The Sounds of Togetherness

Hanieh Shakeri
School of Interactive Arts and Technology, Simon Fraser University
Surrey, BC, Canada
hshakeri@sfu.ca

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

William Odom
School of Interactive Arts and Technology, Simon Fraser University
Surrey, BC, Canada
wodom@sfu.ca

ABSTRACT

When people live in a home with others, they feel connected through passive, subtle signs of togetherness. Feeling co-present and connected over distance is a challenge, especially when living across different timezones. A key challenge when designing for communication over timezones is the difficulty of arranging synchronous communication, which makes traditional methods like phone conversations or video calls difficult. Additionally, the richness of passive, ambient togetherness is lost through these communication methods. We investigate the role of sounds in passive togetherness in co-located homes, and speculate about their implications for asynchronous design for togetherness over distance.

CCS CONCEPTS

• **Human-centered computing → Ubiquitous and mobile devices**.

KEYWORDS

family communication, togetherness, soundscapes, smart homes

ACM Reference Format:
Hanieh Shakeri, Carman Neustaedter, and William Odom. 2021. The Sounds of Togetherness. In *Companion Publication of the 2021 Conference on Computer Supported Cooperative Work and Social Computing (CSCW '21 Companion), October 23–27, 2021, Virtual Event, USA.* ACM, New York, NY, USA, 4 pages. https://doi.org/10.1145/3462204.3481776

1 INTRODUCTION

Maintaining a sense of togetherness is a challenge for families and couples that are separated by distance. A major part of the interactions people share in a co-located household are implicit, passive actions that span long periods of time rather than session-based interactions. Examples of this are hearing someone walking around in another room in the house, or seeing them in your peripheral vision. Previous research has suggested that passive interaction can create a heightened sense of closeness [de Ruyter et al. 2003]. However, common communication technologies - such as video calls [Heshmat et al. 2017; Judge and Neustaedter 2010; Judge et al. 2011; Kirk et al. 2010] - revolve around high-engagement interaction sessions and shared activities. While these systems are effective for *communication*, they are not necessarily the best way to capture *togetherness*. We define togetherness as the feeling of being together in the same place.

Here, we specifically examine the role of sounds in creating this sense of passive togetherness. Sounds play a major role in establishing togetherness in the co-located household, marking people's presence even when they are not visible (such as when they are in a different room). We conducted a week-long field study in the home of one of the authors, examining how sounds create a sense of togetherness, and conducted a small survey to collect preliminary data from other households. The findings of these studies then led to the proposal of three technology designs that are fully asynchronous and assume different timezones.

We aimed to answer the following research questions:

(1) RQ1: Through what sounds do co-located families experience passive togetherness?
(2) RQ2: How can we replicate or support this experience when designing for delayed communication over distance?

In RQ1, we intended to learn about the types of sounds that create a sense of passive togetherness, and field research in the home was the best way to gather information for this. Other methods outside of the home would provide a very limited view of the sounds present in the home, constrained by participants' memories and impressions. A limitation of this approach was that we conducted the study only in one home, which is not representative of sounds of togetherness in all homes. To help overcome these limitations, we collected some preliminary data from two other homes through a survey. The contributions of this research are the following:

- Describing types of sounds that can create a sense of passive togetherness.
- Proposing three asynchronous-togetherness technologies for distance-separated togetherness.

2 RELATED WORK

2.1 Passive Togetherness

When people are co-located with members of their household, much of their social awareness is in the periphery, and is always present. For example, a study by de Ruyter and Huijnen found that the peripheral awareness of a remote group of friends' video feeds resulted in feelings of social presence and belonging while watching a television program together [de Ruyter et al. 2003]. This phenomenon was confirmed by a secondary study by Markopoulos et al [Markopoulos et al. 2005], and was leveraged in several social presence systems. For example, the Social Hue is a system that uses lighting to create social presence between the elderly and their caregivers by adjusting the lighting according to users' physiological information [Davis et al. 2016]. Another example is Damage,

CSCW '21 Companion, October 23–27, 2021, Virtual Event, USA

ACM ISBN 978-1-4503-8479-7/21/10…$15.00
https://doi.org/10.1145/3462204.3481776

a wearable prototype display that shows ambient group messages [Williams et al. 2006]. Strong and Gaver introduced three systems for distributed togetherness [Strong et al. 1996] including Feather, Scent, and Shaker, which connect homes through visual, olfactory, and tactile senses. An ambient tangible system called *cAMpanion* connects pet owners with their dogs [Pan and Kuo 2021]. While these interactions are non-session based, they are not fully passive, and require at least one person to be actively engaged in the interaction. Here, we explore togetherness that can fully fall into the background of one's attention.

2.2 Meaningful sounds

In a co-located home, we hear a soundscape that is uniquely recognizable and meaningful in establishing emotional associations [Torresin et al. 2021] and togetherness. Lottridge et al. created a system called the Tangible MissU for sharing this soundscape - specifically, the Tangible MissU allows a distance-separated couple to share their ambient home sounds as well as music playlists [Lottridge et al. 2009].

Soundscapes have been extensively studied in contexts outside the home. For example, The World Soundscape Project was started in 1969 to examine how environmental sounds were being masked by noise pollution. The audio compositions that were created from a wide range of field recordings characterized the audio environment of Vancouver, BC, where the project took place [Truax 2013].

2.3 Slow technology

Slow technology is a design framework that shifts away from the model of quick fleeting interactions, allowing for interactions to be experienced over months or years [Odom et al. 2012]. Hallnas et al. describe the potential of slow technology to support reflection, rest, and expression, and they emphasize the importance of aesthetics in slow technology [Hallnäs et al. 2001]. An example of this is PhotoBox, a photo printer that is designed to fit within the aesthetic of the home that automatically prints photos at random times over several months [Odom et al. 2012]. Another example is LunchTime, an interactive multiplayer game about making healthy food choices, where each game is played across 10 days, with each move happening once every 12 hours [Orji et al. 2013]. Hallnas and Redstrom explain that slow art can be a method of amplification in the way that it brings emphasis to things that may otherwise have quickly passed by. Meanwhile, it also creates abstraction [Hallnäs and Redström 2001]. These are two qualities of slow technology - the emphasis on meaningful moments and abstraction of private details - were inspiring to us, and we applied them to the design proposals for slow home-to-home interactions that are richly social while maintaining a level of privacy.

3 DATA GATHERING

Field Study: We conducted a week-long field study in the home of one of the authors (young adult living with a parent), in which they made use of a design probe in order to record sounds that they associated with togetherness, and took notes on what those sounds meant to them.

We found that a good way to capture audio from a variety of spaces within the home was not to create many recording devices, but to have one that could move with the participant. We designed a sound recording belt (Figure 1) - worn around the waist. It captures a minimum of movement noise, while also being convenient to access. We sewed two compartments into the belt attachment to hold the recorder and note cards. The participant wore this belt throughout the week. The recorder was always recording audio; when they heard a sound that created a sense of togetherness, they would hit a button immediately afterwards to mark where that sound had occurred, which allowed retroactive recording rather than anticipating when a sound will occur. They would then pull out a note card to note down what the sound was and how it made them feel, and then place it in the back of the stack. The order of sound recordings and written notes remained the same, such that they could be matched after the study.

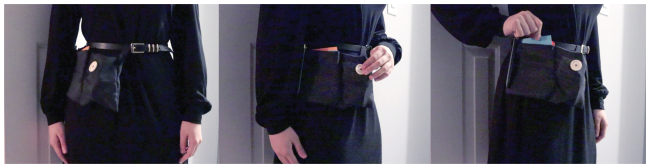

Figure 1: The sound recording design probe was a belt which held a constantly-recording microphone that allowed retroactively marking sounds, and a stack of note cards for making notes on the marked sounds.

Survey: Since the field study was conducted in just the home of one of the authors, we wanted to compare this with sounds from other homes to see how people in different living situations experience passive togetherness through audio in different ways. We conducted an informal online survey where we provided seven different prompts, (e.g. "What sounds make you feel at home?", "What does companionship sound like to you?") for recording sounds that create a sense of togetherness, and asked the participants to reflect on each sound. There were two respondents to this survey: P1 is a young adult who lives with a partner, while P2 is a young adult who lives with a partner and 7 year old child.

Results: Across the field study and survey, there were a wide range of sounds recorded. We conducted a thematic analysis on the note cards collected during the field study and written notes collected from the survey, listening to their corresponding sound clips for clarity when needed. We coded each note with descriptors for the information communicated through that sound, as well as any emotions evoked by that sound. While some of the sounds were very specific to the participants' living situations, all of these sounds fit into one or more of the following themes: *sounds of existence, action sounds, location/distance sounds, sound of others interacting,* and *personally meaningful sounds.* These themes describe aspects of the sound that were notable to the person who recorded them, and are not necessarily categories that are separate from one another. For example, a sound of existence may indicate someone's location in a space, and may also be personally meaningful.

Sounds of existence. This category includes the most ambient and passive of sounds, including things like breathing. These sounds were harder to notice, and were mentioned mainly in the field study. During the field study for example, the participant made a note that the sound of the running aquarium made them feel "warm

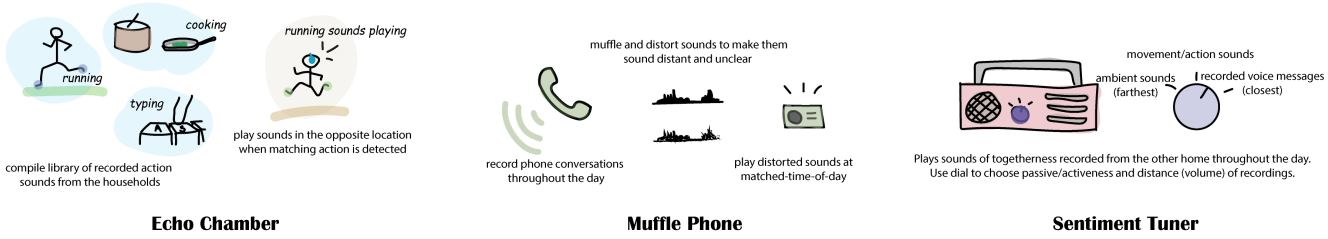

Figure 2: The Echo Chamber records sounds in both homes and classifies them based on activity. When an activity takes place in one home, the corresponding previously-recorded matching activity sounds from the other home are played. The Muffle Phone records phone conversations in one home and muffles and replays them in the other home in order to sound like conversations coming from another room. The Sentiment Tuner plays asynchronous audio that the user can control with a dial, dialing between distance, ambient sounds and close-by, personal sounds.

and at home", connecting them with their pet. With these sounds often being very quiet, they varied a lot depending on where the participant was located. In more communal places in the home, these sounds were much more noticeable.

Action sounds. Action sounds include sounds that communicate what the other person in the home is doing. These were the most commonly occurring sounds for all participants, ranging from sounds of cooking to sounds of a child playing. One of the most frequently occurring action sounds was the sound of typing. P1 noted, "keyboard noises are a near constant background noise in our house". During the field study, the participant found that they were semi-consciously searching for these sounds. When they did not hear any action sounds for an extended period of time, it actually caught their attention, making them wonder what others in the home were doing.

Location/distance sounds. These are sounds that indicate someone's location or distance. This included sounds like walking in another room, opening and closing certain doors, or sounds that are very close-by. An example of this from the field study was hearing fluorescent lights hum for a second, which indicated that they had just been turned on because someone had entered the kitchen. These sounds sometimes indicated the start of an active interaction - for example, before a conversation they would hear footsteps approaching.

Sounds of others interacting. Interestingly, one of the categories was the sounds of other people actively interacting with one another. This included sounds of others interacting in another room, or hearing one side of a phone conversation. P2 even noted that the sounds of her son talking to his toys connected her with his "vibrant childish energy". During the field study, hearing others interact made the participant feel a sense of social belonging even without joining the interaction.

Personally meaningful sounds. The final category was sounds that are personally meaningful to people because of their emotional associations with those sounds. This included sounds of pets, certain tunes being whistled, or other sounds that would not be meaningful without context. In the field study, an example of this was hearing a song that reminded the participant of their childhood. For P1, hearing "[partner]'s feet tippy tapping" was meaningful because it indicated to her that her partner was playing an exciting game. For P2, the sounds of baking had personal meaning to her because of her love of baking, and she found it "deeply comforting and homey".

4 IDEAS FOR FUTURE WORK

To generatively engage with the resulting themes from the field study and survey, we speculated on ways in which these kinds of sounds could be replicated for distance-separated togetherness. Next, we detail early outcomes in the form of three design proposals that are part of an ongoing Research Through Design process. A key characteristic of all of these ideas was their asynchronous nature, which would make them well-suited to a communication delay between homes.

The **Echo Chamber** (Figure 2) idea mainly draws on the category of *Action Sounds*. This design connects people through sound based on their shared activities. Over time, the system gradually builds a library of sound recordings from both homes with associated actions. When an action is taken in the other home, the corresponding sound is played, in order to accompany the person in their activity. For example, if someone goes running, they would hear running sounds that had been recorded in the other location. This hypothetical system emphasizes the need for accompaniment in activities, even when people are not actively interacting with one another. Certain tasks are often passively shared as a form of motivation, such as studying together or exercising together. On the other hand, not all activities are ones that we want to share with others. The Echo Chamber could soon become a nuisance if it prevents people from having alone time where they can focus on their activities. Future design research could investigate which activities are most appropriate to share, and the role of passive accompaniment as a motivator, and the role of wearables and smart home technology in recording activity sounds.

The **Muffle Phone** (Figure 2) draws on the category of *Sounds of Others Interacting*. In this system, the phone calls of one person would be recorded with their permission. The sounds would then be muffled and distorted to sound like they are coming from another room in the house. They are then played in the opposite household at the matched time of day (i.e. if they were recorded at 9AM at one location, they would be played at 9AM at the other location). The Muffle Phone attempts to strike a balance between active and passive interactions. We often want to be social and to feel as

though we are part of a group, even when we don't want to actively engage in interactions. Conversely, witnessing others interacting without having the means to join in could perhaps make the remote person feel as if they are missing out. Future design research could further explore how group ambience can be used to create a sense of belonging for people who are distance-separated from their social groups.

The **Sentiment Tuner** (Figure 2) draws from a few different categories of togetherness sounds, including *Sounds of Existence*, *Location/Distance Sounds*, and *Personally Meaningful Sounds*. This is an audio player that plays asynchronous audio with a dial that lets the user go between the passive, distant, and impersonal side, and the active, close, and personal side. On the passive side, there are far-away sounds of existence, and on the other side there are close-up personal recorded voice messages. The Sentiment Tuner aims to replicate the transition from passive to active interactions in a co-located home. When we are engaged in our own tasks, we are usually only passively aware of others in the home, but can choose to rejoin active interactions when we feel ready for them. However, this system would require each person to always be the one to "initiate" active interaction by purposefully adjusting the dial. When we are co-located with others, different people initiate active interactions at different times. Future design research could explore different methods of control for transitioning from private to public "spaces" in digital asynchronous audio, as well as how to obtain consent when recording sounds in order to prevent intrusions on privacy.

5 CONCLUSION

Feeling co-present and connected over distance is a challenge. A key challenge when designing for communication over distance is the difficulty of scheduling synchronous communication which makes traditional methods like phone conversations or video calls difficult. Additionally, the richness of passive, ambient togetherness is lost through these communication methods. We specifically investigated the role of sounds in passive togetherness in co-located homes through a field study and small survey. Using themes extracted from the data gathered through these methods, we suggested potential technology solutions and implications for asynchronous design for distance-separated passive togetherness. A limitation of this project is the small sample size for the study, especially as all of the participants for the study were based in a North American cultural context. With each household having a unique dynamic, studying a wide range of homes is important in order to accurately characterize common themes.

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