

# Video Kids: Augmenting Close Friendships with Asynchronous Video Conversations in VideoPal

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## ABSTRACT

Consumer-based synchronous video communication is on the rise and is viewed as a valuable medium to support long distance relationships. We were interested in the potential of asynchronous video to augment children's close friendships and what types of activities they would engage in using video. We explored both of these concepts through a 9-week field study with a group of six 9-10 year old girls. We see children as potential media trendsetters when it comes to video communication given their comfort with video and desire for rich social interactions. The results from this study were striking. Despite having frequent face-to-face interactions, the girls used our asynchronous video communication tool extensively to augment their existing relationships. Not only were they able to have rich conversations using asynchronous video, they also demonstrated a strong desire to share more than just a "talking head". The results from this work point to the need for video mediated communication to move beyond conversations, to the sharing of rich experiences.

## Author Keywords

Video-mediated communication; asynchronous video; children; CMC; telepresence.

## ACM Classification Keywords

H.5.3. Information interfaces and presentation: Group and Organization Interfaces.

## INTRODUCTION

Video is an exciting new medium for children and video conferencing technology can support children's rich social interactions with friends [26] and family members [25]. Many researchers have explored the potential of video to connect children with distant family members such as grandparents and travelling or divorced parents [20, 25]; however, video also has huge potential to support children's interactions with their friends [26, 7]. This work explores

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the use of *asynchronous* video mediated communication to support children's interactions with close friends, from their homes.

Previously, Du et al. [7] explored children's use of asynchronous video to build cross-cultural friendships. This work showed that video could be a suitable medium for asynchronous conversations; however, the in-school deployment meant that the frequency of use was limited as well as the types of interactions the children could engage in. Our goal was to extend this work to examine children's asynchronous video communication over an *extended period of time* where the children could use the system in their own *homes*. Additionally, we wanted to explore the use of video to augment *existing relationships* for children who see each other frequently. Just as text messaging has become an important part of youth's social communication [21], video could provide even more richness and enable children to interact with each other in new ways.

The key goals of this work were to explore:

- *asynchronous* video mediated communication,
- to support children's *rich conversations*,
- with *close friends*,
- over an *extended period of time*.

The results of our work demonstrate that asynchronous video is an effective medium to enhance children's existing relationships. It enables children to interact with their friends, even when their friends are not available, with richness not possible in current text media. The children in our study used asynchronous video extensively to interact with their friends (see Figure 1). Additionally, the children had no trouble conversing over asynchronous video and these exchanges seemed as natural as face-to-face

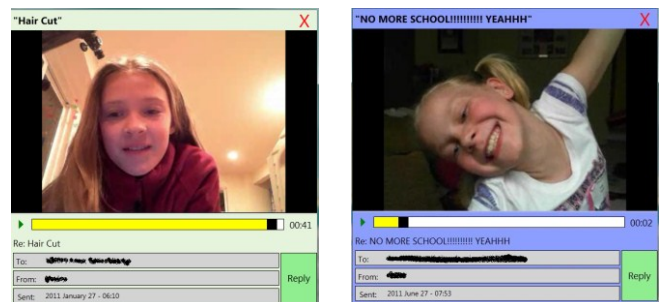


Figure 1. Example video messages sent during our study.

interactions. Finally, observations from this work indicate that asynchronous video is beneficial for more than just talking heads style conversations. Talking heads refers to the phenomenon that during video mediated conversations, the video typically only shows the participating parties heads and they primarily use the video to talk to each other. The girls in our study used video for a wide range of activities, which suggests that video conferencing needs to move beyond talking heads to enable sharing of many different types of experiences.

We first begin with a discussion of related work, followed by a description of VideoPal, the asynchronous video communication tool used in this study. We then describe our field study along with the resulting observations. Finally, we discuss the implications of these results and important next steps.

## RELATED WORK

Video Mediated Communication (VMC) can be either *synchronous*, such that partners can see each other at the same time, or *asynchronous*, where users view and respond to video messages at different times. There has been a great deal of research in the area of synchronous VMC to support distant relationships in both enterprise and home settings, however, there has been much less work exploring asynchronous VMC.

### Theoretical Foundations

Children's verbal communication abilities are typically less mature than adults because they have not mastered the necessary linguistic or cognitive competencies to help them communicate [17]. Nonverbal communication such as the use of gestures, body language, facial expressions, and voice expressions [14] has been shown to provide productive communication because facial and tone cues can convey effective emotional signals to eliminate confusion in conversations [8, 13]. This suggests that nonverbal communication would play an important role in children's communication. Bruner [3] also suggested that knowledge begins with action, progresses towards iconic representations, and then can be expressed with language. Therefore mediums that leverage actions, body movement or imagery might be easier for children than text based communication such as email.

Several CMC theories suggest that video could be a desirable medium to facilitate communication among children because of its capabilities in supporting nonverbal communications. According to media richness theory, video allows people to simultaneously observe multiple nonverbal behavioral cues, including body language, facial expression and tone of voice [6]. Social presence theory points to the fact that communicating partners can have more awareness about each other's states using video than other media like email, text messages or over the telephone [23]. Furthermore, common ground theory suggests that enhanced mutual awareness among communicating partners

provides grounding necessary for the development of conversations, thereby making communication more effective [5]. The contextual information provided in video therefore suggests that it is a more effective medium for communication than text-based media, like email, IM, SMS, or voice-based media, like the telephone.

### Video Mediated Communication (VMC)

There is a long history of synchronous VMC research. Studies in work settings found that in VMC, video can enhance verbal descriptions with gestures, convey purely non-verbal information, express attitudes in posture and facial expression, and manage and interpret pauses, thus making communication more effective [9]. In home settings, to fulfill people's desire to stay connected to family members and close friends [22, 24], VMCs like video conferencing and video chat have been used increasingly to connect to extended family members and close friends who are separated by long distances. It was found that VMC can allow family members and friends to share activities with each other in real time and increase extended family members' and friends' feeling of connectedness [1, 10, 11, 12].

Empirical studies have also found that children can benefit from synchronous VMC. Ames et al. [1] examined children's use of phones and synchronous video conferencing systems to interact with adults and suggested that children benefit from the visual aspects of VMC to help keep them engaged. Additionally, less help is needed from parents because children can participate by simply sitting in front of the camera. In a study of work-separated families, Yarosh and Abowd [25] also found that in some families video chat was an effective way for children to stay in touch with a remote parent. Finally, the Video Playdate project explored children playing with other children using a video conferencing system and found that it was an effective way of supporting free play and was highly enjoyable for children [26].

Although many studies have demonstrated that synchronous VMCs can play an important role in connecting children with adults as well as their peers, there are several challenges as well. One of the biggest obstacles is the fact that synchronous VMCs require both people to be available at the same time. Modlitba and Schmandt [15] found that although children prefer using video chat to talk to their travelling parents, their parents' busy schedules makes it hard to coordinate synchronous video chat. To help mitigate this problem, Cao et al. [4] suggested that asynchronous video would be a more flexible means of communication because it only requires that one party be available.

There are a few studies regarding use of asynchronous VMC to connect children with adults and other children. Zuckerman and Maes [28] proposed the Contextual Asynchronous System (CASYS), which enables family members to send 'good morning' and 'good night'

asynchronous video snippets into a shared family database and the recipient views the snippet in the context of going to sleep or waking up. It was found that the asynchronous video snippets increased participants' feeling of connectedness; however, in this study, the proposed system was not actually tested, and instead the participants were asked to use email to send videos as attachments.

Raffle et al. [20] studied young children's use of asynchronous photographic and video messaging tools to connect preschoolers with distant relatives. Asynchronous video has also been proposed to support globally distributed software developers [2], and as a text-free interface for illiterate users [19].

In previous work, VideoPal, a video pen pal system was designed to support the development of cross-cultural friendships [7]. VideoPal was used to connect children from the United States with children from Greece and was compared to email communication. Results from this work demonstrated that the children preferred VideoPal over email because it was more fun, it enabled them to get to know each other better, and made them feel closer to their new friends. Furthermore, the children liked VideoPal because it enabled natural communication including speech, body languages and facial expressions. These results are consistent with media richness and social presence theories and demonstrate that the benefits from synchronous VMC can also be realized with asynchronous VMC.

In general, video is not often used for children to connect with their peers, and use of asynchronous video to support conversation exchange is extremely low for both adults and children. Prior to this study, it was unclear whether asynchronous video could support children's conversations and whether it would be worthwhile for close friends who see each other regularly. It was also unclear how children would use video to communicate with their friends.

The work in this paper extends previous work by examining the potential of asynchronous video as a communication tool to support rich dialog among close friends. This work also benefits from a having an extended deployment, of a real system, in children's homes for a nine-week period.

### VIDEOPAL PROTOTYPE

VideoPal is a video based asynchronous communication system that supports the easy exchange of video messages. For a detailed description of the system see [7]. VideoPal enables children to communicate with their friends by sending, receiving and replying using video. VideoPal captures video using either a webcam, recording the screen (with or without a voice overlay), or uploading an existing video. Videos can be sent to one or more individuals or a group of people. An earlier version of the VideoPal prototype was used in a previous study examining how asynchronous video messaging could be used to enable cross-cultural friendships [7].

Video messages within VideoPal are organized by conversation topic, and the individual messages within a conversation are visually represented using a node-link graph. The main VideoPal user interface (see Figure 2) contains a list of conversations on the bottom half of the screen, with a selected conversation visualized on the top half of the screen. The conversation list provides information on the properties of each conversation such as the number of messages in the conversation, the number of unread messages, the date the last message was sent, and the people who have contributed to the conversation. The visualization shows the flow of a conversation, indicating who responded to whom and when. The visualization canvas can be zoomed in and out to show more or less of the conversation, and panned to show different parts of the conversation. Each message within a conversation is represented by a thumbnail image chosen from the video.

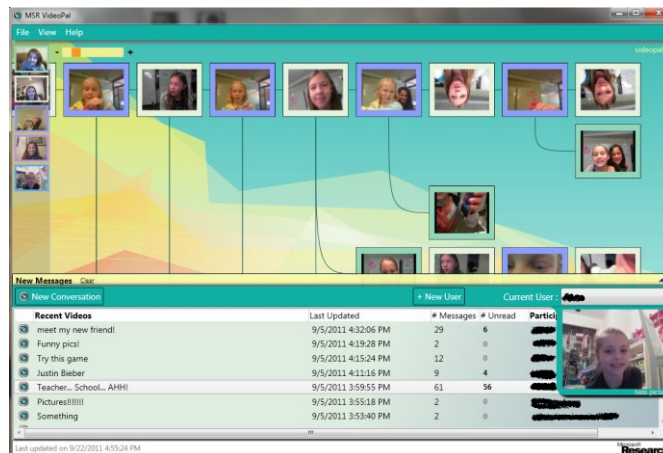


Figure 2. VideoPal asynchronous video messaging prototype

Although most webcam software allows users to record a video using their webcam, which could then be attached to an email message, we believe there are three important differences between VideoPal and video email.

First, VideoPal significantly streamlines the process of creating, sending, playing, and replying to videos. Most of these features only require one mouse click. In comparison, creating a video using a webcam, attaching it to an email, and sending it requires many steps. In addition, the videos that most webcams create by default are too large to send via email, requiring the user to compress the video before sending, complicating the process further.

Second, VideoPal organizes the videos into a conversation thread. This allows the children to easily see the flow of messages, making them feel more conversational. The visualization shows the reply structure, as well as a temporal layout of the messages. The thumbnails also indicate who created the video. The children can easily play any message in the conversation, or play a series of videos with one mouse click.

Third, VideoPal enables screen recording, with or without a voice overlay. This enables children to easily share (and narrate) anything that they have on their computer screen. Screen recording features are not standard on most computers, and many users would not know how to create and send a screen recording.

All three of these components make the VideoPal experience quite different from Video Email. Additionally VideoPal is also intended to be more of a ludic (playful) and phatic (conveying emotions rather than information) communication medium.

## **VIDEOPAL FIELD STUDY**

We extend previous work [7] to explore the potential of asynchronous video messaging for close friends, who have frequent face-to-face interactions. We also wanted to understand children's use of VideoPal in their own homes over an extended period of time. A 9-week field study was conducted from December 2010 to February 2011.

### **Participants**

The participants in this field study were six girls between the ages of 9 and 11. None of these girls attend the same school, but they are all close friends. The girls are on a sports team together and spend at least 16 hours a week together (at practice). This group was recruited because they had strong friendships with each other, and because they see each other frequently outside of school. The girls and their parents knew one of the researchers which helped resolve issues of trust. Pseudonyms are used throughout the paper.

The girls' relationships were primarily supported by their frequent face-to-face interactions. We were interested in whether asynchronous video could "enhance" these

relationships. Before the study, the girls communicated very little outside of their face-to-face interactions, despite the fact that they had each other's email addresses, and had previously communicated via IM and video conferencing, albeit infrequently.

All of the girls were comfortable with computer technology. All of their families had home computers that the girls used on a regular basis, and two of the girls had their own laptop computers. At the beginning of the study, none of the girls had mobile phones, but two received them one week into the study, and two others later acquired iPod Touch devices.

### **Laptop + Webcam + VideoPal**

The girls were each given a Lenovo T61 laptop computer and a USB webcam to use for the duration of the study. All of the laptops were in good condition, but were 3 years old, and as such were slightly larger and heavier than newer laptops (13.2" x 9.3", 5.4 lbs). The VideoPal software was installed on each computer.

In October 2010 the girls pilot tested an earlier version of the VideoPal software that was being used in a different study. At that time they were trained on the features and functionality of the system. No additional training was given prior to the start of the field study.

The field study began on December 22, 2010, at the beginning of the girls' Winter break. No usage requirements were mandated. The girls were told they could use VideoPal as much or as little as they wanted. The girls continued to have almost-daily face-to-face interactions during the break; however, since they did not have school, they had more free-time during the first two weeks of the study than they did over the remainder of the study. After the Winter break ended, the girls had very little free time, except for weekends.

## **RESULTS**

The VideoPal software logged the girls' interactions with the system. Additionally, at the end of January, 2011, the girls participated in a debrief session where they filled out a questionnaire and took part in a group interview to gather feedback on their use of the system. The following section describes the results gathered from the logging data, questionnaires, and interviews. Content from the video messages were also analyzed.

### **Usage Data**

The usage data are shown in Table 1. Within the first 24 hours of having the computers the girls sent 197 video messages to each other. Over the first two weeks of the field study (when the girls were not in school), their use was extremely high, with 585 messages being exchanged in 93 different conversations. Most of the messages were webcam messages (90%), and most were sent to all of the girls in the group (60%). The length of the conversations

varied widely, with some conversations only having one message, and others having upwards of 140 messages.

	First 2 weeks		Next 7 weeks	
<b>Video Messages</b>				
Total # of messages sent	585		523	
Webcam msgs	90%		89%	
Screen record msgs	10%		11%	
1:1 messages sent	27%		40%	
1:6 messages sent	60%		59%	
Total # message views	2670		1796	
Max msg views	36		52	
Median msg views	5		2	
<b>Conversation Threads</b>				
Total # of conversations	93		37	
Max msgs / thread	65		140	
Mean msgs / thread	6		14	
Median msg / thread	3		5	
<b>Message Length</b>				
	webcam	screen	webcam	screen
Total minutes of video	220	33	242	80
0-15 seconds	59%	46%	49%	5%
16-30 seconds	16%	15%	18%	16%
30-60 seconds	14%	15%	16%	9%
60-90 seconds	5%	15%	8%	4%
90-120 seconds	6%	9%	9%	66%
<b>Participant Usage</b>				
	created	views	created	views
Hannah	334	785	193	449
Miki	167	417	142	414
Ava	63	338	115	486
Gail	69	390	3	47
Maya	38	480	70	399
Kasey	19	260	0	1

**Table 1. VideoPal Usage Statistics**

Not surprisingly, after the first two weeks of the study when the girls were back in school, their usage dropped, and was more sporadic depending on their schedules. For example, usage spikes were observed on weekends with 75% of messages being sent on weekends or school holidays. The girls' lack of free time was likely the primary factor in the drop off in messages. The percentage of webcam / screen recording messages was similar throughout the study as well as the ratio of person-to-person and group messages. The number of unique conversations however, dropped in the second part of the study, although the number of messages per conversation grew.

Examining message length, we found that most of the webcam messages were relatively short, with 75% of them being less than 30 seconds long (and 59% were less than 15 seconds long). In the first two weeks of the study, the screen recording messages were also relatively short, with 61% being less than 30 seconds. However, in the second

part of the study, the average length of the screen recording messages increased, with 66% being between 90-120 seconds long.

During the first two weeks of the study, there were 2670 message views. The median number of message views was 5, which makes sense given that there were 6 girls in the group. However, some messages were viewed upwards of 36 times. In the next 7 weeks of the study, we saw fewer instances where all of the girls watched all of the messages and the median number of views per message dropped to 2. However, there were still messages that had very high view counts, with one message being viewed 52 times.

The conversation with the highest number of views (367 views) was one of the early conversations called "broken toe". All 6 girls participated in this conversation, and it had 58 messages that spanned 19 days. The first message was viewed the most (16 times) and several others were view 8-10 times. Almost every message in this conversation was viewed by all of the girls. Although the conversation began focused on one girls' broken toe, it eventually became a playful group conversation on random topics.

Some of the girls, such as Hannah and Miki, had much higher usage than others. This factor was likely impacted by their interest in VideoPal, however other factors such as the amount of homework the girls had, and the amount of time they were allowed to be on their computer also had an impact. For example, in the second part of the study, both Gail and Kasey were extremely busy with schoolwork and spent very little time on their computers.

### Video Genres

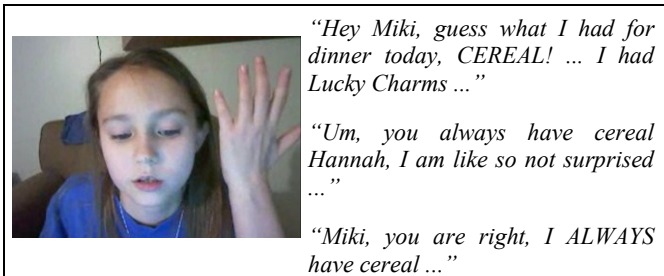
VideoPal was originally designed as a video conversation tool, and as such, we expected the girls to primarily use it to "talk" to each other. One of the biggest surprises from this study was the breadth of use we observed. Although there were many "talking" conversations, there were many other videos that involved different types of sharing and play. A card-sort approach was used to categorize the videos. Each video was watched, and assigned a descriptive label. The videos were then clustered into similar groups. We clustered the videos into six different genres:

1. Conversations
2. Show and tell
3. Sharing activities
4. Screen recording
5. Play acting / Performing
6. Just for fun

### Conversation Videos

There were many videos where the girls would just turn on the webcam and converse with each other. The girls were very comfortable talking over video, and the videos seemed fairly spontaneous, and not rehearsed or planned. The dialog was very conversational and the girls addressed each

othe, and responded to each other’s comments. Below is an excerpt from a conversation Miki and Hannah had about cereal. This conversation had 33 messages, lasted for more than a month, and was comprised of both webcam and screen recording videos (see Figure 3).

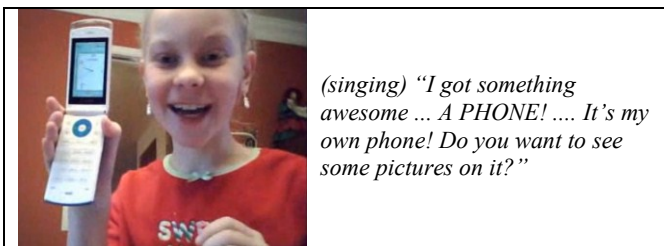


**Figure 3. Excerpt from the video conversation titled “Cereal” where the girls conversed back and forth.**

Many of the conversation videos were normal, everyday exchanges about the things going on in their lives, like homework and what they were doing. Often, the girls’ behaviour in the videos seemed as if they were actually talking to their friend face-to-face. They also took advantage of the visual nature of the video medium to aid the conversation when needed. For example, a pillowcase had been left at a recent sleepover so Miki sent a video to Ava, showing her the pillowcase, to see if it was hers.

**Show and Tell Videos**

Given the visual nature of video, the girls liked to create videos to show each other things. For example, the girls showed their favourite Christmas presents, their pets, their rock collections, and gave tours of their rooms. Because the webcams were not integrated into the laptop displays, the girls were able to detach them when they needed more freedom to point at things (although they still needed to be plugged in the USB port). One interesting observation about the show and tell videos was that the girls almost always choose to show themselves along with the artifacts they were sharing. This sometimes meant pointing the camera at themselves during the video, or videotaping themselves holding the objects they were showing (see Figure 4).



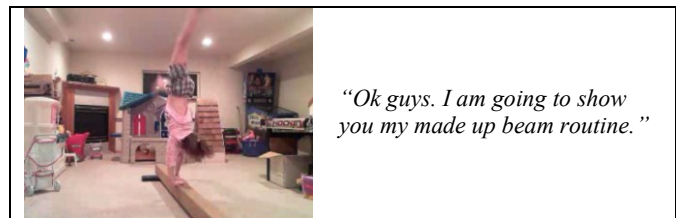
**Figure 4. Excerpt from the video conversation titled “Favorite Present”. Here Gail is showing the cell phone she got for Christmas.**

Mobility was often an issue when the girls were trying to show things. They had to carry their laptop around, and orient the webcam towards the things they were trying to share. This was awkward, and almost always resulted in bad video footage because of excessive movement of the camera. For example, in one video Hannah was trying to show a photo book she received for Christmas. This required her to hold the webcam while simultaneously holding the book, turning the pages, narrating, and pointing to the pictures.

**Sharing Activities using Video**

Often the girls wanted to be able to share the activities they were currently engaged in, even if their friends were not available. For example, the girls created videos of themselves playing Xbox Kinect, doing gymnastics, and building a playhouse with a friend. Figure 5 shows Hanna in her basement performing the beam routine she made up.

Framing was often challenging when trying to share activities because webcams are not designed for room-scale capture. Additionally, it was hard for the girls to know when they were (and were not) in frame of the camera. In one video Ava asked her sister to make sure “it stays on the screen”, meaning that she wanted her to watch the preview window on the laptop to make sure things stayed in view.



**Figure 5. Excerpt from the video conversation titled “Gymnastics” where Hannah is showing her friends the beam routine she made up.**

**Screen Recording Videos**

Although the screen recording feature was only used 10% of the time, all of the girls commented that they enjoyed making screen recording videos and liked having this feature. The most common use of the screen recording feature involved: 1) narrating slideshows and poems the girls created using PowerPoint, 2) showing excerpts from online games they were playing, and 3) showing YouTube videos. Figure 6 shows a slide show Maya created (and narrated) about bunnies.

In one of the screen recording videos, Gail carefully arranged her videos so she could have a picture-in-picture view. This enabled her to not only narrate, but also act out her poem. Many of the other girls wanted to be able to create a picture-in-picture video; however, it was complicated to do in the current prototype.

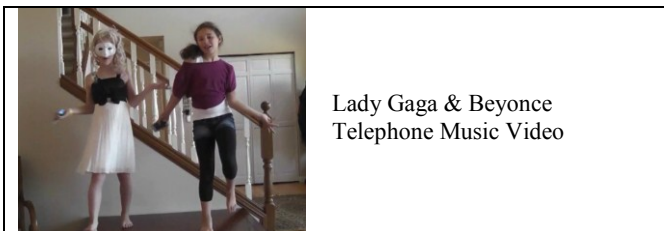


**Figure 6.** Excerpt from the video conversation titled “Funny Bunnies”. Maya recorded a voice-over explaining the slide show.

#### Play Acting / Performing Videos

There were many videos where the sole purpose was to perform instead of converse. The girls acted out things like scenes from Harry Potter, or created lip-synced music videos. To add theatrical effects the girls often used props and sometimes moved in and out of the view of the camera.

For some of the music videos the girls wanted to create a more sophisticated video that they could author with titles and credits. They used a stand-alone video camera and Movie Maker to create the video, and then uploaded it to VideoPal (see Figure 7). The girls initially wanted to upload the video to YouTube, but their parents would not allow it. The girls then realized they could instead use VideoPal to share it with their friends. This also allowed their friends to add video comments to the conversations.



**Figure 7.** Excerpt from the video conversation titled “Telephone” where the girls created a lip-synced music video.

In some of the play acting conversations, the girls’ play would follow on from one another, which we refer to as asynchronous play. Similar to how children build off of each other’s play activities when face-to-face, we observed conversations where one girl would do something, and others would follow along without any explicit coordination. For example, several girls added videos to a Harry Potter conversation where they each, in-turn, acted out different scenes. There was also a conversation where Hannah and Kasey started an asynchronous Nerf/water gun fight.

#### Just for Fun Videos

Often when children get together, they like to do crazy things, just for fun. We observed many conversations that fit this characterization. Ludic actions that had no specific purpose, other than to share something fun with their friends. Examples included: two girls rolling in their play money (see Figure 8); one girl throwing candies up in the

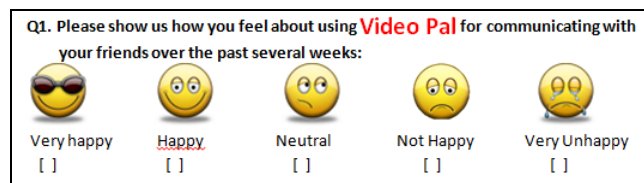


**Figure 8.** Excerpt from the video conversation titled “MONEY” where Kasey and Hannah asked the others to “watch them roll in their money”.

air and catching them in her mouth; and another girl making faces in the camera. It is interesting that VideoPal enabled the girls to do something silly to presumably make their friends laugh, even though their friends wouldn’t see the video until later. Several of the girls commented that these types of activities were fun when they were at home alone, and were bored.

#### Reactions from the Girls

At the end of January, the girls were brought in for a questionnaire and interview session to gather feedback on their use of VideoPal. The first four questions used a 5-point scale to gather feedback on their use of VideoPal and Email. The scale used both words and happy face pictures to reinforce the points on the scale (see Figure 9).



**Figure 9.** Both words and happy faces were used to annotate the points on the scale in the questionnaire.

On a 5-point scale from *Very Happy* to *Very Unhappy*, when asked how they felt about using VideoPal to communicate with their friends, five of the girls indicated they were *Very Happy* and the remaining girl indicated she was *Happy*. When asked the same question about Email, three girls indicated they were *Neutral* and three indicated they were *Happy*.

On a 5-point scale from *Awesome* to *Awful*, when asked how fun it was to create videos, five girls indicated it was *Awesome* and the remaining girl indicated it was *Very Fun*. When asked the same question about watching videos their friends created, five indicated it was *Awesome* and one indicated it was *Very Fun*.

When asked to compare VideoPal and Email, all six girls reported that VideoPal was more fun and enabled them to get more information from their friends. When asked which was easier to use, four girls reported VideoPal and two reported Email.

The questionnaire asked the girls to specify their favourite and least favourite thing about VideoPal. Two of the girls

indicated that the best thing was being able to “*see your friends*” and “*see each other in videos, not just words*”. Three of the girls commented on the asynchronous nature of VideoPal: “*Being able to chat with your friends when they are not with you*”, “*you can see people videos even if they’re not online*”, “*send videos when other people aren’t on the computer*”. There were two additional comments about being able to use the screen recording feature, “*you can use Word, PowerPoint, and you can video videos from like YouTube or a place like that*”. The comments made regarding their least favourite things about VideoPal included the two minute limit on videos and the inability to “*talk face to face like Skype*”.

### **Mobility**

Mobility was an important aspect in this study. Given that VideoPal was running on a laptop, the girls were free to take the computer any place they wanted in their home. This was beneficial and all of the girls took advantage of this capability and created videos from different rooms in their homes. Although the laptops enabled the girls to move around, the form factor of a laptop was still quite inhibiting. Walking around with a heavy laptop, pointing a tethered webcam at artifacts was awkward for the girls. As a result, many of the videos had segments that were poor quality because of difficulty holding the camera steady or movement while the girls were recording.

While a mobile phone could provide a better platform to capture mobile video, it would still be limiting for some of the videos the girls captured. For example, many of the videos required the camera to be “hands-free”, or needed capture (and feedback) of a room-based activity. Both of these would be difficult given today’s mobile phone cameras. Ideally, having a multitude of interconnected recording and playback devices with different form factors would help children share many different types of activities.

### **Framing**

Similar to synchronous videoconferencing environments, camera framing was an issue in our study. It was not always easy for the girls to know what was (or was not) in frame of the camera. This problem was exacerbated in many of the videos where the girls wanted to capture more than just themselves talking. This was especially challenging when the girls changed scale during the video (i.e., up close and then far away from the camera), when they were trying to capture multiple people, or when they were moving in the scene. Possible solutions could include the use of better cameras, and cameras with automated tracking so they can keep people or objects in the environment in frame.

### **Conversation Visualization**

One of the important features of VideoPal was the fact that it organized messages by conversations. Although the girls liked having the messages grouped by conversation, the node-link graph was inefficient in terms of space

utilization, sometimes making it hard for the girls to see the whole conversation. Feedback from the girls suggested that a simpler visualization that still maintained temporal order, but did not require extensive branching, would be better. Future work should explore new conversation visualizations.

### **Comparison to SMS**

The girls’ use of VideoPal in this study was more analogous to SMS conversations, where the main objective is to have a back-and-forth conversational exchange. Additionally, if both girls were online at the same time, VideoPal messages had a rapid-asynchronous behaviour, with a series of messages being sent and received in rapid succession.

As mentioned, three of the girls acquired mobile phones and/or an iPod Touch during the study. Although the girls enjoyed using SMS with each other, when they were home, they often chose to use video instead of SMS, preferring the richer form of communication. However, not surprisingly, using SMS on the mobile phone was more convenient when the girls were outside of their homes.

### **DISCUSSION**

The results from this work strongly support the notion that asynchronous video **can** be used to support rich conversation exchanges. The video messages created were conversational in nature and the girls enjoyed conversing asynchronously. Additionally, the conversations the girls engaged in were much richer than they would have been using a text based medium such as email, IM or SMS. The standard use of smiley faces and emoticons in text-based communication pales in comparison to the expressiveness in the girls’ facial expressions, actions, gestures, and voices.

Another important contribution of this work is the overwhelming evidence that children want to use asynchronous video for more than just “talking”. The breadth of things the girls did in the videos demonstrates that the girls want to be able to share many activities and engage in lots of different styles of play with their friends. This result is consistent with previous work which showed that children engage in many different types of free play when using a synchronous video conferencing system with friends [26].

Although synchronous video conferencing is beneficial for rich conversations, the asynchronous nature of our prototype enabled the girls to engage in conversations, even when their friends were not available. This is particularly important for home computer use where family members are doing many different activities and not necessarily sitting in front of their computer for extended periods of time. This sporadic use, compared to the workplace, increases the chance that people will miss opportunities for synchronous exchanges. VideoPal overcomes this limitation, enabling the children to communicate and play with their friends asynchronously.



### **Generalizability of Results**

There were several limitations of our study which limit the generalizability of our results. First, we only studied six children using the system. Although this limits the generalizability of our results, it did enable us to gather longer-term data and perform more detailed analyses than would have been possible with a large sample size. Additionally, after the first few weeks of use, we began to see individual differences emerge in the girls' behaviours and attitudes which suggested that we were collecting data that was more indicative of normal use, after novelty effects wear off. Second, we only studied girls using the system. It is likely that the types of activities that boys engage in using VideoPal would be different than what we observed with the girls. However, given that both boys and girls enjoyed using VideoPal in the school-based study [7], we believe that the main strengths of VideoPal as an asynchronous video conversation tool will also be realized for boys.

### **Limitations of VideoPal Prototype**

There were several limitations of the VideoPal software that should be addressed in future versions of the system.

First, VideoPal is currently a stand-alone tool, requiring users to install, setup and run yet another communication tool. Ultimately it would be ideal to integrate VideoPal into an Instant Messaging client, an email application, or a synchronous video tool. It should also support capture from a mobile device so users can easily share videos no matter where they are.

A second limitation is the lack of strong privacy and security components in VideoPal. The fact that children are sharing videos of themselves makes the data highly sensitive. In our study we manually set up a closed-group of users and ensured that only they had access to the system. If VideoPal was going to be released on a larger scale, the system would need to look carefully at how to manage the delicate privacy and security issue surrounding children's video. Appropriate parental controls would also be necessary.

A third limitation was the inability to easily search the content. Most of the video thumbnails look alike, making it very difficult for the girls to re-find specific content. Automatic speech-to-text transcription is an option; however, finding good speech models for children's voices is extremely difficult [18]. Additionally, the amount of expression that is often conveyed in the children's voices makes the problem much more difficult.

Another limitation of our system was the lack of awareness and notification cues. The system did not provide awareness to others when the girls were online. Nor did it provide notifications when the girls received a new video message. This was not a big problem in our study since most of the girls used the system frequently, however, it would be problematic with more sporadic use of the system.

Finally, there are several user interface improvements identified from the user study that should be incorporated into future versions of the software. This includes a new visualization for the conversations, the ability to organize and delete messages and conversations, a better way to notify users of new messages, a way to visualize activity within the system (number of views for messages and conversations), and a way to tag favourite videos.

### **CONCLUSION**

In conclusion, this research clearly demonstrates that asynchronous videos can support rich conversations, and that it is an effective way for children to communicate with their close friends. The results from this work demonstrate the plethora of activities that girls like to engage in using video. Similar to earlier findings of IM [27], video communication can be used to maintain, and even strengthen close relationships.

Other important observations from this work showed that children are very comfortable communicating over video and find it very natural. Often the girls looked like they were talking to friends in the same room. However, consistent with results from other research, the current "talking head" structure is limiting as children often want to capture and share a multitude of experiences.

The girls' access to, and use of asynchronous video raised their interest in other forms of computer-mediated communication such as Email, IM, SMS and synchronous video conferencing. In the follow-up interviews the girls clearly indicated that VideoPal was great when their friends were not available, however, they also expressed a strong desire to use synchronous video when they were both online at the same time. A longer term goal of this research is to explore a hybrid synchronous/asynchronous approach where users can seamlessly move between synchronous and asynchronous communication depending on the context. It would also be interesting to further examine the issue of persistence, and whether some portion of synchronous video conversations should also persist and be shared.

When dealing with children's communication over video, privacy and security become extremely important. When young children want to share videos of themselves, or communicate using video, it is important that they have a safe environment to work in. This issue surfaced in our study when some of the girls created music videos and wanted to post them on YouTube. The parents were not comfortable with the girls posting videos of themselves on YouTube and most social networking, such as Facebook and YouTube, require users to be at least 13 to sign up for an account and upload content. VideoPal can provide a safe, closed-group environment, where the children can share videos with their close friends.

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