SINCOM: communicating grandparents and grandchildren living at a distance

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Abstract— In recent years there has been a growing interest in creating applications that allow grandparents to communicate with grandchildren living at a distance, since the involvement of grandparents in the lives of grandchildren is important for both generations. Therefore, it is necessary to know the context of the relationship between grandparents and grandchildren and how they communicate. This article presents a proposal for SINCOM: a simple and intergenerational communication tool that includes the needs and communication preferences of those involved. The proposal has two main characteristics: allowing communication without parental involvement, and incorporating recreational activities to generate conversation topics. These findings help in the development of a functional and complete application that can be evaluated with more users.

Keywords— *Grandparent-grandchild relationship, communication distance, leisure activities, parental mediation, Latin American culture.*

I. INTRODUCTION

The involvement of grandparents in the lives of their grandchildren is important for both generations, because the relationship is viewed as emotionally significant, mutually supportive and it is a relevant aspect of their identity. Contact with grandparents, due to interactions as part of daily routines and activities facilitates the formation of emotional closeness, thus building strong relationships over time. [12]. Interest in the study of this relationship has grown in the last years, since increased life expectancy of older adults and the declining birth rate, means the role of the grandparent may be exercised for several decades [15, 14 , 13].

However, the grandparent-grandchild relationship may be affected or limited by different factors: one is geographical distance, which may restrict contact between grandparents and grandchildren [17, 14, 12, 13]; and another is the scaffolding of parents in the approach and communication of these age groups [5, 9, 14, 8, 13, 15].

Grandparents who live far from their grandchildren want to hear their grandchildren speak in a natural and self-motivated interaction, but the communications by videoconference or telephone can cause children to easily get distracted, requiring intervention from their parents [1]. The parent's scaffold can affect grandparents and grandchildren meetings [5, 9, 14], because if the parents have a good relationship with their parents they are more likely to foster a good grandparent-grandchildren relationship [8, 13]. The grandparent-grandchild relationship is initially mediated by parents, but eventually may become *independent* when grandchildren are able to bypass parents completely, usually when the grandchildren become adults or adolescents [15].

One way that has been implemented for grandparents to communicate with their children at a distance is by playing games through technology, which allows children to be more motivated and engaged in the activity of videoconference than through exclusive conversation. Several applications of this have been proposed, e.g. storytelling and displaying pictures [10, 18, 16].

Therefore, there is an evident need in the communication of grandparents with their grandchildren, where grandchildren can participate with their own initiative, generating conversation threads between them through fun activities and without parental mediation. The contribution of this research is to present a proposal to communicate grandparents and grandchildren living far away from each other, without parental mediation, considering the needs and communication preferences of those involved, while focusing on Latin American culture, to provide a proposal that meets the needs and characteristics of this cultural group. To achieve this, we conducted a qualitative study with semi-structured interviews to parents, grandparents and grandchildren of 3 families from Latin American countries living in different locations (grandparents and grandchildren).

The findings were used to generate design guidelines for the construction of a prototype called SINCOM, or "SImple INtergenerational COMmunication". The prototype was evaluated with the participation of experts in Collaborative Systems and potential end users. Finally, we discuss and analyze assessment results and their future implications.

II. RELATED WORK

This section provides a literature review about grandparents-grandchildren computer-mediated relationships. First we discuss grandparent-grandchildren relationships, then remote communication between grandparents and grandchildren, and finally, we present a review of technological applications for remote communication between grandparents and grandchildren.

A. Grandparent-grandchildren relationship

Grandparent-grandchildren relationships are important because grandparents are a source of support for their grandchildren. Grandparents in family structure are seen as caregivers, sources of motivation and encouragement, and the teachers of morality, values, family history, ethnic heritage and academic work [8].

A lot of the interactions between grandparents and grandchildren were marked by them engaging in various activities that both enjoyed. Grandchildren often felt closer to their grandparents as a result of them spending time together [8]. Some grandparents have everyday contact with their grandchildren; for others contact is only during family celebrations and holidays [12]. Typical activities include: participating in family events, sharing family story, playing, going on holidays, shopping, watching television or videos, helping in emergencies, giving personal advice, joining in religious activities, helping in school [13], or playing sports [8]. But these activities change through time: when grandchildren are young, time is spent on outings, playing together and providing childcare; but when they grow older, the activities are talking, giving advice and support [12].

Despite the importance of the relationship between grandparents and grandchildren, it is usually mediated by the parents. Parents are usually the "gatekeepers" in the participation of grandparents with their children and that families with better relationships between grandparents and parents tend to experience more active grandparent participation [4].

B. Remote communication between grandparents and grandchildren

In a study about communication of grandparents and grandchildren living a distance, it was found that the communications are conducted primarily through telephone or video conference. The content of the conversation between grandparents and grandchildren is focused on new ideas and skills that the children have learned, unexpected events and interesting situations in the life of both [6]. Children are aware that videoconferencing over Skype is a distinctive form of communication with their grandparents [3]. The benefits of videochat communication are the motivation that occurs in children's use of technology and how the visual component helps them to get focused while in conversation [1].

There are several challenges in communication, such as: the need for support and scaffolding for parent communication, and the necessary awareness of grandparents not to disturb their grandchildren with too many questions and barriers when exchanging cultural information [6, 7]. Some studies have found that intergenerational gameplay enhances communication between grandparents and grandchildren [1, 19].

C. Applications for remote communication between grandparents and grandchildren

In recent years, several applications have been created to assist in the communication of grandparents and grandchildren living at a distance. One factor that is considered to facilitate communication between them are recreational activities, e.g. emphasizing the playful component [16]. For the study they provided mobile devices and touch screens to grandchildren and grandparents, finding that the use of the camera phone was seen as a toy for grandchildren and grandparents were able to recognize the different patterns of interaction of their grandchildren [16].

Another way to bring grandparents and grandchildren closer is to provide activities such as: storytelling, sharing photos and a virtual area with pencils to draw [18]. Other applications have tried to emulate the storytelling activity, such as Family Story Play project [10], to help grandparents teaching reading skills of their grandchildren of 2-3 years, with the character Elmo as a central element. This application improved the quantity and quality of interaction between grandparents and grandchildren, in a context of shared activity. A study that assessed viability of a system of co-reading found that younger children may be interested and motivated during videoconferences with added components that connect them with the activities (peak of use of this technology was in children 3 years of age) [11].

For the aforementioned reasons, there is a need to design an application to communicate grandparents and grandchildren living far away, without parental scaffolding and including a recreational component. This study is focusing on Latin American culture, it is a qualitative study in three families belonging to countries from this region, to offer a proposal that will meet the needs and characteristics of this cultural group. Therefore, there are differences from previous studies such as in their activities together, parental mediation and different themes that may or may not be transferred to grandchildren.

III. COMMUNICATION NEEDS OF GRANDPARENTS AND GRANDCHILDREN

A. Methodology

To identify communication needs between grandparents and grandchildren living at a distance, we decided to use a qualitative methodology for data collection. The technique applied in the study was a semi-structured interview for grandparents, grandchildren and grandchildren's parents. The study involved three families, from Latin American countries, in which grandparents were living far from their children and their grandchildren had previously communicated using technology. It is noteworthy that this is a preliminary study and that it included a small number of families because of the difficulty of making intergenerational interviews, so researchers also used existing literature about the topic.

The users were selected using the following criteria: grandparents should have at least one grandchild between 3 and 8 years old, know how to use a video conferencing program and send email. The grandchildren must have speaking skills to answer the interview questions. Table 1

presents the characterization of the families who participated in the study.

TABLE I.   CHARACTERIZATION OF STUDY PARTICIPANTS

	Family	Age	Country of Origin	Location
Family 1	Grandfather	64 years	Chile	Santiago, Chile
	Grandmother	60 years	Chile	Santiago, Chile
	Father	36 years	Chile	Cartago, Costa Rica
	Granddaughter	4 years	Costa Rica	Cartago, Costa Rica
Family 2	Grandfather	68 years	Chile	Santiago, Chile
	Grandmother	65 years	Chile	Santiago, Chile
	Father	40 years	Chile	Massachusetts, USA
	Granddaughter	4 years	Chile	Massachusetts, USA
Family 3	Grandfather	71 years	Chile	Salamanca, Chile
	Mother	45 years	Chile	La Serena, Chile
	Granddaughter	8 years	Chile	La Serena, Chile

Through the interviews, we obtained personal information of grandchildren, parents and grandparents, also know form and frequency of communication; likewise conversation topics and if they make fun activities. Additionally if there is mediation by the parents of the grandchildren and inquire about the preferences of communication and transmission of information from grandparents to grandchildren.

B. Analysis

Interviews were recorded and transcribed. Subsequently, each interview was assigned a code depending on the family and kinship; E1 corresponds to the Family #1, and within that interview, the parent is assigned the letter A, the grandparent is B and the grandchild is C. For example, interview E2-C corresponds to the granddaughter of family #2. We used thematic analysis to identify, analyze and report patterns (themes) within the data [3]. The resulting theme map is presented in Figure 1.
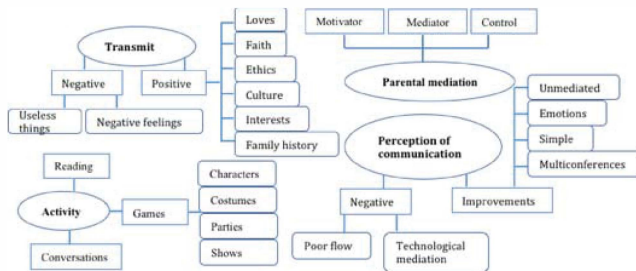

Fig.1. Thematic map

From the interviews, four main themes emerged, which are the following:

1. Activity: describes the activities that the grandparents did with grandchildren. E1-B: "*I believe that 80 percent of the*

time we are playing and we are ... because when she acts for us, it is also a game. We also play this game when we meet in person, playing different characters, so she also likes to do it on long distance communications. Around 80% of our communication is based on games".

2. Parent Mediation: it includes different ways in which parents mediate grandparent-grandchild communication. Mediation can occur in three ways: (1) Motivator: when parents encourage their grandchildren to communicate with grandparents, (2) Mediator: in this case the parents involved in the use of technology (turn on your computer, run video program, etc.) and the issues that speak grandparents and grandchildren (3) Controller: it occurs when parents supervise grandparent-grandchildren communication, as time, issues and place. E2-B: "*My son ask his daughters to use the application, even if it's only five minutes, so they can at least say hello to us. He ask them to tell a family story, so we can keep in touch...*"

3. Transmission: issues that may be transferred and not transferred to grandchildren. The negative issues are anxiety, pain by distance, frustration, etc. Positive themes include: love, faith, family history..

   E1-A: "*[I don't want to transmit] Anguish, pain by distance, frustration and any negative feeling about how dificult it is to have grandchildren at a distance*"

   E3-B: "*From my point of view it is interesting to convey that they are a person of faith, people who believe in something. In God, in any form ...* "

4. Perception of communication: it refers to negative aspects related to technical problems, also some improvements that can be applied to communication: that it can be simple, unmediated by parents, can transmit emotions and allow multi-conferences.

   E3-A: "*... it is important that I mediate, but should be a little more fluid. It shouldn't be only through me* "

Interviews and thematic analysis identified several needs in grandparent-grandchildren communication. These include: lack of recreational activities in applications that communicate children and adults, which decreases the motivation of children and the duration of their communication. The technological complexity of these applications is also considered a problem because it hinders beginning communication by both grandparents and grandchildren. This complexity is also apparent when they have to resolve emergent technical problems, interfering with communication.

IV. PROPOSAL

In this section, the proposal to communicate grandparents with grandchildren is presented. In first place, the factors that were considered in the prototype design are presented, then, the process of its creation is mentioned.

A. Prototype design

The literature review allowed us to identify needs: first, the presence of a virtual character that supports the participation of grandchildren in their communication; second, the lack of applications for communication between grandparents and

grandchildren through games without requiring mediation by parents. Six elements were established that should be in the prototype:

1) Synchronous and Asynchronous Communication: synchronous and asynchronous activities allow both grandparents and grandchildren to communicate at different times, in different time zones.

2) Awareness: it means being aware of grandparents and grandchildren's presence, and to know what you are doing to facilitate communication between them.

3) Recreational activities: the existence of recreational activities that give a context and allow the game between grandparents and grandchildren to generate talking topics and keep the kids interested longer in communication.

4) Differentiated interfaces: generational differences and familiarity with technology motivate the need for two different interfaces, one for grandparents and another for grandchildren.

5) Unmediated: mediation by parents does not allow a fluid and spontaneous communication between grandparents and grandchildren, so it is considered that it should be conducted by them without the intervention of others.

6) Multiplatform: the existence of different mobile and desktop technologies requires the application platform for effective use regardless of technology.

B. Prototyping

The prototype "SINCOM: Simple Intergenerational Communication" was created using these six elements as a simple and easy-to-use solution for grandparents and grandchildren. To build the prototype three steps were executed: (1) the application content was defined, (2) paper designs were created and (3) mockups for each interface were created. Among the main prototype features are the following:

1. Grandparents and grandchildren can initiate communication without parent mediation (see Fig. 2).

2. The incorporation of a virtual character in grandchildren's interface (see Fig. 2.a).

3. The inclusion of one activity: Pet.

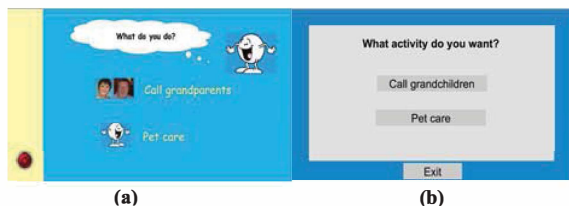4. Grandparents and grandchildren can talk via videoconference.

Fig.2. Initiate communication (a) grandchild's interface (b) grandparent's interface

The Pet activity is asynchronous and involves pet care by grandparents and grandchildren, allowing them to add clothing, food, accessories and objects. These items are available on the display of the pet as shown in Fig. 3.

Each time the pet receives care from grandparent or grandchild the application count a heart more as shown in the main screen (see Fig. 3). Depending on how many hearts accumulate, the application will make available more accessories to play with the pet.

Fig.3. Activity Pet (a) grandchild's interface (b) grandparent's interface

In this activity, grandparents or grandchildren can send messages that include audio and video. The idea of the message is that grandparents and grandchildren record a video of the pet with any changes and will add a voice message (see Fig. 4)
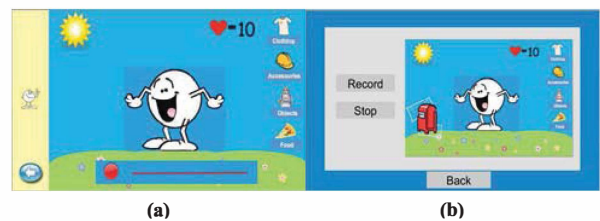

Fig.4. Record message (a) grandchild's interface (b) grandparent's interface

The message is placed in a shared mailbox, so the addressee can open it later (see Fig. 5). The grandparents and grandchildren can talk about their pet for videoconferencing, which can generate talking topics in common.
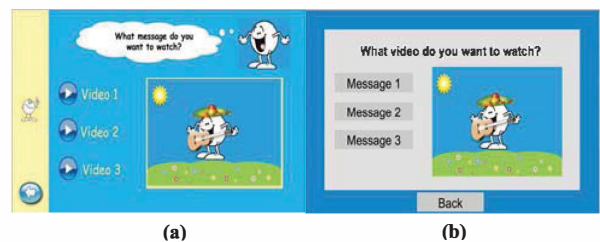

Fig.5. Message menu (a) grandchild's interface (b) grandparent's interface

This proposal includes elements obtained from literature, such as incorporation of the virtual character in the grandchildren interface and the possibility that grandparents or grandchildren can initiate communication directly without the parent mediation. The qualitative study highlighted that grandparents and grandchildren enjoy performing together recreational activities. For this reason, this proposal presents an extension in this communication type, mixing these elements to enhance the experience when the grandchildren and grandparents living far away interact through applications.

V. PROTOTYPE EVALUATION

Two evaluations were conducted to measure the degree of collaboration that the prototype has, both experts and end users

participated in evaluations. First, we used the groupware heuristic evaluation method, in which experts in the heuristics tried to find problems with the interface [2]. Two experts in the field of Collaborative Systems participated, one performing the grandparent role while the other performed the grandchild role.

Four users participated in the second evaluation, two grandparents and two parents of children living at a distance, in Table II the characterization is presented. The sample consisted of parents rather than their grandchildren, because of the difficulty of children using a prototype and understanding the interview questions. The technical evaluation consisted of a semi structured interview applied to users, about collaborative prototype perception.

TABLE II.   USERS CHARACTERIZATION

Expert	Age	Sex	Role
Grandfather	64 years	Male	Grandparent
Grandmother	60 years	Female	Grandparent
Mother	38 years	Female	Grandchild
Father	30 years	Male	Grandchild

The user evaluation consisted of the following steps:
1. Each user used the prototype, according to the role that corresponded (grandparent or grandchild).
2. Each user was interviewed and answered ten questions related to collaborative systems and based on groupware heuristics.

The results of these evaluations are presented in next sections.

A. Expert evaluation

Each problem mentioned by the experts in assessments was analyzed. The results are presented in Table III.

TABLE III.   EXPERTS EVALUATION RESULTS

Problem Description	Heuristic violated	Gravity
It isn't possible to know if someone else is using or making changes on pet simultaneously It happens if both make changes at the same time.	Heuristic 5: Provide protection	High

B. User evaluation

The interview was analyzed to obtain results for both users: grandparents and parents. The grandparents said that the characters presented in the prototype enhanced speech, gesture and body language. They also indicated that the activity allowed them to have more conversation topics with their grandchildren. They mentioned that they were able to be aware of their grandchildren's presence and their actions; except when they were using the pet. Parents felt that the application was generating conversation topics and bringing grandparents and grandchildren closer. Parents mentioned that

grandparents should add their grandchildren to the application and that multi-conference should be included. For Grandparents, it could be complex to take care of many pets, or to interact with several grandchildren.

VI. DISCUSSION

In collaborative systems with shared resources such as the one presented in this study, objects must be considered to foster awareness about their concurrent use. For example, in our prototype, there is a simultaneous use in pet care.

An important aspect to mention is that the virtual character that supports the grandchildren while using the application, can reduces the visibility of objects in the real world, not just physically obstruct, but also make them less noticeable, leaving outside the focus of the participants interaction as is the case of videoconferencing.

However, it must be particularly careful when interpreting the validated data, because the prototype was not a fully functional application, so that the results are based on the user's perception of a potential application based on the prototype.

VII. CONCLUSIONS AND FUTURE WORK

This work presented our research about the communication needs between grandparents and grandchildren living at a distance. Relevant communication needs were detected: awareness, recreational activities, scaffolding and differentiated interfaces. This study established design guidelines for a proposal to mitigate communications needs of different intergenerational users.

The evaluation techniques for collaborative systems, allow end users to identify that doing game activities give the perception of proximity, and generate topics for developing interaction and communication between grandparents and grandchildren. The contribution of this research is a proposal to communicate grandparents and grandchildren living far away from each other. We conclude that to create an application to communicate these age groups, the solution has to be dynamic and simple, with striking activities, different interfaces and without parental mediation. It is also important to mention that the results are based on the literature and preliminary study was conducted with few end users

In future work it is considered to apply user usability assessment to the prototype. It should also continue with the following software development phases.

Given the small sample of study users, it is difficult to speak of generalizable results, so that assessments done by participants shed more coverage about different application user profiles. It is also suggested to extend the evaluation including more people and other evaluation methods. In addition, it is recommended an experimental comparison of the implementation with respect to other technologies on the market, the latter in order to measure the added value of our solution with respect to existing alternatives.

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