

Orit Zuckerman

Final Project

A System to Increase Connectedness in Distributed Families using Contextual Asynchronous Video Communication

INTRODUCTION

In recent decades families have become more geographically distributed, making it challenging for family members to maintain a feeling of intimacy. Distributed families face many challenges trying to maintain a sense of intimacy: Different time zones, limited conversation topics, and limited knowledge of the other's availability and mindset, to name a few. Distributed family members tend to share more information, and practical issues (when and where to meet next time), as well as special occasions (e.g. birthday events or job promotion) and less emotional information. Patrick et al 2001 [17] found that "communication for shared experience, so important in maintaining distance relationships, is not adequately supported by the communication media available today. Reinforcement of these mediated relationships currently takes place through seeing each other, participating in events together, and engaging in common activities and interests. It is clear that people need better reinforcement of "closeness" to maintain mediated relationships..." The result is a more fragmented relationship, which gradually leads to less intimacy. William Schutz's interpersonal theory, as described in Washington 2001 [23] lists three factors that motivate interpersonal relationships: Sense of control (influence), inclusion, and affection. In contrast to closely located family members, it is challenging for distributed family members to satisfy these motivations. Modern communication technologies (phone, cell phone, email, instant messaging) improve communication, but in most cases, do not achieve the same level of intimacy and connectedness as in face-to-face communication [17]. In the past few years, the "Awareness and Presence Systems" field has emerged [4, 7, 8, 10, 12, 15, 18], focused on connecting distributed family members in a more meaningful way. Figure 1 lists the main research projects in this emerging field, side-by-side with traditional communication technologies (more details in the Related Works section).

We present CASY-G, a new communication technology in the "Awareness and Presence" field. Integrating audio/video messaging, asynchronous communication, and context-based delivery, CASY-G is designed to enhance connectedness between grandparent and their grandchildren.

Grandparents-grandchildren relationship suffers the most from lack of face-to-face communication. B. Evjemo et al [1] compared phone to face-to-face conversations between grandparents and their grandchildren. The researchers found that face-to-face conversations were longer, and closely tied to the concurrent activity. Phone conversations were shorter, less frequent than face-to-face, and mostly used to organize and schedule visits. B. Evjemo et al conclude that: "...Children and grandparents need a common context for their conversations, telephony does not offer this context, and systems offering such context will be well received by distributed families..."

The role of a grandparent in a child's life is significant. Grandparents have a short-term as well as long-term contribution to a child's development. For example, addressing challenges such as eating habits, sleeping patterns, and discipline, as well as more complex challenges such as developing moral values, sense of belongingness, and connection to tradition and history. CASY-G enables family members to send 'good morning' and 'good night' video snippets into a shared family database. The recipient views the snippet in-context of going to sleep or waking up.

The next sections present an overview of the related work in the "Awareness and Presence" field, a detailed description of the CASY-G prototype and design process, as well as an exploratory study of a few distributed families using asynchronous video communication.

RELATED WORK

Many research projects have explored the area of connecting remote households. This section presents different categories within the different projects done in the area, and CASY-G's inspiration and differentiation from these projects.

Presence vs. Communication.

Presence/awareness is a lightweight indication of a person's current status or activity, such as 'at home', 'at work', 'sleeping', 'biking'. Social presence was described by (Ijsselstein et al 2001) [11] as the feeling of "being with". A simple example for online presence indication is the IM online availability indicator. Communication is delivery of messages between people via text, audio, image, or video. For example an actual IM Messages. Most research projects focus on either communication or presence. Some of the projects use certain aspects of the other category, but still focus on one main category. Some examples of research projects in the presence category are: In the work of D. Hindus, S et al. (2001) [4] - Casablanca's Intentional presence lamp - When one household turns on the Casablanca lamp, a corresponding lamp is activated in the other household. In E. Mynatt et al. (2001) [8] Digital family frame – A portrait of an elderly person, in a digital frame, display to family members icons on the current state and well being of the elderly person. In, Pedersen, E.R., & Sokoler, T. (1997) [18], Aroma, the system captures an activity in one household and translates it to abstract images that indicate the level of activity on that household. Although CASY-G belongs to the communication category, some of the presence system's attributes had inspired the design of the CASY-G system: Awareness – Making family members aware of the current situation of another family member in another household (e.g. presence, availability, activity) promotes more communication between households. "The aim of such systems is to make people feel that they are not alone and trigger spontaneous interaction." [22]. Esthetically pleasing - Communication tools for domestic usage should be aesthetically pleasing; they should have the appearance of a home decoration and blend in with the background, rather than stand out as a piece of technology." The visualization should be aesthetically pleasing, a typical home decoration." [8]. "Prototypes in homes require a higher level of finish than in offices, due to the importance of appearance in homes along with safety and convenience concerns." [4] Crabtree et al [3] suggest that displays should be "ecologically distributed"; they should be placed in such a way that they are merged in the normal flow of activities in the home.

Synchronous vs. Asynchronous,

Synchronous communication is a real-time communication, where a sender and a recipient engage in communication in the same time. For example phone, instant messenger (IM) and video conferencing. Both sides need to be in the same time zone and available to talk. It is more interactive and satisfies the sender's need to share information. Asynchronous communication is when there is a delay in time between the time the message was sent and the time it was received. It is less interactive, but the sender and the recipient don't have to be in the same time zone and the recipient can view the message in her own time and convenience. Examples for asynchronous communication: email, SMS, message-boards, voice mail. Some of the research projects that were done in the area of connecting households in a synchronous way were: D. Hindus, S et al. (2001) [4] - Casablanca's - RoomLink? – an "always on" high quality sound system that connects 2 household. Both can hear what is going on in the other side all the time. Another work was Heeter, C et al. (2001) [10] Telewindows - An audio/video system that enables confined elderly people to be connected to their daycare centers and be part of the activity. CASY-G was designed as an asynchronous system to support families that are located in different time zones. Another reason was to examine the possibility that asynchronous communication reduces the pressure of a real-time discussion in intergenerational communication. Since CASY-G is not trying to replace other means of communication the assumption is that more frequent asynchronous communication might contribute to more synchronous communication.

Immediate delivery vs. Context-based delivery.

In the previous paragraph we described 2 kinds of communication methods. In this paragraph we focus on the delivery of the message and the recipient's availability in asynchronous communication. Immediate delivery: when a message is sent, it is immediately available for the recipient to access it. (Immediate does not mean synchronous, for example an SMS message is both asynchronous and immediate delivery). Context-based delivery: when a message is sent, but is not available for the recipient to access it until a specific activity occurs. For example getting a farewell present and not open it till sitting in the plane in mid air. Most of the work reviewed for this paper in the asynchronous category was designed as immediate delivery. For example, P. Markopoulos et al. (2004) [15] Astra - an awareness system that supports a mobile user to share daily life experiences with family members. The mobile user can send images and text to the house user. The house user can see the images and notes, can comment on the

images and see if the other side is at home. Another example is S. Conversy et al. (2004) [20] Videoprobe – A webcam + display device that “watches” the activity at the household. Whenever something is static for 3 sec, the system takes a snapshot and sends it to the other household. CASY-G is designed as a context-base delivery system that is described in more details in the next section.

SYSTEM OVERVIEW

This section presents an overview of the CASY-G system, detailing the context-based delivery approach.

Interacting with the System – a User’s Scenario

It is a rainy afternoon in San Francisco, CA. Martha is coming home from shopping. She glances at her CASY-G picture frame on her furnace, showing three portraits of her grandchildren. From the portrait’s icons she sees that Ethan (five years old, Chicago, IL) is not at home right now, Maya (four years old, Amsterdam, The Netherlands) is asleep, and Aden (nine years old, Brooklyn, NY) is at home. Martha decides to leave video message to Maya and Aden. She touches Maya’s portrait and records a ‘good morning’ message for Maya (who is currently asleep). For Aden’s she decides to read a few pages as a ‘good night’ story, from the new book she bought him: ‘The Lion, the Witch and the Wardrobe’ by C.S. Lewis. A few hours later, at his home in Brooklyn, NY, Aden is about to go to sleep. He says good night to his parents, and goes to bed. He glances at the small screen mounted in his CASY-G pillow, and says ‘good night’ to the portrait of Martha, his grandmother. Martha’s portrait reacts with a gentle warm smile, and he sees that there is a new ‘good night’ message waiting from her. Aden touches the screen to activate the audio/video message – Martha reading him a bedtime story. He relaxes in his bed, enjoying his grandmother’s soothing voice. When the message is over, he can’t wait to hear the rest of it. He replies to Martha through his CASY-G pillow, saying how much he wanted this book and pleading her to read him a few more pages when he wakes up the next morning.

Motivation

The CASY-G system is framed around three main concepts: Context based delivery, asynchronous communication, and video/audio communication. The goal of the system is to establish a more consistent, intimate, and meaningful communication between grandparents and grandchildren that are distant located.

Context-Based Delivery

In face-to face communication context has a great importance in creating good connection. Following multi-sensory cues, such as visual, auditory, emotional, and cognitive, the communicators know when is the right time to talk (availability), why it is the right time (mood), what to talk about (content), who to talk to, and where to talk about it (environmental settings). Knowing the when, why, what, who and where, is more difficult in distributed family settings. It is difficult to know who is at home, what are they doing, what is their state of mind and what are they thinking about right now. One way to solve the problem is to sense what is the other side doing right now. This way one household knows the activities that goes on in the other household and makes it easier to communicate. This solution raises serious privacy issues. What’s more in different time zones this would not work. The solution implemented in CASY-G is to identify activities that most people do every day, activities that most people can imagine their nature, and associate a message with these activities. If we take a look at a day’s course, there are many moments that can be tied to context-based delivery, getting up in the morning, getting dressed, brushing teeth, eating breakfast, going to work, driving a car, working in the office, coming home, watching TV, reading a book, playing a game, entertaining friends, eating dinner, going to sleep. CASY-G is focused on home activities (getting up eating breakfast, going to sleep, watching TV). A home environment is more relaxed, secured and encourages a certain state-of-mind than outside of home, at work or with people from a more distant social circle. It is more intimate, reflective and family oriented. Context-based delivery is, recording a message, and assign it to a specific activity. The system will deliver the message only when the context event occurs; for example, grandma is recording a children’s story as her message, to be read the next

time her granddaughter eats her breakfast. The system will deliver the message next time the child is eating breakfast. Using context-based delivery can promote behavior change. If a child has difficulty going to sleep, having his grandmother reading a story or singing a song can potentially make it easier. Delivering a message when a certain activity occurs can:

- Provoke content ideas (for example, reading a story because it will be delivered in bed time).
- Create anticipation and surprise – will I get new messages? What will they be? Who from?
- Establish consistency – the grandparent becomes an integral part of the child's daily schedule.

In CASY-G two contextual events were implemented: going to sleep and waking up in the morning ('good night', 'good morning'). These activities are intimate transition moments in daily life (waking up and going to sleep starts and ends the day) promoting quality sharing and intimacy, which is a crucial first step to a communication that can help behavior change.

Asynchronous communication

Asynchronous communication enables recording of video snippets at one's own time and pace, making it easier to communicate between different time zones, and helps maintain privacy. Asynchronous communication doesn't require informing the sender about the recipient's activities, instead, the recipient's actions are known to the system alone and whenever a message needs to be delivered in a certain context it will be an interaction between the system and the recipient. In addition, asynchronous communication demands some personal effort and forethought, such as thinking what the content of the message should be, which can make the snippet of the sender more meaningful to the recipient.

Video/audio communication

Video communication is as close as possible to real life, Daft and Lengel (1984)[5] described in their rich media theory that the richness of media is judged based on the following criteria: 1) the availability of instant feedback; 2) the capacity of the medium to transmit multiple cues such as body language, voice tone, and inflection; 3) the personal focus of the medium; 4) the use of natural language. According to these criteria video/audio technology is a richer medium than text and voice but less rich than face-to-face communication. Although CASY-G is an asynchronous system that doesn't have the dynamics of a back and forth discussion and don't really use the availability of instant feedback, creating the environment and circumstances that will promote instant feedback can contribute to more frequent communication between a grandparent and a grandchild. Many research projects in the area of connecting distributed families who analyzed how different types of media (text, voice, images and video) perform in these situations, found that in practice, synchronous video is often of poor quality and prohibits natural eye contact, limiting consistent, high quality communication. We believe that video's potential to connect people would materialize in asynchronous communication systems. The reasons might be higher quality video (since the video is not streamed in real-time but stored in the shared database), and high comfort level when recording/viewing since there is no time pressure (asynchronous).

High-level Design

CASY-G (Contextual Asynchronous System for Grandparents and grandchildren) allows grandparents and grandchildren to record video snippets into a shared family database. The recipient views the snippet in-context of a transitional moment at their home, such as going to sleep or waking up.

CASY-G is a client-server system. Multiple clients can communicate with a shared server and perform queries on a shared database. Each client has the following modules: Record, Sensing, Context, and Display. The server has the Communication management and Database modules.

The CASY-G client:

As it was mentioned in the "related work" section, communication tools for domestic usage should be aesthetically pleasing; they should have the appearance of a home decoration and blend in with the background, rather than stand out as a piece of technology. Generally speaking there are two categories of interfaces to CASY (Contextual Asynchronous Systems) – general interface, and specific interface. There are pros and cons to each category. A general interface is not specific to a certain type of user or need. There can be one interface that everyone can use. In the case of CASY it can be a cellphone. In a specific interface, it is tailored to specific users

with specific needs. CASY-G was designed to use a specific interface that is tailored specifically to the communication needs of grandparents and grandchildren and as such supports and facilitate affective communication need. Since the first prototype uses 'getting up' and 'going to sleep' as the context-based delivery points, and we want to leverage household objects, two specific interfaces were chosen:

- A picture frame for the grandparent's house.
- A pillow with an embedded screen for the grandchild.

A picture frame is something almost every family has in their home. It shows pictures of family members. It is usually placed in either a central social location like the living room or the kitchen, or in a more intimate private place like the bedroom [8].

The pillow (a plush pillow) is something between a stuffed animal and a blanket. It is usually in bed, it has a special meaning to its owner and in the case of CASY-G it represents the grandparents. Both picture frame and the pillow are objects that are associated with home, intimacy, and warmth. Since they represent other family members, they act as a virtual persona of those people, making it a meaningful affective object.

In the ideal scenario, the pillow (or any other object like stuffed animal, small device, watch etc...) will be a special gift from the grandparents, which can initiate intimate communication between the grandparents to the grandchild.

Each of the objects (picture frame and pillow) is equipped with: 1) A camera and a microphone to record the video messages, 2) A display screen to view the images of the family members, their current presence status (home or not, asleep or awake, time, weather), and the video messages, 3) Speech recognition – interface to assign context to a message (good morning/good night) or to check for new messages in a specific context. Looking at the display of CASY-G, the user sees images of distant family members. Touching one of the images will zoom-in on that image and the user can do the following:

- 1) Record a new message.
- 2) Check for new messages from the selected family member in a specific context (by saying the contextual keyword)
- 3) View old messages from the selected user.

After recording a message the user need to assign a context to it, or in other words decide when will CASY-G deliver the message to its recipient. Currently there are two options: When the recipient goes to sleep or gets up in the morning. CASY-G prompt for context and the user specifies the keyword in voice. The message with the keyword and user ID is stored in a database.

To view a message the user need to say the keyword to the system ('good night', 'good morning') and the system will check and notify what new messages there are for that user in that specific context. The user can then choose which messages to view. If there are no new messages, the user can always browse old messages in the system.

The CASY-G server:

- Communication Management
- DB module

EVALUATION

In the study we conducted we wanted to see if CASY-G increased the number of times (CASY-G and phone) and the range of topics grandparents discussed with their grandchildren, thus contributing to a better feeling of intimate and connected relationship. In other words, we wanted to see if the design of CASY-G contributes to deeper engagement In distributed families. An experimental study was conducted to test the three main ideas in the CASY-G design. Four distributed families (four grandparents and three grandchildren ages three four and seven) participated. The families filled out a questioner about their current communication patterns and in a period of two weeks were asked to record video/audio messages, using a digital camera. The messages were sent as email attachment. The sender specified in the email if the message should be viewed in the morning, or at night before going to bed. The families logged the

communication patterns for that period including number of phone calls, and at the end of the two weeks filled out another questioner.

The results of the questioner about the existing communication patterns support the findings of Evjemo B. et al [1] and Patrick et al [17] and show that:

1. Phone is the most frequently used communication method in distributed families. (Skype is the second most popular tool)
2. They usually talk once or twice a month.
3. The topics are practical issues (visits, gifts requests), external events (weather, holidays, birthdays) and things that relates to the current activity of the child (if the child is about to go to the pool, it will embark a discussion on the topic)
4. The child never initiate the contact and the parents are part of the conversation.
5. Phone is somewhat engaging but not enough.
6. There are occasions where one of the sides wishes to make a contact, but refrain from doing so because of time differences and not knowing if the other side is available for a discussion.
7. Both parents and grandparents felt they are only somewhat involved in the child's life and don't know enough about it.
8. All grandparents felt they are not contributing to the child's education.

The findings from the simulation are:

1. Current technology has a lot of obstacles. Even though there are ways to record video messages and send them by email, it is cumbersome, difficult, requires too much preparations and attention and as such discouraged the families to send messages.
2. Context-based delivery increases awareness. Grandparents found themselves thinking more about the grandchildren when they got up in the morning and before they went to bed.
3. Video/audio increases awareness and connectedness in the grandchildren. The children talked more about the grandparents that sent messages than the grandparents who didn't. When the children had an event to share with someone, during the two weeks experiment, they expressed their wish to share it with the grandparents.
4. Context-based delivery makes it easier for grandparents and grandchildren to come up with topics. Things that were shared were bedtime stories, feelings, weather, small events that happened the same day and simple "good night" or "good morning"
5. Asynchronous communication makes it easier to send messages. There is no real-time pressure, which made it easier to invest personal effort in recording the messages. The communicators know that the message will be delivered in a certain time and a certain mindset and that contributed to more relaxed communication.
6. Recording and sending the messages had also increased the number of phone calls between the grandparents and grandchildren.

CONCLUSION

In recent decades the number of distributed families has increased, making it harder for family members to maintain a feeling of intimacy. Out of all distant family members, grandparents-grandchildren relationship suffers the most. Research shows that phone is the most popular communication tool for intergenerational communication, but it lacks the ability to maintain intimate and engaging relationship. We conducted a small experiment to check our hypothesis that the combination of video/audio asynchronous communication and context-based delivery is a better tool for intergenerational communication that might promote deeper engagement. Our results showed that asynchronous video/audio communication alone made a huge difference in the way family members communicated with each other. Context-based delivery benefits were less significant in the eyes of the users, but it may have different results over a longer period experiment.

REFERENCES

1. Bente Evjemo, GunnvaldB?. Svendsen, Eivind Rinde, Jan-Are K. Johnsen. Supporting the distributed family: The need for a conversational context In: Proceedings of the third Nordic conference on Human-computer interaction, ACM International 2004, p309-312.
2. Cialdini, R. (2001). Influence: Science and Practice. Allyn & Bacon, Boston, 4th edition.
3. Crabtree, A., Rodden, T. and Hemmings, T. (2002). Supporting communication in domestic settings. Proceedings of the 2003 Home Oriented Informatics and Telematics Conference, Irvine,

California.

4. D. Hindus, S. Mainwaring, N. Leduc, A. Hagström, and O. Bayley. Casablanca: designing social communication devices for the home. In Proc. of ACM CHI 2001 Conference, pages 325–332. ACM Press, Apr. 2001.
5. Daft, R.L. & Lengel, R.H. (1984). Information richness: a new approach to managerial behavior and organizational design. In L.L. Cummings & B.M. Staw (eds.), Research in organizational behavior 6, pp. 91-233. Homewood, IL: JAI Press 1984
6. Detailed overview of the Transtheoretical Model
(<http://www.uri.edu/research/cprc/TTM/detailedoverview.htm>)
7. Dourish, P., & Bly, S. (1992). Portholes: Supporting awareness in a distributed work group. Proceedings of ACM CHI '92, 541-547.
8. E. Mynatt, J. Rowan, S. Craighill, and A. Jacobs. Digital family portraits: supporting peace of mind for extended family members. In Proc. of ACM CHI 2001 Conference, pages 333–340. ACM Press, Apr. 2001.
9. Georgia-Tech-“aware-home” <http://www.cc.gatech.edu/fce/ahri/>
10. Heeter, C., Gregg, J., Dekker, D., Climo, J., Biocca, F., Reed, G., Haley, L., & Wilson, C. (2001). Telewindows: Case studies in asymmetrical social presence. In G. Riva & F. Davide (Eds.), Being There: Concepts, Effects and Measurement of User Presence in Synthetic Environments. Amsterdam: IOS Press.
11. IJsselsteijn, W.A., Freeman, J., Ridder, H. de (2001). Presence: Where are we? [CyberPsychology?](#) & Behavior, 4(2), 179-182.
12. Liechti, O., & Ichikawa, T. (1999). A digital photography framework supporting social interaction and affective awareness in home communication. Proceedings of the International Workshop on Handheld and Ubiquitous Computing HUC '99, 186-192.
13. Malone, T. and Lepper, M. (1987). Making learning fun: A taxonomy of intrinsic motivations for learning. In Snow, R. and Farr, M., editors, Aptitude, learning, and instruction: Cognitive and affective process analyses, chapter 10, pages 223-253. Erlbaum, Hillsdale, N.J.
14. MIT-PlaceLab http://architecture.mit.edu/house_n/web/placelab/PlaceLab.pdf
15. P. Markopoulos, N. Romero, J. van Baren, W. IJsselsteijn, B. de Ruyter, B. Farshchian . Keeping in touch with the family: home and away with the ASTRA awareness system. In conference on Human Factors in Computing Systems ACM 2004. pages 1351-1354
16. P. Markopoulos. ASTRA. [PhD?](#) dissertation (unpublished)
17. Patrick, E., & Metcalf, C. (2001). Mediated communication between extended family and friends: A case study. Technical Report for the Motorola Labs RMTR 2001, Schaumburg IL.
18. Pedersen, E.R., & Sokoler, T. (1997). AROMA: Abstract representation of presence supporting mutual awareness. Proceedings of ACM CHI '97 Conference on Human Factors in Computing Systems, 51-58.
19. Pryor, K. (1999). Don't Shoot the Dog. Bantam Books.
20. S. Conversy, W. Mackay, M. [BeaudouinLafon?](#), N. Roussel. [VideoProbe?](#): Sharing Pictures of Everyday Life. 2004 unpublished.
21. S.S. Intille, "A new research challenge: persuasive technology to motivate healthy aging," Transactions on Information Technology in Biomedicine, vol. 8, 2004.
22. Sawhney, N., & Gomez, H. (2000). Communication patterns in domestic life: Preliminary ethnographic study.
23. Washington, W. (2001). Exploring Ambient Media Presence Awareness. Masters Thesis, University of Washington. http://depts.washington.edu/dmgftp/publications/pdfs/wwashington_thesis.pdf

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• Figure 1:

	CONTEXT	NO CONTEXT
SYNCHRONOUS	INSTANT MESSENGER CHAT TEXT	TEXT
	IMAGE	IMAGE
	AUDIO	ROOMLINK PHONE TELEWINDOWS
	VIDEO	VIDEO CONFERENCING VIDEO
	IPL HABITAT WATCHME A R O M A ONE2ONE DIGITAL FAMILY FRAME	ICONIC
ASYNCHRONOUS	TEXT	SCANBOARD EMAIL SMS MESSAGEBOARD TEXT
	IMAGE	ASTRA VIDEO PROBE KAN-G IMAGE
	AUDIO	VOICE MAIL AUDIO
	VIDEO	VIDEO
	ICONIC	ICONIC

CASY-G