

# Elderly's Comprehension on Facebook: a Communicability Evaluation

Carolina Sacramento<sup>1,2</sup>, Simone Bacellar Leal Ferreira<sup>1</sup>

<sup>1</sup>Universidade Federal do Estado do Rio de Janeiro (UNIRIO).  
Av. Pasteur 458 – Urca, Rio de Janeiro  
22290-240, Brasil  
{carolina.sacramento, simone}  
@unirio.tec.br

<sup>2</sup>Fundação Oswaldo Cruz (FIOCRUZ)  
Av. Brasil 4365 – Manguinhos, Rio de  
Janeiro 21040-360, Brasil  
carol@fiocruz.br

## ABSTRACT

This paper describes a qualitative research using the Communicability Evaluation Method for Collaborative Systems. The objective is to evaluate the elders' interaction with the most popular social network in the world (Facebook), using a different approach to the proposed by the HCI community: communicability. In our case, we use younger volunteers to compare the results. As a result, there was a necessity to review some interface aspects, such as the meaning system adopted by the designer. It was also realized the need to establish clearer criteria for the information organization and to correct usability and accessibility problems that influence on the communication failures that occurred during the elders' interaction with the social network.

## CCS Concepts

• **Human-centered computing** → **Human computer interaction (HCI)** → **HCI design and evaluation methods** → **User studies**

## Keywords

Communicability; MAC-g; Accessibility; Elderly.

## 1. INTRODUCTION

Technological innovations have transformed the way as people live and work through the history. Online social network systems are transformers tools that enable people interaction in the contemporary society.

On the other hand, the most widely used social networks like Facebook, were designed for younger people who are within the average population age users. For this reason, the design of interfaces in these social networks bring interaction challenges for elders [10] [27].

In this regard, the impact that aging problems may cause in the interaction of older people with social networks is essential to provide accessibility of those social networks. In addition, it is also important ensuring a good communicability, because it allows that the message transmitted by the designer through the interface (metacommunication) would be understood in the user-system interaction as in the interaction between social network user's avoid that communicative failures discourage or obstruct the use of these social networks by elder people [20].

This research aims evaluate the interaction of elder people with the most popular social network in the world (Facebook), attending to an innovative perspective in the Human Computer Interaction (HCI) Community: communicability. The purpose of this work is

to analyze and compare interaction of elder and young people on Facebook, based in the application of a communicability evaluation method for collaborative systems (CEM for groupware, or MAC-g in Portuguese) and the evaluation of aging limitations with communicability results in elders, compared with younger users.

## 2. ELDER PEOPLE AND ONLINE SOCIAL NETWORKS.

The global population projection published in 2015 by the Department of Economic and Social Affairs of the United Nations [6] exposed that population over 60 years is increasing. Although in 2015, the elderly population in the world was made up of approximately 901 million people (12% of the entire population), the projection is that this number will grow to 1.4 billion by 2030, 2.1 billion in 2050, being able to reaches 3.2 billion in 2100 [6].

The aging population is also reflected in the virtual world. A report of the use of social media 2015 by American adults (2005-2015) published by the Pew Research Center, showed that the use of these media for people over 65 is increasing progressively. In 2005, the elderly were only 2% of the total of the considered people, 11% in 2010 and 35% in 2015 [17].

The online social networks can help to reduce the feeling of isolation of elders in society, motivating reasoning skills and increasing the sense of self-responsibility. In addition, it can contribute to the well-being and social inclusion of this portion of the population, according to Morton & Genova (2015) [14].

## 3. COMMUNICABILITY EVALUATION

Communicability is the main criteria of quality of a system according to the Semiotic Engineering (EngSem), a Human-Computer Interaction (HCI) theory based on Semiotics, science responsible for study meanings and the communication between signs. Signs are anything used by a person to say something, can be words, images, sounds, etc. [25].

The Semiotic Engineering is focused in the designer-user communication during the interaction between users and the system, and considers that the system interface communicates to users the designer perception about who the users are, their desires and needs, the reasons why they use it and how they prefer it to be [24,25].

Consequently, the communicability is the software's property to transmit to users the intention of the project and its interactive principles in an efficiently and effectively ways [19].

To evaluate the communicability of an interface with the users participation, the Semiotic Engineering proposed the Communicability Evaluation Method-CEM (or MAC, in Portuguese) [21,24,25], which consists in the observation of users by experts who analyze how users the interchange of messages between users and the interface and identify communication breakdowns that may take place during interaction with system [21].

The MAC has three main stages: 1) preparation: In this phase, participants are selected and the evaluation materials are prepared; 2) tests: In this stage tests are conducted in a controlled environment with recording of users interaction and facial expressions 3) analysis/interpretation of interactions [24].

Meanwhile, the last stage has three steps [24]:

- a) tagging: Researchers watch recorded test session and identify moments when communication breakdowns happen (each breakdown is tagged with one of the thirteen pre-defined tags that represent the researcher interpretation of the user behavior in the context of the interaction);
- b) interpretation: In this stage, the meaning of the acquired tags is interpreted based on the presence (or nonexistence) of each tag, their frequency and distribution in different interaction contexts as well as the theoretical categorization of those tags, considering the expressions classification of the breakdown by type of failure (complete, partial or temporary);
- c) semiotic profiling: In this phase the whole process is completed with a detailed characterization of the metacommunication message reception.

In collaborative systems, it is necessary to expand the MAC's point of view for a view that also considers interaction between users in the system [20].

The MAC-g consists in an extension of the original MAC and considers the interaction between people in the system, not just the user-system interaction. Data and analysis collection in the MAC-g are identical to the original MAC, incorporating the tag "Who?" to the thirteen present, considering that in collaborative systems may be breakdowns related to the identification of who performed a certain action.

The Mattos's proposal [13] indicates that tags must be mapped from a combination of values that correspond with dimensions that are relevant to the interaction in collaborative contexts and represent the possible communication breakdowns. These dimensions are used in the formation of tuples, which completely characterize the breakdown.

The MAC-g considers four different dimensions: Interaction level where a communication breakdown may happen; Important collaborative aspects to bring support to the communication activities, coordination and collaboration among the system members; Time in which the breakdown happens and communication breakdowns. Table 1 illustrates the values that each dimension can assume.

**Table 1 – Values for each dimension – MAC-g [13]**

|                                 |                                                                                                                                                                                                          |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Interaction level</b>        | Individual, Interpersonal and Group                                                                                                                                                                      |
| <b>Collaborative aspects</b>    | Artefact, Local, Vision, Audition, Speech, Action                                                                                                                                                        |
| <b>Time</b>                     | Present, Past and Future                                                                                                                                                                                 |
| <b>Communication Breakdowns</b> | Who?, What's this?, Where is?, Oops!, I can't do it this way, Why doesn't it?, What happened?, Thanks, but no, thanks, I can do otherwise, Looks fine to me..., I give up, Help!, What now?, Where am I? |

In the interpretation step of the MAC-g, the identified breakdowns are associated with four categories for group interaction problems [13]:

1. "Lack of perception of the virtual space": There is no information about the other group members or their interaction with the workspace where they operate in the application;
2. "Lack of discourse perception phenomena": Means the absence of information about the responses and reactions of the other members in relation to communication, and also, about the lack of processes and communication protocols;
3. "Lack of coordination possibilities perception": The user does not have enough information about the mechanisms to support the coordination of the group.

"Lack of technology perception": Missing information impede the user to infer appropriate assumptions related to problems with the technology, like when happen an Internet connection failure that is not perceived by the user, and he could incorrectly infer that is being ignored when not receive responses from another user.

## 4. RELATED WORKS

Even with the benefits that social networks bring to elders, Sundar *et al* (2013) [27] and Graças (2013) [10] specify that many of them can't make a correctly use of them, due to the interface of these applications were not designed for this audience.

Although there were many works related to usability and accessibility of Facebook and its features [1,2,7,11], including elderly [10,18], few of them have explored the communicability principle in the social network.

Carvalho *et al.* (2012) [3] and Souza *et al* (2012) [26] explored communicability problems about privacy and security settings of Facebook, with young users from the original MAC.

Were found few papers that explore the application of MAC-g. VILLELA *et al* (2012) [28] attempted to consolidate the method from the results of a case study in the social network Research Gate while DANTAS *et al* (2014) [5] applied the MAC-g in a three-dimensional environment of distance education (Sloodle) to identify improvements in the method for three-dimensional environments.

Therefore, none of the presented works performed a comparative analysis of the communicability of a popular collaborative system like Facebook, among users with different age ranges, being considered this the contribution of this research.

## 5. RESEARCH METHOD

In order to achieve the purpose of this research, was adopted a qualitative-exploratory approach, based on case study with multiple analysis units and consisting of the observation and application of the MAC-g in the interaction of elder and non-elder people with Facebook in a comparative approach. The method was divided in four stages: a) Definition of the social network system and the characteristics to be analyzed; b) Definition of the Facebook version analyzed c) Definition of the evaluation method d) Communicability evaluation.

The research was limited to study the Facebook communicability for old and young users. The age range of the elders that participate in our tests was between 70 to 90 years old and for young people between 30 and 50 years old.

In addition, they were not considered all the features of the social network. The evaluation was restricted to chat conversations, the share of information through the timeline of another person and the action to like the public person page.

### 5.1 Definition of the social network system and their features.

Facebook was selected as scope of this work due to its popularity in the United States [17] and Brazil [8], [23], even among elder people [9].

The election of the features of Facebook analyzed has taken into account collaborative aspects of social networks such as interpersonal communication (from the chat and sharing features) and the use of the "like" in a page considered popular.

### 5.2 Definition of the Facebook version analyzed

The Facebook interface has three versions: a desktop or classical, which is presented to users that connect with the social network from desktops and notebooks, a mobile version, which can be accessed from browsers on smartphones and the app version, displayed smartphones or tablets. In this work we chose to evaluate the desktop Facebook interface, because is the most commonly used by the Brazilians elder people, according to the results of a study made by the Brazilian government in 2014 [4].

### 5.3 Definition of the Evaluation Method

In the election of the evaluation method was considered the analysis of the interface taking into account users from the point of view of the Semiotic Engineering. Considering different methods based on the theory, MAC-g [13] was selected because it allows analyzing the quality of communication focused on the reception of the metacommunication message by the system users in collaborative contexts [22].

### 5.4 Communicability Evaluation

The development of the case study was prepared through the application of the MAC-g method in observation sessions: five elders and five adults (non-elders), and was considering each session as a unit of analysis, which enabled the successive comparison of results. The communicability evaluation will be detailed in the Section 6 and followed the steps proposed by MAC-g: preparation, tests and analysis/interpretation of the results.

## 5.5 Limitations of Method

The MAC-g method orients that tests must be conducted in a controlled environment, because studies made in the laboratory are more accurate and generalizable [13]. This research followed this suggestion, however, in order to do more flexible the elders participation, because they could present difficulties if were necessary go to a laboratory, was used a mobile laboratory. This allowed perform the tests in the participant's home or in their workplaces, but with a controlled equipment, provided by the researcher, with a built-in camera and a software for recording the interaction.

The use of the portable laboratory facilitated the participation of elders and prevented differentiated communication actions among the participants of the study, in an elder-elder, elder-not elder and not elder-not elder approaches. The tests were restricted only to a researcher-participant communication approach, because it was non-viable to reconcile remotely tests with participants. This approach would require the synchronized participation from five to ten researchers in the test conduction.

## 6. COMMUNICABILITY EVALUATION

The communicability evaluation followed the steps proposed by MAC-g: preparation, tests and results' analysis/interpretation. After the method application, was briefly consulted an expert in the method in order to clarify doubts and to validate the obtained results.

### 6.1 Preparation

The preparation step focused on the profile definition and the selection of participants, definition of tasks and elaboration of all the materials used in the tests.

#### 6.1.1 Profile definition and selection of participants

Steps of preparation and implementation of the MAC-g o does not have any difference in relation to the same steps on the original method (MAC), as well as other users observation methods in controlled environments [13]. For this reason, we considered five participants from each profile, as indicated by Nielsen [16].

Our study was carried out with elders aged between 70 and 90 years old and adults (non-elders) aged between 30 and 50 years. In order to preserve similarity between the profiles, we tried to select participants with similar characteristics, i.e. the same experience on the social network and information systems use and the homogeneous distribution of participants between education levels (secondary and higher).

None of the participants, regardless of age (elder or not elder), could act in computing and information technology areas, to prevent that previous experience in the use of computers and information systems could influence in the results between the different profiles.

The age range election (between 70 and 90 years old) considered retired people only. This option assumes that this public professionally worked in times when professional activities had very little or inexistent contact with digital technologies. The age range election (between 30 and 50 years old) was justified because this generation is considered a transitional generation that does not grown in a digital environment, instead, in his school period, they researched in libraries and did scholars works by hand [15].

Although all elders participating in the tests were officially retired, two of them continued professionally working in activities not related to the use of digital technologies.

The selected participants of each profile were recruited through personal or telephone contact and they were part of the social and professional environment of researchers. The participants' recruitment was one of the biggest challenges in this study, for both profiles.

Regarding elders participating in the tests, main difficulties were related with the use of Facebook, for those elders with the age range required in the study, just a few had account on the social network. This difficulty converges with observations of HOPE *et al.* (2014) [12] about perceptions and use of the social media (digital and materials) for elders. The author of this study explained that even when statistics indicates that people aged 65 or more is one of the Internet user groups that are growing fastest in the United States, elders over 75 years, the account is still a small number in relation with Internet and social media use for other groups. Another aspect that made it difficult the elders' participation was the participants' agenda. In some cases, the test session had to be rescheduled more than once due to health problems of the participant or some commitments with the family (i.e., taking care of a sick son, taking care of grandchildren).

With the adult (not elderly) audience, the greatest difficulty was to find Facebook users with little or average user experience with social networking, given the popularity of Facebook with users of this age, i.e., most have experience.

In order to maintain the anonymity of the volunteers, their names were encoded in I1, I2, I3, I4 and I5 (elderly) and J1, J2, J3, J4 and J5 (non-elderly adults).

### 6.1.2 Task definition

Tasks were defined as follows:

Task 1: Start a chat session with a friend (researcher). The conversation will be closed when the friend says goodbye.

Task 2: Access the profile of any friend; to select the publication you most like and share it with another friend (researcher).

Task 3: Access a celebrity, politician or public person page that you admire and click "Like" this page.

Two researchers were required to perform the test: one on the role of observer and the other as a participant.

The volunteer's friend with whom the volunteer must chat (task 1) and share a publication (task 2) must be the researcher who acted as a participant. For that reason, before the test starts, the participant (researcher) must add the volunteer to his friends list (if he was not part). The participant (researcher) also had to search, in the volunteer friends list, a person who had common friends with the volunteer.

The chat interaction between the researcher and the volunteer was predefined to ensure the same interactions for all volunteers, regardless of the researcher who participated in the test.

To carry out the chat conversation the participant (researcher) had to make the following actions: after receiving the voluntary message, it was necessary to ask him/her to check how many mutual friends he/she had with the other user (previously chosen)

and to inform the names of those mutual friends. The participant (researcher) offered help about how to get the information via chat conversation. Task was closed when the volunteer finished answering the required questions or after 10 minutes with no answering. This time was set as the maximum for each sub-task requested in the chat. The time limit was set in 10 minutes to avoid long chat sessions that could result exhaustive for elders.

In order to verify if tasks were clearly described and if could be done in the limit time defined, it was conducted a pretest with an elder user. This pretest also contributed to review the materials that was used in the tests.

### 6.1.3 Material preparation for tests

The following supporting material for the tests were developed. Firstly, a Consent Form, with a guidance for the tests and some ethical considerations. Secondly, a pre-test questionnaire mostly composed by closed questions, specifically focused to collect demographic data and to identify the volunteer profile. Finally, a script for a post-test interview, in order to record the main difficulties declared by the participants in the test, as well as suggestions for improvements proposed by them.

## 6.2 Tests

The tests were conducted at volunteers' homes or workplaces. It was used a mobile laboratory with a laptop with a webcam, using Windows 8 Operating System and Google Chrome browser. Participants provided the Internet connection, via Wi-fi. When there was not Internet connection was used the 4G connection from the researcher's smartphone. This aspect delayed the tests duration but did not interrupted the tasks. Facial expressions and user interactions were captured using Camtasia Recorder Software.

Before starting the tasks, users was instructed about the necessary procedures, signed a Consent Form and answered a pre-test questionnaire. Furthermore, participants received information about the researcher's role, as the responsible to guide and monitor the tests, but that he could not help them during the test, because the test purpose was to evaluate Facebook, and not to the participant. This explanation was necessary to avoid that users might feel intimidated or embarrassed when having any difficulty performing tasks.

Elders participants had an average age of 75 years old. Four participants were women and three were retired. Two elders were still working, but their professional activities did not involve information systems. Regarding to the most commonly used devices to access to Facebook, desktop computer and laptops were the most used. Four participants reported they access to Facebook at least once a day. Concerning to the user experience using Facebook, on a scale of 1 to 5, where 1 is few experience and 5 is much experience, the mean of the responses was 3. Considering the same scale regarding the experience in the use of computers and information systems, the mean was 4.

Regarding to the non-elders participants, the average age was 38 years old, with three women participating. The most commonly used devices to access Facebook were the smartphone and the desktop computer. Three non-elders declared that they access Facebook at least once a day. In relation to the user-experience using Facebook, considering the same scale mentioned before, the average was 2. The user-experience using computers and information systems was 3 in the same scale.

The participants performed the tasks in their own Facebook profiles. Firstly, the researcher read aloud each task to participants before they started and repeated it partially when the user was completing the task. A repeated reading was done to make easier to elders understanding. Was considered an assumption which states that aging provoke a cognitive decline in the short-term memory [29]. The objective of this approach was that the results were related to communicative breakdowns in the interface and not in the conduction of the test.

In most of test sessions, two researchers were physically present: one in an observer role and the other conducting the chat session (task 1). This last, when possible, was in another room of the house or the participant's workplace. In four of ten sessions (two of each profile), the researcher responsible for conducting the chat session had to act remotely due to mismatch in schedules. Since the task was a remote chat, this aspect did not affect its implementation.

In the course of the test sessions, some participants complained about the used equipment, due to its characteristics (especially the keyboard), different from what they were familiarized. This problem was detected with two elders and one non-elder participant.

After being completed the test, the researcher conducted an interview to the participant with the objective to record the general impression and main difficulties detected in the test realization.

## 6.3 Analysis/Interpretation of results

This stage followed the MAC-g method, and was performed in three steps: tagging, interpretation and semiotic profiling.

### 6.3.1 Tagging

This step consisted in making observations of all the recorded interactions for all participants in the three test tasks, totaling 140 minutes. For elders, it was analyzed 92 minutes of their interaction in tests and 48 minutes for non-elders. The intention was to identify communicability breakdowns that happened during the users' interaction and relate them with the set of possible communicability expressions (tags), composing tuples according to each situation.

In all the composed tuples, the first dimension represented by the interaction level in which the breakdowns happened was "individual", because the second and third tasks had asynchronous features and other characteristics that do not allow the execution of an action or an actions sequence that could cause communicability breakdowns to the other social network members. Although the first task was synchronous, the fact that the interlocutor was the researcher, that received a script to conduct the task and not another Facebook user, did not generate breakdowns in an interpersonal level, since the answers given to the researcher did not impact on the interaction with the system.

The second dimension is related to collaborative aspects and was restricted only to "action" communicative breakdowns. None of the tasks performed by users involved collaborative aspects related to locations or environments with restricted access in the application. The same for communication skills related to vision (access permissions), listening and speaking (the possibility that owners and non-owners of an artifact talking about it) or artifact (all that is part of the application and can be arbitrarily transformed by the user, that also could manipulate attributes).

Regarding the third dimension, related with the time when the problem happens, all communicability breakdowns were associated

to the "present", because interactions made by users considered only the current time. No testing has been done on actions that happened on the past or on actions that could cause problems in the future. These kinds of situations are more common in collaborative systems, where participants perform group tasks for long periods, which is not the case for the tasks proposed in this study.

Once the first three dimensions presented the same values in all the identified tuples in the tagging process (first dimension – interaction level: "individual", second dimension - collaborative aspects: "action" and the third dimension - time: "present"), the obtained results will be presented in the next section by the fourth dimension's values: communicability breakdowns.

It was not identified any occurrence of the tag "Who?" This tag was proposed by [13] because in collaborative systems may exist communicability breakdowns related to identifying who performed a particular action. The nonappearance of this tag on the test results is related to the nature of the proposed tasks. Both in the task 1, as the task 2 and even in the task 3, participants was oriented about which social network member they should search or interact. In addition, the interaction of researchers involved in tasks 1 and 2 was not observed or evaluated.

### 6.3.2 Communicability breakdowns interpretation

Elders presented lower tasks completion rate than the non-elders. It was made a comparison between the experience factor and the completion of tasks factor and we realized that elders tended to complete tasks that they already knew. Non-elders presented better creativity facing unknown tasks.

In general, duration of the tasks was longer with elders, with an average of 18 minutes against 9 minutes of non-elders. The more delayed task was the first, because it required, besides contacting with other person, perform other activities in Facebook. An aspect that may have influenced in the dissimilarity between the results regarding times obtained for the profiles was the fact that in general, elders typed slowly and looked to the keyboard. This habit also avoided the utilization of the auto complete feature provided by Facebook, which can be used to tag a friend in a photo/publication or to facilitate the search for a friend. This problem did not happen with any of the non-elders.

The low skills in the mouse use, probably caused by deteriorations in the motor functions was also present in tests of three elders. For example, these elders made additional mouse clicks to reach an interface element or delayed the action of placing the cursor over an element. These factors did not cause communicability breakdowns, only usability problems in interaction and impacts on the completion time of the task.

Regarding the amount of communicability breakdowns, the elders volunteers presented the higher value: 158 against 66 of the non-elders volunteers, as showed in table 2.

**Table 2 Tagging Results for Elders and Non-Elders**

|                    | Tags           | Elderly | Non-elderly |
|--------------------|----------------|---------|-------------|
| Temporary Failures | Where is?      | 21      | 8           |
|                    | What happened? | 27      | 8           |
|                    | What now?      | 14      | 9           |
|                    | Where am I?    | 2       | 0           |

|                   |                          |    |    |
|-------------------|--------------------------|----|----|
|                   | Oops!                    | 6  | 4  |
|                   | I cannot do it this way. | 10 | 8  |
|                   | What is this?            | 49 | 10 |
|                   | Help!                    | 13 | 12 |
|                   | Why does not it?         | 3  | 2  |
| Partial Failures  | Thanks, but no, thanks.  | 0  | 1  |
|                   | I can do otherwise       | 2  | 2  |
| Complete Failures | I give up.               | 4  | 2  |
|                   | Looks fine to me...      | 7  | 0  |

The identified tuples was restricted to a specific combination of values in relation to the three dimension of the MAC-g method (interaction level: "individual", collaborative aspects: "action" and time: "present"). In addition, there were no occurrence of a "Who" tag (proposed by MAC-g), exclusively using tags from the original MAC-g method in the fourth dimension. For these reasons and finding to support the interpretation of communicability problems, it was used the theoretical categorization of tags in relation to the metacommunication failures (complete, partial and temporary) from the MAC traditional method.

Most of the identified breakdowns in the elders' tests were classified as temporary, especially the tag "What is this?" (49 occurrences). The frequency of breakdowns occurrence with this tag may indicate user's unfamiliarity about the meaning system adopted by the designer. During tests, participants tried to understand icons and page elements, hovering mouse above them. The expectation was to find tooltips that could support their understanding. In some cases, these tips were not available, showing failures in the standardization of the interface and generating other sequence failures, such as "I can't do it this way" and "I can do otherwise", which induced participants to change their interaction strategy or give up of an initiated interaction sequence.

The quantity of the "What's this?" tag between the non-elders, although less significant than in elders (10 occurrences) may indicate that even with non-elders may be conflicts between the meaning system adopted by the designer and the meaning system known by the user.

All elders and one non-elders demanded that Facebook's language does not help the interaction intuition when they asked about improvements that could be done in the social network in the post-test interview.

The second most frequently identified tag in elders was "What happened?" (27 occurrences), this fact was probably related to the recognition of low-contrast and of grayscale interface elements, common aspects in this social network. The higher incidence of this problem was identified in the first task (chat). The three elders who were able to open the chat window correctly to start an interaction with the researcher had the same difficulty in identifying the correct place to enter text. The nonexistence of a conversation record mechanism on the chat window provoked that elders had to click several times in the conversation record area, tempting to place the cursor there, without realizing that the correct location (at the

bottom of the window) already had focus. Facebook do not presented feedback, which caused other temporary communicability breakdowns in the sequence, such as "What's this?", "What now?", "Help!" and "I can't do it this way". In addition, this behavior was perceived in a non-elder participant (J4), but she realized faster than the other elders where cursor should be positioned.

Another frequent tag in elders was "Where is?" (21 occurrences), which indicated the difficulty presented by the participants to find items in the interface. The nonexistence of organization criteria respect to the friends list influenced in the fact that elder I4, for example, took more than 1 minute and 30 seconds searching for a friend in the list (task 1), when she was asked about the amount of common friends with another social network user. In the task 3 (liking a page), when three elders typed the name of a public person, and tried to find her/him and access him Facebook page, was identified a communicability breakdown in the search results. These results are displayed in list format with a small photo and the person's name on the side. It is possible that the low visual acuity of the elder I5 did not allow her to recognize the right person in the photo, causing that she incorrectly access to another person's page and generating the tag "Oops!". Summarizing, the frequency of the tag "Where is?" in the elders participants was probably related to non-intuitive sorting criteria, font size and low contrast in some system functions.

In contrast to elders, breakdowns obtained by non-elders showed heterogeneous results among participants. The interaction of J1 caused 29 of the 66 communicability breakdowns of non-elders (about 44% of total), while J5 did not record any breakdown. Although J1 had declared similar experience in the use of Facebook and information systems compared to the other volunteers, the fact that she do not use computers to do her professional activities (she is elder caregiver), probably may have influenced on these differences in the results, considering that all others use computers in their professional activities.

Temporary failures were also the most frequent failures among the non-elders participants. However, for this public, none of the proposed tags reached over 12 occurrences. The most common tags were "Help!" (12 occurrences), "What's this?" (10 occurrences) and "What now?" (9 occurrences).

Tags associated to complete failures, although fewer in number, are more serious than partial or temporary ones, since they represent a total failure of communication [19].

Regarding to the elder profile, there was a higher incidence of the "Looks fine to me..." tag in relation with the "I give up" tag. This happened because some elder thought they have reached the tasks goal, when actually, it did not happen. For instance, one elder (I1) liked a publication with a photo of a chosen artist in her own timeline instead of do the like action at the artist's Facebook page. Another example happened with I5, she typed all the dialogue in the chat window and did not press the enter key. The volunteer believed that the message was sent to researcher, but that did not happen. None of the non-elders participants generated the tag "Looks fine to me..." and only J1 generated "I give up" when could not complete the tasks 1 and 2.

Tags related to partial failures had the lowest incidence in the test (5 in total). Only one non-elder participant generated the tag "Thanks, but no, thanks", which was generated for a non-elder. The tag "I can do otherwise" occurred with two non-elders and two

elders. In the case of the elders, one of them was generated in the first task (chat), when the volunteer tried to start a video call.

A great part of the communicability breakdowns found for both profiles, could not be classified in the interaction problems categories, defined by [32] and proposed by [11] in the MAC-g method. There were no breakdowns related to "Lack of coordination possibilities perception" because there were no groups tasks or with coordination activities. Similarly, the category "Lack of discourse perception phenomena" was not identified in the obtained breakdowns because there were no situations where information of responses and reactions of the other members regarding communication were absent.

Regarding the category "Lack of perception of the virtual space", only one communicability breakdown could be associated: the tag "Looks fine to me..." that was identified in the elder I1 interaction, because she did not know that there was a Facebook page for the chosen artist.

The "Lack of technology perception" category was present in breakdowns obtained by the elder I2 and the non-elder J4. In the task 2 (share a publication), the internet connection of the elder I2 presented a temporary failure, resulting in a set of 35 tags, including "What happened?", "What now?" and "What's this?". The elder did not realize that it was a connection failure and gave up the task, probably because Facebook provided a feedback indicating that was necessary to repeat the operation. The non-elder participant (J4), in turn, had connection problems in task 1 (chat), resulting in 16 tags. The difference in this case was that J4 perceived the connection problem and continued interacting after the Internet service was restored. It is worth noting that in both cases, the problems occurred with Wi-Fi connection provided by participants.

The proposed tasks and consequently, the communicability breakdowns obtained in the test limited the MAC-g dimensions in individual (interaction level), action (collaborative aspects) and present (time). This fact can lead us to question if the application of traditional MAC method would not be enough to obtain the results. The same question was made by [28] when applying the MAC-g on Research Gate social network.

The goal of [28] was applied the MAC-g method in a different context from which was originally proposed as a way to evaluate it. The results showed that MAC-g was the most appropriate method for the proposal evaluation, but would need to be reviewed. The definition of interaction levels was a critical aspect. The authors realized that many of communicability breakdowns obtained at the individual level would be more properly classified as interpersonal; despite not explicitly generate breakdowns to other users. Another conclusion was related to the few quantity of communicability breakdowns classified into the problem categories proposed by the MAC-g method. Authors identified several breakdowns that, although it were related to collaboration, could not be classified in the proposed categories, suggesting that the interaction rating problems in collaborative systems proposed by the method might not be enough, and it would be interesting to investigate other existing ratings or even modify the original proposal, to cover not covered situations.

The conclusions of [28] about the "Lack of technology perception" classification can be improved by our results. This category was originally proposed by [11] with restrictions on the absence of perception of problems associated with physical failures of technology. For [28], this category could be extended to cover

situations where user does not realize the moment it ends to interact with the application and starts to interact with external technologies, like browser features or operating system. Although several tags obtained in the communicability test ("What's this?", "Where am I?", "Where is?", "Help!" and "I give up" happened because the elder I2 do not realize the Internet connection failure, many of these tags and a "Where am I?" from another elder's interaction were related to the absence of context's participants awareness where they were interacting.

Even with the indicated necessity of review the MAC-g method in order to consider a number of different issues or doing it more directed to social networking context, the fact that the method is based on the traditional MAC enabled the identification of the communicability issues in the interaction of elders with Facebook

### 6.3.3 Semiotic Profiling

In the last stage, was created the semiotic profile based on a metacommunication's messages characterization. These messages were obtained through the tagged communication breakdowns and their corresponding interpretations, in order to reconstruct the meta-message created by the designer through the interface. Based on analyzes, the semiotic profile was constructed considering the needs of the elder population:

*"Based in my interpretation, you are a user with little experience using Facebook that would like to socially interact with family and friends through social networks. Therefore, I designed this system for you. I learned that you would like to use the system to interact with your family and friends, to share and like publications and pages, in a simple and intuitive way. I also learned that you have difficulty interpreting some icons, when these represent metaphors of system actions, such as 'tag people in its publication' and 'add what you are doing or feeling'. Finally, I learned that visuals resourced should be clear, to facilitate the information search on the social network, and it is necessary to use texts in the place of symbols, because I realized that you have difficulty interpreting metaphors of system actions. In the process of using social networks and for the communication with other members, the system needs to warn you about any problems on your Internet connection"*

## 7. CONCLUSION

This paper presents a detailed communicability evaluation of the most popular social network in the world: Facebook.

Results in the communicability evaluation revealed considerable differences between elders and non-elders regarding the amount of communication breakdowns and complete failures in the incidences found and in the duration of the tasks conclusion.

One of the main differences between these two profiles was related to the language used, given the quantity of tags "What's this?" evidenced in the interaction of elders. They had difficulties to understanding the signs (often represented by icons) available on the interface. The "What's this?" tag may denote unfamiliarity by users of the meaning system adopted by designer or generate conflicts between the meaning system known by users and the specified by the system. Difficulties understanding the Facebook language may also have influenced on the low conclusion rates of the unknown tasks obtained by elders compared to younger participants. These results confirm that elders presented difficulties understanding meta-messages used by the social network designers.

Although we choose the MAC-g method to consider communication breakdowns related to the users interaction on the social network, the combination of the tuples obtained in the analysis resulted in a distinction in the breakdowns only by the fourth dimension: communication breakdowns restricted to the original MAC tags. This allowed us to explore the communicability problems only between users and the system, which did not reduce the seriousness and relevance of the encountered communicability problems.

Even when this research was restricted to analyze and compare communicability in Facebook by the two proposed profiles individually (without evaluate interaction between younger people and elders). The results indicated the necessity to review the intercultural metacommunication in long-range systems such as Facebook. This is because Facebook integrate in the same environment, several generations with cultural differences related to behavior, values and communication styles.

As future work, we pretend to evaluate the Facebook accessibility and do a triangulation of the two evaluations (accessibility and communicability) in order to verify the converging points and suggest a set of guidelines to support designers when creating new spaces for elderly social interaction.

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