Master's Thesis

What's up: dynamically adapting features for a better experience for elder users

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ABSTRACT

Aging reduces human capabilities in numerous ways. These age-related biological changes in the perceptual, cognitive and psychomotor abilities in elderly users are expected [3] and applications should be carefully designed to fit consumers' decreasing capabilities. When we design application interface for old users, usability (that is, whether the application interface is easy and enjoyable to use) and applicability (the user perceptions about how much the application was appropriate for solving their problem) are among the most important criteria that should be taken into account. However, the number of classes of features present in the application can dramatically influence the levels of these criteria. To test this influence, four different navigational layouts of the of What's up application - a new communication channel in which elders receive information (text, pictures, videos) from youngsters, with different number of provided functionalities were developed, tested and evaluated to assess their ease of use. The results demonstrated that generally the most of the tested users experienced the highest level of usability when they were provided all the classes of features. However when we examined the results by taking the age differences into account, we observed that the eldest group (85+) predominantly tended not to be fond of using complicated features and preferred interfaces with only navigational features, the middle group (75-84) showed huge variability (different participants in favor of all the different interfaces) whereas the youngest group (65-74) predominantly enjoyed the interface with all the features. Taking this finding into account, in applications for elders the classes of available features should be dynamically adapting correspondingly to the ability of the user. Aspects of the experimental layouts suggest promising new directions in the development of interfaces for all the different groups of adults.

1 INTRODUCTION

Adults represent a very diverse group of individuals. Older adults (ages 54–94 years), as a group, are more variable than younger adults (ages 17–36 years) considering differences between persons measured on a single task on a single occasion (show greater interindividual variability) [1]. Elders also show greater variability within person across tasks (measuring a single person once on multiple tasks), and variability within persons across time (measuring a single person on a single task at multiple occasions) than youngsters [1].

Scahie (1996) [2] distinguishes "young-old" adults, 60-74 years, and "old-old" adults, 75 years and older. Drolet, Schwarz and Yoon (2010) are following and enlarging this classification into three subgroups: the young-old group, age 65-74; the middle-old group, age 75-84; and the old-old group, those 85+ and in this work I will follow this categorization (Table 1). These groups have often different needs (and wants) from applications. Young-old adults are much less impaired than middle-old adults who are beginning to show problems with the daily activities such as shopping and cleaning, whereas old-old adults are likely to suffer from disabilities that lead to problems with basic daily activities such as mobility, bathing, toileting [2]. However, when it comes to looking at normative, age-related changes in the perception of usability and applicability of an application, we consider the data coming from the three groups, altogether.

Category	Age
Young-old adults	65-74
Middle-old adults	75-84
Old-old adults	85+

Table1. Segmentation of adults into different groups proposed by Drolet, Schwarz and Yoon (2010)

Despite their diversity, older adults generally do experience changes in a lot of segments:
- changes in the vision: their ability to see as clearly as they did is affected, they experience loss of acuity, particularly

for near, but also for distance vision; less sensitivity for light; and a reduction in the ability to distinguish colors [3],
- changes in the hearing: elders begin to notice subtle changes in the ability to hear high-frequency tones in our 40s and ,and those losses usually progress as people age [3],
- changes in the psychomotor abilities: show lowering of the speed on processing on specific tasks, as well as decrease in the performance of both work memory and long term memory tasks [4].

Because of these changes, elders are quite limited in experiencing life. Their interaction with relative and friends is very limited, often restricted to sporadic phone calls and face to face meeting usually initiated by the elders. Most grandparents talk to their grandchildren less than once a fortnight, the phone-calls seldom last for more than five minutes, and further, grandparents or parents initiate the great majority of the calls (Figure 1, data taken from [5]. Very frequently they lost touch with friends and communication is difficult.

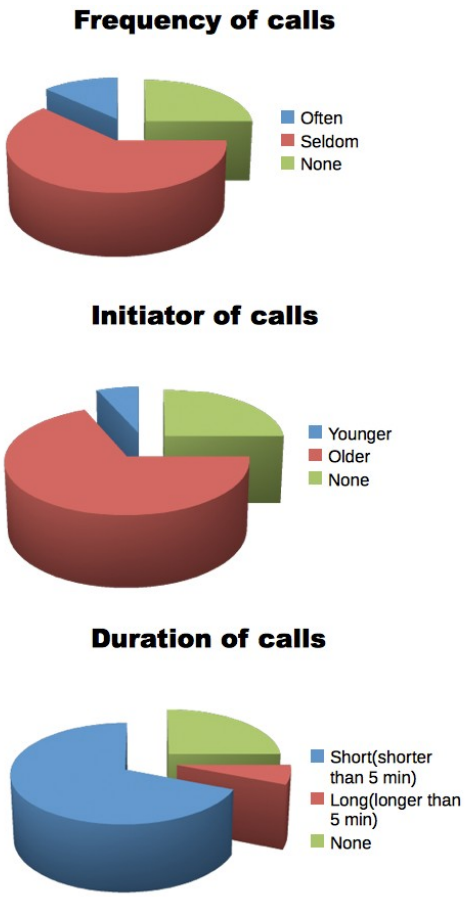

Figure 1. Summary of a study performed in [5] in which the frequency, duration and initiator of the phone calls between youngsters and their respective grandparents were characterized. Only 2 out of 16 youngsters call their grandparents often, in most of the times the duration of the calls are short, and almost all the time the initiators are the elders.

There are already some projects on the market targeting this issue:

- **Bettie** is a package of devices to allow the elders and people without computers to participate in a social network. There is a tangible user interface for navigation and the integrated keyboard allows for the users to send messages back to their friends and family. The user places a friend pass in the device and any updates, news and messages will be displayed. Aggregated information such as grandchildren who are on Facebook and Twitter or who have uploaded pictures on a photo site is presented to the user [6].This can be sometimes inconvenient since not all the Facebook and Twitter photos from the youngsters are suitable for the elders. Another inconvenience is that every time the elder wants to add a friend a new pass needs to be purchased; this solution is both not handy and expensive for a usual elder. Up to now, Bettie got out of the development stage and it is planned to be open source although there is still no available firm confirmation about this.

- **Epigraph** represents another available tool that reached a development phase of a working prototype ñ it is a screen divided into a number of channels, each representing each family member. Channels can be updated via email, text or picture message. This prototype provides different ways of sending content to the elder. The sense of not being able to manage incoming contact was reported as one of its drawbacks. Moreover, additional disadvantage of this tool is that it has is that it has a fixed number of channels for a limited number of family members [7].

- **Eldy** is another platform which is recommended to elders who have never used a computer before and which is claimed developed to be used on tablet PCs. It has almost over 220,000 users and currently runs in Italian, French, English and Dutch. It is an application which runs on top of Windows/Unix and can be set to be started when the operating system starts, so that the elder doesnít have any problem in accessing it. Eldy has been reported to have some problem with specific symbols with accents in the Dutch version, as well as misleadingly chosen label names in the English version[16].

- Meza-Kubo, Moran and Rodrigez (2009) propose a pervasive system for elders, in particular, a system that targets elders suffering from cognitive decline diseases. This system consists of multimodal interfaces and distributed software components: Elder's Client, SFN(social family network) Member's Client, SFN Member's Communication Client and Therapist's Client. This system enables the members of the elders' family to motivate elders to carry out Cognitive Stimulation (CS) activities - activities which are proven to prevent cognitive decline diseases such as dementia for example[15].However, the implementation, evaluation and use of these technologies are left as future work.

-InTouchLink [18] offers IT solutions for retirement homes, and other senior living environments: individual usage to simplified email, internet, photos, calendar. Users can access to local news, organizations of trips and discounts in local shops. Elders can also send and receive emails, bonding to relatives and friends, and giving them a high sense of indipendence. It was observed that the residents become more

sociable and see an improvement in their life quality, being happier.

Here, we present a new project that deals with the same problem. The goal of **IT4Life** project is to enable elders to "participate" to life. Participating to life, for what concerns this project, has three meanings:
i) experiencing life, typically by participating to the events and emotions of the elder's family members, in this application it means developing interfaces to assist older people in consuming and possibly reacting to life experience content (text, photos, videos);
ii) interacting with ñ or at least receiving information about ñ the elder's friends, in this application it means receiving and responding to content(text, photos, videos) ;
iii) contributing to the development and wellbeing of society, by motivating elders to stay proactive and to prevent any possible cognitive decline which can occur as a biological change in the process of aging

Experiencing, interacting, and contributing are considered as essential to a person's happiness. Steptoe and Wardle (2011) analyzed data from a representative cohort of older men and women living in England and in this study, feelings of happiness were assessed by aggregating momentary assessments over a single day in 3,853 individuals aged 52 to 79 years who were followed up for an average of 5 years; the data showed that happier person live longer by 35% [9].

The IT4Life project is composed of four main dimensions: Spectator, Active Lifestyle, Life Sharing, and Life Participation and the Spectator dimension is composed of two applications: What's Up and LifeShare. LifeShare is an application that lets young people share information (e.g., text, pictures, videos) with elders. These data is retrieved and read by elders' application – What's Up (Figure2) which is a one-way communication channel in which elders can only receive information send by the youngsters. This communication is asymmetric, the spectator, an elder, is physically and technically deficient.

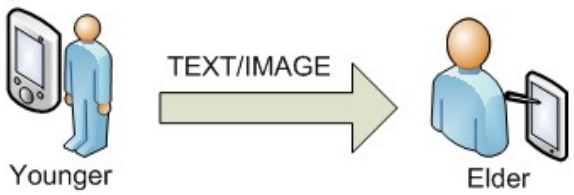

Figure 2. What's Up , a one way comunicational channel in which elders receive messages sent by others

Research has shown that consumers buy products based on the number of features provided [10,11]. The enormous competition on the application market has accelerated the addition of new features to the applications, because companies assume people will adopt applications that deliver more value or utility than the existing ones [12,13] .The results on a research of "feature fatigue", or increasing the number of useful functions at the expense of usability, shows that even though consumers know that products with more features are harder to use, they initially choose high-feature models[12] (Figure 3). In the thesis we aim to check whether the same premise reflects in applications for elder users. Is the number of provided classes of features determining the usability of the application? For this purpose we designed four different GUIs (with four different classes of features, described in details in the next section) of the What's Up application and evaluated the experienced usability and levels of satisfaction. A level 0 GUI ("no buttons"), a level 1 (with "What's up" button to request news from relatives), a level 2 (with boolean feedback buttons "yes-no") and a level 3 ("complete"). But they will be described in the method chapter.
Three different situations in which the What's Up application could be used are presented in the following stories:

Scenario 1:
Carl is a very busy 47 years old businessman, he meet his mother once a week but he would like to meet her more often. But since she lives in a different city it's very time-consuming to meet her, so he decides to give her an ipad with It4Life What's Up installed. She keep it in the living room and sometimes, when she feels like having news from him, she turns on the ipad and pushes the What's up? Button. She would prefer a phone call, but that is not always possible;
she knows that her son is working almost all the time. After pushing the button, an email is sent to her son, that is very busy so he just write her a sms "i'm working now, I will send you a picture of my new project in the lunchbreak". She receives the message and continues with her activities. After lunch, she check the ipad and she finds a really nice picture of her son with his coworker and a big scale model of a parking that they were developing for the city centre.
She feels so happy because without bothering him, and without writing any thing on a cellphone she received exatly what she wanted: news about her son.

Scenario 2:
Alice buys an ipad for her grandfather. She installs the What's up? Application on it and set the complexity level on 0. At this level, the application can visualize resources (text and images) sent by her to him. After one week the elder feels bored because talking with Alice he says: "i wanted to say i disagree on your last message" so Alice understand that he needs more features on his application. She put the application complexity on 2 and explain her grandfather how to give boolean feedbacks (yes-no, true-false, ...) since the design is changed by little it's not a problem for the grandpa to learn the new actions he will perform when he will receive the new resources.

Scenario 3:
Bob gives to his grandmother Carla his iPad and install What's up? Application. He set the difficulty on 2 (boolean feedback features). His grandmother Carla seems to understand, but after some days strange feedbacks arrive as feedback to Bob's smartphone. After some time he also notice that his grandmother is not answering anymore at his messages, but she answer on the phone. "this is strange" Bob thinks, and goes to meet Carla in person. Talking with her

he discover that she was confused on which button she had to press (she had a disease that made her more and more blind, making hard to distinguish buttons) and she stopped using the application. So Bob lowers the complexity to 0 returning to the basic features of visualizing his resources, this makes Carla feel more safe, confident towards the application, and she starts using it again, this time simply watching Bob's pictures, calling him only by phone when she wants to communicate with him

We organize this thesis as follows: First, we briefly describe the four different graphical interfaces and the features they provide. Second, we report the results of three evaluations of the usability and applicability of the application that we designed to test our hypotheses. On the basis of our results, we propose suggestions for development of applications for elders based on our experiences from What's Up. We conclude this thesis with a discussion of our results, their implications, and directions for further research.

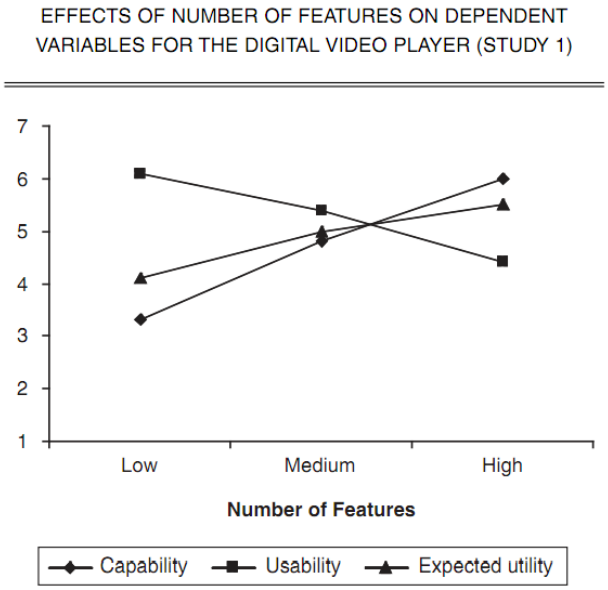

Figure 3. This figure shows the impact of increasing the number of features on ratings of capability, usability and expected utility for a video player.[the figure is obtained from a study from Thompson, D.V., Hamilton, R.W. and Rust, R.T. (2005)]

2 METHODS

The application What's Up? runs on iPad, with IOS operating system. The code is written in objective c language. The project is designed for ipad tablet because of diffusion and potential as well as its hardware potentials.

From the second version, the Ipad tablet has two cameras (frontal and rear), a microphone, wi-fi and 3G connection and it can be used with just one button and the touch screen. These are hardware reasons that make iPad a suitable device for applications specially designed for elderly people that range from simple interfaces to make calls such as TapTell, Elder411, and Elder911 to more complex solutions such as Auto-Med, MedLog, Medsy, or Dosecast to alert elders about medications' time, or iDown and Fall Alert that uses the accelerometer sensor to automatically detect falls and communicate assistance support whenever they happen. Other examples of application for elders for iPad include: iHealth BPM to monitor blood pressure, the iDiabetics to control glucose, Perfect Vision to exercise the eyes' muscles, Medic PHR to stores health records, AroundMe to provider geographic localization of hospitals and pharmacies near to the user.

The touch screen technology heavily contributes to motivate seniors to use the computer, since it is much easier and intuitive to use the fingers instead of the traditional mouse, for elder users it is more intuitive because they have to touch directly the target (button, icon, or general resource). The following youtube video show elders that are delighted because of the use the iPads [19].

To obtain resources, subscribe, and to do anything that requires a connection it relies on a server (currently located on http://lifeparticipation.org/) that accepts REST requests, returning json objects. The server implements Kspaces, that is a metadata-driven, distributed knowledge management platform. It is designed to be lightweight, transparent and extensible, and in this case it handles communications between youngsters and elders . Knowledge spaces (Kspaces) aims to ease the communication of scientific knowledge by providing models, processes, metrics and tools. The original use is aimed to enable the capturing of scientific knowledge shared in an informal way, ideas, comments and opinion about the data and use it as a channel to continue distributing knowledge, no matter how it is expressed. The first time the user run the application What's up? A configuration view appear, to set contributors and show a brief tutorial on how to use the application. During the installation, the user is asked to login with his/her facebook account, after doing that the user and his/her Kspace are created on the server. Kspace is the core of the module as it defines the context in which all the interactions are done. We can think of a kspace as a mix of workspace and collection in which contributors can share resources and augment them with annotations and relations. Kspaces represents an abstraction for the transfer of knowledge in the scientific community by defining abstract conceptual models, proposed architecture and high level API which can serve as a base for future systems. Users can post resources on the kspaces of other users only if they are invited, that's why during the setup of the application the elder (or one of his/her relatives) has to manually invite other users, they will become contributors of his/her kspace whenever they will click the link in the email that the system will send to them. A brief description of the four different interfaces with their characteristics follows:

Figure 4. Interface 0 (no buttons)

2.1 No buttons interface

No buttons interface; this is the simplest of the interfaces and it has only the reading feature: the user constantly receives content(text, photos) on his/her device and navigates them by scrolling with the finger on the ipad. Contents or resources are dynamically read and whenever a new resource becomes available - it is simply added(if it is new) to the scrollView and is presented to the user.

Figure 5. The What's Up? Button from interface 1

2.2 Request interface

In this interface the user has two kinds of features, the possibility to visualize/navigate the resources and to request/ask for updates. For visualization of the resources, the user has to press the arrow button on the bottom of the screen and this button presents the next available resource (absent in the previous interface). In this interface it is still possible to scroll the resources with the finger, forward and backward, like in the previous one. In order to request updates from his/her relatives the user has to press the What's Up button in the home screen. The button is translated in different languages (during the testing with italian elders the button label was 'novità'). When the button is pressed, an email is sent to all the relatives and friends in the list of contributors of the user.

Figure 6. Feedback buttons

2.3 Feedback interface

With this interface the elder user can reply to messages with boolean answers (yes-no, good-bad, etc...). All the other features are available, for example, the user can still navigate the resources by pressing the arrow button or can request updates by pressing the What's Up button. If the user just wants to avoid the answer, and he/she can skip it by pressing the arrow button that leads to the next resource without giving the boolean feedback.

Figure 7. Keyboard to reply with a SMS in interface 3

2.4 Complete interface

This is the most advanced interface, it grants all the features plus the possibility to summon the ipad's software keyboard and write a short text message to the sender of the resource the elder is visualizing. To invoke the keyboard there is a new button on the bottom left of the interface with a small keyboard depicted on it. This brings the total number of buttons in this interface to four, and brings the number of different features to four (visualize, navigate, request, reply). An example of the interface with the keyboard opened is given in Figure 7.

2.5 Testing methods

To test the application we proceeded by first introducing the ipad to the elder users. Then the application was set on a complexity level different from the last testing (to have heterogeneous opinions on the different interfaces) and the basic functionalities were explained to the user, asking him/her to get confident with it, by navigating between the resources and explaining what he/she felt, his/her toughs and concerns (the detailed procedure is included as appendix, Procedure to fill in the questionnaire).

The levels of usability and applicability were measured using the following means:

a) each participant answered a questionnaire in which the he/she commented on ease of use/comfort of the starting GUI, i.e. the GUI that was presented the first to the particular user
b) each participant was asked to produce a ranking of GUIs by the level of enjoyment in using each of them
c) each participant was video recorded while interacting with the prototypes to elicit the way the user perceives the different GUIs during their use. This is the think aloud method.

Questionnaires and rating scales are typically employed to evaluate levels of usability and applicability, although some care is needed to probe for different aspects of the application. Questionnaires are centered around the focus groups being asked to comment on the interface design.

The think aloud method was also employed in the testing phase. It is largely used in usability evaluations, it consists in letting the subject use the application describing orally everything that the he/she thinks, his/her impressions and considerations about what he/she is experiencing. The user follows a navigation path to reach his/her objective and explains his/her choices, his/her doubts and his/her perplexities to the tutor, who keeps on record every comment. In the tests executed for the four interfaces of What's Up? the information were collected through a camera pointed to the ipad to track the hands of the user so that every movement (touch, scroll, gestures) is recorded. The objective of the think aloud testing is the complete emersion of the mental model that the user uses during the solution of a task[14], and to use that data to improve the interface. For shy people, and people that cannot talk because of some disease or verbally impaired, the think aloud can be implemented through a qualitative eye-tracking, to determine where a user is looking at a certain point in the process. For more details and the complete explanation of the method, see Task-Centered User Interface Design: A Practical Introduction [14].

3 RESULTS

The application was tested by 28 users, 16 from the young-old users group, 6 from the middle-old elders, 6 from the old-old elders. The source of testing subjects was mainly from friends relatives (see thanks paragraph) and two retirement homes that kindly gave us the permission to test the application on their guests.

The aim of one of the questions in the questionnaire was to give a formal qualification whether 'the application is easy to use' with multiple answers offered varying from definitely not to definitely yes, and the results are shown in Figure 8. The most of the users found all the different GUIs with the different classes of features easy to use.

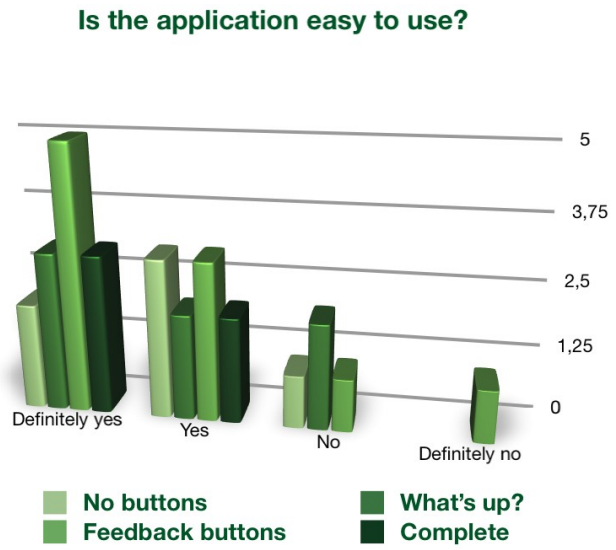

Figure 8. How many users found the application easy to use; seems like most users found it definitely easy.

Another question tested the readability of the written text ñ the results were entirely (100%) positive; every participant found it readable, the chosen font for the purposes of this application is Arial rounded.

A different question tempted to give an overall qualification whether the meaning of each button was clear. In this case the answers were again predominantly positive and the users were mainly satisfied.

The overall aesthetics of the application was tested, and almost all feedbacks were positive (many thanks also to the catchy design of the iPad physical device).

The comfort while using the application was tested as well and the data were collected just after the elder users were using it for the first time. These data depicts the first real

feedback about the general opinion of the user about the application. Figure 9 shows the results of the question. In general, the participants felt comfortable in using the application, the rare definitely no answers can as results from motor impairments in the participants..

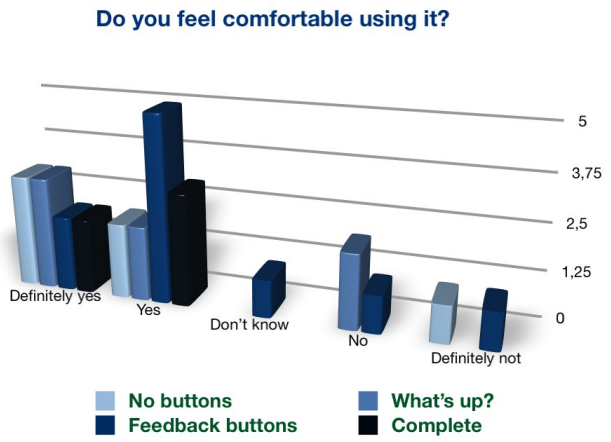

Figure 9. "I felt comfortable using the application". Also here, most of the users answered positively

Consequently, most of the tested elder users were happy about the simple design and felt comfortable using it; but when the question 'Would you use the application' was asked, they divided into three main groups: users willing to try it, people that found it useless - due to the fact that they don't have any relatives or friends who to contact, and people that found it scary - people terrified from technology in general.

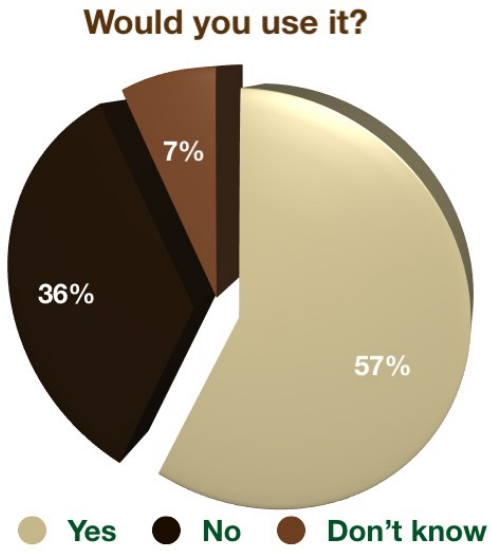

Figure 10. How many users would like to give to the application a try.

Many elders in fact, are extremely scared and/or skeptical about new technologies, bringing some of them to refuse the application only because too 'technological' or, in their opinion, only for youngsters (many elders suggested to show the application to their children and grandchildren because they would have been more interested in it). Was some users really scared by technology in general, or only about this application? We could find out asking another question: do you use a computer? Probably one of the most 'technologic' labeled device in every day life. Results shows that people that answered 'no' (so elders that wouldn't use the application) don't use computers as well; while users that answered that they would like to use it are more in touch with technology, see Figure 11 and 12.

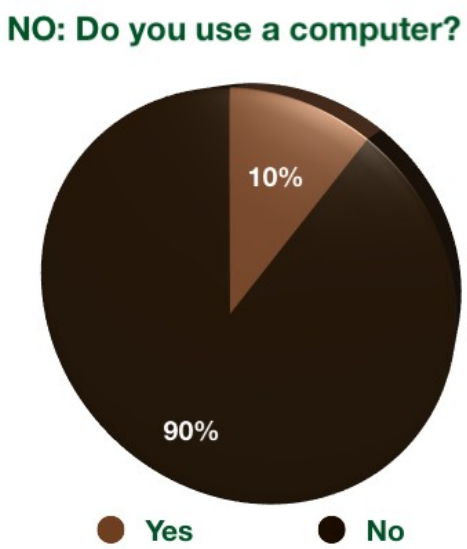

Figure 11. Users that answered no and so won't use the application don't use computer as well

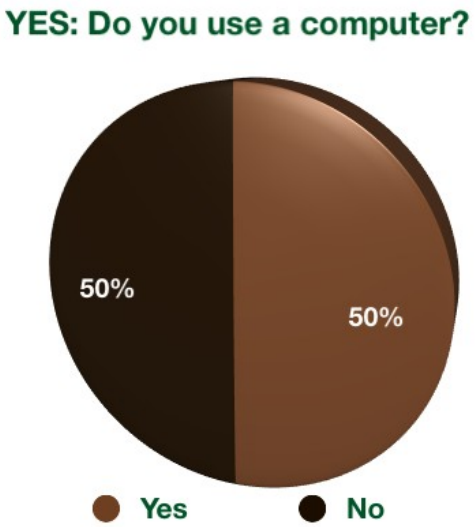

Figure 12. Half of the users willing to try the application
use a computer regularly

The questionnaire also examined the frequency of the communication between the elders and the youngster as well as the medium that is used for this communication: telephone, SMS, physical meetings, internet. The collected data(Figure 13) showed that people that are not willing to use the application are actually in general less willing to communicate also with other technologies; even meeting with relatives happen seldom or not at all (it should be also taken into consideration that very old people can be without relatives and without friends out of the retirement home).

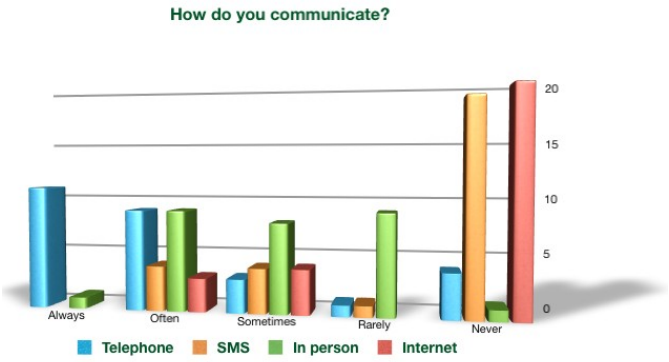

Figure 13. Elders are disconnected: internet and SMS technologies are not used

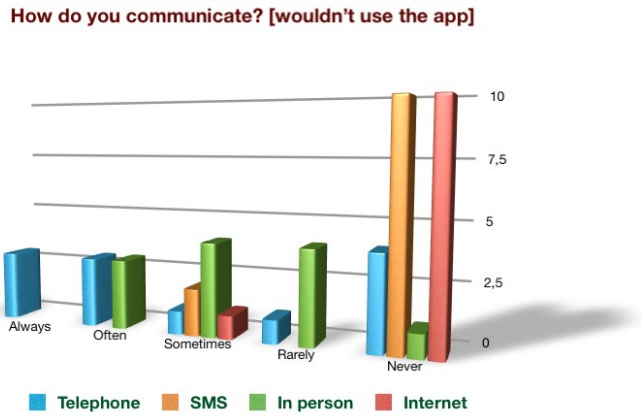

Figure 14. Users not interested in the application are also less inclined to communicate or scared by other communication technologies

Elder were also asked if they would be able to use the application alone; once explained how the iPad is turned on-off and goes to sleep mode, most users answered positively (see Figure 16). The undecided users explained that they didn't feel like using it by themselves right at the moment of the test, but they think that after some exercise they will be able to use it by themselves.

After trying all the different interfaces the tested elders were asked to sort them from their favorite to the least favorite based on the level of enjoyment.; to achieve this printed miniatures of iPad device showing the interfaces were given to the subjects, in order to sort them keeping in mind the dif-

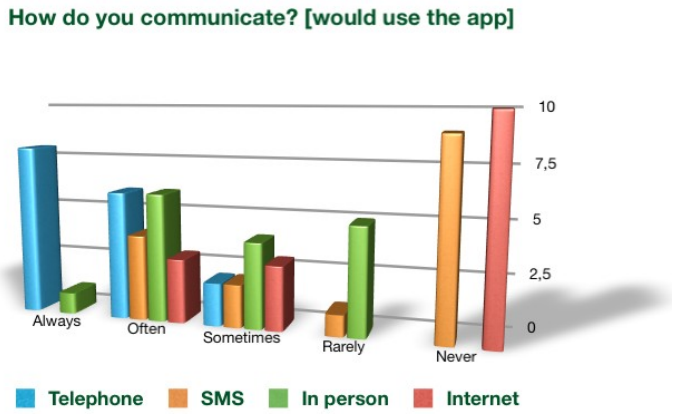

Figure 15. How often users willing to try the application use other communication techniques

ferences between the different interfaces. The results are shown in Figure 17. Predominantly the most complex interface is the favorite, people wanted to have more features if possible (even if they were not proficient in them), second on the ranking there is the "no buttons" interface, that people liked because of its elegance, order and simplicity.

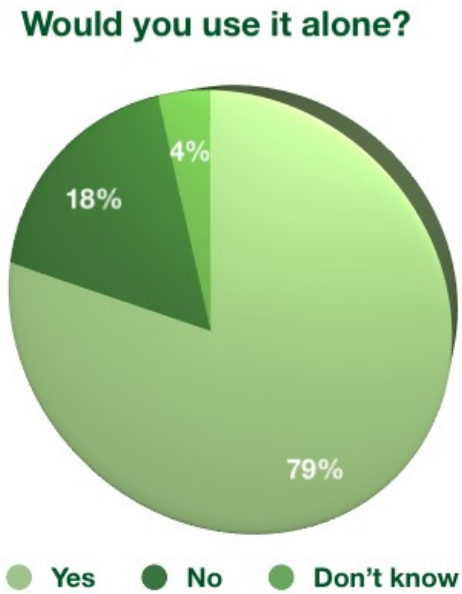

Figure 16. How users answered to the question "could you use the application alone?"

But the different age groups had also different opinions; if we split the pie chart into the three different classes of elders (young-old, middle-old and old-old) results are different (see Figures 18-20). The graphs clearly show that young-old elders prefer complex application, with more features possible, while the old-old users are more willing to use a simple application with no buttons and to use just the finger to navigate the resources. After calculating the great mean - that is not taking the numerosity of the group into account and describing the general trend of likeliness of each group (calculating mean of the means), we came with the finding

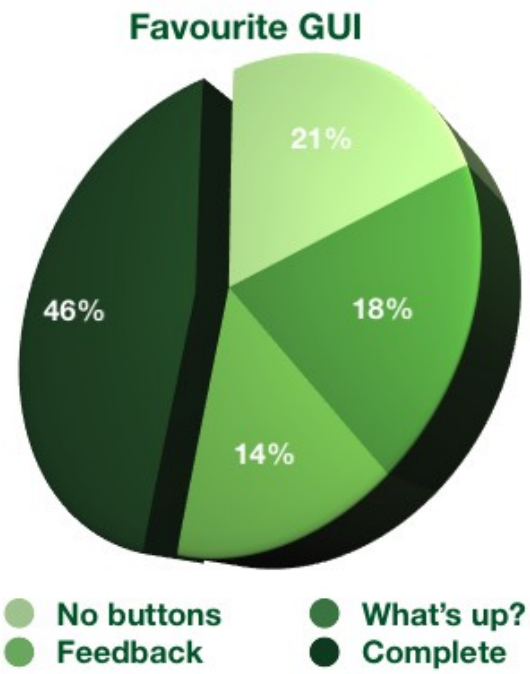

Figure 17. In general, users preferred the most complex interface with more features

that different GUIs were preferred almost equally from different age groups (see Figure 22), or with other words, the number of the most appreciated number of classes of features is strongly correlated to the age. From here comes our last recommendation and conclusion that when people develop applications for elders they should leave the possibility of manually and dynamically setting the classes of features available to the final user. In this application anyway the relatives are given the opportunity to set the number of features available for the elder, and decide which classes of features could be of huge importance for the particular elder, adapting to the user needs.
The results from the third method (think aloud) are available on youtube [17].

Figure 18. User sorting the different interfaces according to her preferences

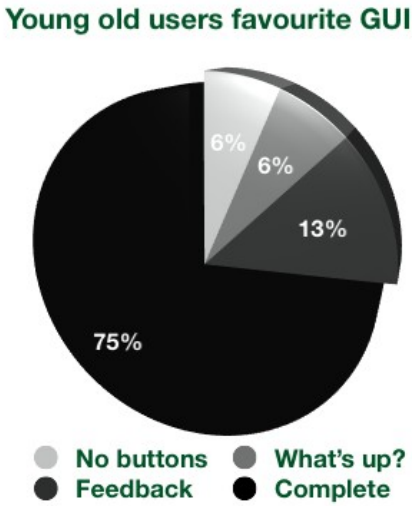

Figure 19. Young elders (65-74) preferred most complex interface

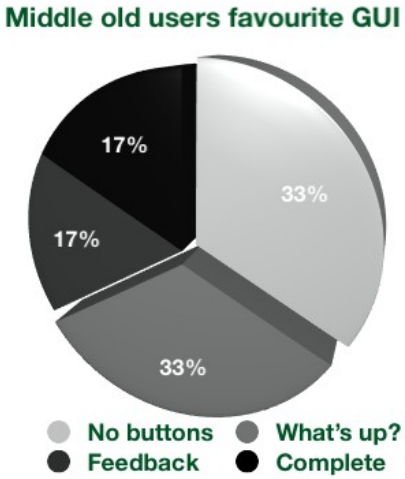

Figure 20. Middle old users tend to prefer simpler interfaces

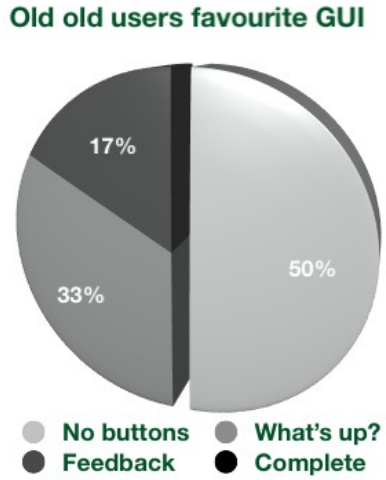

Figure 21. Old-old users definitely prefer simple interface

4 CONCLUSIONS AND FUTURE WORK

4.1 Conclusions

We showed that the number of provided features changes the levels of experienced usability and applicability in the elders. The most appreciated interface was the most complex one: anyway, the young-old elders(64-75) comprised the bigger share of the testing group compared to medium-old and the old-old elders so these results may be affected by this cause. Taking the age dispersion into consideration, we observed that the eldest group (85+) predominantly tended not to be fond of using complicated features and preferred interfaces with only navigational features, the middle group (75-84) showed huge variability (different participants in favor of all the different interfaces) whereas the youngest group (65-74) predominantly enjoyed the interface with all the features.

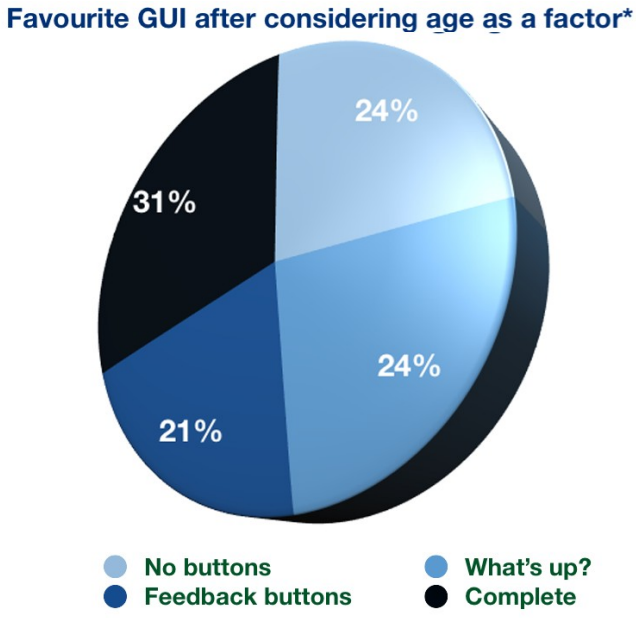

Figure 22. different GUIs were preferred almost equally from different age groups, or with other words, the number of the most appreciated number of classes of features is strongly correlated to the age.

In general,57% of the participants stated that they would like to use this application if it appears on the market, and 79% of them were feeling confident to use it alone after the first testing. Interestingly, 50% of the people that would like to use the application are not using computers in the their everyday life. 90% of the participants that are not interested in using the application, never use computer, and show disgrace towards technology in general (they also don't use the SMS because labeled as “too much technological”). Although the application seemed simple to use for some of them, they showed rigidness and unwillingness to change the already established routines of communicating with their relatives. What emerges as apparent from this study is also that efforts should not be only invested in creating new technologies, but in improving of the understanding, learnability processes and the ease of use of existing solutions, i.e not only new applications should be developed but also people should be somehow made less afraid of using technology.

Many worried elders not willing to use the application (not now, specified some of them) said that the application is more suitable for their children, or grandchildren, believing that they are not meant be using technology, while young-elders that would use the application said that they like the fact that is really simple to use, and they said that when they will grow even older they will be willing to keep the features if they get used to them. This means that tomorrow's elders will be different from today's elders and that old users that now use certain features will need them also in the future (adapted for their senses impairment). An elder that uses a keyboard now will be able to use a keyboard again in ten years, with bigger keys and letters. It is also plausible that using features similar to computer features (e.g. the keyboard) makes the older adults more willing to try to use a real computer [23].

From the testing also it emerges that elder users generally appreciate simple design interfaces. The applications initially should be presented to the elders with the most simple interfaces, and limited classes of features- a new class of features should be added only after the elder user gets confident or improves the skills of using the current one. It is hard and not pleasant to remove features once the user knows of their existence.

4.2 Suggestions for development of interfaces for adults

From the testing phase we came to the following interesting findings.

Some elders showed limitations and impairments in using buttons because of their shacking hands. Instead of pressing the button once, due to their psychomotor limitations, they were clicking the same button multiple times in a row.

This issue in general can be dealt by leaving a delay period between the action of pressing the button and the actual performance of the action. The screen can stay locked and dark for some seconds and a feedback message can appear on the screen: in this way the display is inactive and buttons are disabled until the screen return bright. Elder users generally tend not to touch the screen during it is dark, they tend not to touch what they cannot see.

Another discovery during the testing was that, if possible, each time a new application is presented to an elder, he/she should be provided a tangible non-computer science real life example of how to use it - this can dramatically improve the usability levels and the overall enjoyment in the application. In our example, it was really difficult to explain to an elder users how to 'scroll' with the finger on a touchscreen: an action apparently very easy for skilful computer user, was very difficult for some elders, some of them tried many times without succeeding, no matter how detailed the instructions

were ('touch softly', 'move the finger from right to left', 'caress the device'...).
We used a tangible, everyday real life gesture in order to depict the use of the function: we presented the user a piece of paper on the table and moving it with the finger made him/her immediately succeed in the scrolling gestures (keep this in mind if you need to explain how to finger scroll).

4.3 Future Works

The first future plan is to upgrade the already present version of the What's Up? application on the App store so the features implemented for the purpose of this study become publicly available.

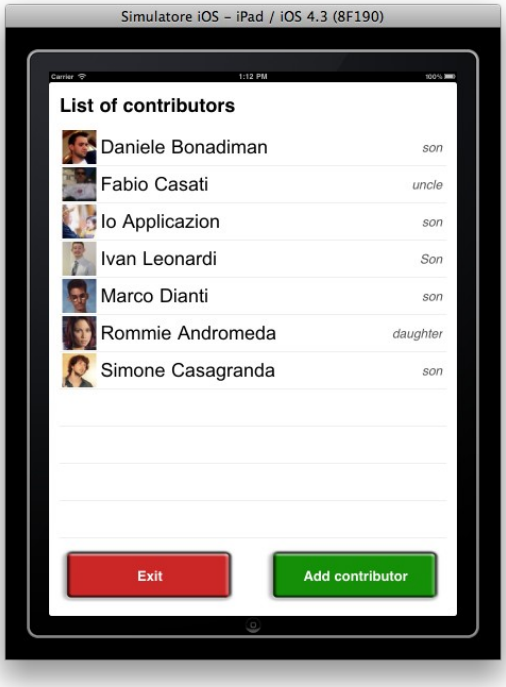

Figure 23. Potential interface of the address book in which an elder can add a contact and connect to a particular relative (at the present, this is the setup view of the application, aimed for the relative that install the application to the elder)

Next improvements of the application capabilities include an expansion of the current content options and allowing the relatives to send videos in What's Up as well. Many subjects stated that they would are strongly interested in having this option, once the feature was well explained(video clip of the birthday of a far away relative).

The feedback buttons interface was really well accepted. Although without labels, almost everyone understood perfectly the meaning of the boolean buttons, and the users also used them when the keyboard was available, because faster. One possible improvement of this feature is to let the relatives choose the two possible boolean answers: choosing from a predefined collection of possible boolean answers in the predefined pattern: positive and negative variation (examples: yes-no, like-don't like, good-bad and so on).

A very interesting improvement which we leave as a last future work came as a proposal from the class more proficient elders (mainly from the younger-elders group): to add the possibility to contact/call a single relative, i.e an implementation of a really simple phonebook with the name of the relative in big font and with pictures for each contact. To do this, it is possible to use the view of the setup mode of the current application: it shows a list of all the contributors (relatives) of the elder user, see Figure 23. Another class of features requested was the real-time communications, like a status for each relative (online-offline) and the possibility to talk by voice with them while watching the pictures. Some of them (usually the least old) had contact with the chats, and they were interested by that kind of communication that they label as 'young' but now they see closer thanks to the simplicity of the what's up? Application.

Does the app on the iPad also help elders to be more confident with technology in general? Are older adults more willing to learn how to use a computer after using the app for a while? According to Karavidas [23] it is possible, and it can be a future study.

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Attachment 1: Procedure to fill in the questionnaire
These are the instructions that an interviewer (person performing the testing) should follow in order to collect data properly.

The procedure is as following:

1. The interviewer gives a brief explanation of what's the purpose of the application to the participant. During the explanation the ipad remains on the table turned on and unlocked.
The explanation should contain the information contained in the next paragraph.
"This application is meant to help communicating with relatives and friends, in an easy way and without the need of a computer for the elder user. The resources received can be text, images and a combination of the two."
The interviewer refers to the resources as “messages”, a more familiar word for elders.
During the explanation the participant is asked for a special person they would like to keep in touch with. If they answer is a grandchild, the investigator makes an example with him.

2. In order to start the testing, the application should be in test mode. This is done by: accessing the the settings of the ipad, selecting What's up? on the bottom left menu, and enabling the “fake-resources” switch.

3. Set the complexity of the application: this is done in the menu beneath. There are 4 levels (or interfaces, or levels of complexity), and each time the interviewer contacts a new participant he/she starts with a level for one higher than the previous participant. If the level 4 is reached, the next time the interviewer starts a testing, he/she starts with the interface with level 0 complexity.
In test mode, the application loads a bunch of fake resources, shows them about 10 seconds after loading, then goes back at the home screen. In the “no buttons” interface the only way to go back to the home screen is to position the view on the last resource and wait approximately 20 seconds. During all the testing, the participant is asked to “think aloud”, to say anything he/she thinks and wants to do. The main purpose is to get situations like “i want to exit, i cannot find the button!”.

4. The interviewer asks the participant if it's ok for him/her to turn on the camera and if positive answer is obtained, the participants starts using the first interface.

5. After finishing the first interface, the interviewer orally asks the participant the questions from the the first page of the questionnaire and fills the answers in.

6. In order the interviewer to change the interface (or complexity), and to start a test with the remaining three interfaces, he/she must pause the application with the central bottom button of the ipad, then go to settings, increase or decrease the difficulty, then open again he application. This step is repeated for three times, each time with a new interface.

7.After finishing the last interface, the participant is asked to sort the interfaces, he/she is provided miniatures(each of them representing one of the 4 levels of complexity) and the participant is asked to sort them out, from the best to the worst.

8. The interviewer orally asks the participant the questions from the the second page of the questionnaire and fills the answers in.

9.The interviewer thanks the participant for the involvement in the testing.

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Codice GUI:

What's Up? Restate in contatto!

Fare una crocetta sulla risposta:
Età: (64-70) (71-75) (76-80) (81-85) (86+)
Sesso: (M) (F)

Barrare la risposta che rappresenta meglio i vostri sentimenti:

L'applicazione è facile da usare:

Decisamente no | No | Non so | Si | Decisamente sì
O----------O----------O----------O----------O

E' facile leggere le scritte:

Decisamente no | No | Non so | Si | Decisamente sì
O----------O----------O----------O----------O

Il significato dei bottoni è chiaro:

Decisamente no | No | Non so | Si | Decisamente sì
O----------O----------O----------O----------O

I messaggi sono presentati in modo esteticamente piacevole:

Decisamente no | No | Non so | Si | Decisamente sì
O----------O----------O----------O----------O

Mi sono sentito a mio agio nell'usare l'applicazione:

Decisamente no | No | Non so | Si | Decisamente sì
O----------O----------O----------O----------O

Potresti ordinare le diverse grafiche da quella che ti piace di più a quella che ti piace di meno?

Usi il computer?

Si | No | Non so

O----------O----------O

Come comunichi di solito con i parenti e amici?

Con il telefono

Sempre | Spesso | Qualche volta | Raramente | Mai

O----------O----------O----------O----------O

Via SMS

Sempre | Spesso | Qualche volta | Raramente | Mai

O----------O----------O----------O----------O

Di persona

Sempre | Spesso | Qualche volta | Raramente | Mai

O----------O----------O----------O----------O

Via internet

Sempre | Spesso | Qualche volta | Raramente | Mai

O----------O----------O----------O----------O

Useresti questa applicazione?

Si | No | Non so

O----------O----------O

Perchè? (opzionale).....

Potresti usarla da solo?

Si | No | Non so

O----------O----------O

Ti piacerebbe che tra i messaggi ci fossero anche video?

Si | No | Non so

O----------O----------O

Cosa vorresti di più dall'applicazione?

.....