

# FamilySong: Designing to Enable Music for Connection and Culture in Internationally Distributed Families

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## ABSTRACT

FamilySong aims to connect internationally distributed family groups via synchronized music-listening. It fosters feelings of togetherness and mutual belonging, that is, connection and culture. We conceptualize it as a domestic Media Space with no live audio or video. It emphasizes intimacy without intrusion, and lives within an existing ecology of interactive technologies. The design journey includes both autobiographical and research-through-design components with similarly-structured family groups (very young children with parents located in the United States and grandparents in Ecuador). Parents, children and grandparents all participated both in the moment and in subsequent interaction grounded in the FamilySong experience. Grandparents took the lead in expressing the importance of the values and goals they saw embedded in the system. This work presents a design that illuminates what it means to *connect like a family* in which values, needs and priorities are interdependent, and joy and delight are important.

## Author Keywords

Media Spaces; Sharing Music; Co-listening; Expressive and Intimate Communication; Design-Based Research; Autobiographical Design; Research-Through-Design

## CCS Concepts

•Human-centered computing → Empirical studies in collaborative and social computing; Empirical studies in HCI; Collaborative and social computing devices;

## INTRODUCTION

Families separated at distance and across national borders develop a network of practices, devices and services to maintain connection with dear family members [50, 51, 74]. The difficulties already present in maintaining rich interactions at a distance [7, 41, 53–55] are too frequently exacerbated by issues with the adoption of technology and infrastructure problems such as poor internet access or connectivity in other countries. For families with very young children the complications are

even more dire as the opportunities for direct inter-generational bonding are more limited. Parents and grandparents perceive an ever-growing divide between their pre-verbal children and the rest of the family, especially if the child is learning a language different than theirs. The HCI and CSCW communities have extensively explored the difficulties of *sustaining rich communication* and developing meaningful relationships between small children and far-away relatives [3, 4, 52], including through the use in domestic media spaces.

Our design impetus begins with a whole family approach. Parents have an overarching interest in family connections while keeping control of their time, privacy and intimacy. Evjemo et al. [22] recommend that systems connecting young children and grandparents should *offer a context* for participants to take up in their interactions.

The key contribution of FS is the design of a system in which shared-synchronous music (1) is important and enjoyable for all family members, (2) provides a context for the participation of young children, and (3) grounds other inter-generational interaction occurring through the existing ecology of communication devices and practices.

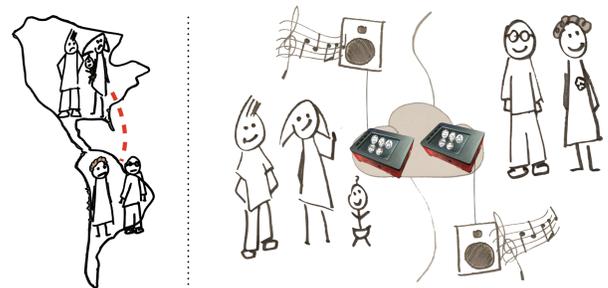


Figure 1. The families in this study struggle finding ways to maintain relationships with far-away loved ones. Using FS they can connect by sharing music.

*Media Spaces* and *music* are used to allow *shared expressive, intimate, minimal* everyday experiences between loved ones. The system requires little effort from participants, and avoids privacy breaches between the individual households—an undesirable characteristic of many domestic Media Spaces [7, 41–43, 53, 54]. The investigation surfaces some properties of what it can mean to *connect like a family*, that is as an entity in which values, needs and priorities are interdependent and joy and delight are important. At their best, the values in play

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can be described as analogous to *umami*, the fifth component of taste that indicates a fulfilled richness of experience. FS has the potential to enrich daily quotidian moments with a sense of mutual-awareness, and creates mutual belonging that lends itself to take-up in conversation without distracting from necessary life activities.

FS alters our thinking about Media Spaces by creating the opportunity of having a shared place without the immediate sharing of virtual space [37]. It also deepens the discussion of computer-mediated intimacy. We are motivated by family separation. Some of our finding may be relevant for families separated under more fraught conditions; however, this work assumes stable residency and access to sustained connectivity.

This paper reports the evolution of FS from autobiographical research [55–57] to small-scale research through design (RtD) [75, 76] including a two-week study with two family groups including 12 users.

## BACKGROUND

One of our basic needs is to maintain connections, especially with loved ones [39]. The current work begins to drill down on a design potential associated with internationally-separated families. The design solution we propose and explore here constitutes a weaving of design opportunities and tensions into realized action [69] that is of direct interest and as part of a historical, cultural development. FS offers a remedy to the fact that interaction on video-chat is most successful when participants are engaged and focused. This remedy is important for all family members but most important because young children have difficulty engaging in focused interaction in the absence of a shared sensory environment [3, 4, 50]. Particulars of the design go beyond remedying a problem to the creation of the opportunity for multiple valuable kinds of connection and intimacy for all users.

### Family Separation

Family separation across international borders creates conditions that arguably make the maintenance of connection even more important than it would be otherwise. But not all separations are the same. In this case, participants have geographic distance and live in different cultural contexts than one another; however, unlike in other work that addresses forced migration, they are not fleeing injustice and their living situations are stable. Mobile connections have been explored [48] and may be design requirements under more fraught conditions. So, though sharing many of the same concerns and values, the current exploration is of a different part of the design space that allows us to draw on the power of the creation of shared place.

### Extending Space

Media Space was the early idea that video and audio connectivity could be envisioned as an extension of physical space. The core idea of extension turns out to be more complex—both more and less than the original Media Space impulse—so it still requires theoretical explanation, design elucidation and empirical, experiential exploration.

The earliest Media Space research used “always on” audio and video connectivity [6, 19, 20]. It focused on facilitating serendipitous, as opposed to planned, opportunities for interaction and collaboration. In this original conception, “space” was the opportunity and “place” was the socially understood reality [37]. “Place” was therefore a social construct that appeared in the intersection of a specific location, of people interacting in it, and of events occurring [38]. A Media Space sets up the conditions under which places for shared experiences between participants may be created. The potential for serendipity is an important and enduring value in the design of such systems.

### Privacy

One area of foundational complexity is that using technology to extend space has different effects on visual and audio perception, so that from the earliest days of research it became apparent that advantages to one did not always align with advantages to the other. People can more easily gauge their behaviors and the behaviors of others in the visual realm than in the audio. This underlying difference led to a great deal of exploration of privacy [36].

Prior work has sought to address privacy concerns through various mechanisms. The first observations of the seminal Media Space at Xerox PARC showed that users would make actions private by simply occluding or refocusing the camera. The RAVE Media Space at EuroPARC expressed a concept of degrees of engagement in a highly configurable Audio/Video Environment. Users could select between different modes of connection to remote locations, from brief one-way connections called sweeps and glances, to two-way office-sharing and video calls. Users could also determine which individuals would be able to initiate any of these types of interactions [33]. Other authors have attempted various alternatives for assuring privacy by filtering the audio and/or video to remove sensitive information, by encrypting communication channels to prevent eavesdropping, and using sensors to provide feedback on connectivity and presence [7, 21, 26, 53, 54].

In each case, the creation of privacy reduced the potential for serendipitous encounters, creating a kind of gradient of trade-offs.

### Intimacy

Privacy is not the only challenge to the successful use of media space connectivity in intimate settings. An omnipresent human challenge is how to negotiate the unfolding of interaction over time. There are multiple and overlapping frames of experience from from public to very intimate. When is it appropriate to say something? How long should a contribution to conversation be? What is enough to say? [12–14, 63]. Task-oriented, goal-directed speech is easiest to gauge and regulate, so much early research engaged in examining how well it could be conducted, for example, with and without video [23–25, 30, 45]. Indeed, video-based interaction with children suffers from lack of context so that Ballagas et. al., [3, p. 162] write “most families still had trouble keeping the children engaged for more than a few minutes ... videochat alone seems not to be sufficient for addressing families’ desires for a sense of togeth-

erness.” Some research on promoting intimacy has prioritized serendipity in creating context.

The current work is in the realm of Domestic Media Spaces, those that can facilitate the building of relations between remote family members. Judge et al. [41] contrast *sharing conversation*, fully-engaged experiences that focus on an exchange of messages through the medium, with *sharing life*, that is, sharing daily activities especially with respect to toddlers and infants (e.g., feeding and bathing babies, or watching them sleep). Sharing life contributed to a sense of connection between remote family members. A more focused approach to sharing life is exemplified in Performance Apron and Talking Bottle [10], a project that brings design attention to a particular kind of moment, the experience of shared cooking, by using everyday items augmented to permit the exchange of messages and sounds in the kitchen. Arguably, the trade-off between privacy and serendipity became even more important in Domestic Media Spaces than in workplace ones. A negative outcome is that some participants who do not wish for connection may avoid the room where a domestic Media Space is installed. Some such media spaces have promoted privacy by avoiding the use of microphones altogether, or implementing virtual restrictions on the two-way video such as lowered-frame rate or resolution, or occlusion via virtual blinds [43].

#### *Expressive, Intimate and Minimal Communications*

A number of important lines of research solve the problem of privacy and serendipity by creating minimal, punctuated moments of anticipated attention. They emphasize reminders of the idea of the remote person rather than in-the-moment, known, verifiable interactions.

By relaxing the constraint of making a shared *space*, Strong and Gaver were able to experiment on “designing for minimal, expressive communication.” Feather, Scent, and Shaker allow their user to engage the remote partner’s sight, sense of smell, and touch, respectively with a remotely-activated gesture [68] that caused a fan to make the feather to float in the air inside an enclosure, essential oils to burn to impart a pleasant scent to the room, or an object to vibrate (shake). These actions contextualize a potentially powerful communicative intention between intimate partners, transmitted and received with minimal cognitive effort.

Brereton et al. [8,9] showcase more opportunities for minimal, unobtrusive connection with their Messaging Kettle and Ambient Birdhouses. Both projects create artifacts that combine message and opportunity. By glowing in one place when in use elsewhere, the Messaging Kettle can be seen as providing ambient knowledge and associated sentiment. The object sits in the background and does not require attention, but does permit it.

We consider these projects at one extreme of a design space also occupied by Media Spaces because of their openness to casual, serendipitous awareness.

#### **Beyond Intimacy: Music as a Nexus**

Sound and music are more important than many tend to realize. Horowitz [40, p. 12] argues that the vibrations associated with sound are the foundation of the first sensors created by

organisms, the most primitive form of detecting change in the environment (through motion in aqueous surroundings). Hearing is a specialized form of detecting vibration. It thus constitutes an elemental form of embodied connection to the world, including, of course, other people. The mother’s breath and heartbeat are early sensations, both heard and felt. Dance, a human activity that crosses ages, cultures, and history, ties together the experience of particular forms of sound that we call music with physical expression, often in a social context.

These encompassing properties have been described in the literature. Music is described as an agent in developing “social, psychological, and emotional structures” [46] and as a space where relationships are built. O’Hara et al. [59] argue that all the activities surrounding music, from listening or overhearing it, to selecting and purchasing it, form our cultural identity and give shape to our experiences of sociality when listening together, or sharing music with others.

Music may act as a recognizable sign [16–18] but technologically motivated changes to how we encounter music (such as via ring-tones and notifications) may push the meaning of music-like sounds more towards limited foreground content (such as “*answer the phone*”) rather than rich cognitive or emotional experiences [35].

#### **Co-listening**

Prior work has brought together music, intimacy and Media-Space-like connectivity. Building on the allusive properties of music, Kirk et al. focus on sharing. They emphasize the role that music can have in bringing people together who are *spatially* co-located [44]. Their PocketSong system enables such connections between strangers.

Kirk et al. also support and mention *temporal* co-listening but it is not their focus. The CoListen project [66,67], discussed below, uses the term *co-listening* to designate *only* temporally synchronous listening. We follow CoListen’s usage because we explore the emotional immediacy and assurance of known temporal synchronicity.

MissU is close to our vision because it investigates the importance of “sharing empty moments” in the daily routine of romantic couples living at a distance, as a way to enrich their lives [49]. The project integrated the consumption of music into a media-space-like environment. The couples shared a private-radio station with a user-controlled option to transmit ambient sounds through a microphone. Users were able to listen to music synchronously and also mix-in live ambient audio from their microphones. Participants employed a range of different behaviors with MissU. Some used it as an always-on connection, some as a readily-available phone, and some as a shared music player only. This allowed users to have different relationships to the music itself, running from focused attention to ambient background.

Like MissU, the CoListen project supports a range of relationships to music; however, MissU integrates different modalities, creating one trade-off between privacy and serendipity, while CoListen [66, 67] takes a different approach. In CoListen, only music is shared, thus eliminating any concern about inappropriate over-hearing or distraction. CoListen is aimed

at students, especially 10-13 year old children, who wish to maintain a sense of contact with friends—even though explicit contact may be unavailable or forbidden for various reasons including maintaining a primary focus on homework. It assumes one child in a location per device and is therefore aimed at children listening with headphones. Unlike MissU, it also assumes that students exist in fluid social networks that may involve switching partners in the shared listening endeavor.

In conceiving, designing and analyzing the current work, we have found ourselves tying together these threads of the literature. Initially, we considered the ways that Media Spaces try to allow participants to feel together; however, technologies that provided sharing in the office were seen as intrusive at home. We found inspiration in simple but highly expressive designs for sharing, such as those in [8, 9, 68], but these focused on a kind of notification, punctuating ongoing moments with thoughts of the other, rather than providing a shared background. Along with our personal observations, other lines of research led us to consider the immediate, on-going and enduring properties of music for shared experience, communication and building relationships [44, 46, 47, 59].

Work in this area balances privacy and serendipity on one hand and intimacy and intrusiveness on the other. The balances that projects choose are tuned to the kinds of relationships and situations that they address. Like MissU and CoListen we saw that music could ground relationships [49, 66, 67]. The design journey has revealed that, at its best, designs may support important human values in connection more than mere grounding, by analogy, closer to *umami*.

## THE CURRENT WORK

We began experimenting with connectivity in the homes of our primary researcher and his mother-in-law as a way of providing a shared co-temporaneous sensory experience of music that would be acceptable to all residents of multiple households. We saw the potential for music to facilitate a multi-layered experience.

FS provides assurance to users that they are hearing the same music at the same time as others. However, while CoListen is centrally concerned with one young person reaching out to a peer-group, FS is centrally concerned with building and maintaining a web of connections with known and important family members who share an interest not only in their own positions but in all the relationships. From the beginning, FS differed from CoListen in two ways that cause it to occupy a different socio-technical design space: (1) FS connects two known places rather than a dynamic and mobile group of friends. (2) FS uses dedicated devices and speakers in publicly available places within the homes rather than privately held smart-phones. Maintaining the web of relationships necessitates a design that (1) finds the right balance of respect for privacy and sharing, (2) integrates socially with the larger ecology of devices that maintain connections between the family members and (3) allows freedom of action while refraining from imposing too much on any kind of family member (children, parents, grandparents).

Iterative design and debugging continued as we began to study use and reactions to the system in two new groups of families, recruited through personal connections. Both family groups consisted of parents and young children living on the East Coast of the U.S. and remote grandparents living in Ecuador. This geographical constraint meant that our participants did not have to negotiate significant time-zone differences when communicating.

## Methods

We started with autobiographical research and self-study [56] and moved to Research Through Design (RtD). These related methods involve self-study and a tight-coupling of design adjustments to qualitative indicators of satisfaction from participants and as noticed by observers. Both are components of handling wicked design problems in which the definition of the problem and solution are tightly coupled [62]. Autobiographical design is appropriate when the researcher has personal and intimate access to the complexities and priorities of the design space and enduring interest in the outcomes. RtD engages participants in the elucidation of multi-faceted, tentative and unknown aspects of the relationship between technological decisions and use [32, 75, 76]. In this case, the researcher's own experiences and informal encounters constitute the basis for adjustments to design and approach. The RtD was informed by email, WhatsApp chat group interactions, and focused, semi-structured interviews with parents and grandparents.

Initial observations led to the implementation and testing of the first prototype. Lessons learned from this prototype informed the design and testing with other families of a second prototype.

## STUDY 1 AND FIRST PROTOTYPE

The autobiographical portion of this design journey began by observing the interactions between our primary researcher's young daughter Eva (18 months) and her grandparents Juan, Laura, Miguel, and Leticia (all over 50 years old); all names are pseudonyms.

Eva is the first grandchild for both sides of her family. Around the time of the move, Eva was beginning to use words and short sentences to express needs, but could not yet engage in running conversation. Not surprisingly, her verbal environment consisted primarily of discussions about on-going processes, play-led activities, and objects. Interactive play primarily consisted of physical interaction (such as walking together, playing on swings, and so forth) or artifact-oriented interaction such as passing toys. As noted by [3, 4, 52], communication with her depended on her physical environment and co-present objects, making connection via videochat technologies difficult.

After the move to the U.S., the researcher observed that videochat did not seem to hold Eva's attention. Eva's grandparents expressed frustration because they did not receive appreciative replies to their prompts. This caused concern in the parents. We speculate that cultural factors caused a heightened sensitivity to this because there appears to be a relatively high expectation for extended kin relationships including co-operation in parenting practices between parents and grandparents in the

Ecuadorian context. Although middle-class families do not live together, they often live nearby, share childcare, and spend at least one entire weekend day together in family groups.

The family as a whole cherished small opportunities but developed them in different ways based on their interests and successes in eliciting responses. With Juan and Laura, daily conversations with Eva, mediated and supported by her parents, revolved around a game of showing her their already familiar apartment and asking “what is this?” Eva remembered decorations and paintings on the walls, as well as specific locations and rooms. Juan and Laura took their phone around the house and prompted her to say the Spanish names of artifacts (e.g., “pez” referred to an abstract painting with some fish shapes, there was also a “barco” painting and various “aves” paintings). Eventually, they introduced English nouns (fish, boat, birds) into the conversation. The interactions became more bidirectional as Eva began to request objects (e.g., “show me the fish”) instead of only replying to questions. Juan and Laura went on to accumulate small toys and figures in a coffee-table basket that they could use to play the game at the dinner table, without touring the whole place. Five years later, although their respective bilingual skills are considerably more sophisticated, they still enjoy parts of this routine.

These interactions echo the kinds of findings that have encouraged researchers to supplement focused activities by making visually attractive shared prompts like Family Story Play [5, 60], StoryVisit [61], People in Books [27, 28], TakeMeWithYou [52] and ALLT-Book [52].

Miguel and Leticia drew our attention to another potential. They were interested in getting Eva to sing songs in Spanish. As Eva developed her capacity for this, we observed expressions ranging from heightened interest (as opposed to disinterest in regular conversations) to repeating the melody and eventually memorizing pieces of the songs.

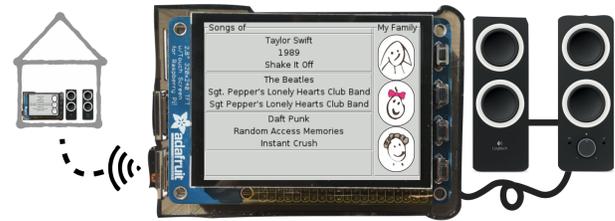
This endeavor drew our design attention toward sharing music but highlighted a practical shortcoming of telecommunications, namely that the latency of the medium meant that co-action was not really possible. That is, remote participants could not sing together without interference.

Both of the strategies that we observed in the grandparent groups emphasize the significance of simple and intimate connections to building relationships through the shared creation of meaning and identity at a distance. Leticia, in particular, saw the effort to get Eva to sing songs in Spanish as an attempt to help Eva maintain her identity as Ecuadorian.

The role of the parents in this was subtle but important. They created the conditions under which it could happen; they enjoyed and participated as spectators; sometimes they sang along, displaying their own knowledge of the songs; they monitored and redirected the child’s attention and they also occupied the connected time with their own connection to their parents and in-laws. The burden of connectivity did not fall upon the child but was constituted in the shared space created by Skype.

## Initial Design of FamilySong

The lessons that we took from these initial observations defined a novel place in the design space. Unlike shared readers, FS would create opportunity for sharing without demanding prolonged, unvarying attention. Like CoListen, it would position itself along the privacy-serendipity trade-off to avoid intimacy violations. It would implement a medium, that like Feather, Scent and Shaker [68] would require very little attention from the users, while offering a shared space that *could* come into focus for individuals or family members as they please.



**Figure 2.** The first prototype included rudimentary playlist control and information through its touchscreen interface, as well as a limited area for some of the family members status displays. Each device needed wireless connectivity and access to wired speakers.

In this initial installation we used a Raspberry Pi (RPi) to connect to a private streaming server (Mopidy). The device featured a built-in touchscreen to show the current song’s name and artist, along with a limited way to control playback (i.e., play/pause, back, skip). Users’ faces were shown in the screen and their opacity could be toggled by touching on them to indicate the family members’ presence. See Figure 2. Music selection was performed via a front-end plugin to Mopidy called Musicbox, which provided a responsive web interface that participants interacted with via phones, tablets or computers.

Having decided not to support live video or audio, we focused on creating features to support awareness. We implemented and tested two independent features to notify users about the remote party’s presence: *audible notifications* would announce that a participant’s status had changed; *bilateral availability* required that at least one participant from each home was reported as available for music playback.

### Findings

FS met with initial success in that Eva and Leticia found that, although they could not sing together (because of latency) they could still share songs in other ways in interactions held *after* listening to them through FS. Eva would sing nursery rhymes in English, which Leticia recognized. In turn, Leticia found that though the lyrics were different, melodies persisted. She enthusiastically tried to teach Eva the Spanish-language versions of those songs and Eva began to sing in Spanish as well.

The importance of the ability to have *subsequent discussions* of the music was an important outcome of this experience.

However, neither notification system proved entirely satisfactory due to their obtrusiveness. There were immediate com-

plaints that *audible notifications* interrupted the enjoyment of the music, and forced the system to the forefront of attention. Similarly, *bilateral availability* imposed too high a barrier to listening to music, requiring coordination that took away from spontaneity. Leticia listened to her favorite radio station playing while doing chores but Eva and her parents were away all day. Bilateral availability meant that Leticia had to use a different music system most of the time, only switching to FS when prompted.

Initially music selection was limited by an available collection of .mp3 files and CD's. Though some music was in Spanish, all the available children songs were in English. Although Miguel and Leticia learned what music was accessible to their grandchild, it did not include the repertoire that Leticia preferred in her home.

## THE SECOND PROTOTYPE AND STUDY 2

### Using the Design Insights to Create a Second Prototype

The Second Prototype had five differences from the first. (1) It removed the notification alert. (2) We separated the toggleable faces from the semantics of indicating bilateral availability. (3) We removed the bilateral availability requirement. (4) Music selection was expanded by implementing access to the Spotify catalog. (5) We created a separate cell phone/computer interface for managing the connection to Spotify and removed control from the local device.

In jettisoning bilateral availability and control over playing from the local device, but keeping the toggleable faces, we created room for families to create their own semantics of connection.

Adding Spotify complicated the system and the interface(s). Each family group was given a unique web address to manage their song selection and playlist generation through their phones, tablets or computers. Figure 3 shows the architecture of the FS system consisting of a server running Mopidy and other subservices, one RPi per household, and a web application to support the faces awareness feature.

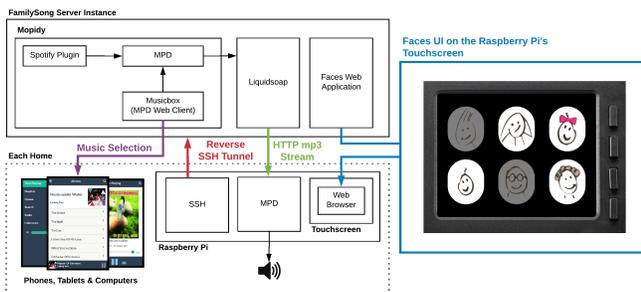


Figure 3. Implementation Architecture: The FamilySong Server, a RPi, and the Faces web interface.

This design made it easier for adults to control the FS device without interrupting their on-going activity.

### Participants and Procedure

For our second study, we engaged in research through design by recruiting two family groups: the Abad family and the

Valencia family (see Figure 4). Both families used FS for a period of two weeks.

The Abad parents (Jorge and Cecilia) and children (Alicia, 5 years old, and Diego, 3 years old) moved to the U.S. for Jorge to study for an MBA. Jorge's parents (Pablo and Ana) participated in this study from Ecuador. The Valencia parents (Antonio and Marina) and children (Miguel and Sebastian, 5 and 3) moved to the U.S. for Marina to study a PhD. Marina's parents (Rafael and Lina) also live in Ecuador.

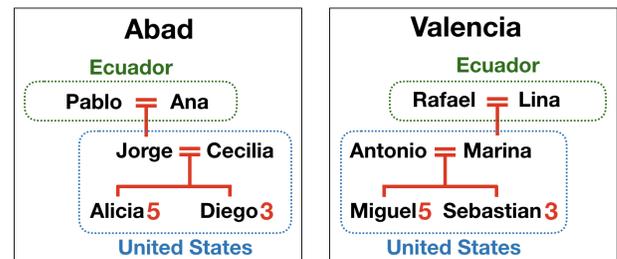


Figure 4. Our two family groups: The Abads and the Valencias.

In both cases, we had a chance opportunity to conduct the study just before scheduled vacations that brought the grandparents to visit their relatives. Interviews were performed in Spanish and face-to-face at the families' homes in the U.S.

We interviewed the participants by couples (e.g. one interview for a parent couple and one for a grandparent couple), expecting partners to help each other in building a narrative of their experience with FS.

### Analytic Method

The semi-structured interviews lasted roughly 30 minutes. We took notes and recorded audio of the conversation. We requested that participants describe musical habits and tastes through the study period, sharing and coordinating of music, awareness of each other, opportunity for communication, and behavior around the Faces feature.

The audio recordings were transcribed and translated to English. Following standard qualitative practices [11], we analyzed the transcripts by identifying themes and looking for emerging patterns within the communications practices of all three participant groups. Themes were tested and refined by discussion with the lab group. These codes were used to create narratives of use and interpretation by the participants, presented in the next section.

### Results

FS met with success in that it was used almost every day by both families during the two week study. Furthermore, the families expressed interest in continuing to use it in the future and even expressed design ideas and directions for the future.

Four themes emerged in our interactions during the study and through the interviews: the ecosystem of technical connections, listening and sharing, culture and family, and awareness through faces.

### *The Ecosystem of Technological Connections*

The ecology of devices and practices in the participants' homes already included heavy use of video conferencing technologies. Primary uses, at various times of the day, were to connect with each other and help entertain the children. The Abad family described habitual videocalls around breakfast, including turn-taking with the grandparents. Cecilia Abad told us “[she] would serve breakfast and setup Skype so that during breakfast it would be like [grandma Ana], [grandpa Pablo] and the kids were having breakfast on the same table. At least in theory.”

Ana Abad related that her grandchildren frequently “did a show” for them—selecting music and dressing up in costumes to dance and sing to her. Through opening up a Skype connection, they verified the same music was playing and then enjoyed it with their usual singing and dancing. Her son Jorge also indicated that knowing that Ana was listening triggered many “shows.”

Video technology was not without problems. Cecilia Abad also reported that, unhappily, video connectivity seemed to spark rivalry in the children in which they would fight to be the center of attention. Marina Valencia related to us that, due to her busy schedule, it was very hard for her to coordinate with her parents about opportunities to have videocalls. Marina also contrasted the interactions between her children and parents, before moving and now: “the kids did everything with their grandparents. It was all love, kisses and everything. Now we have to push them to say hi.” Lina also reported that her youngest grandson would sometimes protest and cry about the request that he greet her: “I don’t want to... [let me go].”

All eight adult participants expressed themselves favorably toward FS as a device that facilitated listening and sharing music. FS increased their mutual awareness. Although, for example, “shows” were not a new occurrence, they happened more often. Video or chat conversations frequently happened specifically due to FS-based awareness. Marina reported texting more frequently with her mom. Often, the purpose was to make sure they were all listening—“Mom, the music is on. Are you listening?” To her, this was a valuable connection.

#### *On listening and sharing: a sometimes synchronous activity*

Rafael and Lina describe listening to music at home and in the car, having shared many car rides with their grand-children before they left. They now missed these favorite opportunities for listening together. As is often the case in Ecuador, the grandparents had played a large part in the grandchildren’s upbringing prior to the move to the U.S. music had been an important part of this. Lina reminded Rafael that—before using FS—they had meant to prepare a USB drive so that he could bring it to their grandchildren filled with their music. With FS, this no longer felt necessary. Lina’s feelings about the connection brought through music were particularly powerful: “We don’t want the babies to lose it [the music]. Because they were raised with the music and singing. This [FS] was a way to continue doing that.”

The embedding of music into these families’ lives and its frequent function as a form of connectivity was captured in Marina’s remark that she and her parents used to play music at

bedtime through their cellphones. Now FS—a separate device—made it easier to control. She was also thinking that her parents would fall asleep to the music.

These comments encouraged the FS approach of creating music as form of experience that could exist in either foreground or background relationship to on-going activity and that could serve to cement relationships, even among adults.

The participants developed usage practices. The Valencia’s home in Ecuador is a two-story house; Lina said that during the mornings she would come downstairs and find the music playing, remarking: “Marina has put music for the babies... It was lovely to see that the babies were listening to music, and that we could see that.” Oftentimes they would unplug the device at night and she would tell Rafael to go turn it on in the morning. At once they would hear the music, affirming that Marina and the children were awake.

Awareness became an important topic that our participants called out directly:

*Jorge: When the device wasn’t working, we noticed. It was easy to spot the difference: You arrive home and it’s not working. It’s something you interact with when you get there.*

*Cecilia: But you still had a topic of conversation.*

*Jorge: [It’s the] presence of the device leads you to that awareness. [It] increases the awareness of the others by a lot. You have this device whose functionality and the setup is shared between both parties. So, for it to work well you always must be aware of whether it’s working on the other side, even if you do see it working in your home.*

These are all examples of our participants themselves constructing the notion of on-going connection. This sentiment was echoed by both parents and grandparents in both families. One grandparent explicitly called out FS’s role, not just as a music player, but in creating connection, commenting “...that is the gadget where we communicate.”

#### *Culture and Family*

Participants reported seeing FS through the lens of culture and family. Throughout the interview, Lina emphasized that she saw FS as a medium for “Family Musical Communication,” a term of her own. The Valencias recall with joy several instances of the children yelling: “that’s abuelito’s [grandpa’s] song!” Lina says of these events: “we heard that and thought that was lovely.” These comments built on Lina’s integrated thoughts about music, family, culture and their role as grandparents:

*Lina: The most important thing was that there was a musical communication ... That we, as grandparents and old people, we don’t want the babies to lose it. Because they were raised with the music and singing. This was a way to continue doing that. Right?*

All four grandparents were enthusiastic about the proposition made by FS and readily took to creating playlists for their children and grandchildren. All four of them pointed out that the songs being shared instilled a sense of Latin culture that the children would otherwise not experience. They enthusi-

astically expressed their emotions about FS with superlatives, deeming the experience “fantastic” and “unbelievable.”

The parents said less about this explicitly, but it is important to remember that they were the linchpins in making the system operate, that they also listened to the music, and that parents in both families went to considerable trouble to maintain connection across the family through a variety of mechanisms.

Sharing culture and connection was not only just a matter of simply playing music, but also of figuring out what music worked in the situation. Descriptions of the activity of playlist creation revealed how different participants conceptualized hopes and knowledge of others. Grandparents and parents created shared playlists, purposefully to please other participants or with an interest in sharing their own preferences.

Not all music appealed to everyone, but people worked around differences in taste. Grandparents tried to make playlists that would please their children (the parents). One grandmother made a playlist for the grandchildren that a father did not like, but he appeared to approach it philosophically:

*Jorge: As a father, you understand that the grandparent is making an effort to interact.*

FS evoked quite a bit of poetic sentiment in some:

*Pablo: Love must be spread every day. If you don't see them, you start... Falling apart. Ana: Memory is fragile.*

Our participants tied together notions of important values and of belonging that could be communicated through music:

*Pablo: Music is a learning process. ... You also start introducing in your grandchildren a sense of belonging to something. We are part of something. There's something in common between you and me.*

It is worth noting that, despite the element of nostalgia in this, these families had varied tastes in music, including Ecuadorian and Hispanic songs but also incorporating American and English 80's rock music and jazz in their conversation with us.

The parents were comparatively muted, but still supported these ideas. They tended to phrase their comments more in terms of what they had done rather than the effect it had on them or their family members. Marina said that, especially at the beginning, she focused on creating playlists and playing songs that her mother and father liked and listened to often, recalling “Merengues or songs from Nat King Cole.”

#### *Awareness through Faces*

It turned out that the Valencia family had put the FS device in a place that the children could not reach. This meant that they did not use the face interface.

However, the Abad family created function and rituals for it.

*Cecilia: I loved that the kids would wake up. They would run to press the faces and say: “Ah! There's grandpa”. And they would ask me: “Should I put you as awake mommy?” They loved the photos, they loved it. They would always wake up and come check them, even if I would've forgotten to do it. Then I would come back and check if they'd done it right.*

The Abad children's use of the faces feature spread through the whole day.

*Cecilia: Diego especially, they always play in this area (living room) and they are close to the machine. They always get tired of a game and turn back to check, they would see the face and say: “Look mommy, grandpa Pablo and grandma Ana are there, they are there now ... They must be listening to our music.” So, though they only checked for a short time, they knew that they were there because they saw their pictures. [Diego] is fascinated by the faces. When it's time for bed, he would be in bed already and get up: “Mommy, I didn't turn off my face” and he would get up to turn his face off. Sometimes we wouldn't even turn on music or anything, but he was paying attention to the faces and he would say: “this face yes, this face no.”*

The readily visible information about their grandparents' availability generated opportunities for interaction.

*Cecilia: Alicia loved that when grandma was there she would put music for her to dance for her, because she loves to dance and a do a show ... Ana already knows the song and would say: “what do you think of this one? And this one?” Then she would take out all the costumes, get dressed, hats, do the show for the grandparents. Because I would also turn on Skype so they could do the show.*

*Ana: It was good because they realized when someone is connected because of the faces and they would call me and tell me ... Or they would send me a message through WhatsApp and ask me to connect. The same with Pablo, he's there on the faces and they say: “ah, grandpa Pablo is connected”. You imagine it, of course ... Are the kids listening or not? Are they listening to the same music I am? Because you can't always be connected.*

Jorge and Cecilia began to elaborate on the benefits about alternative designs for the faces feature that would provide more agency to the children. Jorge points out that before using FS they used to play music through an Amazon Echo, and the children would have mixed success in articulating song choices. Such failure was discouraging but they tried. Their first design suggestion was to enable the adults to define a “favorite song” that would be played when a child touched their face. Cecilia indicated that Diego wanted to use the faces to express more complex activity indicators like eating, going to sleep, or being in the shower.

*Jorge: I really loved how the kids interacted with the faces. For them, to have a visual display with which they got to play was nice. Sometimes they played too much ... It's a little sad that they could pick not the music, only say I'm here or not.*

#### **DISCUSSION**

The initial motivation for this project was to create opportunities for connection between internationally-separated family members. We saw opportunity in exploring an architecture that stretches the boundaries of research in Media Spaces, especially domestic Media Spaces, and technologies of intimacy. Instead of conceptualizing music as belonging to the individual, we conceptualize it as shared. There are a few

other projects in this design space, but none that focus on designing for families or attempt to discover what is important for families.

At a minimum, FS was promising because it was used. Participants reported that FS had an effect in their daily interactions and awareness of the others. Four themes illuminate *how* it was important for the families involved:

*The Ecosystem of Technological Connections:* The families appropriated FS within their own socio-technical systems for communication. The benefits of using FS were both individual (it replaced other listening mechanisms) and motivated by sharing. Connection through FS was both novel and unique (or to use a grandparent's words "*unbelievable*" and "*fantastic*"). FS did not look to supplant existing technology use. It sought to add opportunities and context that could be appreciated in the moment and through other media. In-so-doing, however, it may have subtly influenced use of the other media.

*Listening and Sharing:* Families developed routines and patterns-of-sharing of the music itself, awareness of the other mediated by the music and associated faces, and discussions motivated and contextualized by the music. These moved along a spectrum between focus and background, and levels of assurance about the attention and experience of remote parties.

*Culture and Family:* Our participants experimented with playlist creation as a means to share both well-established and new music preferences. Most were perceived by other family members as valuable efforts to communicate. The grandparents were especially interested in the ability to present the children with songs that expressed their cultural identity and history. Parents, though less focused on these aspects, seemed eager to facilitate these exchanges.

*Awareness through Faces:* One family's children engaged with the face interface consistently, developing a semantics of use.

These four themes describe elements of FS use that were important to the participants. Implicit in these descriptions were two types of special *moments* around FS use:

*Listening to music together:* Listening to music together (or believing that one is listening to music together) creates a common experience with many levels of feeling and meaning. We claim that it is this that leads to the use of superlatives and poetic overtones in the grandparents' description of the system and the Abad children's excitement and focus on connection through the faces interface.

*Recalling shared music:* After the fact, participants could refer to songs by singing, humming, name, lyric, or playlist in Spanish or English. Music's multi-faceted denotative properties make possible many of the claims our participants make about culture and identity. Music is the vehicle for communication of these values. It also provides the kind of context that Evjemo, et al. [22] called for as a mechanism to support grandparent-grandchild communication including conversation, singing and dancing.

Within this small and select group, the balance between effort and value appears to be regarded as positive. According to

the parents the children appreciated the songs being shared by their family members, at times identifying intentions within the selections (e.g., "*this is abuelito's song!*"). Both groups of adults acknowledged mutual intentions for communication and were happy to find new topics for conversation drawn from the particular songs, playlists and genres that were shared. The Abad family expressed great interest in enabling more agency for the children in the song selection process. Although the grandparents were the most effusive about the benefits of FS in allowing them to share bits of culture, we must emphasize the parents' role in wanting and facilitating these opportunities. Importantly, all of our participants talked about FS in relationship to values and emotions. Its significance was rarely reduced to simple music listening.

### Limitations

The work described here is very preliminary. Only three families, 19 people, have used FS, including an author's family and two other families recruited by personal connection. Other families might prove to be uninterested or less tolerant of difficulty. The potential of the system may be limited to certain kinds of families in certain cultural contexts. It is also possible that the excitement is due to a novelty effect [15] which might still manifest itself in a significantly longer study.

Nonetheless, the work captures some reason to be excited and interested in the design directions. While our findings should not be treated with excessive certainty, we explore some of their implications.

### Design Within This Area

In focusing on families, the research uncovers more about (1) the subtlety of the design at the intersection of Media Spaces, spaces for intimacy and music and (2) the kinds of important human values for which we are designing.

#### *Design at the Intersection*

Small differences in inter-personal relationship can be associated with importantly different design needs. We originally thought that explicit bilateral symmetry would be important but this turned out to be a burden that limited system use. Therefore, in the second prototype, knowledge of whether shared listening was happening moved to the face interface and participants used social mechanisms on other devices in the ecology.

The exact role of always-on audio is debated in many systems. MissU presents real-time audio connectivity as an option for the romantic couples it targets, seeing conversation as possibly continuous with music and, presumably, assuming that couples can discuss it if they prefer privacy [49]. Pre-teen children might want audio connectivity but CoListen does not provide it, because parents of pre-teen children might not want the distraction of audio connectivity for their children [65–67]. The designers hope to give pre-teen children *some* enhanced sense of social connection while supporting the parents' perception that CoListen use is consistent with sufficient focus on homework. FS does not offer real-time audio connectivity because it offers too much risk of privacy violations that might be difficult to discuss in inter-generational households.

We discuss this area as a design “space” but it is very important to remember that design solutions are not continuous within the space. A crucial on-going question for the field is what constellations of affordances can operate sufficiently well together to constitute designed systems. The current work establishes that FS is one such constellation, “satisficing” the complementary and even the conflicting needs of multiple users.

#### *Important Human Values*

Moving beyond preliminary viability, an important question to the DIS community has been whether and how systems interact with important and enduring human values [29, 31, 64, 70, 72]. The current work is founded in a concern for such values. Although the families’ excitement about the system is likely to abate over time, it is important to note that *they* perceive connection to aspects of being that really matter to them. We were only able to include a few quotes in the findings section that support this, but it is not too much to say that the grandparents were thrilled—and that the parents looked on and supported that excitement with approval, even when they did not like the particular songs chosen.

We have tried to indicate the strength (and therefore importance) of the feelings they expressed through an analogy to *umami*. Of course, we are not talking about *umami* as a component of HCI [34, 58]. We are talking about it as a term that characterizes notions of an embodied, sensory experience, an enjoyment related to completion or fulfillment, that we heard in some discussion of the system.

One power of RtD is to bring our attention to important variations and possibilities of human experience. The analogy of *umami* serves to alert us to the need to populate our understanding of the variety and kinds of human delight and pleasure we address through the design of our systems. We stretch the meaning of this term in order to describe a constellation of important feelings and experiences that the design seemed to touch upon that are not easily described in words.

One way to advance the field is to locate other words and concepts in many cultures that capture important feelings and values that the community should attend to. Intimacy, a term already used in the field, captures a powerful notion, but there are many kinds of intimacy and associated forms of feelings of satisfaction and fulfillment. The moment of missing the romantic partner that MissU targets is not just bitter but can be bittersweet [49]. Akama [1, 2] has brought the related but very different concept of *ma* into HCI discussion. *Ma* is, roughly, a concept of “between-ness,” connoting a shared and peaceful transcendent experience. The Yiddish word *kvelling*—not yet introduced as a value enabled by HCI design—denotes the shared pleasure that parents and grandparents take in the details of their children’s existence. Although it means something akin the English notion of “taking pride in”, to *kvell* is a deep emotional experience, often almost wordless, only shared with people who are also presumed to share it.

However, whether we have pre-existing words or not, it is important to note designs that have the potential to go beyond the provision of information to touch important human values and experiences.

#### **Future Directions**

Several directions emerge from the current research. Obviously, there is a need to gain more experience with FS with more families for longer periods of time. There are also design changes. At the level of local design, these include making the FS box attractive enough so that families want to put it in visible places in their living rooms where children can share more in the activity. Furthermore, although we did not dwell on this in the current paper, parents felt too much responsibility in the midst of their busy days for making the system operate and grandparents too wanted the young children to have more agency. These wishes can be addressed through design. Lastly, a more profound question is, assuming that FS has a constituency, how wide is that constituency? The analogy to *umami* is an attempt to describe a universal, positive, lighthearted experience. But other important and enduring human values focus on a rawer need for comfort and connection in the face of suffering and desperation.

#### *Other Migratory and Family Separation Contexts*

In cases of forced-migration, individuals find themselves destitute of their homes, families, possessions, and are then forced to exist in a foreign context where they do not fit [71, 73]. Various researchers have discussed the importance of developing social capital: (1) within migrant communities, (2) between immigrants and their host countries, (3) and if possible, maintaining links to their past home, relatives, and culture.

What is the relationship between FS and these more dire circumstances? The creation of a shared place is fundamental to FS in ameliorating the feelings of separation between families. We believe that place may also be important to migrants who face more dire circumstances, but it might not be so easy to establish.

We see an opportunity within the design space that includes FS, MissU [49] and Colisten [66] to foster similar feelings of connectedness within these groups. But this is an extremely challenging question. Careful research is required at a pragmatic level to know how to fine-tune affordances. For example, assumptions about public vs. private consumption of music and the relative cost of materials and connectivity may be crucial and may differ from the circumstances examined here. More troubling is the thought that the elements that lead to delight in a secure context may be perceived differently in an insecure context. Instead of offering some connectivity, they may be seen as painful reminders of all that is missing, a kind of cruel facsimile of the wished-for connection.

#### **CONCLUSIONS**

FS is Media Space research because it permits opportunity for serendipity in informal communication, and because participants appeared to experience it as communication (e.g. “*This is the gadget where we communicate*”); however, FS is also a system with a high level of privacy.

Satisficing across different users, but enabling shared experience and emotion help define what it means to *connect like a family*. Valuing this complexity and inherent subtlety is essential to good design in the area.

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