

# G2G: The Design and Evaluation of a Shared Calendar and Messaging System for Grandparents and Grandchildren

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## ABSTRACT

Distance separated grandparents and grandchildren often face challenges in staying connected. To explore this topic, we designed G2G, a shared calendar and video messaging system to connect young children (ages 5-10) with their grandparents over distance. Our design focused on providing grandparents and grandchildren with an awareness of each other's lives to support conversations and design elements to help reduce the need for parent scaffolding. A field study with two grandparent-grandchild pairs over two months showed that systems designed around structured communication can help young children develop a routine around staying in touch with their remote grandparents. Autonomy in maintaining awareness can help children to be engaged more easily. This suggests that designs focusing on connecting young children to their grandparents over distance should be flexible yet structured and designing to reduce parental scaffolding can lead to positive effects and strengthened relationships.

## Author Keywords

Family communication; grandparents; grandchildren; calendaring; video; asynchronous communication.

## ACM Classification Keywords

H.5.3. group and organization interfaces: Computer-supported cooperative work.

## INTRODUCTION

Technology has provided a variety of ways for distance-separated family members to maintain connections over distance. Yet many families still face challenges in building strong emotional bonds between young children and their grandparents over distance [2,3,6,9,10].

Video applications such as Skype and FaceTime have

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CHI 2018, April 21–26, 2018, Montréal, QC, Canada.

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ACM ISBN 978-1-4503-5620-6/18/04...\$15.00

<https://doi.org/10.1145/3173574.3173729>

improved remote communication with children [2]; however, children's limited attention span makes it cumbersome to keep them engaged in remote conversation at young ages. Thus, maintaining regular frequent phone calls or video calls between young children and remote grandparents which satisfy all can be a challenge [2,3]. As a result, most research in this area has focused on connecting young children with their grandparents through sharing a limited set of activities rather than direct conversation [8,18,26,28]. While beneficial, these systems mostly direct communication to focus on superficial exchanges, rather than more detailed information that might help grandparents and grandchildren feel closer despite the distance between them [9]. Such information might include personal stories and daily life experiences, which might help grandparents feel confident during communication [9].

In this paper, we present the design of a communication system for distance-separated grandparents and young grandchildren called G2G (Grandparents to Grandchildren). G2G is a shared calendar and video messaging system designed to help grandparents and grandchildren (5-10 years old) maintain an awareness of each other's daily lives through a simple and playful calendar while communicating asynchronously through video messages. We hoped that a mutual awareness of each other's lives, gained through the system could act as a catalyst to promote communication between grandparents and grandchildren.

Next, we conducted a field evaluation of G2G with an emphasis on middle class, heterosexual families with two parent-households. Our research questions focused on how distance-separated grandparents and young grandchildren would use it to communicate over distance; if and why such a system would change their communication behavior; and, what benefits and challenges families would find in such a system. Our goal was to understand what design factors were important for mutual awareness and communication between grandparents and grandchildren. Our deployment was conducted with two pairs of families—including a total of eight adults and four children—for eight weeks.

Our evaluation revealed that both grandparents and grandchildren valued G2G and were able to incorporate it into their communication and establish new routines for staying connected. The structured nature of communication,

as facilitated by the system, made this possible as did the emphasis on providing mutual awareness of one's life. However, both grandchildren and grandparents wanted features that might help them develop closer relationships with individuals, such as targeted messaging. They also desired communication mediums that were expressive and lightweight. Together, these findings point to design implications for the creation of technologies to support grandparent-grandchild communication over distance, with an emphasis on awareness and context.

## RELATED WORK

### Children and Family Communication Over Distance

Technology in today's world offers various communication mediums for families to communicate effectively either synchronously or asynchronously according to their needs, age and schedule. Yet young children face several challenges such as cognitive challenges, social challenges and attention/motivation challenges to build a close relationship with their family members over distance [2]. Children's limited attention span, undeveloped perception of time, limited verbal communication skills, and limited writing and reading skills makes it challenging for families to engage children in technology-mediated family communication [2,3,9]. Time differences and mismatched schedules makes it harder for all family members including children to stay in touch while separated over distance [6]. They might also experience cultural differences, language barriers in cases where children are growing up in another country rather than their distant families [9].

Video communication has been shown to be more successful for family communication with children by supporting face-to-face contact and natural communication such as body gestures and facial expressions [2]. However, the sedentary nature of video chat can cause children to become bored or frustrated. For this reason, there have been a few research prototypes developed to explore how children can be more engaged in activities over a video call [8,26,30,32,34]. We also know that video chat comes with various 'social' and 'technical' work in order to make a call happen [2, 20]. This includes coordination around schedules to find a free time to call and parental scaffolding during the call [2,20]. As a result, video chat can strain the amount of effort needed by adult family members [2,20]. Calls between grandparents and grandchildren may also need to align with parents' schedules which may result in less frequent communication [2].

### Communication with Grandparents Over Distance

Several systems have been proposed to connect distance-separated grandparents and young grandchildren. Some of these systems were built for families more generally to help grandparents gain a better sense of what their grandchildren were doing inside or outside of home. Always-on systems such as the Family Window [16] and Family Portals [17] helped grandparents to be involved in the ongoing lives of their grandchildren inside the home. Conversely,

Experience2Go [13] was proposed to share children's outdoor activities with remote grandparents.

There are other systems built specifically for children to stay in touch with their grandparents. These systems have been mainly focused on shared activities to compensate for children's short attention spans, which result in a lack of engagement in direct conversation [8,21,26,28]. Systems such as Family Story Play [26], Story Visit [28], and People in Books [8] have been proposed to enable grandparents and young grandchildren using a tangible physical book coupled with video conferencing technologies.

From our previous research, we know that grandparents are able to engage their young grandchildren with direct conversation over distance if they have enough awareness about their ongoing lives [9,10]. Thus, feelings of closeness and togetherness can come from shared awareness, gained through conversation [9]. However, both parents and grandparents must deal with social issues that arise from potential interference in children's lives and a lack of truly knowing one's grandchild [9,10]. The latter can lead to self-consciousness and feelings of perceived annoyance. We designed our system based on our prior work to explore if an awareness of the daily activities of grandparents and grandchildren could benefit communication.

### Awareness Systems for Families Over Distance

Research on interpersonal awareness and calendar sharing between extended families shows that a sense of awareness of current and planned activities might increase the amount of communication, make extended families feel more connected, and spark more conversations [5,12,23,25]. LINC was a family calendar designed mainly to coordinate within a single family's household [23]. While the design was simple enough to be used by all family members [23], relying on text can make it harder for younger children who are not able to read and write yet to use the system. In the Shared Family Calendar, calendar information was shared across two households including grandparents and grandchildren [25]. The system was valued by grandparents to see the schedules of their grandchildren, but raised concerns around privacy for the children's households since it was the family's 'regular' calendar that was being shared. In contrast, in our design, children and grandparents decide what to share and when to share it. Thus, the system does not show a family's regular family calendar.

SPARC encourages frequent sharing of photos and calendar information between extended families by offering suggestions about what to share [5]. Unlike our system, messages could only be sent via textual exchanges. While text might be useful in some aspects of communication such as coordination, there is a chance it may limit interactions. We explore this idea by incorporating and studying video messaging within our system. VideoPals [7] and VideoThreads [14] highlight the value of asynchronous video messages, however, these systems were designed and studied for child-to-child relationships. Thus, we do not

know how such systems would be used to support other demographics, including grandparents and grandchildren.

Overall, we do not see systems similar to ours that are designed specifically for grandchildren and their grandparents, where the core idea is to promote frequent exchange of awareness information to support conversations where the design includes a conversational medium. In our case, this is asynchronous video messaging.

### G2G: A SHARED CALENDAR AND VIDEO MESSAGING SYSTEM

G2G is a shared calendar for facilitating communication through visual media and asynchronous video messaging. We were interested to explore if providing an awareness of the lives of grandparents and grandchildren would help them to be more engaged in conversations with each other. G2G was designed to map to the needs of these demographics (e.g., children's attention span, grandparents' lack of confidence) and their relationship.

We chose two communication channels for G2G: 1) stickers which are a lightweight way of expressing daily activities, feelings or thoughts and 2) video messages to facilitate longer conversations asynchronously. We chose an asynchronous communication method to allow communication to be more flexible, where they could use G2G in their free time or depending on one's mood.

Over distance, grandparent-grandchild communication can happen less frequently because it is often embedded within parents' communication rituals with grandparents or needs a considerable level of scaffolding from parents [2,3,9]. To overcome this problem, we designed G2G to be simple for children to use. We used child-friendly visual components in an effort to decrease the level of parental scaffolding that might be needed. We were inspired by design concepts such as physical calendars as well as prior work on digital calendars for children [1,4,19,23, 33].

User posts are differentiated by color-coding and each user's picture. For example, in Figure 1, Katie's posts all have a pink circle around them and are shown to the right of her image. Julie's posts all have a purple circle around them and are shown on the bottom, to the right of her image.

Similar to other digital calendars, users can navigate through days and months by using buttons on top of the main window or through a drop down menu. G2G consists of two main features:

**1) Shared Calendar:** Children and grandparents can add their daily events, activities, thoughts or feelings through stickers categorized in 12 main categories (shown in Figures 1 and Figure 2). Any added stickers are shown on both the grandparent and grandchild's version of the calendar; the views are reciprocal. Studies of family calendars have found that using visual representations such as stickers can make communication more fun and playful for family members and easier for children [23]. To add an

event to the calendar, users simply need to select a day and then choose a sticker from the related category. Users can also take a picture and that image becomes a new sticker. The sticker categories were chosen based on research that documents the typical conversational topics shared by grandparents and young grandchildren [9, 14].



Figure 1. The main view of G2G being used between Katie (grandchild) and Julia (Grandmother)



Figure 2. Katie is changing the date through the calendar in the drop down menu and is trying to choose some school activities under "School" category

**2) Video Messaging:** G2G's video messaging features support asynchronous communication between grandparents and grandchildren where they can send video messages to each other. Videos are recorded and associated with a particular day. For example, if a user clicks the 'camera icon' on the right side of Figure 1, a dialog appears on top of the window and allows the user to record a video clip. The recorded video is then added to the user's wall and visible to both parties. Our design initially gave users the option to post on their own Wall or on someone else's Wall. However, during our pilot testing with one family pair (2 grandparents, 2 grandchildren), we found that it was

confusing for users to choose between these two options. As a result, we changed the design to the current one but added a “Reply” option where users could reply to each other’s videos. The replied video would be posted on the Wall of the video’s original sender.

Our target age range for G2G was between 5 and 10 years old for children because at this point they are able to converse with other people, including grandparents. They are also not yet at the pre-teen stage of life where they might want to talk less with grandparents [21].

We deliberately do not have private accounts in G2G. In the current design, children and grandparents in multi-child and multi-grandparent household can easily switch to see each grandchild or grandparent by touching one of the user’s images. This reveals a list of people’s walls that can be viewed. We did this because we wanted to keep usage very simple for children and grandparents alike. However, we were interested to see if this design decision might create tension between siblings or if grandparents might be concerned about their privacy.

### FIELD EVALUATION

Following the design and implementation of G2G, we conducted a field evaluation to explore how grandparents and young grandchildren would use the shared calendar and video messaging system to communicate over distance, how and why the usage of such system might change the way they communicated and what benefits and challenges families would find in using such a system.

### Recruitment

We aimed to find families of grandparents and grandchildren between age of 5-10 who were separated over distance and desired to stay connected and potentially improve the communication between grandparents and young grandchildren. In order to build a stronger rapport with our young participants, we wanted the children’s families such that they were local to the city containing our university, Vancouver, BC, Canada. We wanted to visit the children’s houses in person, spend some time with them and create a friendly trusting relationship [15].

We advertised our study through snowball sampling, social media, community houses, parental forums. 19 families applied for the study and through a set of screening questions, we selected participants that spanned different life situations (e.g. middle class, lack of major current conflict and health issues), children’s gender, time zone separation, relationship closeness, technology familiarity, and desire to be connected. We chose two families after a short video conversation over Skype with all of the family members who were interested in participating. We compensated each family pair with \$250 for participating.

#### Family1

The grandchildren’s family was composed of a male and female parent (both working full time) and their 9.5-year-old son and 12.5-year-old daughter. They lived in Metro

Vancouver. We refer to them as *Family1\_GC* (GC for grandchild), *Mom1*, *Dad1*, *Girl1* and *Boy1*. This family used G2G with the maternal grandparents. Only Boy1 was in our target age range. His sister, Girl1, fell outside of our participant group though we still collected data about her reactions to the system and infrequent usage. The grandparents’ family, *Family1\_GP* (GP for grandparents) was composed of both grandparents, *Grandma1* and *Grandpa1*, and lived on the east coast of Canada with a 4-hour time difference from their grandchildren. Both grandparents were retired but they had a very active life. These two families considered themselves to be very close and the children had an intimate relationship with both grandparents.

#### Family2

The grandchildren’s family of *Family2\_GC* was also located in Metro Vancouver. The family was comprised of a male and female parent (both working full time), their 8-year-old son and 5-year-old daughter. We refer to them as *Mom2*, *Dad2*, *Boy2* and *Girl2*.



Figure 3. Our child participant using G2G

All family members took part in this study with the paternal grandparents located in the same time zone as the grandchildren’s family but separated by a car drive of approximately four hours.

The grandparents’ family, *Family2\_GP*, was composed of both grandparent, *Grandma2* and *Grandpa2*. They were both retired. *Grandma2* was moderately tech-savvy but *Grandpa2* was not into technology and rarely used it. The grandparents were not very close to the grandchildren. There were no family conflicts between the two families and both the grandparents and parents wanted to build a closer relationship between the grandparents and grandchildren. Initially, both grandparents showed interest in the study, however, *Grandpa2* did not end up using G2G on his own, although he took part in the initial interview.

### Method

We asked our participants to run G2G on a dedicated iPad for the duration of the study and place the iPad in an area in the house that the children would spend most of their time in. However, we strongly encouraged them to move the device around with them wherever they wanted to. Those families who did not have an extra device to dedicate for the system were shipped an iPad from us before the start of

the study. Thus, all families were able to dedicate an iPad solely to running the system. Figures 4 and 5 shows children in one of the families using G2G during the study.

To start the field deployment, we scheduled an hour-long video conferencing session with the grandparents in which we did a background interview with both grandparents and introduced G2G and its features. Then we gave grandparents some scenarios and tasks to try out with G2G to make sure they were comfortable using the prototype. Each family also received an instruction booklet with steps on how to use G2G. We purposely did not prescribe any particular patterns of usage in the instruction booklet.

We then scheduled a visit to the children's family to spend an evening with them when parents and children were all home.



**Figure 4. Siblings are watching a video posted by their grandma together**

During this visit (~3 hours), we ordered pizza or brought a snack (based on parents' preference) to spend some time with the family. This helped families and particularly the children to feel closer to the main researcher as an acquaintance and not as a stranger or a researcher. We then talked about the study, went through the system, and reviewed the instruction booklet. Parents and children were separately interviewed about their current communication practices with the grandparents. At the end of the visit, the researcher set up a video call with the grandparents and had the grandparents and grandchildren use G2G together to make sure they understood how to use it.

#### *Semi-Structured Interviews*

We conducted semi-structured interviews with the grandparents, parents and children every two weeks. We interviewed the grandparents over Skype or Facetime while they had G2G in front of them so they could refer to specific posts or days. We connected to the same view so it was mutual. The interview questions focused on their usage behavior, experiences of using G2G, the benefits and challenges they had faced along with anything interesting from the logged data that we noticed. We also had brief

phone calls with each family once a week between interviews to ensure they were not having any issues. We used this opportunity to further establish trust and rapport with the participants.

One of the limitations of interviews is that adult participants may self-censor their responses. For example, one grandmother in our study who did not have a very close relationship and frequent contact with her grandchildren was not very expressive in the interviews due to likely fear of being judged. In these cases, we talked about our professional and personal experience so she felt more comfortable with us. Children also might not be very accurate about their experiences when being interviewed. We feel we were able to sufficiently overcome this challenge by building a close personal rapport with each participant, comparing responses between family members and reviewing the information exchanged with them in the system.

#### **Data Collection and Analysis**

Usage data was collected through the home visits, interviews, and check up calls. Software usage was logged throughout the study and, with the families' permission, we reviewed all of the stickers and the videos that grandparents and grandchildren exchanged using G2G. All interviews were audio recorded and transcribed later. Videos and stickers were coded. We performed open, axial and selective coding on all of the above sources of data. We watched and reviewed each video message and all stickers, and coded them based on the types of content.

We begin the results sections by describing the communication patterns and relationship background between grandparents and grandchildren in our participant families prior to using G2G. Then, we describe the usage behaviors and patterns that occurred in these two families using G2G. We then discuss how using G2G changed the communication patterns between grandparents and grandchildren and discuss what benefits families found in using G2G. We also explore the challenges they faced and the cases where G2G could not be fully adopted by some family members.

#### **COMMUNICATION AND RELATIONSHIP PRIOR TO G2G**

##### **Family1**

Prior to the start of the study, the grandparent and grandchildren families said they usually called each other on Skype once a week or every other week and communication between the children and their grandparents was part of this family routine. The only time children had any independent communication with grandparents was last year when grandma was visiting and Boy1 started to send Skype messages to his grandpa who did not visit at the time. Soon after grandma returned back home, he stopped sending messages to his grandpa and their communication returned back to the family routine. The grandparents visited their grandchildren once a year. When they visited,

the parents tried to involve the grandparents in the children's activities, e.g., going to the pool or walks at the park or any school functions.

### Family2

Prior to the start of the study, the grandparents and grandchildren communicated in this family only occasionally (two to three times a year) for Christmas or children's birthdays where they used FaceTime to talk. They did not talk on the phone or communicate on a regular basis. Only Dad2 was frequently in touch with his parents through phone calls or text messages. Regardless of the somewhat close 4-hour drive distance between the households, the two families visited each other in person only two times a year. According to Mom2, the grandparents and children did not know each other very well and the children tended to forget about them until their next visit due to their young age. She said that the in-person visits and any infrequent FaceTime video chats were usually very awkward and the grandparents and grandchildren did not have much to talk about.

### G2G USAGE BEHAVIORS

#### Usage and Non-usage

Both grandparents in Family1\_GP were interested and excited to use G2G. As expected, both grandparents in this family started to use G2G soon after the beginning of the study. However, Grandma1 started slower at the beginning as she needed some minor help from Grandpa1 and Mom1 to learn how to use the system. At the middle of the study, a sudden renovation in the house caused Grandma1 to not actively post anything for a period of one to two weeks, yet she was still checking out the grandchildren's posts. However, for the rest of the time, she used G2G at least three to four times a week. Conversely, Grandpa1 began using G2G soon after the beginning of the study and he was actively using the system almost every day with only a few exceptions over the course of the study. Boy1 started to use G2G very quickly from the first moment we set the system up for him and he became very active and a primary user in Family\_GC1 where he posted multiple times a day, nearly everyday. Unsurprisingly, Girl1 did not engage much with the system as she was in her pre-teen years when children have less desire to stay in touch with their extended families [21]. She still posted stickers a few times a week and occasionally posted a video or watched videos posted for her. The parents in the Family1 also occasionally watched some of the videos and were entertained by some videos posted by the grandparents and Boy1.

In Family\_GP2, Grandpa2 who initially agreed to participate in the study due to Grandma2's suggestion did not turn out to use the system at all. According to Grandma2 and Dad2, fear of technology and satisfaction with the amount of current communication with his grandchildren caused him not to use the system. However, he enjoyed watching videos posted by his grandchildren whenever Grandma2 showed him one.

Both children in Family\_GC2 started using the system quickly. Girl2 used the system a few times a week where she was always posting video messages in addition to stickers. Boy2 needed reminders from his parents only for the first week (as prompted by us) to use G2G. While he used both the calendar and video messaging features, Boy2 did not enjoy the video messaging much and repeatedly mentioned that he would rather type messages for his grandparents. All users in these two families, including Boy2, who was not always enthusiastic about the system, kept using the system even after we officially ended the study (even without pressure from the parents).

All family members who were actively using G2G would look at it a couple of times a day to see if there was new content. When posting something themselves, they would either post at the beginning or end of the day.

Our log data shows that the average number of videos sent by children per day was 0.87 (SD=1.18) and the average stickers per day was 3.37 (SD=4.95). The average number of video messages sent by grandparents per day was 0.7 (SD=0.85) and the average stickers per day was 1.73 (SD=1.96). The average weekly usage shows that while the usage was more in the 1st half of the study in comparison to the 2nd half, users continued to use the system in the 2nd half of the study where usage averaged between 3 and 6 posts per week in the 1st half compared to between 2 and 4 posts in the 2nd half.

#### Location

We asked families to put the iPad on a stand and place it in a location in their home where children spent most of their time as a default location. However, the parents and researchers reminded children that they were allowed and encouraged to take the iPad to other areas as desired.

Both grandparents' families and Family\_GC2 in our study put the iPad on their kitchen counter. Family\_GC1 placed the iPad on a console table in the living room (as shown in Figure 3) which was next to the "working space" where Boy1 spent most of his time. All family members looked at G2G from the default location to see if they received a post. However, they mostly took the iPad to other places in the home to post stickers and video messages. Children in Family\_GC2 mostly took the iPad to the couch in the living room close to the default location. Boy1, who invented a daily game with his grandparents, mostly used G2G at his desk next to the default location. In this game that he called "Daily Questions", he and grandpa asked each other questions with different topics back and forth. For daily updates he would take the device to different places including his room or the backyard to show his different activities. The small number of videos posted by Girl1 were all recorded in her room as she needed a quiet space. In contrast, the grandparents used G2G from many different locations as they wanted to record video messages of their garden, backyard, different rooms, different parts of the house, and their swimming pool.

In addition to the aforementioned usage behaviors, our analysis revealed key findings around what design features in G2G benefitted usage and what features created challenges. We describe these in the following sections.

### **STRUCTURED ROUTINE-BASED COMMUNICATION**

First, we learned that by having a technology designed to provide structure around communication, young children were able to develop a routine around staying in touch with their grandparents. This contrasted their behavior prior to the introduction of G2G, which as mentioned, was less structured and more sporadic. This routine and structured style of communication was highly valued by all participants as it meant they could know when to expect communication exchanges and integrate them into their daily activities.

We also learned that a routine-based communication tool tied to time could engage young children and their grandparents to talk about their daily activities and what was happening in their life. The stickers triggered even the 5-year participant to keep remembering to talk about her daily activities without any reminder from her parents. According to the parents and grandparents, this had been mostly missing between the grandparents and their young children during their prior communication routine (through weekly Skype calls).

The routine-based nature of communication inspired Boy1 to start daily activities akin to simple games that he could play with his grandparents such as “Daily Questions”, “Daily Items” and “Daily Emotions” where he and grandpa were asking each other questions with different subjects back and forth. For example, he would show a new object each day and would make an emotion with his face. He would then ask the grandparents to guess what it was.

*“I get annoyed if [my Grandparents] don’t post because that’s my daily routine” -Boy1*

The grandmother in Family1 was very satisfied with this communication and the frequent contact that the grandfather now had with his grandson.

*“Before, they talked every 1 to 2 weeks but now it’s more focused and the daily thing he enjoys. Also this daily questions he enjoys and teach him about Boy1 much.” – Grandmal*

### **MUTUAL AWARENESS**

Our results showed that by using a technology designed to support mutual awareness between grandparents and young grandchildren, they were able to get to know each other better and feel more emotionally close. For example, in Family1, the grandparents and grandchildren had a close relationship prior to using G2G. They were frequently in touch using Skype. After using G2G, Boy1 started to share his thoughts and his daily routines using the stickers. He also posted videos about many activities he was doing in the house that his grandparents did not know about.

*“There are many things that I did not know about him [Boy1] and now I know. I can see a different side of him” – Grandpa1.*

As mentioned, “Daily Question” was a game invented by Boy1 to challenge his grandparents and to show off his knowledge in different subjects. Grandpa1 who was gradually getting to know Boy1 and his interests better through his posts could engage him in the game by asking questions based on his interests. Soon the game itself became a platform for them to maintain more awareness about each other and know about their interests such as favorite foods or their favorite musician. Grandpa1 started this platform to associate his answers with some personal information. This gave Boy1 the chance to know the grandparents, his parents and his extended family better. For example, when answering a question about a historic event, grandpa added that this event was two years before he got married. This allowed the grandson to begin to think about the grandfather’s life in relation to his learnings.

In Family2, the videos they exchanged were typically quite short and involved them only saying a single sentence. Videos focused on their upcoming plans for the day or what they had already done that day. Through short videos Grandma2 posted, they also got to know other family members such as their uncle, aunt and their cousin. It seems that the awareness of one’s daily routines helped them to know each other better and to feel emotionally closer. This family visited each other at the middle of the study. Interestingly both parents noticed that the children and also the grandma warmed up quickly and the whole family was more relaxed. We were told that this contrasted to last years’ visits where there was always some level of awkwardness. Unlike before, the grandparents could easily engage grandchildren in conversations by following up on their life events and interests as known through G2G.

### **PARENTAL SCAFFOLDING**

We learned that by having a technology designed to minimize parental scaffolding, young children were able to develop a personal relationship with their grandparents and communicate with them independent of their parents. This was different than their communication prior to the introduction of G2G where the communication between grandparents and grandchildren was part of the family routine between parents and grandparents. That is, the children previously only communicated with their grandparents during calls that the parents were having with them. G2G made the contact between the grandparents and grandchildren more flexible and frequent because it was not dependent on the parents’ schedules.

G2G also helped parents to have more opportunities to step away from this communication if desired and let the children gradually develop an independent relationship with their grandparents separate from their parents. This made the communication more personal between grandparents and grandchildren and made the children the main audience

of grandparents' life stories and events. As a result, children were following up with their grandparents even if the topic was not very exciting for them. This gave the grandparents and parents more satisfaction; they felt the communication had changed from being forced to more genuine.

*“Sometimes it’s boring when [Grandma1] talked about her garden stuff but I still watch it but I like it when she tours around her house, that’s more interesting.” -Boy1*

*“If I was having Skype with my parents and they were talking about renovation my kids would leave the room, if it was an adult conversation that kids were not interested but when the same conversation directed right at [Boy1], so [Boy1] is a little bit more interested.” – Mom1*

In Family2, where the existing relationship was less close, the mother intentionally kept herself separate from the communication between the grandparents and grandchildren because she wanted it *“to be about kids and the grandparents”* and *“to flourish on its own”*. The 5-year-old girl did this by using the stickers in G2G. She found it easy to find them and post them as updates about her day for her grandparents. Similarly, when recording a video, the stickers and calendar structure acted as a reminder to talk about her daily activities.

In turn, because the grandchildren were able to communicate with the grandparents on their own, the grandparents told us that they felt less like a burden to the parents and more confident about their relationship with their grandchildren. They knew that the contact had been initiated by the children themselves, which showed that they willingly communicated with their grandparents.

*“It’s nice to see what they are doing and not having to ask. The parents are busy too so they can not tell me everyday what kids are up to, that’s how the way we are. I know some families are constantly in touch. I was always one to think ok, if I don’t hear from them everything is fine, everything is ok, so I was fine. I used to have kids away from me.”-Grandma2*

### **SELF-CONSCIOUSNESS**

We learned that grandparents can be very self-conscious when sharing their daily routines with their young grandchildren. At the beginning of the study, we observed that the grandparents in both families were hesitant to share their daily activities with their grandchildren through the stickers. Due to the slower-paced life style that they had, the grandparents assumed that their life would be too ‘boring’ or too ‘routine’ for the children. However, our analysis showed that this self-consciousness eased over time as the grandchildren saw and began to comment on the activities that the grandparents were participating in. This acted as feedback for the grandparents that the information they were sharing was of interest. For example, in Family1, grandpa started sending videos about their renovation in their house. As Boy1 was very much into recording videos, he also kept recording videos and asking the grandparents

about the details of the renovation. At times people did not provide any feedback to others that they enjoyed seeing content in the G2G, and this caused people to think that others were not interested in seeing certain things that they had posted. For example, Girl1 was also interested in hearing about the grandparents' renovation process, but did not follow up or provide feedback to the grandparents in G2G. This made them assume that she was not interested. In other cases, we learned that recording video messages was too heavyweight of an act to provide feedback on content. For example, there was a period of time where Grandma2 was very busy and did not have time to record a video. As there was no other way of acknowledging that she had watched the children's messages, they were disappointed and used G2G less during that period of time.

For the first two weeks of the study, Grandma2 was very conscious about the fact that there was not much going on in her life and somehow she felt uncomfortable to share her “routine life” with her grandchildren. When she mentioned this to her son and daughter-in-law (Mom2 and Dad2), they told her that the children, particularly the 5-year-old girl, enjoyed getting updates from the grandma and about her daily activities. They told the grandmother that the girl “read the stickers” grandma posted out loud and she updated her parents about grandma's activities. Again, this points to the value of making it easy for people to share feedback that they were interested in content.

*“I like to add funny faces to videos and add speech bubble and saying that “it was funny.” -Boy1*

Here we see the need for adults to sometimes let the grandparents know that the children are engaged with what they post, without having to perform heavyweight actions with the system. It also suggests that systems like G2G could provide automated features that alert others when items are viewed or watched.

### **TARGETED MESSAGING**

Throughout their use of G2G, we learned that the grandparents and grandchildren wanted to have different levels of access to their posts for different family members. We found that most children and grandparents were fine with everyone having access to see all of the posts, even stickers or videos meant for only a single person. However, they preferred to target some posts to a specific person, if given the choice. This was for different reasons, such as building a personal and unique relationship between one grandchild and one of the grandparents, preventing some users from feeling left out of conversations, or having private conversations that they did not want others to hear.

*“I would post about what they enjoy because I’ve two sides and each one like a different side, [Grandma1] likes art stuff and [Grandpa1] likes my trivia.” -Boy1*

Soon after starting the “Daily Question” game, the communication between Boy1 and Grandpa1 was heavily focused on this game in addition to daily updates.

Grandma1 started to take part in this game once in a while, but due to a lack of interest in some topics, along with a lack of enough free time because of the renovation in their house, she was not actively participating in all of the questions. However, she was still sending regular ‘catch up’ videos. Grandpa1 and Boy1 kept using their own wall to post these videos and this could be seen by everyone else. When we asked Boy1 why he posted on his own wall instead of his grandfather’s wall he said: *“Because I am lazy, I don’t like too many steps. I like to keep thing nice and flowing.”* However, later he added: *“Sometimes I wanna just post for [Grandpa1] because [Grandma1] might think it would be waste of time or I can say: ‘This thing is for grandma you might pass on that because it is little bit boring for you’.”*

It became clear to all of the family members that there was much less usage by Grandma1 and Girl1 and this caused feelings of angst amongst them. Dad1 commented in a family Skype call, *“G2G is all about [Boy1] and [Grandpa1]”*. This made Grandma1 slightly annoyed and right after hearing this comment, she started posting videos in G2G.

In Family2, the grandmother felt that having targeted messaging would help her to build a personal and unique relationship with each child separately. This seemed more crucial for her as G2G had been the first step towards building a close relationship with her grandchildren.

#### COMMUNICATION MEDIUMS

Our design offered two mediums for communication between grandparents and grandchildren; 1) stickers as a lightweight, quick medium and 2) video messaging as a flexible expressive medium. We intentionally did not include typing features as we wanted the design to be fully usable by young children who might still not be able to read and write. However, we learned that the mediums we chose were not always easy to use and understand.

The grandparents valued the stickers and used them frequently because they thought that the visual medium could attract children’s attention. However, none of the grandparents actually liked the stickers as a communication medium. They felt that the stickers were not expressive enough to communicate their ideas. They could not understand the meaning of some stickers posted by their grandchildren and sometimes they could not find the stickers they were looking for. They could resolve these issues by posting a video and asking the child what a sticker meant or choosing custom stickers by saving images from web pages; however, they did not end up doing so.

*“I wanted to tell them that I have been to a birthday party for my aunt, so I posted a picture of a birthday cake but they think that it was my birthday. Well it was a birthday that I celebrated and it was not mine, for those sorts of things it’s better to put on video, so they get the whole story” –Grandma1*

In the design process, we, perhaps naively, assumed that the ambiguity of some stickers might create additional conversations where family members might record a video and give or ask for additional explanations. However, it seemed that this was too much effort for our users.

Conversely, the grandchildren had different opinions about the stickers depending on their age and their personality. Those who were not in favor of videos, needed a quick medium to communicate their ideas. Stickers gave them this opportunity but they desired to add more context to the stickers by typing even if it was just a single word.

*“I like stickers better because it’s more fun to find them but I liked to type and make words, like if you have typing and sticker you can type ‘I ate hamburger’ and then put the hamburger’s sticker.” – Boy2*

Some children did not like videos because they had less expressive personalities and they did not enjoy recording themselves or expressing their emotions directly in the videos. While they were not outgoing enough to feel comfortable saying “I love you” or “I miss you” to their grandparents in the video, stickers were not expressive enough to communicate their emotions for their grandparents. For outgoing children though, video was a perfect outlet to express themselves and to accompany stickers when needed. However, even in these cases a quick and expressive medium was desired in addition to the video messaging. For example, Boy1 who enjoyed videos also loved stickers as they were quick to use.

*“I like [stickers] because it doesn’t take TWO HOURS.” – Boy1*

#### DISCUSSION AND CONCLUSIONS

We now discuss our results where we briefly summarize our main findings, outline the design features that helped support grandparent-grandchild communication, and suggest design directions to further enhance such communication routines and practices.

##### Structured Routine Based Communication

First, our results showed that a structured-based communication technology could help young children to build a routine around connecting with their grandparents and engage them in conversation about daily routines. Due to their limited attention span, children face different challenges to stay in touch with their remote grandparents [2,3]. While synchronous video chat has been shown to be a suitable medium to overcome some of these challenges, the generally sedentary nature of video chat can make children bored or frustrated which can, in turn, make it difficult for parents and grandparents to handle the situation [2]. As a result, most related work has focused on supporting grandparent-grandchild connections through shared activities such as playing games or story telling [8,26,28,32]. A few systems have focused on supporting conversations between children and their close friends or other school children in different parts of the world [7,14];

however, this is somewhat different than grandparent-grandchildren communication, considering the age differences between grandparents and grandchildren and the different life styles.

Our results showed that children can get engaged in having conversation about the ongoing life of their grandparents and can make a meaningful conversation about their life given a proper structure. In this regard, our work highlights the importance of providing a structure around communication and offering a context to facilitate conversation. We did this through a shared calendar and sequences of asynchronous video messages; however, there could be other ways of achieving similar results. The overarching goal should be to provide a structure that is flexible enough to allow grandparents and grandchildren to develop a routine based on their own interests if desired. In our study, the “Daily Question” game, invented by a child to play with his grandparents, is an example of building a routine around communication.

### **Parental Scaffolding**

Our work shows promise for designs that attempt to reduce the need for parent scaffolding in grandparent-grandchild communication. We found that this could lead to children feeling like they are able to create an independent, engaging and genuine communication with their grandparents. It also helped grandparents to have more confidence in their relationship with their grandchildren as they knew that contact had been initiated by the children themselves.

Previous work in this area has considered communication practices between grandparents and young grandchildren over distance as part of the family’s broader communication where parents can offer the required scaffolding [16,17]. This scaffolding could be either technical or non-technical, where parents help children to facilitate the conversation. Some other systems built particularly for grandparents and grandchildren are either built for very young children where parents act as a gatekeeper or need to be always around [26,27,28]. Our results provide a different direction for designs aimed at school-aged children who are pre-adolescent, where scaffolding can be reduced in order to strengthen relationships between grandparents and grandchildren. We used a relatively simple design and visual components to decrease the need for technical scaffolding; however, alternative design solutions may be as equally appropriate. In fact, not all of our design features were liked by certain users (e.g., stickers), which suggests different directions for such features where the same underlying goal of reducing parental scaffolding can be achieved.

### **Mutual Awareness**

A technology designed to support mutual awareness about daily life can help grandparents and grandchildren to get to know each other better and, as a result, feel more emotionally close. Unlike past systems where awareness was used for collocated or distributed family members to

provide peace of mind, coordinate, organize, or be updated about each other [23], we used awareness as a catalyst to facilitate conversation. Our results point to the value in designing technology that supports mutual awareness for grandparents and grandchildren. Our study suggests that a mixture of structured and unstructured awareness can help grandparents and young grandchildren to gradually know each other at different levels of detail. For example, in our design, stickers and calendars as a structured medium and video messaging as a flexible open medium complemented one another. The stickers and calendar promoted conversation and video provide additional context.

### **Targeted Messaging**

Our result showed that targeted messaging and one-to-one communication was desired by most users. This suggests that designers of communication technology for this demographic should consider a targeted channel between users in addition to a shared space. However, offering a shared space also seems necessary to keep the communication shared with other family members. This way, parents and other family members can observe the communication posted in a shared space. While this concern did not come up in our study, it may also be beneficial to provide ways for parents to monitor targeted, one-on-one communication, though such features, if known by children, could cause relationships to erode or be questioned. For example, if children know that their one-to-one messages can be viewed by parents and parents act on this, the children may resent or question the parents’ authority in doing so. There are also interesting questions about if and how grandparents should be made aware of a parent’s ability to oversee targeted messaging.

### **Generalizability**

Our study focused on evaluating G2G with two family pairs, given the complexity and challenge of studying families in detail, over long periods of time, as a part of field deployments [5]. By chance, all of our families were representative of middle class families of European-descent, with two heterosexual parents, within broader Western culture. Our families also did not face any cases of marital separation or family conflict.

Certainly our findings do not generalize to families who might face a different lifestyle, for example, where one might experience separation, divorce, or other family conflicts. Two family pairs is also not enough to claim generalizability across the types of families we studied. Instead, our results point to the likely routines and values that families of a similar type and demographic would find in systems like G2G. Thus, our design suggestions should be best thought of as a series of ideas that should be further tested, refined, and tried with a broader range of families. Other families are likely to have their own idiosyncratic practices and values, and it is important to understand these as a part of future design work.

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