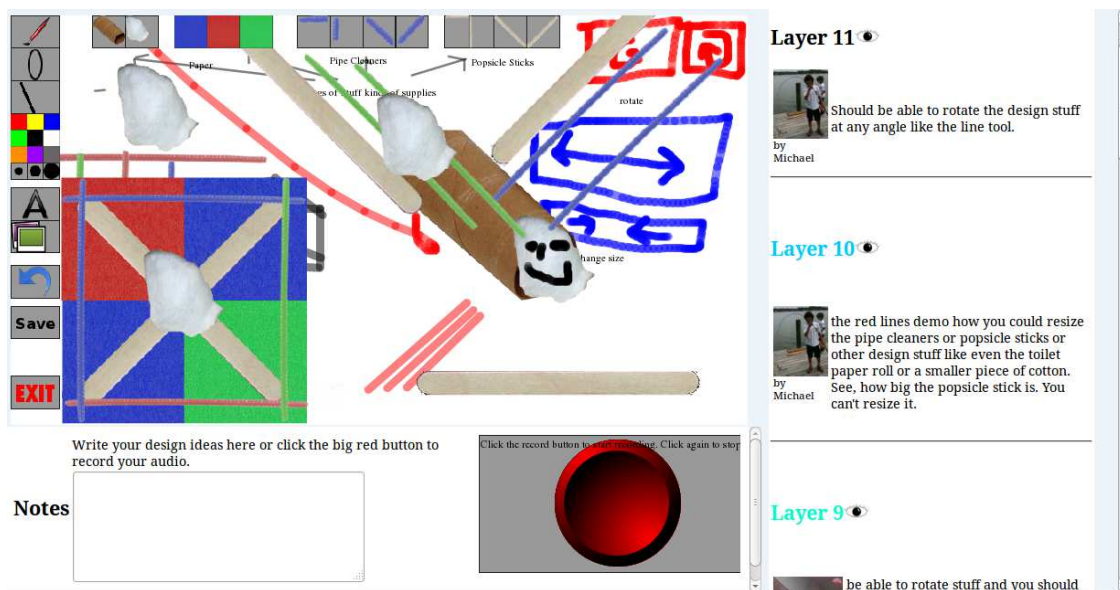


*Figure 27- Virtual Bags of Stuff*

The e-Bags of Stuff tool was still not well received by the designers even after incorporating many of their suggestions while maintaining the same user interface as the previous DisCo tool. This was not surprising to me as my experience with face-to-face Kidsteam has shown me that Bags of Stuff is one of the favorite activities of the children. Much of the feedback involved the limitations of the two-dimensional graphics and the desire for true three-dimensional assets that are movable and can be rotated. Because this was the last week of exclusively online activities, I added a new badge to all the design partners' profile pages called Online Kidsteam: Summer 2011. The badge was a blue square with the year 2011 and a photograph of a tube from a toilet paper roll.

Reframing the Problem

Similar to the previous week's reframed problem, this week was a lesson on the shortcomings of two-dimensional workspaces. The concept of Bags of Stuff did not work with the paradigm of flat layers and the two paradigms (three-dimensional objects and two-dimensional renderings on paper) are not compatible in this context. It may be due to the fact that there was already a positive attachment to Bags of Stuff because of in-person use.

Design ideas from Week 6:

- Rotating and translation need to be implemented for objects that are representations of three-dimensional objects

- More art and craft items for designers to choose from

- e-Bags of Stuff needs to be designed as its own tool and not as an add-on to DisCo.

In week 7, the Online Kidsteam environment was used in a different way than the previous six weeks. Instead of all of the participants connecting when and from where they wanted, some participants designed in co-located groups while other continued using the tool as before. Instead of doing a circle time in-person, the design team logged into Online Kidsteam and answered their questions of the week within the environment (See Figure 28).
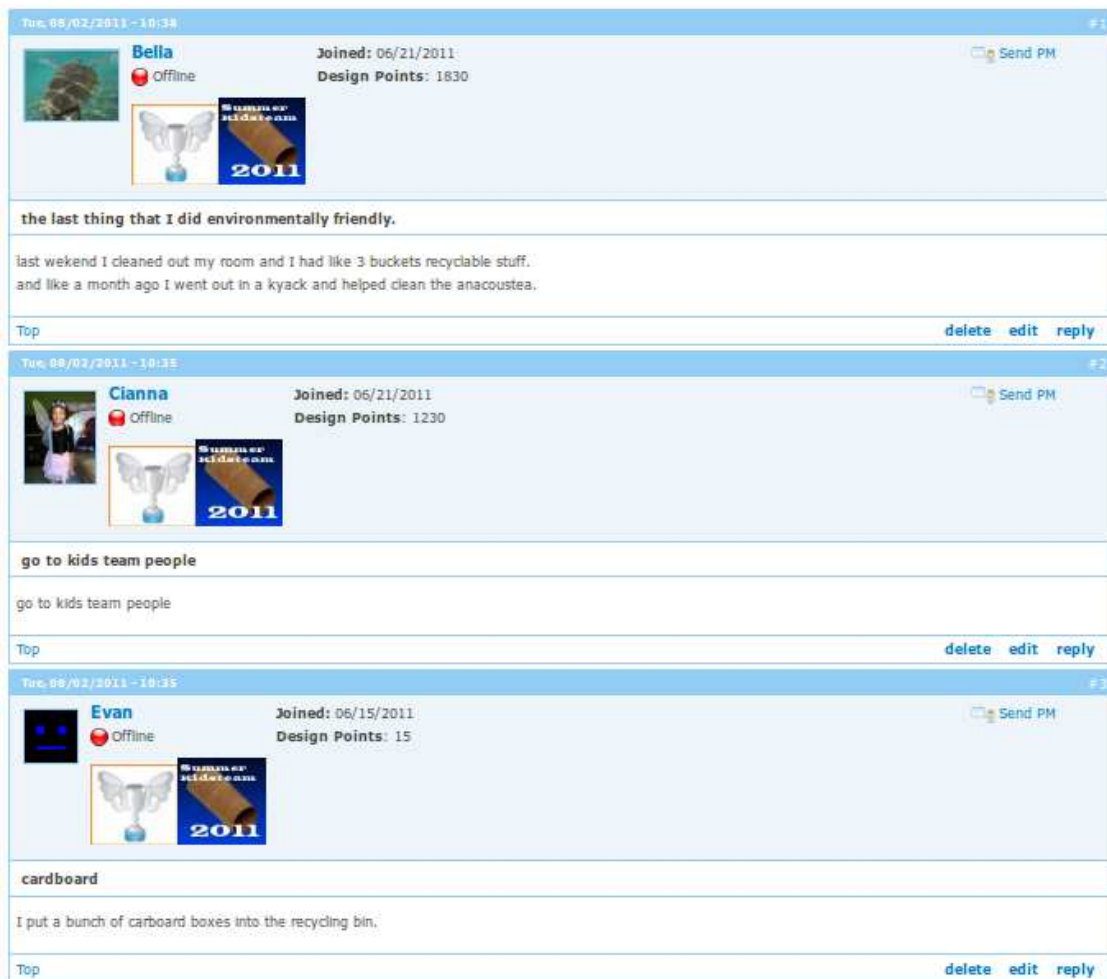


*Figure 28- Example of Circle Time activity within Online Kidsteam. In this example, three of the participants have won awards for having high scores and being a part of Online Kidsteam in the Summer of 2011.*

After virtual Circle time, the children were split into three smaller groups made up of participants of Online Kidsteam, exclusively face-to-face Kidsteam members, and adult participants. The goal of the week was to design something to help more children be environmentally conscious at home, school, and while going on a trip to visit the White House. The groups were assigned to the topics, given discreet amounts of time to design, and then were asked to move on to another design. This was repeated so that all of the groups were able to add to each of the design challenges. After this time, participants in remote locations were able to add to the designs as well. One participant in Online and face-to-face Kidsteam who was unable to attend the design session added her ideas to the three topics.



*Figure 29- An example of "clumping". Children work together on one computer.*

In previous versions of the environment and the DisCo tool, only one person was credited with authorship if multiple designers were working on the same creation at the same computer. For example, if three participants sat together at the same computer and added their design to the environment, the only one that would be attributed in the notes section would be the one that was logged in (See Figure 29). This scenario occurred in the pilot study when one child designer worked with adult designers at the same computer but only the child was attributed for the work. In order to prepare for co-located design work by some participants, I implemented a new attribution system that allows multiple users to log in to the design tool, enabling multiple attributions. I call this a "Clumping" login because the phrase clumping is sometimes used in face-to-face Kidsteam to describe children gathering around one machine.

### Reframing the Problem

The problems previously experienced seemed as though they began to disappear in a synchronous multi-user environment. Supporting multiple users at once, similarly to KidPad, could be a panacea for younger users or contextually disconnected users.

### *Week 8*

In the final week of using the Online Kidsteam Environment, the design team elaborated on the previous week's ideas by expressing their likes, dislikes, and design ideas. This activity was similar to Week 5 and based on Week 5's design ideas, I designed a new tool called LaDDI (laddie) to be used in the environment that captured likes, dislikes, and design ideas and will display them as virtual sticky notes for clustering analysis.

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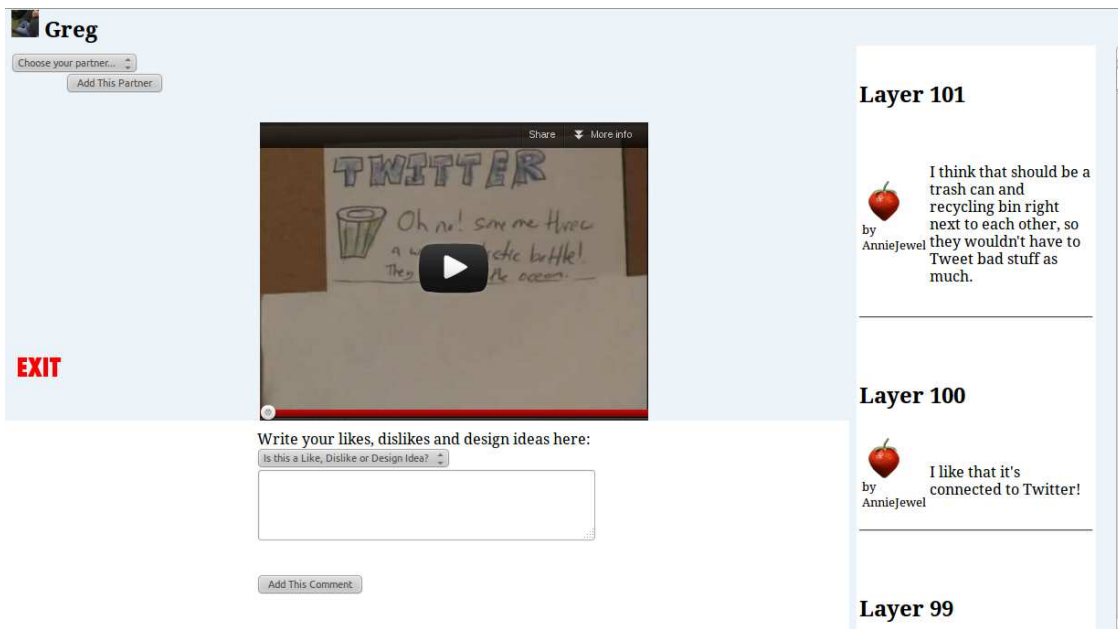
*Figure 30 - An example of the LaDDI tool. In this example, design partners watch a video prototype and add likes, dislikes, and design ideas.*

Although the screen layout is based on the existing DisCo tool, there is a difference in functionality. The screen is divided into four sections: attribution, prototype, design section, and existing comments. The attribution section displays who is associated with this design session and enables users to add other co-located co-designers in the same way that DisCo does. The prototype section demonstrates the low-fidelity prototype being worked with. In the design section, participants can chose "Like", "Dislike", or "Design Idea" from a drop down menu and then fill in their idea. The existing comments section displays the feedback and design ideas from other participants.

In order to organize the notes developed with the LaDDI tool, I also designed a tool that puts each of the pieces of feedback on to a virtual "sticky note and arranges them in the order that they were entered. When all of the likes, dislikes, and design ideas have been entered into LaDDIe, a designer can organize and lay them out in a virtual

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whiteboard to group the like items. This enables designers to develop frequency counts of ideas and concepts in order to create the next iteration of the design.

The group used the LaDDI tool to evaluate and expand upon the ideas generated by the previous week's design session. After reviewing the "big ideas" generated in that design session, I developed a video animation of one of the ideas that I thought was both novel and practical: a park-based smart recycling bin that sends a message through the Twitter service when it is used correctly and incorrectly. The video featured paper animations of the main features of the recycling bin while maintaining a feel that it was very easily changeable in order to encourage a design discourse.

The design partners were able to watch the video and then enter a like, dislike, or design idea. This was different than the previously used workflow because the LaDDI tool forced them to choose a category for their feedback. Also different from the previous version was the fact that the designers stayed on the same page after submitting their input and did not leave the design tool until after they chose to exit.

The tool was successful in capturing many generated ideas for the next iteration of design. There were over 100 pieces of feedback from the design partners who were both co-located and distributed. In one case, one design partner worked in a co-located group during the lab-based activities and then went home to form another co-located group with his brother who was not participating in the in-person activities.

Many of the design partners seem obsessed with earning points during this activity and asked clarifying questions to ensure they would receive points even if they continued to use the clumping tool implemented the week before. I had never seen this

kind of level of activity and engagement in any activity that In-person Kidsteam had ever done with paper sticky notes.

### *Design Summary*

The Research through Design framework combined with the Cooperative Inquiry method worked well in the iterative design of the geographically distributed co-design environment. The iterative design of Online Kidsteam happened in three phases: the overall environment, the refinement of a major tool, and the development of additional tools to support the environment.

The first few weeks saw multiple changes to the overall environment from the original design. As previously mentioned, the environment was built with the content management tool Drupal combined with several pre-existing modules. Though one pre-existing module needed to be changed by adding avatar support, most of the environment changes were content-based, meaning, I needed to create additional content and tailor the content to meet the needs of an intergenerational design team. The additional content was in the form of instructional videos, graphic badges, and new sections of the environment.

The DisCo tool went through some major changes during this project. New drawing tools, such as additional colors and virtual bags of stuff, were added in order to support creative expression. An audio tool was implemented, although not often used, in order to meet the needs of young design partners who have difficulty typing. A novel way for multiple design partners to indicate authorship for group designs was developed for the DisCo tool to support distributed co-located group design that may occur in homes or dedicated design spaces.

The LaDDI tool was added to the Online Kidsteam as a way to expand the kind of design activities available in a distributed, asynchronous environment. By enabling small amounts of design ideas to be expressed quickly and easily, I was able to increase the number of ideas generated to about five times those generated through the DisCo tool. The LaDDI tool also opens up new research opportunities with the field of Natural Language Processing and Machine Learning to develop visualization techniques and automated organization of the ideas.

In this chapter, I presented the design findings of eight weeks of iterative development of an online environment to support geographically distributed, intergenerational co-design. *These new tools and techniques that were designed through design partnering and observation enabled intergenerational distributed co-designers to create, elaborate, and evaluate new technologies*.

# Chapter 6: Experience Findings

In this chapter, I present the findings of my study pertaining to the experiences of the child participants of Online Kidsteam. I will present both qualitative and quantitative data including participants' ages, geographic location, access times, types of participation, analysis of participation by participant, and a summary of the participant interviews.

### *Geographic Location*

The participants in the first session, including myself, connected to the online environment from two countries, 15 states, and 33 different cities (See Table 3). There were 12 children and 9 adult participants besides myself, and some participants connected from multiple places. Nine of the child participants reported going on vacation during the period of Online Kidsteam and five reported that they connected to Online Kidsteam while on vacation.

*Table 3- Participant locations based on IP Addresses.*

| Country | Region | City |
|---|---|---|
| Spain | Madrid | Madrid |
| United States | California | Los Angeles |
| | Colorado | Colorado Springs |
| | District of Columbia | Washington |
| | Florida | Winter Park |
| | Hawaii | Mililani |

| | Louisiana | Denham Springs |
|---|---|---|
| | Maryland | Annapolis |
| | | Baltimore |
| | | Bowie |
| | | College Park |
| | | Derwood |
| | | Elkridge |
| | | Greenbelt |
| | | Hyattsville |
| | | Laurel |
| | | Rockville |
| | | Takoma Park |
| | Michigan | Ann Arbor |
| | New Jersey | Phillipsburg |
| | New York | Bronx |
| | | Brooklyn |
| | | Saratoga Springs |
| | Pennsylvania | Collegeville |
| | Rhode Island | Providence |
| | | Smithfield |
| | Utah | Ogden |
| | | Provo |
| | Virginia | Aldie |

| | | Alexandria |
| | | Arlington |
| | | Roanoke |
| | Washington | Seattle |

*Aggregate Access times*

The mean local access time, or the average time of day, for all page views over the entire 8-week period for all participants (child and adult) excluding myself was 14.27 (N=2915, SD=4.44) which equates to just after 2:15PM local time. There was a significant difference between adult participants (N=1110) and child participants (N=1805) in their overall access times for the entire 8-week period, $F(1,2913)=8.67$, $p<.01$. This means that adults and children accessed the site at different times throughout the day.

The mean local access times for page views during the initial online-only portion of the research for all participants excluding myself, was 14.47 (N=2485,SD=4.66) which equates to just before 2:30PM local time. There was no significant difference between adult participants (N=1080) and child participants (N=1405) in the overall access times for the online only portion of the design team, $F(1,2913)=2.55$, $p=.11$.

The mean local access time for the two weeks that Online Kidsteam was used as part of face-to-face Kidsteam was 13.15 (N=430,SD=2.5) which equates to 1:09PM local time for all participants excluding myself. The difference between the number of adult (N=30) and children (N=400) access times is so great that a test of statistical significance would not be a valid way to say if there were or were not a difference in access times

during the in-person activities. This may have also influenced the statistical tests for the access times for the entire 8 week period.

### *Aggregate Participation and Activity*

Participation and activity can be measured by the participants' page views, the number of ideas generated, and the number of sessions in which the children participated. This data does not include my participation because of the large amount of system use by me in order to facilitate Online Kidsteam.

There were a total of 2915 page views over the 8 week period. The average number of page views per participant was 112.12 (SD=90.21). There was no significant difference between adult participants and child participants in the number of page views, $F(1,24) = 0.2$, $p=.65$. Over the 6 weeks of online only, there were 2485 page views and there was no significant difference between children and adults during that time, F(1,19)=.005, p=.95.

Overall page views only indicate a cursory amount of activity. A better example of activity were ideas contributed during the design activities that occurred during the distributed participatory design sessions. There were 95 design ideas submitted during the online-only portion of the research (M=4.52, SD=4.43). Again, there was no significant difference between adults and children in terms of the number of ideas submitted, F(1,19)=.85,p=.37.

The number of ideas generated weekly varied. In week 1, there were 34 ideas submitted about the vacation of the future. In the next four weeks, participation leveled off to be between 17 and 25 ideas per week with one week, week 5, having two design challenges. See Figure 31 for a chart illustrating the weekly ideas added during the entire

research period. Week 6 saw the largest decline to only 11 ideas submitted. In week 7, the tool was used as part of Face-to-face Kidsteam and several people worked on each idea which accounts for only 17 ideas being submitted. Finally, Week 8 saw the largest amount of design ideas, 102, posted in response to a video-prototype of technology to help kids recycle.
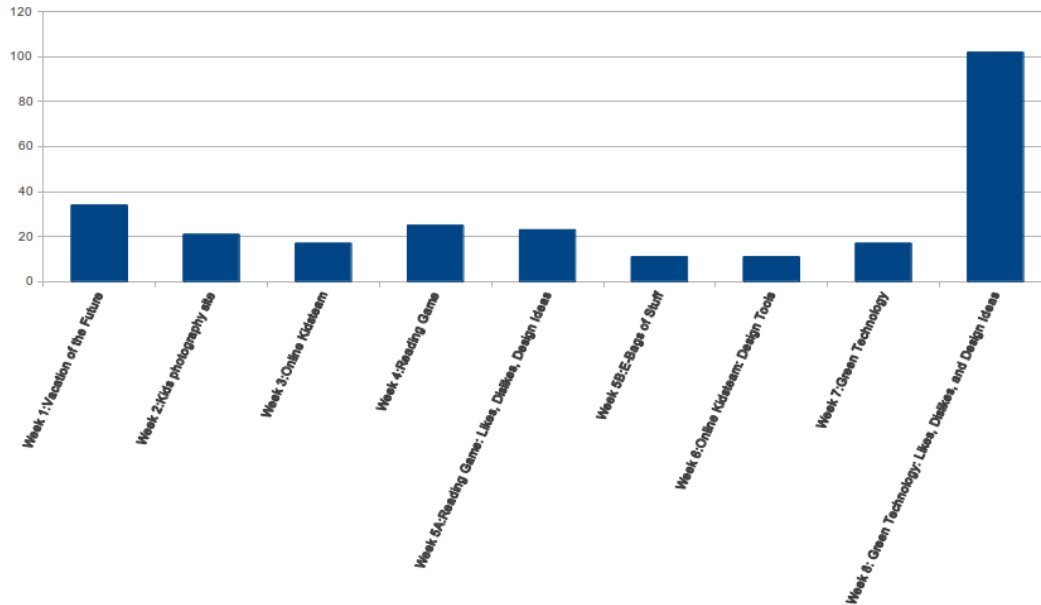


*Figure 31- The number of ideas submitted weekly.*

Using the log data, I was able to determine the number of sessions that occurred during the online portion of the research and the length of those sessions. The in-person portion of the research had a set duration for those who participated in the Face-to-face Kidsteam.. The sessions were considered a single session if there was no more than 15 minutes of inactivity between page views. There were 191 sessions (M=9.10, SD=6.93). There was no significant difference between adults and children in the number of sessions, $F(1,19)=.005, p=.94$. The average session lasted 775.66 seconds, or, 12 minutes

and 55 seconds (SD=435.81). Again, there was no significant difference between adults and children in the amount of time spent in sessions, $F(1,19)=1.99, p=.17$.

Usually, the findings of no significant difference between groups could be demonstrative of failed research. *The lack of significant difference between adults and children in page views, sessions, design attempts, and ideas submitted reinforces the idea that the online-only portion of the project was truly intergenerational and neither adults nor children participated more than the other group*. This is an important finding because it illustrates that the online environment met the goals of intergenerational co-design.

### *Participation*

In this section, I will present summaries of each *child participant*'s participation and experiences derived from system logs and interviews. The geographic locations were found by cross-referencing the participants' computers unique internet protocol (IP) addresses with the known locations of those addresses. See the methods section for a full explanation of this technique.

Analysis of the logs show that five of the twelve children connected from more than one location which is consistent with the results from the interviews. Three more children had multiple unique IP addresses which could be due to the way that Internet Service Providers assign these addresses over time and does not necessarily indicate that the children participated from another location. See Table 4 for a list of locations participants connected from.

During the in-person Kidsteam, the design session begins at 4:00 PM. As you can see in Table 4, all but three participants connected to the online system at times that averaged earlier in the day (based on their local time) than in-person design sessions.

This means that the children incorporated Online Kidsteam into a part of their day and not necessarily a late-afternoon or "after-school" activity. This could be because the children had more flexibility in their schedules in the summer.

*Table 4- Locations from which participants connected to the online environment, the average time of day, and the number of sessions participated in.*

| Name | Connected From (Unique IP Addresses) | Average Time of Day | Sessions |
|------|--------------------------------------|---------------------|----------|
| Alice | Colorado (1) Utah (2) | 11:54AM | 27 |
| Amanda-Jane | Maryland (2) California (1) | 1:32PM | 9 |
| Bethany | Hawaii (1) Maryland (2) | 2:15PM | 6 |
| Breanna | Utah (1) | 3:13PM | 6 |
| Selena | Maryland (4) Virginia (1) United States (1) | 3:16PM | 10 |
| Hugh | Maryland (1) | 2:42PM | 12 |
| Max | Maryland (3) | 3:29PM | 11 |
| Mason | Maryland (2) | 4:39PM | 14 |
| Oscar | Maryland (1) | 10:44AM | 2 |
| Raoul | Maryland (3) | 1:44PM | 1 |
| Samantha | Colorado (1) Utah (1) | 2:57PM | 9 |
| Tomas | Maryland (1) | 6:00PM | 1 |

Although the number of pages accessed does not equate to engagement, it gives an overview to how active each participant was within the online environment. There is a strong correlation between the numbers of pages accessed and the number of layers added, $r(10) = .91$, $p < .01$, as well as the number of pages accessed and the number of projects attempted, $r(10) = .92$, $p < .01$. Following that, there is a correlation between the number of sessions and the number of layers, $r(10) = .77$, $p < .01$. This correlation is

expected as a user who is more active by accessing more pages and participating in more sessions seems to be more likely to contribute a greater number of design ideas. See Table 5 for a comparison of the participation of the children.

*Table 5- Participation by the child designers in the online environment.*

| Name | Pages Accessed | Sessions | Layers Added | Projects Attempted |
|---|---|---|---|---|
| Alice | 368 | 27 | 9 | 14 |
| Amanda-Jane | 188 | 9 | 8 | 8 |
| Bethany | 118 | 6 | 3 | 7 |
| Breanna | 44 | 6 | 1 | 2 |
| Selena | 164 | 10 | 5 | 5 |
| Hugh | 140 | 12 | 4 | 9 |
| Max | 134 | 11 | 4 | 6 |
| Mason | 244 | 14 | 9 | 10 |
| Oscar | 34 | 2 | 1 | 5 |
| Raoul | 30 | 1 | 0 | 1 |
| Samantha | 94 | 9 | 0 | 3 |
| Tomas | 21 | 1 | 1 | 2 |

To understand how the participants felt about their involvement, I asked how often they thought they participated in the interviews. Based on their answers, I classified them into two groups, low and high participation, N=8 and N=3, respectively. One child participant did not answer. If the participants answered "not much", I put them into the low participation and if they answered that they participated a least weekly, I categorized them as high. There was a small difference in the number of sessions between those that were categorized as high participation compared to those that were categorized as low participation based on their responses, $F(1,9)=3.57$, $p=.06$. See Table 6 for a comparison of actual participation as compared to self-reported participation.

*Table 6- Participation of the children in comparison to their self-reflections gathered during the interviews.*

| Name | Average Time Online (MM:SS) | Sessions | Layers Added | Projects Attempted | Participation Self-reflection |
|---|---|---|---|---|---|
| Alice | 10:56 | 27 | 9 | 14 | "three to four days a week of maybe thirty minutes to an hour" |
| Amanda-Jane | 15:19 | 9 | 8 | 8 | About 5 times for 5 to 10 minutes each |
| Bethany | 14:06 | 6 | 3 | 7 | "Not much" |
| Selena | 14:57 | 10 | 5 | 5 | "every five days" |
| Hugh | 11:05 | 12 | 4 | 9 | "Not very much" |
| Max | 16:22 | 11 | 4 | 6 | "Almost every week" |
| Mason | 20:18 | 14 | 9 | 10 | "Not really that much" |
| Oscar | 22:05 | 2 | 1 | 5 | "once or twice during the summer" |
| Raoul | 00:29 | 1 | 0 | 1 | "A little" |
| Samantha | 10:56 | 9 | 0 | 3 | "Not very much" |
| Tomas | 33:07 | 1 | 1 | 2 | Once for forty-five minutes |

## *Experiences of Children*

After reviewing all of the child-participant interviews through an open coding scheme and the tagging of passages with keywords, I determined that there were twelve experience themes present. Those themes were: technology, feelings, problems, Online Kidsteam, motivation, activities outside the home, family, creativity, face to face Kidsteam, communication, collaboration, and social. The passages were analyzed down to the "phrase" level. The smallest unit I tagged was phrases or sentence fragments. The passages that had tags applied ranged from an individual sentence fragment up to an exchange between the participant being interviewed and me. The codes were not

mutually exclusive and passages coded with one tag may also have been coded with another tag as well.

Online Kidsteam

Because of the topic of this research, the most frequently emerging tag was Online Kidsteam. There were 97 passages identified as pertaining to Online Kidsteam. Many of the comments involved the parts of the environment (17 passages), or the features (both existing and suggested, 48 passages). This tag appeared most frequently (8 passages) in the second interview when discussing the tools used in designing. The second most frequent appearance of this tag (6 passages) was in the first interview when participants were discussing their favorite parts of Online Kidsteam.
The comments about the environment were either about a particular part of Online Kidsteam (*"The hardest part-well it was kind of easy because I got my mom to do it…It was circle time"*-Max) or Online Kidsteam as a whole (*"I guess it's really cool how you just replicated what we do in real Kidsteam like the design time circle time and that stuff. I think that's just really cool."* – Bethany).

The comments about the features were about both existing and proposed features. The comments about existing features were often about tools available within Design Time ("*I used the line in the art kit*" - Bethany), the awards for participating in different ways ("*I have seen trophies before next to people's names*"-Amanda-Jane), or the sound recorder ("*Mostly I used the lines and …just the normal drawing and sometimes I did the recording*"-Samantha).

There were comments about Online Kidsteam that discussed proposed features. Some of the proposed features were additions to the drawing tools (*"Also a good thing to*

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*be on that would be a fill bucket...with a fill bucket you could just do it then."* – Alice), a modified point system (" *So, like once you get points for doing everything else and then two times the amount you just got after all of that....you would get a bonus and an achievement."* – Hugh), and new ideas to solve problems found in the environment (*"I would say...it's hard to find my friends when they're on...So, like if there was like a homing device..."* – Bethany).

Face to Face Kidsteam

One of the more striking themes that emerged was the relationship between Online Kidsteam and the original face-to-face Kidsteam, also referred to as "real" Kidsteam. There were 42 passages marked as discussing face to face Kidsteam and 18 passages that mentioned both at the same time. The most frequent appearance of this tag (8 passages) was during the second interview when I asked if we should use Online Kidsteam as a part of face-to-face Kidsteam. The second most frequent appearance of this tag (4 passages each) was during the first interview when I asked participants if they had learned anything while participating in Online Kidsteam and in the second interview when I asked what the favorite thing they had designed was.

Some of the participants came into the team with a negative expectation ("*I didn't really think that it was gonna be as good as the real one*" – Annie Jewel). Other members of the team felt that the two experiences were almost equal:
"*I mean it does make me feel like I am back with Kidsteam... just not entirely"* – Mason, *"[I learned] that I can make stuff better than the real Kidsteam like in well I can't, it's basically the same...not that much the same because we don't have the like the Legos"* - Max.

Parents of participants had opinions about Online Kidsteam and its relationship to face-to-face Kidsteam:

*"Samantha of course is always comparing it to in-person Kidsteam so it felt like a let down a little bit... I mean it's just a different task when you're sitting around with kids like brainstorming it's just a very different experience then when you're sitting at a computer alone"* –Alice, Samantha, and Breanna's father

"*Um, it was fun to participate a little with her since I don't get to do that with the face-to-face Kidsteam*" – Selena's mother

Another important theme of comments regarding face-to-face Kidsteam was that Online Kidsteam can enhance face-to-face Kidsteam:

*"Because I still want to know the people who do Kidsteam and all Kidsteam and stuff and not forget their name"* – Max

"Tomas: *It's going to be better if we actually do it. Like, if we actually make it.*

Greg: *So you mean like if it if we design it on the computer you think it'll be better*

Tomas: *I think if we design it at the regular Kidsteam from the computer*" – Tomas and I discussing if these tools should be used in face-to-face Kidsteam

Problems

There were 74 passages coded as dealing with problems. The only code that was more frequent than the Problem code was the Online Kidsteam code. Passages that were coded with the problems code were centered on difficulties that the team members may have had while taking part in as members of the Online Kidsteam. This code was most frequently identified (10 passages) in response to a question in the first interview that asked about the participant's least favorite part of Online Kidsteam. It was followed by

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responses to questions in the second interview of what was the hardest part of Online Kidsteam (9 passages) and what was the participant's least favorite part (7 passages). The most frequent code that was associated with the Problem code was the collaboration code (22 passages). The next most co-coded tags were Online Kidsteam (11 passages) and Feelings (10 passages). The types of problems team members described included personal limitations, conceptual problems, and technical problems with the environment.

One personal limitation that some of the participants had was the inability to type:

*"All of the typing you have to do and because it's kind of hard cause I'm not a very fast typer" – Bethany*

*"Probably the part where you type because I'm not very good at typing" – Samantha*

Some involved their families to help them type.

*"Yeah, like sometimes my mom helps me with stuff…Or my dad…Sometimes my dad and mostly my mom…Um sometimes mostly they helped me with typing and reading and stuff. But they don't really um help that much with design ideas." – Mason*

Another limitation was the inability to draw with computers:

*"I don't hate anything but my mom never lets me use her computer and she's the only one who has the mouse.  So the design time was kind of hard for me. Cause we only have the laptop which don't have mice. So it's hard to move around." – Alice*

*"I've learned how much harder it is to draw on the computer" - Bethany*

*"um you had to  color on the computer" – Raoul on what was the hardest part of Online Kidsteam*

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*"you could make the models on the computer. It was kind of hard to drag them around." - Selena*

Some users encountered problems because they didn't know what to do after they logged into the environment:

*"The hardest was when the challenge didn't really make sense to me…I think I sort of got it and I posted something…but the reading game…that was hard… I didn't totally understand it"* – Amanda-Jane

*"He would try to figure out things that were happening…If he had had a chance to have let's say an orientation session in person where he learned how the tool was supposed to work…he could have done it pretty efficiently… but as it was he would kind of try to struggle to understand what was going on there"* – Oscar's father

Due to the experimental nature of the environment, there were some isolated technical problems that contributed to the designers' experiences:

*"One thing I don't like is that when you go on something one of them and you decide to go off…Like you want to, maybe try it again, like try out the other things to see what you like more…It makes it so you can't go on"* – Oscar

*"You know, I can't really save that my picture."* – Mason

*"The worst part was ... there was nothing the worse except when I couldn't save."* – Max

### Feelings

There were 73 passages coded as having to do with Feelings. Passages that were coded as related to feelings included comments about emotions (e.g., happiness,

frustrations, boredom). There were 55 passages coded as dealing with positive feelings

and 19 passages that involved negative feelings. Feelings was most frequently tagged (7

passages each) during the first interview in a question pertaining to the participants'

favorite part of Online Kidsteam and how Online Kidsteam made the participants feel. It

was most co-coded with Online Kidsteam (15 passages) and then Problems (10

passages).

Passages that described positive feelings talked about personal likes (*"It makes*

*me feel good because, um, I get to meet some of my friends online"* –Oscar, *"I like the*

*design time"* -- Samantha) and fun (*"I like it, it's really fun. And you can do a lot of fun*

*stuff"* – Selena). One participant discussed the feeling of being part of something larger:

*"It's with a group of people that you don't even know in real life and it's just it*

*makes you feel I guess bigger" (Bethany)*

But passages also described negative feelings as well. Some passages discussed

that a system problem was confusing (*"We got that to work after a while. It was just sort*

*of confusing"* – Mason) or that participating was hard. This exchange was about how

participating in Online Kidsteam is different than other activities the interviewee

participates in like school or sports:

*Raoul: We do more work.*

*Greg: Oh, you do more work, is it more fun work?*

*Raoul: No*

Parents recognized that there were negative feelings about the online environment

with 5 of the 19 passages coming from them. These negative feelings were due to lack of

engagement (*"It didn't seem like it really grabbed her and there were a few times and*

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*occasionally we'd say have you gone on Kidsteam?"* --Veronica, Annie Jewel's mother)

and the sense that it was not fun (*"but it... I think it just felt too much like homework or*

*something to her"*--Doug, Alice, Samantha and Breanna's father). Parents reported that

another source for negative feelings came their children being frustrated with the

environment:

*"I think at the beginning maybe she got a little frustrated" (Terry, Bethany's*

*mother)*

*"I think that was frustrating to them and they did say that it was frustrating"*

*(Beth, Mason and Max's mother, on a technical problem).*

*"...but as it was, he would kind of try to understand struggle to understand what*

*was going on there" (Darren, Oscar's father on trying to understand what to do)*


Family

The family code was applied to 71 passages. The theme of family was applied to

passages that described other members of the family, such as siblings and parents, and

activities performed as part of the family, such as vacations and moving. This code was

most frequently identified (8 passages) during the second interview when participants

described if they traveled during the research period. The second-most frequent

appearance (6 passages) was during the second interview when participants answered if

they worked with anyone else co-located while using Online Kidsteam. This tag was

most frequently co-coded with the Online Kidsteam code (6 passages) followed by the

collaborate code (5 passages).

One discovery from the interviews was that five of the twelve members involved their parents in their design experience and formed ad hoc intergenerational design teams in their own remote locations. These teams varied in scope from adults interacting with the system as proxies for the children to full partners who brainstormed ideas. This is the same kind of dynamic that occurs during our intergenerational design team sessions. Amanda-Jane included her parents in the process by showing what she had done on the system. During the final interview, she had the idea to send her designs automatically to her parents:

*Amanda-Jane: What if you could email the parents everything that the kid does so like email is right in your inbox*

*Valerie: So that I can check it out.*

*A: You can see what I designed*

*V: Amanda-Jane just had an interesting idea which probably would excite me...*

*A: It would be sort of like Facebook like you see what you do and click on it and you can either see it or click on it to go to my account*

*V: Yeah Okay...*

*V: Yeah that would be kind of cool then I can say ... Oh Amanda-Jane...tell me more about this design or this looks really cool like what was the assignment or who was the partner?*

During the interviews, two parents explicitly said that they would be interested in somehow being involved with the online design team.

Within the group of children, there were three sets of siblings: two sets of two brothers and one set of three sisters. Of those sets of siblings, one family of brothers,

Mason and Max, and the family of sisters, Alice, Samantha, and Breanna, discussed participating with each other at the same time which was corroborated through system logs and activity analysis. The other child-participants did not involve other children such as friends, family, or near-by Kidsteam members in their design sessions.

Mason and Max also worked together during the two-week, in-person Kidsteam as part of the online environment. The older brother, Monty was a former member of face-to-face Kidsteam and his younger brother, Mitch, was now a member. When Mitch came home from in-person Kidsteam, his mother suggested that he show Monty how to use the clumping login. After that, the two brothers used the clumping login to elaborate on designs that the in-person Kidsteam had created extending the team from co-located in the lab to being partially co-located in the home.

While discussing the potential ability to have co-located team-members work together in the interview, one member expressed interest in the ability to enroll friends to the Online Kidsteam so that they could work together on challenges while co-located.

*Alice: Um, that would be good. What if you could get a friend that wasn't on Kidsteam to help?*

*Greg: You mean and sit next to you... Do you mean that they could just come and join online Kidsteam or that they could sit next to you and you guys could design together?*

*A: They could sit next to you and help…*

Another family activity that was discussed during the interviews was vacations. Eight of the members of Online Kidsteam reported going on vacation. Bethany connected to Online Kidsteam while on vacation in Hawaii. Her mother said, "It was harder than I

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thought to find time when we were on vacation for her to do it. I thought we'd have more time to do it and it just didn't happen as much as I had thought it would. Part of it was we didn't have the internet a couple of weeks while we were gone." Oscar had a similar experience while on vacation saying, "We didn't have internet I think…When we were at the beach house…we didn't have Wi-fi."

Another family activity that contributed to this theme was relocating, or moving. Two of the families moved from Maryland to either Utah or California. Moving impacted the participation of Alice, Samantha, and Breanna. Their father explains: "we were pretty consistent doing everything until we got into our new house and our lives just kinda got turned upside down." During her interview, Amanda-Jane said that she signed up for an email address because she was moving.

Collaboration

The Collaboration code was applied to passages that discussed concepts of working together with other people in some way. Those people could be co-located or they could be geographically separated. The Collaboration code was applied to 60 passages. It was most frequently coded (8 passages each) during three interview questions: during the first interview when I asked if they worked with any adults online, in the second interview when I asked if they had worked with any other participants online, and in the second interview when I asked how we could help participants feel more like a team. It was most often co-coded with Problems (22 passages).

A number of participants mentioned that an experience they had was the inability to see anyone else while online. There was a status indicator on the left-hand side of the Online Kidsteam environment that indicated who else was logged in at that moment and

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users were able to chat synchronously in Snack Time. Although the environment was intended to be asynchronous, the team members thought it was a problem that they never "saw" other designers and this affected their communication and collaboration experiences. This contributed to participants saying that the lack of seeing anyone else online was the worst part of Online Kidsteam. Bethany thought it was "hard to find my friends when they're on." Tomas said, "When you see people when they're not online is not cool to not actually talk with them."

Another experience that participants discussed was not feeling part of a team. Alice, Samantha, and Breanna's father said, "There just wasn't that collaborative atmosphere." Selena's mother also said that her daughter did not feel as though she was part of a team. Hugh thought that it was more of a competition than teamwork because he worked by himself. Amanda-Jane felt as though she feels like a team "when everyone's in the same place and you can see everyone and it's not, like, online."

There were positive experiences regarding the collaboration in Online Kidsteam. Bethany felt "very much so" a part of a team even if she didn't see anyone else on at the same time. Oscar felt he was part of a team "especially when you did those ones where you added on to a picture." Mason thought that he was a part of the team when he worked with someone, especially when he and Max were able to work together at home using the clumping login.

The Online Kidsteam participants had some ideas on how to make people as though they were more part of a team than before. Many of the ideas involved scheduling a time for people to meet at the same time. Samantha said, "but it would probably have to be a time we're not at school," and realized that some of the participants were in a time

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zone different from hers. Her sister Alice thought we should have a mascot or a song to represent Online Kidsteam. Hugh wanted a machine that changes people's minds to being more agreeable to working together.

There were some negative thoughts about communication and collaboration as it pertained to the collaboration. For example, Doug felt as though the first designer to attempt a design problem was "privileged" because they set the tone for the entire design session. Along the same lines, Hugh mentioned that his least favorite thing about Kidsteam was seeing other participant's designs. He said, "Seeing other peoples drawing or what they did when your, uh, designing something… makes it harder to do something."

Communication

The Communication tag was applied to passages that talked about the act of communicating between participants and someone else, including other participants. These forms of communication included sending messages, chatting, and voice communication. There were 30 passages marked as Communication and were evenly mentioned throughout interviews so they did not appear during any question in particular. It was most often co-coded with the Online Kidsteam code (9 passages) followed by Face-to-face Kidsteam (5 passages).

An experience that contributed to the passages marked as Communication was intra-environment communication. Samantha felt as though she learned about the other members during circle time "because you can see other people's things of what they wrote." Oscar said, "I get to communicate to people in a different way." Mason explained the best part of Online Kidsteam, "It's um really fun. You can like talk to other people

that are from that were from the Kidsteam session um by snack time and circle time and stuff and you can design stuff on online and there it's just really fun all together."

Outside Activities

Experiences that directly affected the participation of the child design partners included the outside activities that many of them participated in during their summer breaks. There were 28 passages marked as outside activities and was discussed most frequently (6 passages) when discussing activities that the participants did outside of Online Kidsteam. It was discussed the next most often (4 passages) with the parents during their interview. I chose this tag when the passage involved commitments outside of Online Kidsteam and outside of the home. These activities included camps, sports, and time with friends. This tag was co-coded most frequently with family (5 passages).

During the time of Online Kidsteam, most of the participants took part in some kind of structured activity outside of the home in the form of camps or sports. Design partners went to theater camp, circus camp, photography camp, cooking camp, sailing camp, tennis lessons, rock climbing, hockey, and swim team.

Some of the participants actually participated in Online Kidsteam from their camps. Amanda-Jane said, "I've gone on at camp a lot…because you get like some amount of time for free time." Mason confirmed that he was able to access Online Kidsteam from the camps when he was able to adding, "I couldn't really bring my computer to camp depending on which camp I went to."

Other participants told me that participating in camp restricted their time to use Online Kidsteam. Raoul and Tomas said that their other activities affected participation in Online Kidsteam because they had other things they needed to do. Oscar's father said

"he didn't have much time to participate. He was fairly busy this summer between swimming and camps." These activities can be exhausting as Bethany explained, "It took time away from me remembering to do it because after circus camp I was really tired."

As children, spending time outdoors and playing with friends are important activities. These kinds of activities also had an impact on the children's participation in Online Kidsteam. During my interview with Bethany, her mother said "summer is just kind of crazy with a lot of we get home and go straight to the pool and stay at the pool until bed time so, in a way it's kind of odd, but, the in the summer, we have less free time." Mason and Max's mother told me that Max and another member of Online Kidsteam were supposed to get together and try using the environment at the same time but added, "Because they were into the play date they completely forgot."

Participation

Through the interviews, I found that a number of experiences motivated and unmotivated the design partners to participate. Passages were tagged with participation if they mentioned why the participant took part in Online Kidsteam or did not take part. Examples of participation included altruism, partners, and incentives. There were 23 passages tagged as Participation. The code most frequently appeared (3 passages each) in the second interview while discussing if the participants feel like they actually designed new technology as well during the parent interview while discussing if their child had mentioned anything to them while participating. It was most often co-coded with the Online Kidsteam code (5 passages).

The idea of helping others was motivation to participate for some. In one example, Bethany mentioned "I just kind of felt like that we were helping the greater

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good not just thinking about what would be cool for…us to have…". Another example of altruism was Max's comment that Online Kidsteam was good because "because it would be really fun for the kids that can't afford to be going to Kidsteam."

Partners and projects contributed to the experience of the design partners and motivated them to participate. When discussing Online Kidsteam, Amanda-Jane said "You get to work with these really famous companies." During Tomas's interview, he said "I want to be involved with Nick[elodeon] and Poptropica, or the Cartoon Network … I want to be a part of those." In other interviews, participants mentioned several of the projects that we undertook through the summer: the recycling bin that connects to social media, the vacations of the future, and the reading game.

Some parents took a role in motivating their children to participate throughout the summer. Alice, Samantha, and Breanna's father Doug said "we kind of equally promoted it to all three" and reminded and encouraged them to go on every day. Alice interpreted that as, "our rule was we had to do Kidsteam before we did anything else on the computer." Bethany's mother was usually in the room with her when she participated in Kidsteam "just kind of encouraging me to write more." Oscar's father Darren took a different approach to Kidsteam this summer by not pushing it on his son and letting him choose when he participated saying, "we decided we weren't going to prompt him to do this".

Creativity

The theme of creativity emerged from the references to design, artistic acts, or the idea of expressing one's self. The theme appeared in 17 passages and was most often mentioned (6 passages) in the first interview when discussing the participant's likes about

Online Kidsteam. It was most often co-coded (4 passages each) with Online Kidsteam and Feelings.

Online Kidsteam provided an environment for some participants to express themselves in ways they may have trouble doing in other parts of their life. Raoul said that the best part of Online Kidsteam was "You get to make your own designs." His brother Tomas thought the best thing was "drawing things, anything that you wanted" and reiterated that thought throughout his interviews. He also was fond of the fact that "if there was a mistake we could make a new one" which he considered a difference between Online Kidsteam and face-to-face Kidsteam.

Online Kidsteam offered other participants ways to express themselves as well and factored into what they liked best about Online Kidsteam. Selena said that she liked to write in Online Kidsteam while Samantha liked to draw pictures. Amanda-Jane thought the best part of Online Kidsteam was that "you can…see other peoples' work all at once in designs and it gives you ideas." Hugh's favorite thing in Online Kidsteam was "creating stuff."

Some participants thought the creativity made it different than other things they participated in. Mason thought that it was different because it was "funner than school cause you get to design things of the future. "Oscar felt as though it was different because "you really get to show your ideas."

Technology

The theme of technology appeared 20 times within the data. The kinds of technology mentioned almost always involved a computer or computer peripherals. In fact, one of the most common trends was the identification that Online Kidsteam was

different than other activities in the child design partners' lives because it was on the computer. This code was most frequently discussed (7 passages) during the first interview when discussing how Online Kidsteam was different than other activities that the children did.

> *"Um well you doing on the computer so you're not usually on the computer all the time at school..."* – Alice
>
> *"Um, it's different because it's all on the computer."* – Samantha
>
> *"Well for first of all it's online for sure. and well I get to communicate to people in a different way."* – Oscar
>
> *"Because some of my teachers don't let me do stuff on computers like this"* – Max
>
> *"It's on the computer which is one of the big ones"* – Bethany (Referring to differences between this and her other activities).

One participant mentioned that the computer replaces driving, "Well cause you don't actually like drive there…instead you can just walk to the computer and go to the site website" – Hugh

Technology also included social web sites and games that the participants may have referred to or even the use of a computer mouse.

*Experience Summary*

In the chapter, I presented the findings from my study on the experiences of children as they participate as members of Online Kidsteam. The children and adults participated equally in the online environment with some participants connecting from

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vacation. Although the adult and children participated equally during the first six weeks, the children were frustrated by never seeing anyone else online at the same time. To reduce their frustrations some children formed intergenerational design teams with their parents and siblings at their own locations.

# Chapter 7: Discussion and Future Work

In this chapter, I discuss my findings, how they are inter-related, and how they answer my research questions. I also discuss how this research will influence my future work and the kinds of research questions I want to answer.

I broke my research into three components: investigating the scaffolding that occurs in co-located design sessions, the technologies that are needed to support geographically distributed co-design teams, and the experiences of children who participated in an online co-design team. In a sense, there is a logical progression from what I learned from observing the in-person co-design team to designing a system to exploring the experiences of the child-participants. But in reality, the latter two elements constantly influenced each other and even had an influence on later meetings of an in-person team by the end. For example, in one interview, I found out that two of the participants in this study asked to use Online Kidsteam as a way to participate in another project being conducted at the Human-Computer Interaction Lab. They were unable to participate the last few days of the research into scientific inquiry through cooking and thought it would be a good idea if all of the groups posted their projects and experiments in Online Kidsteam so that the two of them could participate from vacation. In that way, the online environment influenced the face-to-face activities.

My research questions were:

[RQ1] How can co-located, cooperative design with children be translated to an online distributed environment?

[RQ1A] What are the purpose and benefits of each stage of a cooperative inquiry design session?

[RQ1B] What features must be built into an online design environment to facilitate the purpose and benefits of each stage of a cooperative inquiry design session?

[RQ2] What are the experiences of children as they participate as online design partners and how do those experiences influence their participation in an online asynchronous distributed co-design environment?

[RQ2A] What were the social and affective experiences of the children as they co-designed new technologies in an online, asynchronous design environment?

[RQ2B] How were those experiences shaped by their context as children?

[RQ2C] How did those experiences affect their participation in the online environment?

[RQ3] What are the tools and technologies necessary to successfully support distributed co-design with children?

### *Transferring In-Person Co-Design to Online*

As previously mentioned Kidsteam is the instantiation of Cooperative Inquiry in a co-located environment and achieves the following goals: eliminates traditional power dynamics, nurtures a safe space through social interaction, focuses the conversation, enables creative expression, captures ideas, and facilitates creative discourse. Online Kidsteam was modeled after the in-person Kidsteam observation and accomplished those goals in an online environment that supported geographically distributed co-design.

Snack Time

Although snack time seems irrelevant to a distributed design team, this time works as non-design focused social experience among the child and adult team members. A similar, free-form social activity was created for the Online Kidsteam to create a similar social experience for participants. This functionality facilitates a general meeting area that supported asynchronous communication through an instant messenger-like interface. Design partners were able to share what they were doing in their lives outside of the design activities. This area was conceptually adjacent to the design area and available throughout the entire research period.

Through the iterative design process, this module was refined and the goals of eliminating traditional power dynamic were achieved through informal conversations about on varying topics. The participants openly expressed how they wanted items changed in the Snack Time module and I was able to add avatars and make other small changes that participants had requested.

Circle Time

The circle time is the part of the design session that begins to focus the team on the day's activities. A question that relates to the design goals for that session is asked. In each circle, design partners introduce themselves with their name, age, time with Kidsteam and answer the question of the day. Through introductions using first names and sitting on the floor, the typical power dynamics that exist in environments that children often participate in are reduced. The use of a "question of the day" focuses the discussion and puts the participants in the mindset of the design session's domain. A similar activity was done with Online Kidsteam in the form of a pre-design message

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thread. Each week, a new question of the "week" was posted within a message board-like tool. Before any designing took place, adult and child participants answered that question and were able to see others' answers. Because each user had a profile, there wasn't a need for the similar introductions that happens in co-located design sessions.

Design time

The design activities in the co-located group were where participants spent most of the session's time. During the session, the design partners used low-fidelity prototyping techniques with art and craft materials to collaboratively create low-tech models in order to express their ideas. These techniques supported creative expression of ideas, enabled elaboration between participants, and were child friendly. The software that powers the design activities in Online Kidsteam, DisCo, also supports creative expression, enables elaboration, and is child friendly. At the beginning of the research period, DisCo was simply a web-based simulation of a paper-based tool built upon the Layered Elaboration technique. As the project matured and DisCo was iteratively designed, the tool became more than just a computer-based version of paper. Instead, the tool exceeded what was possible with paper with features such as soloing layers and the ability to undo as well as leaving recorded messages describing design notes.

Big Ideas

The Big Ideas segment of the design session did not transfer to an online tool in the same way that the previous parts of the design session were adapted. In the in-person session, the Big Ideas segment was the time at the end where the group came together to discuss their designs. As each small group presented their ideas, the design elements were recorded on a white board in the front of the larger group. This recording of ideas

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becomes the summary of the current design session and creates a pool of ideas for the next iteration of development.

In an asynchronous environment that has multiple design projects week after week, similar to the way that in-person Kidsteam operates, a central place that houses a discussion about the outcomes at the end of the design period in which the participants can participate becomes difficult. For example, if the design period is one week (Monday to Sunday) in order to accommodate users' asynchronous schedules, then the Big Ideas wouldn't happen until after the end of the design period, in this case Monday. It would require users to log in to the Online Kidsteam at some point to see those Big Ideas and then begin designing the current week's activity or design challenge. In essence, *the Big Ideas section is no longer the end of the previous design session but instead becomes the beginning of the latest one*.

In order to address this, I communicated the Big Ideas from a previous design session to the participants in three different ways throughout the research period: textual description that was similar to the way the in-person whiteboard is used, verbal description as part of the introductory video, and as a prototype for further iterative development when applicable. The alternative would be to create a section of Online Kidsteam in the same way that the Snack Time, Circle Time, and Design Time were displayed—as prominent sub-sections of the online environment. I felt as though that would be confusing because a Big Ideas section may have led designers to believe that the section was about the current design challenge and not the previous one. Based on my experiences within the environment, moving the Big Ideas to the beginning of the next week was a good way to address this consequence of an asynchronous design period.

<u>*The Experience of Children*</u>

Based on the analysis of the interviews, the social and affective experiences of the children as they co-designed new technologies in the online environment were varied. In some ways the experiences were very positive, such as the amount of fun that some users had while participating, but those experiences could lead to negative affective experiences. As mentioned, some users were frustrated at different points during Online Kidsteam.

The social experiences were also important as participants had both positive and negative ones. Participants were excited to be able to keep up communications with members of Kidsteam that they may only have known through the in-person design sessions. Taking that further, they became upset that they were not able to interact in real-time with those other participants. I believe that the asynchronous nature of the online environment combined with the normal isolation of summer vacation worked as an amplifier of feelings regarding being alone in the environment. *Even though the group was successful in designing new technologies for children, the lack of feeling experienced as a member of a team is an important and crucial element that needs to be addressed in future versions of these tools and techniques.*

I found that the children had three contexts that shaped their experiences and affected their participation: their context as an individual, their context as a member of a family, and their context as a member of Online Kidsteam. These contexts are not mutually exclusive and their experiences come from the combination of contexts in which they interact.

When I refer to the self of the children, I am referring to their age, the things that they dealt with on their own, their skills, and their responsibilities. This included their participation in activities outside of the home such as sports and camps, as well as their personal likes and dislikes. I also include their skill abilities including reading, writing, and typing.

The children as family members included things such as going on vacation and including their parents and siblings in their designs as partners. These experiences were important because the children rarely had a say in their own participation. The children were also reliant on the parents to communicate with me because, except in few cases, they did not have their own e-mail addresses. I had to contact the parents to inform their children about something on Online Kidsteam.

The children as family members also created positive experiences for them on Online Kidsteam as well. In some cases, the children included their parents in the design process. In some cases the parents and children formed intergenerational teams from within the family in order to navigate the more complex computer proficiency requirements (e.g. typing) while in other cases, the children included their parents in Online Kidsteam by sharing their designs and ideas.

The children's context as members of Online Kidsteam influenced a number of their affective and social experiences as determined by the interviews. Had it not been for their involvement, they would not have participated in an online environment in which they could see their acquaintances from in-person Kidsteam. Conversely, had it not been for their involvement in Online Kidsteam, they would not have had a frustrating experience due to the lack of "seeing" the other members online. Many of the positive

and negative feelings that the children had because of Online Kidsteam were due to the combination of contexts.

I think that the context of participating in Online Kidsteam by several of the members who moved was reflective of their affective and social experiences as they adjusted to their new locations. In particular, the two oldest members who had moved, Amanda-Jane and Alice, had very different affective and social experiences and yet they were both reflective of their current situations.

Amanda-Jane moved from Maryland to California and did not feel as though she were part of a team while participating in Online Kidsteam. I think this was a combination of her new situation in California, her time as a member of in-person Kidsteam, and the limited real-time interactions she had in the online environment. I believe that her positive experiences as part of in-person Kidsteam had given her a sense of team and when that was coupled with her move to California and the stresses of making new friends as well as starting a new school, exasperated the feelings of aloneness.

Alice moved from Maryland to Utah with several stops along the way to visit family. When she explained her experiences in Online Kidsteam, her suggestions and ideas tended to involve learning more about people and involving the people you were with in the design process. I think this reflected her experiences of moving and meeting new people as well as seeing family in short visits. Alice had never been a member of in-person Kidsteam and I think that was reflected in her experiences with Online Kidsteam as she had been part of a team.

These different contexts that the children were a part of had an effect on participation in Online Kidsteam. Their initial participation in Online Kidsteam was the outcome of being a member of Online Kidsteam. Their context as family members influenced their participation in ways beyond their control. Their context as self influenced participation through the outside activities that they chose to participate in.

Through the interviews and analyzing the log data, I learned that the experiences that the children had as members of Online Kidsteam influenced their participation. As members, they agreed to participate weekly in the online environment. The positive experiences that the children had as members of Online Kidsteam, including creative expression, positive motivation, and positive feelings encouraged the users to continue participating. The problems that the children encountered such as technical issues and the lack of seeing others online had a negative impact on their feelings toward the environment and may have been the cause for the downward trend of weekly ideas. In fact, some comparisons were made between face to face Kidsteam and Online Kidsteam that painted the online environment in a negative light. When Online Kidsteam and Face-to-face Kidsteam were concurrent, there was an increase in the number of people participating and the number of ideas generated.

The context of family member was perhaps one of the most influential in terms of its effects on participation. I learned from the interviews that as a member of the family, the children rarely had influence on how their time was spent while on vacation. One parent mentioned that finding the time to participate while on vacation was much harder for her daughter than she had thought because the family was so busy. Another parent explained that there was no internet at their vacation destination with prohibited any

online interactions. Finally, one participant told me that her father never sent her the email explaining how to participate in Online Kidsteam until we were three weeks into it and she felt that had negative influenced her participation for the rest of the summer.

The self context influenced the participation in a few ways. First, their age and skills directly influenced how they participated with the tools. Some participants included their family members due to the help they needed to participate. The second way that the self influenced participation was their engagement with activities that took time away from Online Kidsteam in which they chose to participate. These activities, such as camps, sports, television, or playing outside, competed for time with Online Kidsteam from the design partners. This is different than in a co-located environment where the design partners are there in the same space and time as the commitment to participate is fulfilled at a pre-determined time.

There was an interesting disconnect from the self context and the members context when it came to the amount of participation that the child-designers reported compared to how much they actually participated. In chapter 6, table 6, one can see that the level of participation by the children as determined by log data was not necessarily congruent with what the child participants self-reported. In one case, Mason reported that he didn't participate "that much" and yet he had the second highest number of sessions and was tied for the most layers added. Similarly, Amanda-Jane participated in design sessions for over two hours, yet thought that she participated for much less than that. This is important because it illustrates how the non-positive feelings (loneliness, frustration, disappointment, etc.) may have influenced their own perception of participation to the

negative and that these non-positive feelings can tarnish the otherwise successful design experiences.

*Technological Design to Support Intergenerational Co-Design*

In order to investigate how successful the design of the online environment was, it is necessary to look at how each of segments of the in-person design sessions works and compare it to the segments of the online environment to see if achieved similar results. From these achievements or deficiencies, I will make recommendations for new approaches and features necessary for an intergenerational online co-design environment.

Because of the influence of in-person Kidsteam on Online Kidsteam, it follows that there are a number of similarities between the two types of interactions. More importantly, there are a number of differences as well. The similarities are apparent in how both design environments are structured and the differences are often in how the structure is executed. But the analysis must be deeper than just the superficial structure of the two environments because it is not only the structure that makes a design team successful.

Comparison of In-person Kidsteam to Online Kidsteam

Based on the interviews and my observations, it is important to approach each of the segments of design sessions through three contexts: cooperation, communication and creative expression. The inquiry into the cooperation context comes from the conflict between the sentiment expressed during the interviews by some child-participants who didn't feel part of a team and the completed design challenges in which team members worked together and collaborated. The communication context stems from my

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observations of in-person Kidsteam and the amount of verbal communication that occurs during design sessions as well as the amount of text and voice communication that occurred within Online Kidsteam. Finally, the creative expression context will be used to examine how the particular segments of the design sessions encourage or discourage participants to express themselves creatively. I will compare and contrast the in-person Kidsteam design session with the exclusively Online Kidsteam design sessions and the design sessions that utilized Online Kidsteam as part of in-person Kidsteam which I will refer to as Hybrid Kidsteam.

One of the differences between the two design experiences is how the child participants begin. In the in-person Kidsteam, adult participants arrive at the lab and children are brought to the meeting place by a parent or guardian at a set meeting time. Conversely, there are no set meeting times for Online Kidsteam and the adults and children are empowered to start the design session without needing to go anywhere which increases the independence of the child participants by putting them on equal footing with the adults. This was highlighted by the multiple responses of Online Kidsteam participants who mentioned that one of the big differences between it and other things they do is that it is on the computer and there is no need to go anywhere.

Superficially, the snack time experiences are similar to each other in that the conversations are informal and unstructured. During an in-person Kidsteam session, when one designer (child or adult) talks to another designer, they are acknowledged and answered as part of the conversation. From a cooperation perspective, the sharing of food and talking freely begins to remove the power dynamics that society often favors when adults and children are together and begins the expectation of collaboration that will be

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necessary at later parts of the design session. When thinking about in-person Kidsteam's snack time in the context of communication, it is hard to ignore the fact that multiple conversations occur in this time and it is not necessarily one group discussion. Creatively, the participants are free to discuss what they would like in a way that they feel most comfortable with.

The snack time module in Online Kidsteam is asynchronous therefore a comment directed at another participant is not answered immediately unless the other participant is online at the same time. This difference is substantial when looking at the snack time experience in the context of cooperation and encouraging participants to be invested in the design team; without the immediate feedback, some participants could feel as though they are alone which may negatively impact their participation in the online environment. As previously noted, the current instantiation of snack time utilized an asynchronous chat room that supported one persistent conversation which was very much contrasted by the in-person snack time's multiple conversations that were extemporaneous. Creatively, the participants were limited to expressing themselves through text and an avatar with no room for any other kinds of expression, like tone or pitch that someone communicating with voice may be able to utilize.

The snack time segment of the Hybrid Kidsteam was a combination of children and adults co-located eating snacks with those co-located individuals going on to the computer to add to the online snack time discussion. Most of the conversations took place outside of the online environment and interaction with that environment was mostly due to novelty as well as a motivation to communicate with people who were not co-located.

The circle time portion of both the in-person and online Kidsteams are surprisingly similar in some respects. As part of in-person Kidsteam, the participants each take a turn introducing themselves and need to wait to hear the others' answers. In this way it is like an asynchronous activity that all participants experience in the same amount of time. The Online Kidsteam's circle time experience is also asynchronous but it is experienced at different times. One difference comes when a participant asks another participant to follow-up on what was said as part of a real-time conversation. Another difference is that the team experiences in-person circle time together and hears, or at least is present for, what each participant has to say before ending the experience.

Experiencing circle time at a set time and as a complete experience is different from Online Kidsteam where participants may log in, add their own contributions to circle time, and move on to the next section of the design session without going back to see what other designers had contributed, or not participate in circle time at all and go right to another section of the design session. During in-person Kidsteam sessions, some children give creative answers for their age or the length of time with Kidsteam or emphasize certain words with their voice. Similarly, Online Kidsteam participants tried to emphasize their writing with exaggerated punctuation during circle time. In terms of cooperation, there was limited back and forth in the Online Kidsteam circle time between children but some adults did ask follow up questions.

During Hybrid Kidsteam, the children and adults were given the task of completing the online circle time in lieu of actually sitting in a circle. Only some of the co-located children and one adult participated during the first week this was used, but, children and adults who were both co-located and geographically distributed participated

the second week. In this way, the two groups were able to communicate within the environment. There was little cooperation and creative expression was similar to the exclusively Online Kidsteam.

The design time portion of the in-person and online Kidsteams have differences, but, these differences are not necessarily because of the nature of environments. Instead, the major differences between the design times are due to the differences in techniques utilized in each of the Kidsteams. For example, during the observed in-person Kidsteam session, the technique used during the design portion of the session was Bags of Stuff and the technique used through most of Online Kidsteam was an instantiation of Layered Elaboration modified for online use and iteratively developed over the research period. Each of these techniques is similar in they provide opportunities for designers to express their ideas through easily accessible metaphors, building crafts for Bags of Stuff and drawing for Layered Elaboration.

During in-person Kidsteam, the amount of cooperation varied within groups and at different points of the design session. As previously mentioned, it took some time for the groups to cooperate and communicate to create a design and, in one case, made multiple designs around the same problem. This is in contrast to Online Kidsteam where real-time cooperation was impossible yet participants did build on and iterate others' designs. There was more of a sense of contributing to one design during Online Kidsteam compared to in-person Kidsteam.

The way that the two environments supported creative expression during design time is complex because of the stark differences in the techniques each used to elicit designs. Online Kidsteam supports creative expression through an asynchronous

whiteboard. The whiteboard enables users to draw different shapes, add text to the screen, and import graphics from outside the environment in the same way that Layered Elaboration supports creative expression through the use of markers on paper and acetate. Designers are free to draw whatever and however they like. In-person Kidsteam utilized Bags of Stuff, in which participants build low-tech prototypes and then discuss those prototypes later to express the ideas represented. I don't think that either one, Layered Elaboration or Bags of Stuff, support creative expression better. I do think that they support it differently: Bags of Stuff gives participants an opportunity to design their own individual things instead of working in a group while the design tool in Online Kidsteam supports and encourages designs that build on each other.

Hybrid Kidsteam had two different sessions and each one was different in cooperation, communication and creative expression. During the first week, co-located participants sat together and used one computer to create their designs encouraging, if not requiring, cooperation in the design process. Creative expression was the same as exclusively Online Kidsteam because the tools were similar, but, there was more communication going on within the groups as they designed compared to no communication that occurred during the online-only portion.

As previously mentioned, the differences between the Big Ideas sections of in-person Kidsteam and Online Kidsteam were great. During in-person Kidsteam, the groups stand up and discuss their design ideas and the important aspects of those ideas are captured on the board, are discussed, and become the ideas on which future iterations should be built on. In this way, there is two-way communication between the participants and the researchers. Online Kidsteam has the unique property that each idea is already

captured as part of the design tool and those ideas need synthesizing to become the basis for future iterations. The synthesized design ideas are reported back the participants through text or video during the next week's design session and became the basis for future design sessions.

During the first Hybrid Kidsteam session, there was no Big Ideas session at the end in the hopes that the geographically distributed team members would add to the designs. The second Hybrid Kidsteam session utilized the LaDDI tool to collect likes, dislikes, and design ideas about the low-fidelity prototype developed for the session. The creative expression was limited because of the restriction on inputting only text. After all of the ideas were in, the server generated virtual sticky notes that we could arrange on the computer screen and discuss among the co-located group. After this big idea session, multiple geographically-distributed children logged in evaluated the prototype. Even more interesting was the few co-located participants who went home and continued to give input on the prototype from home.

On the Success of Online Kidsteam

The complex nature of an online environment to support intergenerational geographically-distributed co-design prohibits me from declaring a resounding success or a total failure. Originally, the metric by which I would evaluate Online Kidsteam was if it could be used to create iterated designs by an intergeneration team in the same way that in-person Kidsteam does. After the observations & interviews, I came to the conclusion that there was more to Online Kidsteam than successfully creating designs.

If using the original metric of success, then Online Kidsteam was successful in its goal. At the end of the research period, there were eight weeks of designs. Participants

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were able to create designs that could be iterated upon by others. Two of the design topics, the reading game for young children and the interactive recycling bin, have moved far enough along in the design process to begin building prototypes for future iterative development.

But if we compare it to previous research about intergenerational co-design, some deficiencies become obvious. Guha found that the children in her study, those that participated as a part of in-person Kidsteam, considered themselves friends with the other child-members of in-person Kidsteam, yet, that was not something I overwhelming heard in the interviews. Some never felt like they were part of a team because they didn't see anyone else in the environment in real-time.

Guha also found that parents of in-person Kidsteam participants thought that the technology confidence of their children was high because the children could easily go online and operate a computer. This is in contrast to my findings about problems with technology, most notably, the inability for children to type. In the case of Online Kidsteam, the ability to use technology was a requirement of the participants and the troubles they had became barriers to participation, engagement, and the empowerment that in-person Kidsteam was found to instill.

There were positives aspects of Online Kidsteam that could be considered successful. Some of the children felt it was fun. Some mentioned the positive aspects of being a member of Online Kidsteam such as helping others directly through design or making an online environment accessible for children who cannot come to in-person Kidsteam. Other participants mentioned that being creative was something they liked or

the ability to be with their friends who had moved away. In this way, the experiences of the children were similar to the experiences that the children Guha investigated.

As a researcher and designer, it is troubling that the children did not feel as part of a team or feel very connected to the other designers. However, the children I worked with had all been in that in-person environment and had very meaningful social experiences as part of being a member of a co-design team. And, the lack of an overwhelmingly positive experience did not hinder the group's ability to create designs. This leads me to believe that the environment does support geographically-distributed, intergenerational co-design but currently, does not provide the environment for the rich social interactions that Guha found in her research.

It is hard to decouple the co-design from the positive social experiences, but, there are positives that come from this environment as it is today. The obvious one is that it enables more participation from more locations than in-person Kidsteam can accommodate. This includes using the environment as an online-only tool to bring people together that are far away or using the tools during in-person activities in which additional voices can be added to the mix of ideas. In that way, it becomes democratizing in the spirit of the early participation design projects as described by Muller and Kuhn because more people can be heard.

Technology Recommendations

Based on this analysis and my interest in supporting both the co-design aspects as well as the positive experiences for children and adults, I have developed a list of functionality that needs to be included in an online environment to support geographically-distributed, intergenerational co-design. Some of the features were

implemented throughout the development cycle but some participant problems were not

described until after the 8-week period had finished and those interviews led to the

suggested design.

**Existing Functionality**
User Management

The system needs to maintain a database of users. The database stores information

about each user including login and password, roles the user can perform, points the user

has earned and awards that the user has achieved. Users can have a profile page which is

useful if members of the team are not familiar with other members.

Cooperative Inquiry Scaffolding

As previously mentioned, the system currently supports the method of

cooperative inquiry by substituting online tools that replicate the sub-sections of a co-

design session. Those sub-sections are currently: Snack time, Circle time, Design Time,

and Big Ideas. However, the scaffolding should not necessarily go by those names. I feel

as though snack time should become something more representative of the unstructured

nature of that segment with the name such "Free Time". Circle time can keep its name if

the visualization is actually of members in a circle.

Creative Expression Tool

The current online environment supports creative expression through the DisCo

and LaDDI tools. The existing tools enable intergenerational co-designers to create,

elaborate, and evaluate designs from within the environment.

**Upgraded and New Elements**

Multi-Device Support

The most important technological requirement is the need to support Online

Kidsteam on portable, tablet devices and not just on the traditional computer within a

browser. More importantly, our users did not want to draw with the computer. Several times through the design sessions and interviews, children mentioned that they wanted to draw with their finger on a touch screen device. Some parents also requested DisCo be usable on the iPad or iPhone because of the difficulty with recording audio. In fact, the first week of using the fourth prototype in the field saw participants trying to use Apple iOS devices in a way similar to StoryKit. There was a perception that complex computer interactions (recording voice in a browser, drawing on screen) were easier on one of these devices. In a way, our child participants have moved beyond the traditional computer-based web browser as an application deployment tool and onto touch screen devices.

Ad-hoc Intergenerational Design Teams

A challenge to overcome was the difference in design partners' abilities to communicate in an online tool and their ideas on what would help them to better communicate. The most logical conclusion to difficulty in typing would be to enable the designers to record their voices. In fact, this was added in the final prototype and was available for over two weeks of design sessions. But, very few participants took advantage of it. The adult participants only used it when asked to try it out and only two children used it. The prototype used the Adobe Flash Player, which enables audio recording once end-users make a change in their security settings—a change that required technical knowledge. Based on the interviews, I learned that some parents and children took a decidedly low-tech approach and had a parent type for the child. In a sense, the participants created their own intergenerational design teams at their end. Based on my interviews with parents and children, I suggest that any type of distributed co-design must

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be able to include the ability to add family members to the design team in either a formal or informal way in order to enable co-located design.

Another way in which family members could be added to the design team is through an informal, ad hoc mechanism that extends the clumping login by enabling new membership. In this way, participants can add family "on-the-fly" while creating a design. This way would be useful for including family members in the design team who do not want or cannot make the commitment to regularly participate. It could also be used as a way to include friends or introduce new members to Online Kidsteam. This may help mitigate problems stemming from existing family power dynamics.

Design Forking

In in-person Kidsteam, the design partners are encouraged to create one solution per group although that does not always happen. Instead, the individuals in each group sometimes create their own design and those designs are combined with others at the end to determine the requirements of the design. In Online Kidsteam, creating your own design was difficult and some participants mentioned in the interviews that seeing others' designs made their work harder. One participant even wanted to be able to start from scratch. A system feature that allowed designers to "fork" the design or start with a blank canvas would be beneficial even though it has the possibility of stifling collaboration if each designer did this every time. A better solution would be to limit how often this act can be done through points or some other system. That way, forking a design would consume a resource and design partners would need to consider the benefits and costs of not being collaborative.

Ubiquitous Audio and Video Recording

As mentioned in the design history and the interviews, audio recording had the potential to help level the difficulties that younger design partners had with typing. Some participants had expected the audio recording to be throughout the environment and not just in the design session. Also, participants had mentioned that they would like to have the option of recording videos for Snack Time and Circle Time instead of relying on text only. I propose that the system support audio or video recording wherever there is a text input. This could alleviate some of the text input problems that participants had throughout the project.

In-Environment Tracking, Communication, and Synchronous Design

One of the biggest issues that the child participants had with the online co-design environment that was revealed in the interviews was the lack of real-time communication with each other. Although the asynchronous nature of the design environment exists in order to accomplish the goals of geographically distributed audiences, it would be a good idea to support real-time communication between those participants who are on at the same time. In order to accomplish this, there needs to be reporting of who is online and "where" they are in the environment. The system currently lets users know if others are online but it doesn't display a way to contact specific users in real-time.

The online environment would present all users with a list of other users logged in and the section of the environment that each one is interacting with at that time. The location would be important in case users wanted to participate in the same section as other designers concurrently. Participants would be able to click on a name and message that user in real-time.

Communication between researchers and designers would also occur within the design environment due to the lack of e-mail addresses that the child participants had.

Participants also would be able to define some other contact medium, for example a parent's email or phone number with text messaging, that the environment could push messages to as events happen or other users try to contact them.

The final requirement that the online environment needs to satisfy is the ability for design partners to synchronously design. Synchronous co-design is not mutually exclusive from distributed co-design and I foresee a scenario where distributed intergenerational co-designers in adjoining time-zones work with intergenerational co-designers in geographical areas several time-zones away. In this scenario, the designers in adjoining time-zones could synchronously work together and the designers in the different time-zone could synchronously work together amongst themselves. *I call this co-synchronous co-design*. In co-synchronous co-design, the online environment supports asynchronous co-design through a persistent design area that enables synchronous design. This is not dissimilar to the way the tool was used in the last two weeks of Online Kidsteam except that the synchronous designers were co-located.

## *Implications for Researchers*

This project relied heavily on communicating with children in an asynchronous distributed environment. As such, there were instances in which the different ways in which children use technology combined with intentional or unintentional barriers, made communicating differently. Some of the children who participated in the project had e-mail addresses that they personal monitored. In order to communicate with the children, I needed to e-mail their parents and then rely on the parents to relay the messages to the children. Researchers should recognize that this is not the most efficient way to work

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with children and should either use an internal messaging tool or require participants to have their own e-mail account.

Another item that researchers who plan on collecting data from children online should be aware of is the difficulty in asking the participants to take surveys about their experiences in the online environment. I had very little participation in the questionnaires and surveys even after incentivizing their completion. In order to learn what I had hoped to learn in the questionnaires, I modified my interviews to address the same topics. Participation could be ensured through forcing the completion of instruments but that could create a demotivating atmosphere for participation in a design environment as the children may have thought that this was too much like school work and drop out of the design team.

## *Future Work*

At the end of this research project, I have just scratched the surface of geographically distributed, intergenerational co-design. Including more voices into the design process is extremely important to me and, as more projects become international and global in reach, extremely important to Human-Computer Interaction. There are a number of future projects that fall squarely within my research interests.

Kidsteam Variations

**Long-term Online Kidsteam**

One research project I would like to undertake is looking at the technological and social requirements of Online Kidsteam throughout a school year. Maintaining a

distributed design team through the school year and keeping users interested and invested in the design process will require new technologies and techniques.

**Co-Synchronous Online Kidsteam**

A project that has already begun is co-synchronous design sessions between the University of Maryland's in-person Kidsteam and the Montclaire State University's in-person Kidsteam. So far, there have been two sessions between the groups. In one session, the groups worked on designing new tools for the two groups to work together by having their own snack time, meeting together through video conferencing for Circle Time, having their own Design Time, and getting back together for Big Ideas.

Based on the ideas of both groups, we built a design tent at each location and had a second session where members of each locations' Kidsteams worked together in small groups through the Google Docs collaborative environment. This environment proved to be too difficult to use with children, so, a new synchronous version of DisCo and Online Kidsteam would need to be created in order to support more design sessions like this.

**International Kidsteam**

The original intention of this research was to facilitate international collaboration between children and adults in the design of new technologies for children. I would like to work with one of my colleagues in a geographically distributed international collaboration project. At first it should be between speakers of the same language although I could see it evolving to support children who speak different languages.

**Urban Kidsteam**

In my new position at the University of Baltimore, I hope to leverage the unique situation of Baltimore to understand how to include more children, especially those without economic means or family support to travel to a suburban university, in the design of new technologies for children. This project would investigate the physical and virtual environments, time periods, and techniques necessary for intergenerational design in an urban setting.

Augmented Co-located Design Sessions

**Sticky Note Sorting**

The output of the LaDDI tool is a series of Likes, Dislikes, and Design Ideas. This tool was developed in order to simulate the in-person exercise of Sticky Noting. In Sticky Noting, one idea is written on each sticky note, the sticky notes are placed in a common area, and the notes are arranged by topic. I would like to take the output of the LaDDI tool and create virtual sticky notes that are automatically arranged by topic. This would be beneficial for two scenarios: distributed groups and large co-located groups. Distributed groups could participate in the same way that Online Kidsteam members did with LaDDI. Then, researchers could visualize the participants' input in a number of different ways either automatically organizing by like topic or organizing in some other way. A large co-located group could enter their input into the tool and have the ideas visualized in the same way without the difficulty of a person organizing all of topics. This exceeds the capabilities of paper-based sticky notes and would require the input of Natural Language Processing researchers to aid in the investigation.

**Physical prototypes & Bags of Stuff**

One element that the participants mentioned was the low-tech, low-fidelity prototyping tool technique called Bags of Stuff. During the iterative design period, I experimented with creating a virtual Bags of Stuff as part of DisCo. The two-dimensional nature of the medium led to frustrating interactions with the virtual three-dimensional objects. I propose developing or leveraging a physical building kit that enables participants to develop three-dimensional prototypes that are then represented on the screen. From there, participants (both co-located and distributed) can rotate the objects, paint the designs, or virtually add elements from the screen-based tool.

*Conclusion*

This work has been very important to me. My goal was to design an online environment to support inter-generational co-design because of my experiences working with an international arts organization and the inability to bring children in other countries into the design sessions. In order to do this, I investigated and desconstructed an in-person Cooperative Inquiry session, iteratively designed an online environment to support co-design, and talked to the children who participated in the online team to uncover their experiences with the environment and how those experiences affected their participation.

I feel as though I successfully accomplished my goal of designing and using an online environment for co-design. Although there were deficiencies when compared to an in-person co-design session, there were successes in including children and adults who would not have been able to participate in the design process without the technology. I

hope that other design researchers use this work as a starting point to create their own

tools to support online co-design, and ultimately, bring more people into the design

process.

# Appendix A – Search Terms and Results for Participatory Design Literature Search

Search Terms

| | |
|---|---|
| Google Scholar | "participatory design" OR "cooperative design" |
| Web of Science | ("participatory design" OR "cooperative design" in both topic or title) in Science Citation Index Expanded (SCI-EXPANDED) --1945-present Social Sciences Citation Index (SSCI) --1956-present Arts & Humanities Citation Index (A&HCI) --1996-present |
| ACM Digital Library | (("participatory design" or "cooperative design") or (Keywords:"participatory design" OR Keywords:"cooperative design")) |

Results

| | Google Scholar | Web of Science | ACM Digital Library |
|---|---|---|---|
| 1990 | 91 | 0 | 12 |
| 1991 | 181 | 7 | 30 |
| 1992 | 186 | 5 | 42 |
| 1993 | 312 | 10 | 47 |
| 1994 | 309 | 11 | 35 |
| 1995 | 385 | 10 | 71 |
| 1996 | 449 | 16 | 56 |

| | | | |
|---|---|---|---|
| 1997 | 467 | 6 | 80 |
| 1998 | 609 | 11 | 76 |
| 1999 | 636 | 6 | 76 |
| 2000 | 754 | 9 | 79 |
| 2001 | 811 | 10 | 57 |
| 2002 | 1500 | 15 | 149 |
| 2003 | 1190 | 23 | 124 |
| 2004 | 1400 | 31 | 155 |
| 2005 | 1550 | 14 | 180 |
| 2006 | 1740 | 26 | 278 |
| 2007 | 1950 | 31 | 396 |
| 2008 | 1990 | 27 | 435 |
| 2009 | 1990 | 26 | 445 |
| 2010 | 1850 | 27 | 436 |

# Appendix B – Search Terms and Results for Children's Technology Design Literature Search

Search Terms

| Google Scholar | technology AND design AND (children OR child) |
|---|---|
| Web of Science | TS=(technology AND design AND (child OR children)) OR TI=(technology AND design AND (child OR children)) |
| ACM Digital Library | Text = technology AND design keywords=children OR Child OR kid |

Results

|  | Google Scholar | Web of Science | ACM Digital Library |
|---|---|---|---|
| 1990 | 8140 | 1 | 0 |
| 1991 | 9020 | 1 | 0 |
| 1992 | 10300 | 10 | 0 |
| 1993 | 13300 | 13 | 0 |
| 1994 | 13500 | 8 | 1 |
| 1995 | 15600 | 14 | 1 |
| 1996 | 18600 | 13 | 1 |
| 1997 | 22800 | 16 | 8 |
| 1998 | 28700 | 20 | 3 |
| 1999 | 34000 | 24 | 8 |
| 2000 | 43000 | 25 | 7 |
| 2001 | 48400 | 23 | 11 |
| 2002 | 67400 | 19 | 17 |
| 2003 | 60500 | 39 | 28 |

| | | | |
|---|---|---|---|
| 2004 | 67300 | 42 | 40 |
| 2005 | 70100 | 33 | 38 |
| 2006 | 68600 | 49 | 63 |
| 2007 | 67000 | 58 | 99 |
| 2008 | 57600 | 57 | 84 |
| 2009 | 48200 | 77 | 102 |
| 2010 | 62500 | 80 | 101 |

# Appendix C – Search Terms and Results for Children's Technology Design Literature Search

Search Terms

| Google Scholar | technology AND children AND "participatory design" |
|---|---|
| Web of Science | technology AND children AND "participatory design" |
| ACM Digital Library | technology AND children AND "participatory design" |

Results

| | Google Scholar | Web of Science | ACM Digital Library |
|---|---|---|---|
| 1990 | 15 | 0 | 1 |
| 1991 | 11 | 0 | 0 |
| 1992 | 9 | 0 | 0 |
| 1993 | 17 | 0 | 1 |
| 1994 | 21 | 0 | 0 |
| 1995 | 39 | 0 | 2 |
| 1996 | 46 | 0 | 2 |
| 1997 | 47 | 0 | 4 |
| 1998 | 83 | 0 | 3 |
| 1999 | 102 | 0 | 3 |
| 2000 | 115 | 0 | 12 |
| 2001 | 116 | 0 | 6 |
| 2002 | 185 | 2 | 16 |
| 2003 | 220 | 0 | 19 |
| 2004 | 274 | 2 | 45 |

| 2005 | 290 | 0 | 46 |
|---|---|---|---|
| 2006 | 343 | 0 | 68 |
| 2007 | 353 | 2 | 48 |
| 2008 | 416 | 1 | 88 |
| 2009 | 457 | 0 | 80 |
| 2010 | 457 | 2 | 112 |

# Appendix D – Mid-summer Interview

Online Co-Design Partner _____

Date _____

Time of Interview (EST) _____

**Note: Can use "online co-design partner" and "Online Kidsteam member" interchangeably**

**Note: Questions are guidelines. If the conversation continues and needs more prompting from interviewer, this is fine.**

1. Please define "online co-design partner" for me.

2. What is the best part of being an online co-design partner so far?

3. What is the worst part of being an online co-design partner so far?

4. How has being an online co-design partner make you feel?

5. Would you say that you are friends with any of the other online co-design partners? Is your friendship with other kids in Online Kidsteam different than with your other friends?

6. Which adult online co-design members do you like to work with in Online Kidsteam? Why?

7. How is being an online design partner different from other things in your life, like going to school or other activities?

8. What have you learned from being an online design partner?

9. Is there anything else you want to tell me about being an online design partner?

# Appendix E – Pre-Activity Demographic and Interest Questionnaire

When is your birthday?: [month][day][year]
How long have you been with Kidsteam?
New to Kidsteam
One Year
◯ Two Years
◯ Three Years
Four Years
More than Five Years

How good are you at using the computer?
Not good
Not bad
I'm ok
I'm good
I'm excellent

How long have you been using a computer?
Less than one year
One Year
Two Years
Three Years
Four Years
More than Five Years

How do you feel about being part of Online Kidsteam this summer?
I'm not excited
I'm not very excited
I'm somewhat excited
I'm excited
I'm super excited

What do you hope to do in Online Kidsteam? [Text Area]
Are there any partners you hope to work with? If so, which ones? [text area]

## Appendix F – Bi-Weekly Tool Survey Example

This is a survey about the tools that we use and what we can do to make them better and more useful.

What has been your favorite feature on Online Kidsteam so far?: [text area]

What has been your LEAST favorite feature on Online Kidsteam so far?: [text area]

Have you participated in the Snack Time section?: Yes/No

What did you like and not like about the Snack Time section?: [text area]

Have you participated in the Circle Time section?:  Yes/No

What did you like and not like about Circle Time?: [text area]

Have you been able to draw in the Design Time section yet?:  yes/no

What could make Design Time better? Any design ideas?: [text area]

If you could have any design tools that you wanted in Design Time, what would they be?: [text area]

Anything else I should know?: [text area]

# Appendix G – End of Summer Interview

Online Co-Design Partner _____

Date _____

Time of Interview (EST) _____

**Note: Can use "online co-design partner" and "Online Kidsteam member" interchangeably**

**Note: Questions are guidelines. If the conversation continues and needs more prompting from interviewer, this is fine.**

1. How good are you at using the computer?
Not good
Not bad
I'm ok
I'm good
I'm excellent

2. How did you feel about being part of Online Kidsteam this summer?
I'm not excited
I'm not very excited
I'm somewhat excited
I'm excited
I'm super excited

3. What was the best part of being an online co-design partner?

4. What was the worst part of being an online co-design partner?

5. What was the hardest part about being an online co-design partner?

6. Whose computer did you use to participate in Online Kidsteam?

7. How often did you participate in Online Kidsteam?

8. Where you involved in any other activities this summer like camp, sports, or school stuff? Did those activities affect how you participated in online Kidsteam?

9. Did you go on vacation or travel this summer? Did you participate in online Kidsteam away from home?

10. Did anyone else participate with you while using Online Kidsteam by helping you with typing or reading the screen for you or brainstorming new ideas?

11. Did you ever participate with someone on Online Kidsteam at the same time?

12. Did you feel that you contributed to the design of new technologies because of Online Kidsteam? Why?

13. Did you feel like you were part of a team when you participated in Online Kidsteam? What should we do to make people feel more like they are part of a team?

14. Which tools did you use most often to create designs?

15. What was your favorite thing that we designed? How did you contribute to that design?

16. (If participant is part of Kidsteam) Should we use Online Kidsteam as part of regular Kidsteam? Why?

17. Is there anything else you would like to tell me about Online Kidsteam?


If parents are available:

How do you think Online Kidsteam went?




Were there anythings you child told you about it




Is there anything else you would like to share with me?

# Appendix H – Data file for drawing a Beach Ball in the DisCo tool

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