Pet Video Chat: Monitoring and Interacting with Dogs over Distance

Jennifer Golbeck
University of Maryland
Human-Computer Interaction Lab
College Park, MD USA
golbeck@cs.umd.edu

Carman Neustaedter
Simon Fraiser University
School of Interactive Art + Technology
Vancouver, BC Canada
carman_neustaedter@sfu.ca

CHI 2012, May 5–10, 2012, Austin, TX, USA.
ACM xxx-x-xxxx-xxxx-x/xx/xx.

Abstract
Companies are now making video-communication systems that allow pet owners to see, and, in some cases, even interact with their pets when they are separated by distance. Such 'doggie cams' show promise, yet it is not clear how pet video chat systems should be designed (if at all) in order to meet the real needs of pet owners. To investigate the potential of interactive dog cams, we designed our own pet video chat system that augments a Skype audio-video connection with remote interaction features and evaluated it with pet owners to understand its usage. Our results show promise for pet video chat systems that allow owners to see and interact with their pets while away.

Keywords
Video conferencing, pets, dogs

ACM Classification Keywords
H5.3. Information interfaces and presentation: Group and Organization Interfaces – *Computer-supported cooperative work*

General Terms
Design, Human Factors

Introduction

Many people desire to stay in touch and be connected with their family members and loved ones when they are separated by distance [14,18,21]. For example, grandparents want to know about their grandchildren's activities [9,10], couples wish to stay connected when they travel [19], and parents desire to know the whereabouts of their children throughout the day [3]. Given these needs, we have seen a widespread focus on designing technologies to support family connectedness, including video communication systems [10], enhanced messaging services [12,18], and photo and calendar sharing services [4].

However, for many people, the notion of 'family' extends beyond just people to include pets such as dogs and cats. Over 63% of households in the United States have pets [2] where the vast majority of pet owners talk to their pets, confide in them, and celebrate their birthdays [5]. In fact, 98% of pet owners consider their pets to be family members or close friends [5]. Despite this, there has been considerably less focus on designing technologies to allow family members to connect with their pets over distance much akin to the way people connect through technologies when apart.

Several researchers have proposed novel systems to allow pet owners to play with or see their pets when they aren't at home (e.g., [13,25]). However, these have mostly been whimsical design projects, more for fun than seriousness, despite their likely beneficial design. There also now exist a plethora of commercial remote monitoring systems for pets such as dogs (e.g., Panasonic's Pet Cam). These commonly include a video link and some even provide an audio connection. Such systems are marketed towards typical consumers who might be away from their home (and dog) for periods of time during the day [6], for dog kennels where people leave their pets while traveling (e.g., [7,17]), and even dog groomers or spas so pet owners can check up on their pets during their 'treatment' [17].

However, there has been little work on the importance of interaction with pets over remote connections. To test how well this may work, we designed our own system for remote pet interaction that couples a Skype audio-video connection with computer-based tools to attract remote pets' attention and play with them over distance. We present the design of this system and its evaluation with 10 dogs where our results show value for remote pet monitoring and interaction systems that incorporate audio and video connections.

Related Work

Connecting Family Members

We have yet to see any research that explores how people wish to connect, interact, and stay aware of their pets over distance; however, this topic has been widely explored for connecting family members who are people. We posit that some of this knowledge is likely to extend to and apply in the context of connecting pet owners with their pets.

First, studies have shown that people like to maintain some semblance of awareness of family members and close friends [14,18,21]. This relates to knowing what activities they have been up to, where they have been, and how they are feeling in terms of health, wellness, etc. [14]. This information is acquired using a variety of technologies—phone, instant messenger, text messaging, video chat, etc.—when people are not able

to see each other in person [14,18,21]. In these cases, people choose the technology that is both familiar to them and most likely to reach the remote person [14,21]. There is also a preference to choose the richest medium when possible [22].

Second, we have recently seen a number of studies that explore the use of video chat systems for connecting family members. Given their rich medium, many family members find video chat (e.g., Skype, Google Chat) to be especially useful for providing additional feelings of connectedness, which come from actually seeing their remote family members [1,9,11]. Yet such systems are not always easy to use. Studies of children using video chat show that parents must do a lot of "scaffold" work to keep children engaged in conversation [1] as children can easily lose interest in the remote people [24]. We expect that such issues may extend to instances where video chat is used to monitor or interact with pets over distance. Researchers have also found that families with small children find benefit in leaving a video connection going for an extended period of time to show remote family members the children's' activities [9,10]. We anticipate such long-term usage and 'always-on' connections may similarly be useful for pet owners when they are away home during the day.

Systems for Pet Interaction

Technology to support in-person human-animal interaction has largely been implemented in a gaming environment. CAT (Canine Amusement and Training)[23] uses a Wii Mote, dog harness, and monitors to allow pet owners to interact with and train their dogs in a serious-game style environment. Cat Cat Revolution (CCR) [15] is another game, which shows a moving mouse on an iPad that cats can follow. It can move randomly or be controlled remotely by pet owners. We leverage similar ideas to CCR in two of our pet interaction interfaces.

Remote technology that relates to the human-animal bond is also available. As online social networks have arisen as a popular medium for communication and interaction amongst people, similar sites for connecting pets (e.g., Dogster, BunSpace, Hamsterster) have also come online. Pet owners use these to share pictures and information about their pets, view profiles of other pets, and receive advice [8]. They are a good forum for building community, but do not support direct interaction between pets and owners.

Interfaces that support remote pet-human interaction—the focus of our design explorations—have also been prototyped and studied in pilot form. [13] designed a dog-owner interaction system that included remote sounds and a remotely operated tennis-ball throwing device.

Prototype System

Our research goal was to understand how pets would react to a pet video chat system that was coupled with additional facilities to attract a pet's attention to the display. To do this, we built a prototype remote interaction system that works in conjunction with Skype—a commercial audio-video conferencing system. We describe our system's usage and our design rational next.

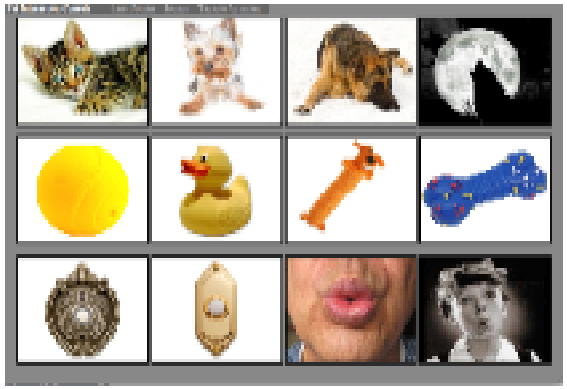

Figure 1. The Sound Panel interface: clicking each picture plays a corresponding sound.

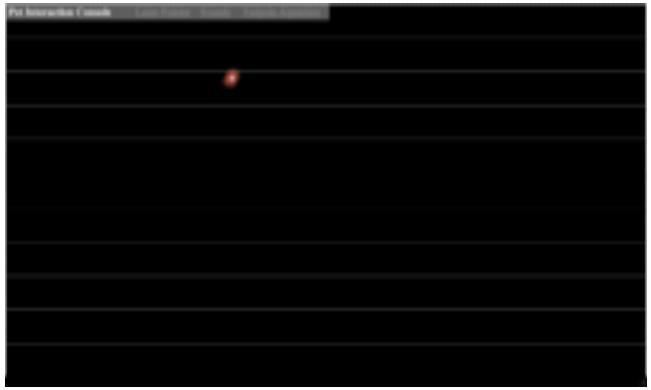

Figure 2. The Laser Pointer interface: users move the mouse to control the position of the red laser point on the screen.

Figure 3. The Tadpole interface: the tadpole is animated and swims around on the screen on its own.

General Usage. First, users place a computer in their home in an area where a pet may typically frequent. Once they are at a remote location, they launch a video chat session in Skype on their remotely located computer (e.g., at work) and connect through Skype to the home computer[1]. This provides both an audio and video link with home. Next the human user opens the web-based interaction console (described next) on their local computer and shares the screen with the pet's computer (via Skype). This means that the pet can see the interaction console and the pet owner can easily manipulate it while remote. This also has the added benefit of sharing the sounds and visuals of the interaction panel while allowing the pet to hear the owner's voice and allowing the owner to see the pet through the video chat. The interaction console window can be maximized to full screen so that it is the only

[1] Skype can be set to auto-connect so that pets don't have to accept the call.

thing the pet sees. This helps alleviate disembodiment concerns that might arise from the pet seeing his or her owner in the video chat session.

Remote Interaction Console. The interaction console provides three interactive components—a sound panel, a virtual laser pointer, and an animated swimming tadpole—where each are viewable by clicking a tab in the corner of the interface. The *sound panel*, shown in Figure 1, features twelve different sounds depicted by images representing the sound. The pet owner clicks on the icon and the sound plays. Sounds include dog barks and howls, cat meows, a variety of squeaky toy noises, doorbells, and whistling. Our goal was to try and provide a variety of sounds that might entice pets to come near the computer display. We also wanted to explore audio interaction with pets that was not based on human voices.

Figure 2 shows the *virtual laser pointer* panel with a red light on a black background. The red light follows the movement of the human user's mouse, allowing them to try to hold the attention of their pet by moving the laser in interesting patterns. Our goal was to provide a visual based way for owner's to attract their pets' attention. Finally, Figure 3 shows the *swimming tadpole* panel where an animated tadpole swims by itself on the screen without any interaction from the user. Here we wanted to explore additional ways of keeping a pet's attention that were not owner controlled.

While our system is still only a prototype, we imagine non-prototype versions of the system to run on a dedicated tablet-like display (e.g., an iPad). This would make it easy to place or mount the display in pet-conducive locations. We also anticipate that non-prototype versions of such a system would create their own audio-video link instead of relying on Skype; however, for prototype testing, this sufficed in our case. We also purposely chose not to include any physical apparatus that might be used to play with or engage pets, such as that provided by [13] and [15]. We were concerned that pets might damage such equipment. We also wanted to focus on exploring interaction that was solely embedded within a single display, in contrast to the related work. The coupling of pet video chat with physical interaction tools certainly warrants future exploration, however.

User Testing

To test the effectiveness of the interaction console and explore the idea of pet-based video chat, we ran a user study with pet owners and their pets.

Methodology

The test was conducted in two parts—*in-person interaction* and *remote interaction*—where each took place in the pet owner's own home. This was to ensure the pet was as comfortable as possible.

In-Person Interaction

First, the human and pet were in the same room together with one computer, and they ran through a series of tasks together as part of the *in-person interaction* stage. A laptop was setup to use the prototype software and it was placed at approximate eye level for each pet (e.g., on the floor, on a stool) as shown in Figure 4. Our goal for this stage was to allow pet owners and their pets to get used to the system, explore its features, and understand their initial

Figure 4: A pet participant watching the screen while their owner is

reactions to it. Users were asked about their preferences for system features and strategies for engaging their pets along the way. If a pet was completely uninterested in a task, refused to participate, or showed any distress, the task was stopped. Tasks included:

Task 1: Sound Preferences - Try each of the available sounds and determine your pet's favorite sound**,** your pet's least favorite sound, your favorite sound, and your least favorite sound. Use whatever criteria you wish to determine what is a favorite and least favorite sound**.**

Task 2: Laser Pointer Warm-Up - Get your pet to follow the laser pointer for five seconds straight without them looking away from the display.

Task 3: Laser Pointer Record*:* You have five attempts to see how long you can get your pet to follow the laser pointer continuously without them looking away from the display.

Task 4: Tadpole Record: You have five attempts to see how long your pet will follow the tadpole continuously without them looking away from the display.

REMOTE INTERACTION

Next participants took part in the *remote interaction* stage. Here we simulated the idea of the pet owner remotely interacting with his or her pet at home. Human participants left the room (and went to another room in the house) and a remote connection was established between the pet's computer and the remote computer used by the human. Human participants were first asked to try and attract the pet's attention to the display:

Task 1: Getting Pet's Attention – Use any of the interface tools available to you to get your pet to come to approximately within a foot of the display. This means you can use any of the sounds, use the laser pointer, use the tadpole aquarium and use the audio/video connection.

They were then asked to repeat Tasks 1, 3, and 4 from the first phase. Together, these tasks tested the effectiveness of the interaction console at gaining and holding the pet's attention in both environments. It also

	Laser Like	Sound Like	Tadpole Like	Laser Engagement	Sound Engagement	Tadpole Engagement
Mean	1.95	4.30	1.90	1.60	3.70	1.50
Std. Dev.	1.17	0.67	1.20	0.97	1.34	0.97

Table 1. Human subject ratings of the likes and engagements for each of the three interface elements.

allowed us to observe how human participants made use of the tools and how pets reacted to the interface components as well as the audio channel, if used by participants. Video was captured of the pets with a separate camera to gauge their reactions.

After completing both sets of tasks, users were given a survey that asked about the pet's engagement with each of the interaction options, the owner's own preferences for the options, and if and how they might use or adapt the system for use in their everyday lives. In total, the experiment took approximately 30 minutes to complete per session.

Human and Pet Participants

In total, we had 10 human subjects participate in our study. Five had more than one dog in the house, three had one dog and one cat, and two had only one dog. Each human was allowed to conduct the test with one of their dogs. Pet subjects included 10 dogs.

Results

Pet Engagement

All of the pets in our study were able to engage with the system, and all of them were engaged by the sound panel when interacting with their owners together at the screen. They frequently stopped what they were doing and looked at the screen, often with a cocked head. The visual panels—laser pointer and tadpole—were less engaging overall, with only three dogs showing interest in the tadpole and three in the laser pointer. This was despite the pet owners trying many possible different movements with the laser pointer.

When we moved from the in-person interaction to remote interaction, all but one of the dogs was able to respond. The lone exception, a young golden retriever, was so excitable that he could not pay attention to the images or sounds. While it was more difficult to draw the dogs' attention remotely, all of the remaining dogs engaged with the sounds remotely. They approached the screen and showed some interest (see Figure 4). In contrast, the laser pointer and tadpole interfaces were difficult to use remotely. Most pets would not look directly at the screen, and only one dog was able to engage with the remote tadpole and two dogs with the laser pointer in the remote setting.

In terms of the audio-video connection, dog owners found it critical to be able to see their pet while they interacted with them and attempted to get their attention. They used the visual information to discern whether or not their dog was near the computer and looking at the system. They could even tell if their dog was engaged by watching the on-screen visuals. The audio connection was also used by several participants in conjunction with the interaction tools. Some used it so they could call the dog’s name while playing sounds or moving the laser pointer. This further enhanced their ability to get the pet’s attention initially such that

the pet would then focus on the display and interaction tools. Some participants even began issuing verbal commands to their dogs, such as "sit" or "come," over the audio link. While this may seem unsurprising, it shows that people were able to naturally employ their normal routine for interacting with their dog, despite being in a different location.

In general, the dogs were able to discern that the owner's voice was coming from the computer. This was evident by the direction of their gaze and proximity to the display (e.g., if they moved closer). We did notice, however, that several dogs would at times get confused looks on their faces if their owner was speaking to them through the audio connection. For example, several would look at the display and then curiously look around the room after their owner spoke. This behavior was typically short-lived, however, and the dogs would respect the commands given by their owners or re-engage with the visuals on the computer display.

Discussion

Interaction with the prototype allowed us to explore the challenges and potential for an interactive pet video chat system.

Some pets showed signs of confusion over owner disembodiment, though this did not appear to negatively affect their experience. This suggests that audio-video based connections show promise. We also recognize that like studies of children's' use of video chat [1,24], pets require additional scaffolding work in order to keep them engaged with the display. At times, this can be challenging and we learned that sound works best to attract the attention of pets. Pets also will often move around a home and it is likely impractical for pet owners to use multiple commercial 'doggie cams' in order to monitor their pets. To alleviate this, systems that incorporate features such as sound to attract the attention of their pets to a single location will likely be most useful. It may also be the case that through additional training, pets will learn the system's attributes and react more quickly.

In addition, we found that not all pets liked the on-screen visual tools used for interaction. Thus, in order to further enhance remote engagement, we hypothesize that remotely controlled physical devices, akin to [13] and [25], would provide additional engagement for pets once they are at or near a display. We also realize that not all pets are the same as we saw a large degree of variability within the preferences of the pets and their owners. Here we suggest designers of pet monitoring and interaction systems provide a flexible and extensible set of tools. This might include additional games, sounds, or other features.

And, lastly, our work certainly suggests future field trials of pet monitoring and interaction systems that explore how pets and their owners use such systems as a part of their normal everyday routines. Our lab study was able to explore what features pets react well to and how their owners use them, but not if such systems truly make owners feel more connected to their pets when they are away from home. It is also not clear in what situations pet owners would like to use such tools. Further studies are needed to understand if this is the situation in which pet owners truly value and use such systems.

Deeper studies into how tools like this are used in everyday life will shed light on the role technology can play in supporting the human-pet bond, particularly in contexts where pet and owner are not physically together. This follows a line of research that investigates the physical and psychological benefits of pet ownership, and opens up a new area of inquiry related to if and how these benefits may manifest online. In addition, this work connects to current research on the role of technologies in families, and additional study will show if pet relationships do indeed belong in this space and, if so, how lessons from our non-human family members may inform the design of technologies for interacting with children and family members with limited technological skills or special needs.

Conclusions

Our paper has explored the potential for pet owners remotely monitoring and interacting with their dogs. We have done this through the exploration of a prototype system, and its evaluation with pets and their owners. Our results show promise for pet-based video chat systems that allow owners to monitor their pets when they aren't at home, and, in the case of dogs, interact with them through on-screen visuals and an audio connection. In these cases, being able to see the pet is critical in order to adequately support interaction. We advocate for continued research in this area to further explore the way pets, in particular, dogs and cats, can make use of such systems as a part of the everyday routines of pet owners. Here we suggest coupling audio and video based systems with physical interaction devices that might bring further enjoyment to pets while their owners are away.

REFERENCES

1. Ames, M., Go, J., Kaye, J., Spasojevic, M., Making Love in the Network Closet: The Benefits and Work of Family Videochat, *Proc. CSCW,* ACM Press (2010), 145-154.
2. AAPMA National Pet Owners Survey, American Pet Products Manufacturers Association (2008).
3. Brown, B., Taylor, S., Izadi, S., Sellen, A., and Kaye, J. Locating Family Values: A Field Trial of the Whereabouts Clock, *Proc. UbiComp,* Springer-Verlag (2007).
4. Brush, A.J., Inkpen, K. and Tee, K., SPARCS: Exploring Sharing Suggestions to Enhance Family Connectedness. *Proc. CSCW*, ACM (2008), 629-638.
5. Cain, A. Pets as Family Members, *Pets and Family,* Hawthorn Press (1985), 5-10.
6. Dogs in Canada, Furveillance: The Latest on Petcams, http://dogsincanada.com/furveillance-the-latest-on-pet-cams
7. Downtown Dog Lounge, downtowndoglounge.com
8. Golbeck, J. The more people I meet, the more I like my dog: A study of pet-oriented social networks on the web. *First Monday*. 16(2), February 7, 2011.
9. Judge, T.K. and Neustaedter, C., Sharing Conversation and Sharing Life: Video Conferencing in the Home. *Proc. CHI*, ACM Press (2010), 655-658.
10. Judge, T.K., Neustaedter, C. and Kurtz, A., The Family Window: The Design and Evaluation of a Domestic Media Space. *Proc. CHI*, ACM Press (2010).
11. Kirk, D., Sellen, A., and Cao, X., Home Video Communication, *Proc. CSCW,* ACM Press (2010).
12. Lindley, S., Harper, R. and Sellen, A., Designing a technological playground: a field study of the emergence of play in household messaging. *Proc. CHI*, ACM Press (2010), 2351-2360.

13. Mankoff, D., Dey, A., Mankoff, J., Mankoff, K. Supporting interspecies social awareness: using peripheral displays for distributed pack awareness, *Proc. UIST,* ACM Press (2005).

14. Neustaedter, C., Elliot, K. and Greenberg, S., Interpersonal awareness in the domestic realm. *Proc. OzCHI*, ACM Press (2006), 15-22

15. Noz, F. and An, J.. Cat cat revolution: an interspecies gaming experience. *Proc. CHI*, ACM Press (2011), 2661-2664.

16. Paldanius, M., Tuula Kärkkäinen, Väänänen-Vainio-Mattila, K., Juhlin, O. and Häkkilä, J. Communication technology for human-dog interaction: exploration of dog owners' experiences and expectations. *Proc. CHI*, ACM Press (2011), 2641-2650.

17. Playful Paws, www.playfulpawskennel.ca/

18. Romero, N., Markopoulos, P., Baren, J., Ruyter, B., Ijsselsteijn, W. and Farshchian, B. Connecting the family with awareness systems. *Personal Ubiquitous Computing*, *11* (4), (2007), 299-312.

19. Stafford, L. Maintaining Long-Distance and Cross-Residential Relationships, Lawrence Erlbaum, (2005).

20. Strauss, A. and Corbin, J. Basics of Qualitative Research, 2nd Edition, Sage Publications (1998).

21. Tee, K., Brush, A.J. and Inkpen, K. Exploring communication and sharing between extended families. *International Journal of Human-Computer Studies*, *67* (2), (2009), 128-138.

22. Walther, J.B. and Parks, M. Cues filtered out, cues filtered in, *Handbook of Interpersonal Communication,* Sage (2002).

23. Wingrave, C.A., Rose, J. Langston, T. and LaViola, J.J. Early explorations of CAT: canine amusement and training. *Proc. CHI EA.* (2010), 2661-2670.

24. Yarosh, S., Inkpen, K.M., and Brush, A.J. Video Playdate: Toward Free Play across Distance. Proc. CHI, ACM Press (2010), 1251-1260.

25. Young, J., Young, N., Greenberg, S. and Sharlin, E. Feline Fun Park: A Distributed Tangible Interface for Pets and Owners, *Video Proc. Pervasive Computing,* (2007)