Supporting Pretend and Narrative Play over Videochat

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ABSTRACT
Remote play over videochat may increase opportunities for social interaction for children who are geographically separated from their preferred playmate or who live beyond walking-distance from their friends. We investigated how currently available videochat technologies may be used for remote play and the role of visual and physical structure in supporting pretend and narrative play between children. We invited 10 pairs of children to play with three videochat prototypes: phone-to-phone, phone-to-laptop, and laptop-to-laptop. Consistent with previous research, we found that laptop-to-laptop videochat was better for pretend play. However, our findings were different from previous work in that we found some evidence that laptop-to-laptop videochat may also be better at supporting narrative play and is higher-rated by children in terms of preference.

Categories and Subject Descriptors
H.5.2 [**User Interfaces**]: User-Centered Design

General Terms
Human Factors

Keywords
Children, videochat, free play, pretend play, narrative play

INTRODUCTION
A recent New York Times article lamented the fact that children in the United States are spending less time in self-organized play and more time consuming media created by adults [10]. This is not a phenomenon isolated to the U.S. In fact, an extensive two-year survey of families across 16 different nations found that time spent in free play is decreasing in favor of increased time spent watching television [9]. Many see this as an alarming trend, because time spent in self-organized, social free play is key to children's social and cognitive development [5].

Communication technologies provide a way to increase opportunities for social interaction by making it possible to maintain friendships over geographic distance or play together when transportation to a friend's house is unavailable. At least for adults, remote communication usually replaces time spent watching TV rather than in-person contact [6]. As the infrastructure for videochat becomes available to more families, there has been a drive in the HCI research community to investigate how video communication may be used for remote play [1,2,12,13]. In this paper, we seek to expand on this work by investigating how the physical affordances of videochat systems influence narrative and social pretend play between children. Our investigation focuses on three research questions:

1. How do physical and visual constraints on the position of the camera and screen affect remote social pretend and narrative play that occurs between children?
2. How do children respond to the limitations of currently available videochat technologies?
3. How do these finding serve to inform future design of videochat systems for children?

We begin with a discussion of related work on play over videochat. We describe the methods of our lab-based empirical investigation aiming to address our research questions. Finally, we provide a discussion of the results.

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RELATED WORK
A number of studies have considered how children may play over videochat. Ames et al. highlight that playfulness is an inherent quality of how families use videochat [1]. There are currently several ongoing investigations of how video can support children and adult relatives in participating in everyday activities like playing and reading together remotely [2,7,12]. Our work is different from these because we focus on children playing remotely with their peers, however it was inspired by these investigations in that they have demonstrated that video-based communication is compelling to children.

In a recent investigation, Freed et al. [3] has demonstrated that children can be successful in communicating by using dollhouses augmented with videochat for the dolls. In this study, the video system was fixed to orient towards the toys, which may have supported the children in telling stories through their characters. However, this may conflict with the findings of Yarosh et al., who reported that a freely movable camera and screen supported the greatest level of narrative play between children [13]. Other systems that support children in telling stories through video also seem to prefer freely movable cameras [11]. This conflict provides an interesting opportunity to expand on these studies. Our work is looking to understand whether more physical structure or more physical mobility provides better support for children engaged in remote narrative and pretend play.

The most relevant investigation to this one is the Yarosh et al. study of children's play over videochat [13]. Like us, they investigated remote free play between children in the lab. They focused on how four different prototypes influenced the levels of social play and the type of play that occurred. We want to expand on this study in several ways. First, we wanted to shift the focus away from the level of social play, as the four prototypes Yarosh et al. tested seemed to score remarkably similarly on this metric. Instead, we wanted to investigate in more detail the reported differences in the presence of narrative and pretend play between

Table 1. The participant demographics, the time they spent in pretend and narrative play (in seconds), the average level of social pretend play, and the smileyometer score for each condition (1=awful, 5=brilliant). Due to a power outage in the home resetting the computers responsible for recording, we did not collect video data for one condition of 5A and 6A.

			Time (s) in Pretend Play			Avg. Lvl of Pretend Play			Time (s) in Narrative Play			Smileyometer Score		
#	A/S	Relation	Laptop	Phone	Combi	Laptop	Phone	Combi	Laptop	Phone	Combi	Laptop	Phone	Combi
1A	7/F	Sister	75	50	30	3.588	3	3.333	75	90	33	4	2	1
1B	6/F		150	70	10	3.95	3.05	2.75	60	5	0	3	2	2
2A	6/M	Sister	140	15	50	4.4	3.36	3.38	142	15	13	5	5	4
2B	10/F		130	40	40	4.5	3.8	3.8	131	30	20	5	4	5
3A	7/M	Friend	25	5	5	3.35	1.9	1.9	0	0	0	5	4	4
3B	7/M		126	301	113	3.15	2	3.6	182	0	0	3	4	3
4A	7/F	Neighbor	150	0	140	4.2	3.85	4.25	60	0	140	4	3	5
4B	6/F		50	0	0	4.3	3.85	3.85	85	0	0	5	4	4
5A	7/F	Neighbor	190	120	no video	3.5	2	no video	52	203	no video	5	1	3
5B	6/F		140	170	120	3.05	4	2.6	84	65	166	3	4	4
6A	10/F	Neighbor	60	10	no video	2.9	2.3	no video	5	0	no video	4	2	4
6B	10/F		150	50	110	3.7	3.15	3.15	40	5	35	4	4	4
7A	6/F	Friend	70	80	120	4.35	4.55	4.3	15	90	20	5	5	4
7B	6/F		70	70	30	4.35	4.4	4.1	0	50	0	3	3	3
8A	6/F	Sister	170	10	0	2.1	3.35	3.9	0	0	0	5	5	4
8B	8/F		50	40	10	3.5	3.65	3.7	0	0	0	5	4	5
9A	9/F	Friend	10	90	60	2.45	2.2	2.85	0	0	0	4	4	5
9B	8/F		30	40	30	2.65	2.65	2.65	0	0	0	5	3	5
10A	7/M	Friend	0	20	0	1.7	1.85	1.25	10	0	10	5	4	5
10B	7/M		10	0	10	1.6	1.6	1.55	0	0	0	4	3	5
		Average:	89.80	59.05	48.78	3.20	3.03	3.16	47.05	27.65	24.28	4.30	3.50	3.95

the mobile and stationary videochat conditions. We code for these types of play at a much smaller granularity than the Yarosh et al. study, allowing us to not only specify whether a particular type of play occurred but also *how much* of it was observed. Secondly, we strive towards a more ecologically valid deployment of videochat. In the Yarosh et al. study, the two rooms were connected with video cable rather than sending data over the Internet. This created unrealistically low-latency and high-resolution video. In our study, we were interested in seeing how children responded to the limitations of real-world over-the-network videochat.

METHODS

We recruited participants by posting to university mailing lists and a local classifieds website (craigslist.org). We had 10 pairs of children (mean age = 7.4) who are used to playing together participate in this study. Table 1 shows the demographics of each pair. Nineteen out of 20 children had remote friends or young relatives. Seventeen out of 20 children sometimes had trouble getting to a friend's house to play. When they couldn't play with a remote friend, five of these children would play alone instead (often videogames). Providing opportunities for remote play may help increase social interaction for these children.

We welcomed the children and parents into a university residential lab and give them a tour of the facility. Each room was outfitted with an equal number of toys of each type, including dolls, action figures, dinosaur and animal toys, a tea set, puppets, and wooden blocks. The pairs of children were asked to try out a total of three different videochat prototypes (described in the next section) in counterbalanced order. One researcher took notes in each room as the children played with each other for ten minutes in each condition. After each condition, the children were asked about their experience, including rating it on the smileyometer scale [8]. The entire study was audio and video recorded to allow for detailed analysis.

To evaluate the level of social pretend play that occurred, we coded the videos using Howes' et al. scale for Social Pretend Play [4], which is a validated measure used in the education domain. The measure ranks the play in 5 levels from level 1 (parallel play where the partners are doing the same activity but not attending to each other) to level 5 (partners are both talking and acting towards each other while playing pretend). To evaluate the amount of narrative play in each condition, we noted the start and end time of each bout of play that involved the child verbally telling a story about the toys or themselves.

PROTOTYPES

In order to test our research questions, we created three videochat prototypes. All three used Skype over a wireless connection. To minimize potential sound quality disparity, all three conditions used the same microphone and speakers for the audio connection.

We used Skype between two Nokia N900 phones for the **phone-to-phone condition**. Both the feedback view and the image shared by the remote child were visible on the phone. To make the phones easier to grab and position, we created custom foam cases for the phones (see Figure 1).

The **phone-to-laptop condition** (we also refer to this as the combination condition) aimed to replicate the mobile condition in the Yarosh et. al [13] study. While the Nokia phone provided the camera and the feedback view screen, the shared image was displayed on the laptop screen of the remote side. There were some key differences about our implementation and the previous work. We transmitted the video over the wireless network, rather than over video cable. The mobile screen was smaller, and we had a front- rather than back-facing camera.

The **laptop-to-laptop condition** used two laptops with standard webcams. Because we are specifically interested in the role of physical structure, we provided additional structure for the children by using a physical stage (see Figure 1). The stage

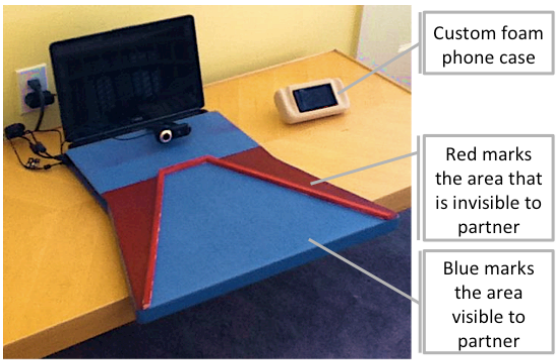

Figure 1. The prototypes used for the study, including the custom stage and phone case.

covered the laptop keyboard and provided visual feedback about whether a toy would be visible to the other child.

RESULTS & DISCUSSION

We discuss the results pertaining to each research question. All statistics discussed in this section are in Table 1.

How do physical and visual constraints affect remote social pretend and narrative play?

Children preferred the laptop-to-laptop condition to both the phone-to-phone and the phone-to-laptop conditions (see Table 1). It also seemed to provide the best support for pretend play (both in the amount of time spent in pretend play and the level of social pretend play achieved). This is consistent with previous findings. However, in contrast to previous work [13], we also found the laptop-to-laptop condition to be preferable for supporting narrative play.

The laptop-to-laptop condition provided two benefits over the phone-to-phone condition: the screen was large enough to easily view the partner's actions and framing the toys in front of the camera was easier because the stage provided cues about what was visible to the partner. The laptop-to-laptop condition provided a benefit over the phone-to-laptop condition because the screen and camera were in the same place, making it easier to understand when the partner was paying attention to one's activity.

Providing children with physical constraints on the placement of the camera and screen and visual constraints for the placement of the toys in front of the camera seemed to have marked advantages over providing mobile cameras (regardless of the size of the display screen). While the advantages for shared attention and for pretend play are consistent with previous findings, advantages for narrative play and for children's self-reported preferences are inconsistent with previous work. Our findings are certainly not conclusive, because the of the low number of participants in our study and because of important differences in the two studies between the types of mobile interventions (cabled vs. networked video, tethered vs. free camera, 8-inch screen vs. 3.5-inch screen, back-facing vs. front-facing cameras) and differences in scoring the narrative play (binary score per condition vs. total seconds engaged in narrative play). However, our results do seem to put the benefit of mobile cameras for narrative play into question compared to the benefits provided by the physical and visual structure of stage-assisted laptop-to-laptop videochat.

How do children respond to the limitations of currently available videochat technologies?

Our study was conducted using currently available hardware and software technologies for videochat. We found that there are still a number of logistical issues with videochat that would make it difficult for children to participate in remote play without at least intermittent help from a collocated adult. However, we also found that children were remarkably flexible in accepting the limitations of the devices and working around them, especially when provided with an explanation of what to expect and a method for handling trouble when it arises. Testing technologies with the assumption of perfect bandwidth may provide some interesting lessons, but may be eventually misleading, as previous work has shown that some families that may benefit from remote play technologies are functioning in environments where bandwidth is extremely constrained. Additionally, designing under the assumption that our videochat systems will someday be completely error-less is unrealistic. We encourage designers to assume that problems will occur and find ways to empower users (even children!) to quickly and independently troubleshoot.

How do these finding serve to inform future design of videochat systems for children?

Our findings point to a number of possible suggestions for the designer of videochat systems for remote play between children.

Create Constraining Structures to Simplify Framing

In our study we found that constraints on the position of the camera and toy could help children focus less on framing and more on play. Additionally, keeping the camera and screen in the same place could help manage joint attention, thus leading to more social play. While we're not taking mobile cameras off-the-table completely, we are saying that constraining how this camera moves and giving guidelines on what is visible to the other child at any given time is likely to benefit both remote pretend and narrative play between children.

Support Remote Toy Interaction

A common problem in play over videochat is that there is no clear way to make toys interact. At best, you can gesture in the general direction of your partner, but typically play tends to dissolve into the mostly parallel process of setting up scenes and showing them to your partner. There have been several solutions suggested in the previous work. The ShareTable suggests a top-down mixed reality view where the remote video is projected directly on top of the local surface [12]. The Video Play work suggests processing the video to show both of the participants engaged in the same environment on screen [2]. Alternatively, physical toys may be represented as digital counterparts on screen, allowing for both people to manipulate and interact with the same set of characters. There may be other clever solutions to this issue and we encourage designers to approach it as an open problem and researchers to evaluate these approaches against each other to understand the benefits and drawbacks of each solution.

Improve the Audio Features with Children in Mind

In our study, we saw that current echo- and feedback-cancellation programs often have more trouble with the sounds of children's play than with those of adult conversation. This is not surprising as these systems were designed and optimized with adults in mind. We encourage acoustic-applications developers to create a mode of audio management specifically intended for the intermittently noisy and quiet, and always higher-pitched sounds of children's play.

Empower the Child to Use and Troubleshoot

We saw that children are capable of independent troubleshooting of some common videochat problems when provided with the necessary information (e.g., speak into the microphone to break an audio feedback loop). We think that designers can provide equally straight-forward (perhaps physical) ways for children to reset a connection when the video or sound is not working in expected ways, as well as letting the child know when resetting a connection is not likely to address the problem (e.g., when low available bandwidth causes the video to display at a very low resolution).

Play over videochat is a promising way to encourage social free play between children. As designers address the limitations of current systems, we will create richer opportunities for this type of remote interaction.

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REFERENCES

1. Ames, M.G., Go, J., Kaye, J., and Spasojevic, M. Making Love in the Network Closet: The Benefits and Work of Family Videochat. *Proc. of CSCW*, (2010), 145-154.
2. Follmer, S., Raffle, H., Go, J., Ballagas, R., and Ishii, H. Video play: playful interactions in video conferencing for long-distance families with young children. *Proc. of IDC*, (2010), 49-58.
3. Freed, N., Burleson, W., Raffle, H., Ballagas, R., and Newman, N. User interfaces for tangible characters: can children connect remotely through toy perspectives? *Proc. of IDC*, (2010), 69-78.
4. Howes, C., Unger, O., and Seidner, L.B. Social Pretend Play in Toddlers: Parallels with Social Play and with Solitary Pretend. *Child Development Vol. 60*, N. 1 (1989), 77-84.
5. Johnson, J.E., Christie, J.F., and Yawkey, T.D. *Play and early childhood development*. Addison Wesley Longman, Glenview, Illinois, 1999.
6. Kennedy, T.L.M., Smith, A., Wells, A.T., and Wellman, B. *"Networked Families." Pew Internet & American Life Project Report.* Washington, D.C., 2008.
7. Raffle, H., Ballagas, R., Revelle, G., et al. Family Story Play: Reading with Young Children (and Elmo) Over a Distance. *Proc. of CHI*, ACM (2010).
8. Read, J.C. and MacFarlane, S. Using the fun toolkit and other survey methods to gather opinions in child computer interaction. *Proc. of IDC*, (2006), 81-88.
9. Singer, D.G., Singer, J.L., D'Agostino, H., and DeLong, R. Children's Pastimes and Play in Sixteen Nations. *American Journal of Play 1*, 3 (2008).
10. Stout, H. The Movement to Restore Children's Play Gains Momentum. *New York Times*, 2011, D1.
11. Vaucelle, C. and Ishii, H. Play-it-by-eye! Collect movies and improvise perspectives with tangible video objects. *Artificial Intelligence for Engineering Design, Analysis and Manufacturing 23*, (2009), 305-316.
12. Yarosh, S., Cuzzort, S., Müller, H., and Abowd, G.D. Developing a media space for remote synchronous parent-child interaction. *Proc. of IDC*, (2009), 97-105.
13. Yarosh, S., Inkpen, K.M., and Brush, A. Video playdate: toward free play across distance. *Proc. of CHI*, ACM (2010), 1251–1260.