Communicating Through A Telepresence Robot: A Study of Long Distance Relationships

Lillian Yang
School of Interactive Arts and Technology
Simon Fraser University
102 – 13450 102nd Avenue
Surrey, BC, Canada
lya59@sfu.ca

Thecla Schiphorst
School of Interactive Arts and Technology
Simon Fraser University
102 – 13450 102nd Avenue
Surrey, BC, Canada
thecla@sfu.ca

Carman Neustaedter
School of Interactive Arts and Technology
Simon Fraser University
102 – 13450 102nd Avenue
Surrey, BC, Canada
carman@sfu.ca

CHI'17 Extended Abstracts, May 06-11, 2017, Denver, CO, USA
ACM 978-1-4503-4656-6/17/05.
http://dx.doi.org/10.1145/3027063.3053240

Abstract
Telepresence robots have the potential to better replicate the qualities of in-person interactions than traditional communication tools, however, there are few studies of their use in domestic contexts. In our study, we explored how two long distance couples used commercially available telepresence robots called Beam® Smart Presence™ systems (Beam+ model) for one month, and collected data from three semi-structured interviews per couple. Analysis revealed the importance of four aspects of telepresence robot communication: 1. Autonomy, 2. Unpredictability, 3. Movement as body language, and 4. Perspectives. These insights provide a preliminary understanding of the use of telepresence robots for communication in LDRs, and can be used to inform future design work.

Author Keywords
telepresence robots; long distance relationships; communication.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

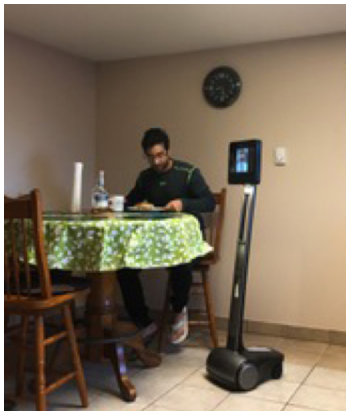

Figure 1: Participant having a meal with his partner using Beam+.

Introduction

Many people experience a long distance relationship (LDR) at some point in their lives [5,7,11]. Common reasons include relocating for school, work, or family obligations. Couples often use computer-mediated communication (CMC) tools to stay connected [2]. These include email, text, mobile phone call, video chat, and social network sites. With the widespread adoption of video chat tools like Skype and FaceTime, it is clear that distance-separated loved ones value rich, high content connections [8]. However, current video chat communication is not an adequate surrogate for in-person interactions. Studies of video chat usage by LDR couples show that they often leave video connections open for long periods of time to 'share life' between homes, but carrying video chat devices around the home can be cumbersome as they are not optimized for such usage [8]. Due to this challenge, this study explores telepresence robots (see Figure 1) as a communication tool for LDR couples given the ability for users to remotely control the position and movement of the telepresence robot. Our goal was to understand how LDR couples would use telepresence robots and what benefits and challenges would exist.

We conducted a field study of two long distance couples that each used a Beam+ for one month. We interviewed the couples about their communication patterns at the beginning, middle, and end of the month. We found that the addition of physical agency to communication benefited the couples' sense of presence and supported natural interactions similar to in-person communication. This fostered a greater sense of connection between partners.

Related Work

Draper, Kaber, & Usher define "telepresence" as "the perception of presence within a physically remote or simulated site" [1]. Video chat tools are an example of a telepresence system. Research has shown that loved ones value the ability to see one another through video chat [4,8]. For some partners, seeing each other is considered a necessity [8]. Studies have found that loved ones use video chat for more than conversing — they also leave video chat on for extended periods just to "hang out", and move the video chat device around to share activities [3,4,8]. Telepresence robots are a form of telepresence technology which provide a physical embodiment for the user's remotely-projected presence. The embodied form of presence has been referred to as "strong telepresence" or "tele-embodiment" to distinguish it as a unique form of projected presence [10]. In recent years, companies have explored the use of telepresence robots to better integrate remote workers into the workplace experience [6]. They have been found to be useful for supporting a sense of presence in the remote location, largely because of the remote user's ability to be mobile [6]. Telepresence robot usage at academic conferences have found them beneficial for small-scale social interactions [9]. However, there has been little research into telepresence robot usage in the home as a communication tool between loved ones.

Study Methodology

The goal of our study was to find out how long distance couples might use telepresence robots to communicate in their daily lives and how this usage would compare to the use of more traditional video chat tools.

Participants
We recruited two couples through word-of-mouth. The first couple consisted of one male (age: 23; occupation: Master's student) in Vancouver, Canada and one female (age: 23; occupation: software engineer) in Singapore. This couple has been married for 4 years and most of the relationship has been long distance. The second couple consisted of one male (age: 25; occupation: Master's student) in Vancouver, Canada and one female (age: 23; occupation: Master's student) in Boston. This couple has been dating for one and a half years and have been doing long distance for one year and four months.

Data Collection
We brought a Beam+ telepresence robot to one of the participant's homes (local to us) and participants used it over a period of four weeks. They were instructed to use the Beam+ a minimum of 4 times during the first week. We chose to set a minimum usage in the first week, so the couples could familiarize themselves with the Beam+. Following the first week, we had no usage rules, because we wanted to see how the couples would use the Beam+ naturally. Remote users could connect into the Beam+ whenever they wanted to. They could use it to move around their partners' homes where they could see and hear things as they would in person. Beams are moved by using a mouse and keyboard, smartphone, or Xbox controller. One camera faces forward for seeing the environment and a second camera faces the floor to aid navigation and movement.

We collected data through semi-structured interviews. We interviewed partners at the end of the first week and asked about the couple's relationship and existing communication patterns prior to using the Beam+. A second interview at the end of Week 2 functioned as a check-in where we asked couples how they were using the Beam+ and whether they were experiencing any issues. A final interview occurred at the end of Week 4 where we began by separately asking partners about their experiences and how they felt in the role of local user (in the same place as the Beam) or remote user (driving the Beam). For example, we asked "Do you have any thoughts about what it was like being the person controlling the Beam rather than the person interacting with the Beam?" Partners were interviewed together for the second half of the interview regarding usage patterns, comparisons with other tools, and feelings of connecting through the Beam+.

Data Analysis
We audio-recorded and transcribed all interviews. A combination of open, axial, and selective coding was used to extract important themes. Elements of the sense of presence experienced by the couples using Beam+ emerged as themes. These elements will be discussed next. Names in quotes have been replaced by pseudonyms.

Findings
As with each CMC tool, the telepresence robot has unique features that help it serve a unique communication scenario. Couples in this study used Beam+ to spend leisure time together after work. Other CMC tools were used during the day when the partners weren't at home, and at night when the partners were too tired to be fully engaged.

Autonomy/Freedom
With the Beam+, local partners reclaimed some of the free movement that they enjoy when communicating

face to face. Rather than sitting in front of their computers or holding mobile phones to their faces, they could walk around their homes with their hands free.

"Umm a very good advantage is that I don't have to hold my phone all the time…When I was using WeChat I used like hold the cellphones on my hand all the time - sometimes I feel very fatigued..." – Couple #1, Local

The convenience of being able to stay in view without local users having to carry a laptop or phone around meant that connections sometimes lasted longer as local partners didn't need to end calls when beginning activities, such as cooking.

"…Skype would be like just quick catch-up. How was your day, and all that stuff, and then I would go cooking, then I can't handle Skype right?...But with the Beam, I could like multi-task…" – Couple #1, Local

As for the remote partners, they were no longer restricted to seeing only the things their partners wanted to show them. With regular video chat tools, they would only see things from their partners' computer or phone cameras, but with Beam+, they could control the video view by moving the Beam+ around.

"it was more personal, like I could roam around with him anywhere in the house…He was just on this table and I could just go in the kitchen and stand with him and see him working…" – Couple #2, Remote

While the Beam+ allows remote users to move around, this movement is confined to indoor environments in areas with WiFi. Users found this very limiting, and expressed the desire to take the Beam outdoors.

"… I already had the plan in mind like to take the Beam outside on the lawn, and go for a walk, show her the garden like fruits we were planting, all that stuff, but that never happened, because of the snow, and even the WiFi is weak in my lawn..." – Couple #2, Local

Surprise/Unpredictability

An interesting finding was the effect of surprise on creating a sense of presence. With traditional video chat tools, an incoming call needs to be accepted for communication to begin. With the Beam+, the user could 'Beam in' unexpectedly. The partners felt that the spontaneous and unannounced calls made the connections feel more like in-person communication.

"There are like 2 times when I just Beam in and Ron is not in the room. I mean it feels weird but I do feel like I'm kind of there." – Couple #1, Remote

"…[S]ometimes she used the Beam unexpectedly, like I didn't know she would Beam in so there's once I was working…and I heard the sound of the Beam and I know she already Beamed in and I was pretty happy - it's the feeling of unexpected she is Beaming in." – Couple #1, Local

The surprise from being able to physically bump into things also created a sense of presence for one user. Sometimes the user would accidentally bump into her partner's chair, and the surprise from the physical interaction made both partners feel each other's presence more strongly.

"…there was one time that when I talked with Ron and my Beam device moved too close to his chair and his chair got like little wheels and it resulted in my Beam device like pushing his chair a bit and Ron starts to feel like I'm like really beside him and pushing his chair, so I think that really brings me to him." – Couple #1, Remote

Movement as a Form of Body Language

A basic element of body language is leaning in when you feel positively towards someone and leaning away when you feel negatively towards them. During disagreements, partners can move away to show displeasure or move closer to show a willingness to reconcile differences. The ability to use meaningful distance cues turned out to be a very important benefit of Beam+ communication. Partners said they were more willing to have serious conversations when using Beam+ than when using traditional video chat tools.

"…[P]reviously when we have a fight, I always cut off the phone, and didn't answer the phone, or didn't want to reply the message, but with Beam I tend to open the Beam but stand here and say nothing, but although I didn't say anything, but this is a better case compared to I cut off the phone and cut off the communication completely." – Couple #1, Local

One local partner explained that being able to move towards his partner after she moved away allowed him to express his willingness to surrender his position for the sake of resolving their issues.

"…[S]ometimes I will surrender 'ok I come to you and talk to you'. I think this rarely happened when I was using some other video chat in mobile. Because you just holding it very easily. You don't have any obligation, any effort to change the position, but this one you have to really move to her." – Couple #1, Local

Importantly, the more expressive dynamic of communicating through the Beam+ opened the couple up to talking about topics they preferred not to talk about over traditional video chat tools.

"Ya we talked about some really serious topics which made her really unhappy…That conversation happens via Beam." – Couple #1, Local

"From my feeling that why would I choose Beam to talk serious stuff. It's because…Ron is more focused with the Beam compared to video chat." – Couple #1, Remote

Viewing Perspectives

The ability of remote users to move around the location created new views and perspectives that users were previously not used to seeing.

"I mean with Beam I always can see surroundings...but with WeChat I normally just see Ron's face so ya it's really different." – Couple #1, Remote

One couple noted that with a traditional video chat tool, the she never saw the perspective of looking at the back of her partner's head and seeing his computer screen, but with the Beam+, she could stand behind him and look over his shoulder as she would in person.

"I think when I was working and she was watching me I had different feeling…Sometimes I feel like she's really

being with me like watching me doing, because she's sometimes like 'what's that on your screen? What's that video for?'" – Couple #1, Local

Participants said that the added perspectives also generated natural conversational topics when the users would notice things in their partners' homes and comment on them.

"…[S]ometimes like random things come up in the Beam like where she would see something in my house and we would start talking about it. – Couple #2, Local

While the Beam allowed users to view new perspectives, users noted viewing issues such as ineffective zooming.

"…[I]t seems like when I zoom in, the resolution gets really bad. So I cannot really see clearly with that, so I just give up that." – Couple #1, Remote

Discussion & Conclusions

The mobility and physicality of telepresence robots led to interesting findings under the themes of autonomy, unpredictability, movement as a form of body language, and viewing perspectives. The autonomy that comes with using the Beam+ was immediately evident to participants who repeatedly mentioned enjoying the control of their views. Unpredictability made one couple feel closer on multiple occasions, allowing for a more natural pattern of communication. The importance of spontaneous interactions for building connections was described in a study of telepresence robots in the workplace [6]. Allowing movement as a form of body language made the Beam+ valuable for conflict resolution. In a previous study on LDR couples, some couples either chose not to argue over video chat or had difficulty resolving conflicts over video chat because they couldn't leave the room [8]. Couples using telepresence robots could leave the room to make a point or to cool off during an argument. Using Beam+ to have serious conversations can help couples avoid the problem of conflict avoidance [12,13]. The additional perspectives that users could see by moving the Beam was also beneficial to the couples in our study. Users were able to participate in watching their partners cook—an activity that was less convenient with traditional video chat tools.

We feel that these findings elucidate areas of importance for future designs of telepresence robots. While the mobility of the robot was valued, it was still limited to the home. Improvements could be made to handle different terrains and weather conditions for outdoor use. While the opportunity to see things from different perspectives was valued, users couldn't always get a clear view. Improvements could be made to enhance zoom capabilities, the clarity of the local partners' screens, and one's ability to pick up items for further inspection.

While valuable, our study has limitations. We only studied two couples at this stage and more are needed to understand if these usage patterns extend to other couples. It is also likely that some behaviors were influenced by the novelty of the technology. Future work should explore longer term deployments to understand sustained usage.

Acknowledgments

We thank the Natural Sciences and Engineering Research Council (NSERC) for funding this research.

References

1. John V. Draper, David B. Kaber, and John M. Usher. 1998. Telepresence. *Human Factors: The Journal of the Human Factors and Ergonomics Society* 40, 3: 354–375.
2. Saul Greenberg and Carman Neustaedter. 2013. Shared living, experiences, and intimacy over video chat in long distance relationships. In *Connecting families: the impact of new communication technologies on domestic life*, Carman Neustaedter, Steve Harrison, and Abigail Sellen (Eds.). Springer, London , UK, 37-53.
3. Tejinder K. Judge and Carman Neustaedter. 2010. Sharing conversation and sharing life: video conferencing in the home. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '10), 655–658. http://dl.acm.org/citation.cfm?id=1753422
4. David S. Kirk, Abigail Sellen, and Xiang Cao. 2010. Home video communication: mediating 'closeness'. In *Proceedings of the 2010 ACM conference on Computer supported cooperative work* (ACM '10), 135–144. http://dl.acm.org/citation.cfm?id=1718945
5. David Knox, Marty E. Zusman, Vivian Daniels, and Angel Brantley. 2002. Absence makes the heart grow fonder?: Long distance dating relationships among college students. *College Student Journal* 36, 3: 364.
6. Min Kyung Lee and Leila Takayama. 2011. "Now, I have a body": Uses and social norms for mobile remote presence in the workplace. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '11), 33-42. http://dx.doi.org.proxy.lib.sfu.ca/10.1145/1978942.1978950
7. Katheryn C. Maguire, and Terry A. Kinney. 2010. When distance is problematic: Communication, coping, and relational satisfaction in female college students' long-distance dating relationships. *Journal of Applied Communication Research* 38, 1: 27–46. https://doi.org/10.1080/00909880903483573
8. Carman Neustaedter, and Saul Greenberg. 2012. Intimacy in long-distance relationships over video chat. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '12), 753-762.
9. Carman Neustaedter, Gina Venolia, Jason Procyk, and Daniel Hawkins. 2016. To Beam or not to Beam: A study of remote telepresence attendance at an academic conference. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing* (CSCW '16), 417–430. https://doi.org/10.1145/2818048.2819922
10. Eric Paulos, and John Canny. 2001. Social tele-embodiment: Understanding presence. *Autonomous Robots* 11, 1: 87–95.
11. Breeana Skinner. 2005. Perceptions of college students in long distance relationships. *UW-L Journal of Undergraduate Research VIII*. Retrieved from http://www.uwlax.edu/urc/jur-online/PDF/2005/skinner.pdf
12. Laura Stafford. 2010. Geographic Distance and Communication During Courtship. *Communication Research* 37, 2: 275–297. https://doi.org/10.1177/0093650209356390
13. Laura Stafford, Andy J. Merolla, and Janessa D. Castle. 2006. When long-distance dating partners become geographically close. *Journal of Social and Personal Relationships* 23, 6: 901–919. https://doi.org/10.1177/0265407506070472