Multimodal Interaction in a Personal Life Assistant for the Elderly

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Abstract

Over the years, people raise their children and watch them as they make their adult lives away from home. Because of that, and the advancing of the age, senior citizens lose contact and intimacy with their loved ones, as physical presence might not be possible. Also, because of physical impairments that may arrive, the seniors may experience some difficulties in communicating and interacting.

Thus, a research called PAELife (Personal Assistant for the Elderly Life) was created, and it aims to fight isolation and exclusion, helping seniors have a full life. Our personal contribution to this project is related to the display of the activity of the users’ contacts, so that they notice which friends are contacting them more and which ones do not contact much. To achieve that, we built two sets of prototypes - low-fidelity and functional - that display contacts’ activity from different sources (email, social networks, etc.) and performed user tests, in order to identify the best alternatives and understand if the seniors could perceive contacts’ activity. The tests’ feedback allowed us to understand, for example, that the length of the activity bars is better perceived than the areas and that the use of transparency should be avoided.

Considering this, it was possible to implement a final solution that matched all the requirements collected. Finally, a user testing session took place, to test the finalized system - with fictitious and real data - demonstrating the validity of our solution while allowing us to make some final decisions.

Keywords

Social Networks, Contacts, Activity, Senior Citizens, Communication
Resumo

Ao longo dos anos, as pessoas criam os seus filhos e vêem-nos a fazer a sua vida adulta longe de casa. Devido a disso, e ao avanço da idade, os idosos perdem o contacto e intimidade com os seus familiares, dado que a presença física não é tão possível. Ainda, por causa de limitações físicas que podem surgir, os idosos podem passar por dificuldades em comunicar e interagir.

Assim, um projecto chamado PAELife (Personal Assistant for the Elderly Life) foi criado, e visa combater o isolamento e exclusão, ajudando os idosos a ter uma vida mais completa. A nossa contribuição pessoal para este projeto está relacionada com mostrar a actividade de contactos dos utilizadores, para que eles percebam que amigos contactar - mais e menos activos. Assim, foram construídos dois tipos de protótipos - baixa fidelidade e funcional - que mostram actividade em diferentes fontes (e-mail, redes sociais, etc.) e realizámos duas sessões de testes com utilizadores, a fim de identificar as melhores alternativas e entender se os idosos percebem a actividade dos contactos. Os resultados dos testes permitiram-nos compreender, por exemplo, que o comprimento das barras de actividade é melhor percebido do que as áreas, e que mudanças de transparência devem ser evitadas. Considerando isto, foi possível implementar uma solução final que combina todos os requisitos recolhidos. Finalmente, fizemos uma sessão de testes, para testar o sistema finalizado - com dados fictícios e reais - o que demonstra a validade da solução enquanto nos permite tomar algumas decisões finais.

Palavras-Chave

Redes Sociais, Contactos, Actividade, Cidadãos Séniores, Comunicação
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1 Introduction

As time goes by, people tend to become and feel lonely, especially if no family members and/or friends are often around [Victor et al., 2002; WRVS, 2012]. As children grow up and move out, so does most of the communication with them and their physical presence. This happens especially to the senior citizens, who no longer need to support and take care of anyone. Because of this, they adopt a lifestyle that allows them to stay at home and not going out as much as before [Minichiello et al., 2000]. As a result, they tend to have less communication and lose intimacy with their loved ones.

Technology, such as social networks, email messages and phone calls, helps us communicate in many ways, and many people nowadays are already embracing those technologies and making a continuous, effective use of them to narrow the emotional distance between them and their family and friends, that often live apart [Satusky, 2010].

In particular, it is interesting to realize that some form of “at-a-distance presence”, already proven to be helpful to bring people closer, is already being used and it really helps people to connect and feel closer to their loved ones that live somewhere else. Tollmar and Persson studied the importance of presence [Tollmar and Persson, 2002] in people’s lives. They studied several families and communities and the result was always the same: people feel better when they know some loved one is around. The authors thought about using technology to try bring people closer (even if they were not physically together); even more recent studies [Satusky, 2010] suggested this approach was helpful in minimizing emotional distance. They built a system consisting of two sets of lamps – each placed in a household of members of the same family – that could light on and off and that detected people’s presence around it. If someone was around the lamp, it made the lamp in the other household to light on. The reverse also happened: when there was no movement around a lamp, its pair was not on. This study (and interviews after the lamps’ use) made the authors understand that people felt much better when the light was on: not only because they felt like they had company, but also because that made them think about the person that possessed the other lamp. This approach revealed to be very interesting because it represents the presence of a loved one, even if that person lives across the planet. However, it is limited in the number of users that can use it and requires a special setup, which involves the presence of the developers in the house the equipment is about to be installed in. Also, that setup is time-consuming.

Despite these problems, this approach shows us how the use of technology can display the presence and activity of friends and loved ones. This discovery can prove to be very useful as it might help in fighting isolation and exclusion and can help people break time-space barriers, which would not be possible without its help.

1.1 Problem

The senior citizens may have trouble using the kind of technologies described before. When growing up, they had not had them around, so they are not used to them. Also, they are commonly resistant to change their lifestyles [Minichiello et al., 2000], mainly when it comes to technological aspects, as they appeared late in their lives. Because all of the reasons mentioned right before, they feel suspicious about technology because of security and safety issues and also because of privacy concerns.

We wonder if we can help the seniors overcome these time-space barriers, using technology to do so. Even if we could do it, there is a possibility that it would not work, because of the strong resistance...
these people have to changes in their lives and because they may not adapt well to the technology. Despite that, we believe that these changes would be acceptable to these users, because they might help them become closer to their loved ones.

An unsolved issue is, thus, how to help these users maintain an active social life, mediated by technology, without compelling them to step out of their comfort zone and, more importantly, without compromising their health. Taking all this into account, the PAELife Project (PAELife AAL/0014/2009), an European Ambient Assisting Living (AAL) Project that aims to develop a multimodal personal assistant for the seniors to facilitate their communication and interaction was created. This application will operate on both tablet devices and TV screens. To operate the tablet device the users must use touch interaction, just as with every tablet. To use the application in the TV, which is not the goal of our study, the users will perform some gestures (swipes and "touches" on the air) that will be collected by a Kinect device. This way, the users can navigate in the application’s details on the tablet and enjoy the visualization on a bigger screen.

In particular, our contribution to the project was related to the problem of showing the contacts' activity and availability. Activity can be understood as all the interactions a user can perform on the social networks, emails and phone calls. We are displaying these interactions in several ways – recent activity, integration of the activity from several sources and posts/messages sent directly to the user - so that the user can perceive the general activity of a certain contact instantaneously. In fact, this project poses a challenge because we are designing this system for the seniors, which is not the same than designing interfaces for everyone else, as it can be seen in sub-sections 2.1 and 2.2. For instance, they may have lost most of their sight and their ability to function, which might impose a problem in the proper interaction with the interface.

1.2 Objectives

It would be better if we could know where and how are all our family members and friends. It would be good if we could have it with low-technology overhead and within safe and private environments.

In the context of the PAELife project, we hope we can successfully tackle the remote availability and recent activity issues, so we can know if a certain person is “there” and also, how often is that person around. This aims to fight isolation and loneliness and to help the seniors to have better quality life, by motivating interaction and communication.

We are hoping to do it, not only in a simple and clean environment, but also in a way that is understandable and not overwhelming for them. Also, we hope to correctly and accurately represent someone's presence by indicating their activity.

Our main objective is, thus, to study the best ways to visually show what are the most active contacts, in order to allow the senior users to identify them. This way, the users will know with whom they can easily interact with, by the means of the activity analysis.

Finding out an effective and efficient way to convey the activity information led us to study some alternatives, first with low-fidelity prototypes and then, with functional prototypes embodying the lessons from the first study. After that, we were able to build a last functional prototype, that gathered results and feedback from both previous phases. Our analysis of those studies allowed us to find a suitable solution, as well as a set of design guidelines that could help and guide the creation of similar applications.
1.3 Document Structure

In section 2 we are going to discuss all the relevant work that was made regarding the understanding of the senior citizens’ physical limitations and how that can affect their lives. After that we will discuss several ways to better design technology for the seniors. Also, there will be a small reference about works already made especially for seniors, and in section 2.4 we will refer the relevant works made regarding users’ activity and its display and representation. Section 2.5 compares all the approaches discussed in section 2.4 and the implications that are derived from that discussion are presented in section 2.6.

Section 3 represents our efforts to build a proper Contacts’ Activity Visualization tool. It includes the description of the low-fidelity prototypes, the user tests made, the results gathered and the conclusions we could take from this study. The same was done for the first functional prototypes, which is also described in section 3.2. A discussion of what was analyzed is provided and the conclusions from these studies is presented in section 3.4.

After that, in Section 4, there is a detailed description about all the implementation process that occurred through the development of this work. In this chapter it is possible to find information like what technology we used, what is the architecture of the system and the most relevant implementation details. This chapter is the one that contains all the description of the final work (which consists on everything after the creation and testing of the first two prototypes).

Section 5 is the section of Evaluation and is meant to describe all the process of the user testing, regarding the final solution implemented. The protocol used, the results gathered and their analysis are presented on this section.

Finally, the conclusion, made on section 6, summarizes the most important topics and the main findings.
2 Related Work

In this section we will present the relevant work that was made regarding, not only technological aspects on how to build platforms that display the users’ activity, for instance, from social networks, but also on how to interact and understand the senior citizens and to develop the correct and adequate interfaces for them.

Firstly, we will discuss some of the main limitations senior users have and how those limitations can change their perception of the environment and understand how to better interact with these users, taking into account the limitations described before and the way they currently perceive technologies. Then, we will present some interfaces specifically designed for the senior users, as they present important contributions and tips. Later, we will introduce some examples of current tools and technologies highlighting the solutions they proposed and making some observations of them.

2.1 Understanding the Senior Citizens’ Limitations

It is stated that man and women with 60+ years old form the group of the senior people, usually called the ‘elderly’ or ‘seniors’. However, because of the existent difference in the age of the senior citizens among the developed and developing countries – developed countries say that a person is a senior at the age of 65 years old; developing countries state that a 50 to 55 year old person can already be in the senior category - it is also acceptable to say that a person who receives pension benefits is a senior. Also, there is a study [WHO, 2008] that refers that the seniors are the people who need more medical care and are hospitalized more often; they are the ones who need extra help when making activities for their personal needs such as washing, dressing and eating; and they are the people who have sedentary lives, even thought, nowadays, they are not the most sedentary ageing group.

Although there are a few general definitions to describe the people who fit in the senior category – even though these definitions are different across countries and cultures -, we cannot find two people who are just equal. Those people do not perform the same. So, we cannot find two seniors, and expect them to perform the exact same actions the exact same way, even if they belong to the same ageing group [Haddad et al., 2014].

West, Munoz et al. studied the impact that function and visual impairment can have on the daily basis of the seniors [West et al., 1997] and see how those limitations can help promote dependent living. They studied a sample of men and women from 65 to 84 years old, who were recruited for interviews and examinations. After the performance of several vision and other motor and functional tests, the authors analyzed the data – from a medical point of view – and reached a conclusion: physical limitations of any sort (and more specifically, vision impairment), are associated with dependence, higher progression of disabilities and lack of social participation of any kind. This study showed us that because of the physical limitations people have (and specially, seniors, who are more likely to develop these limitations over the years), they tend to abandon social living and social interaction.

Other studies [Crews and Campbell, 2004; Van de Watering, 2005], with the objective of investigating health, activity and social interaction in the senior citizens with vision impairments (which causes them to perceive much fewer details, color perceptions, light sensitivity and patterns recognition), hearing loss and lack of motor skills (decreased movement speed, flexed posture, tremors and changes in

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1http://www.who.int/healthinfo/survey/ageingdefnolder
2World Health Organization
balance and coordination [Bakaev, 2008]), stated that these kind of limitations are often associated with the decline of quality life and the capacity to be with other people. Also, the authors discovered that, after the examinations they performed, the difficulty in maintaining relationships is often associated with the difficulties seniors find in being active. Because of this, they stated that the social roles these people have in the society might be highly compromised.

Taking these studies into account, we wonder how can we help these users maintain an active social life, without compelling them to step out of their comfort zone and, more importantly, without compromising their health. Of course, we understand that there are no standard solutions, as two different people normally feel the same limitation very differently.

We studied the already developed technologies described in section 2.4 and ways to interact with the seniors, described in the next section, so that we can, along with the discoveries described in this section, provide a solution for these users who are no longer in their best physical conditions, but need - and want - to maintain their social lives.

2.2 Interacting with the Seniors

In here, we will present works that were made regarding the design for the seniors and how developers and designers should adapt their work to fulfill these special users’ needs.

2.2.1 Dynamic Diversity

Designing for Dynamic Diversity is a study [Gregor and Newell, 2001] that describes two main concepts that can help developers and designers when it comes to building interfaces for senior citizens. It is mostly focused on usability, accessibility and design for every type of individual.

The problem identified in this study was that interfaces do not adjust themselves to fit the senior user’s needs, as they tend to be less accurate in their movements and show less functionality in performing certain tasks, as explained in the previous section.

As a solution, the paper describes two methodologies that can be used to help solution the problems identified. They are the Design for Dynamic Diversity (DDD) and User Sensitive Inclusive Design (USID). The User Centered Design (UCD) methodology, which is widely used, is mentioned as a methodology that is not appropriate to these senior users as it focuses on groups of users that have similar characteristics. As seniors are all very different, not only because they are different people, but also (and mainly) because they have a greater diversity of disabilities than other groups of users, the UCD methodology should not be used.

Hereupon, the USID methodology, which really focuses on studying much greater varieties of users’ characteristics and functionalities, takes into account the difficulties of communication with the users, the lack of a truly representative group and focuses on the creation of personalisable and adaptive interfaces, is one of solutions to help improve the interfaces design for the senior users. This design, and the need for it to be appropriate to a very much wider range of functionalities (than it’s usually normal) leads to the concept of DDD and the abandonment of the same design for everyone – because no person is equal to another.
These design concepts are a helpful manner to the developers and designers that need to create interfaces for the seniors, as they solve many problems of older and widely used methodologies, taking into account the diversity that groups of senior people possess. However, these methodologies assume much more work and research than the others. The developers and designers need to know very well the users’ problems and exactly what are the problems that can interfere with the “normal” operation of the interfaces. Also, there is the need to learn and familiarize with the new methodologies.

2.2.2 Engaging The Disengaged

As senior citizens only tend to use technology to perform very simple operations, such as calling someone, checking e-mail messages, surfing on the web and only a few other situations, they are not as interested as younger adults in learning new features and in operating with new technologies – even if they were confronted with very easily used and simple interfaces and equipment.

[Coleman et al., 2010] refer that the main reason for the non-adoption of the technology (in general) by the seniors is the pure lack of interest. Of course, some of these people may have affordability problems or extreme difficulty in operating with some technologies, but it is stated that the main reason is the lack of interest, only.

The main solution is to find a way to gain a better understanding of the seniors’ needs.

In this paper, it is described that integrating the users and letting them participate in the development and design of the solutions can actually help to achieve the final solution. This will serve not only as a help factor to the developers, so they can understand the needs of the users, but also motivate the latter to engage with the new technologies.

As studies were made, the authors realized that the seniors would feel more tempted to use technologies if they really felt they could use them and if that technology provided them with a certain, specific benefit – knowing the health of a family member, notifications of the meds’ time, etc. Also, the study showed that the seniors felt much more comfortable using “invisible computers” (TVs, for instance) than “visible” ones, because the first ones were not perceived as actual computers; this is very important because of the technology fear that most of the users felt – they were afraid they could not use the technology and, as so, felt behind others that could.

These new way of engaging the seniors in the design of the technologies is very important to let them know they can actually use it and, most importantly, benefit from it. The main consideration is that the technology must fulfill the needs of the users, as that is the only way they would consider to use it!

Of course, this has a few disadvantages. The amount of time needed to perform these methodologies is demanding. That would mean that the users would have to spend a large amount of time helping the developers and designers, which may not be of their best interest. Also, and despite the fact that engaging seniors in this methodology is good for both them and the development teams, it could lead to some of those fear problems. If there were users that could not use the technology for some reason, they would feel “excluded” and incapable, which could mean their complete disengagement.

2.2.3 Engaging Senior People using Participatory Design

As described before, many of the recent technologies are not very used by the senior population.

[Lindsay et al., 2012] explain how developers can engage the seniors using participatory design as
a possible solution to improve the quality of the interfaces designed specifically to the seniors. Recent studies showed that recent technologies are the most problematic because they represent a substitute for what senior people are already using (such as Internet shopping as it substitutes the conventional payment methods). Because of all this, younger designers often face many problems on how to create the appropriate designs for the senior users.

One of the most important things developers and designers need to take into account when designing for the senior citizens, is that those people are sometimes impaired, but are not disabled. This means that a person with severe hearing problems can also enjoy a film if the responsible for the film provides subtitles. That person is impaired, but becomes disabled if subtitles are not provided, which means that many times people only become disabled because society is not paying enough attention. Because of this, when an impaired senior shows difficulty in operating with a certain technology, people tend to think that the senior simply is not interested in that technology, when it might be the case that it is not adapted to the senior’s condition.

However, and as said before [Coleman et al., 2010], senior users might not show interest in technology because they do not see how technology can help them perform their usual tasks. Also, they are more likely to perceive whether a certain device is useful or not than the majority of the younger people. Of course, very little efforts were made to improve these aspects, and because of that, the authors of this work came up with a process that actually involves seniors in the technologies’ design.

OASIS is a four-step process, which can be seen on figure 2.1, that aims to develop the right technologies to the senior users.

The first step is the correct recruitment of people to participate. It is essential that a very large diversity
of elements is chosen, so that multiple opinion profiles can be gathered. As so, a variety of people with different personalities and social and cultural backgrounds are required.

The second step is the creation of videos. Videos are important to help developers perceive how users are performing relevant tasks. Also, and more importantly, videos are shown to the users to let them know how important is the device that is being talked about. The device is never shown, to avoid making the users uncomfortable, but its features are explained in the video.

The exploratory meetings are used to construct scenarios to explore the problem and to develop all the requirements that might solve it. Users are very welcome in this session because they have their own version of the requirements and how they should be implemented.

Finally, prototyping sessions take place. This phase’s result is a set of low-fidelity prototypes that focus on the design requirements of the new technology.

This approach is very useful to the developers because they can interact with the seniors and understand a bit more of how their lives are. The OASIS process may be difficult to perform because the users may not want to participate in these sessions - they are usually very long – and that automatically jeopardizes the activity. However, it is a very good starting point for design teams to engage seniors in the new technologies design.

2.3 Interfaces for Seniors

In this section we will present some interfaces designed specially for senior users.

There are a few guidelines that developers should take into consideration when designing for seniors. For example, the size of the elements should be large enough for the seniors to see, as they have difficulty in perceiving small details. Colors are a key point and should be used in as much contrast as possible[NIA, 2001]. Low saturation levels and transparency are to be avoided, but very bright colors might also fatigue the eyes[LCC], so balance is required. Background patterns should be avoided as well. Also, there is a need to make distinguished and important elements highlighted and visible, but without animations and distracting constituents[LCC].

Even though there are these and others known guidelines, when designing for older users, we intend to expand our knowledge about what should and should not be used in interfaces for these users. We consider that it is important to validate those informations with contexts that are already in production, meaning that they were already tested with real users, as are the studies described next.

2.3.1 OldGen

OldGen [Olwal et al., 2011] is a framework created specifically for mobile phones, that enables caretakers to customize a user interface (UI) that is simple and straightforward; thus, allowing seniors to easily interact with the device. There are three layouts and five basic components available, which can be rearranged to meet the user’s specific needs.

The creation of the UI is made through the use of a platform available online, but as this is not the key point in this study, we will just focus on the design of the layouts and the components used, as they are the factors in the success of the design for older adults.

The layouts created by the developers can be used to arrange components in three different ways: in a list (List Layout - fig 2.2a e 2.2d), divided into a grid (Grid Layout – fig 2.2b) or accessed in an
horizontal menu on the top of screen with a large preview of the current active option (Dock Layout – fig 2.2c).

![Figure 2.2: The four layouts of the OldGen.](image)

The components, as described before, are five: the Label, the Soft Button, the GUI Button, the List and the Text Area. The Label is used for labelling text input areas like labelling images, for example. The Text Area is, as any other text area, used to insert numeric or text input. The Soft Button activates a function when the corresponding physical button is pressed. The GUI Buttons are used to navigate through the applications, but they cannot be accessed physically in the device. The List simply displays items in a list view.

![Figure 2.3: Oldgen’s examples of components.](image)

Even though the developers were interested in testing the potential of the customizable UI, they gathered results about the preferences of the users in terms of what layouts were preferable and what components were more difficult to use. These aspects are the ones that are most relevant to us, so we can have early feedback on what elements we should (or should not) use in our work.

The users did not understand some icons present on some of the alternatives showed to them, and had trouble reading small text and said that the contrast was not very good. Zoom was appreciated very often, as the small device did not allowed them to see properly. As a positive note, all the users felt very comfortable with reading large text on the buttons, and the lack of icons (when it was presented) was not a problem at all. Also, the improvements on the screen contrast were appreciated.

This interface and the study behind it proved to be very important to us, as it showed us, already, what are the components to avoid, such as complicated icons, small text and poor contrast. On the brightest side, we were able to understand that perceivable text is preferable to icons, good contrast is
appreciated and large elements on the screen make everything easier to understand. Even though these aspects might already be known because of common sense, it is good to know that they were tested with real users, which helps to prove that they were correct.

2.3.2 Senior Travel Buddies

Senior Travel Buddies is a system [Odom et al., 2007] that was built to encourage ride-sharing among senior residents. Even though the main goal of this work was to reduce the emissions of carbon dioxide to the atmosphere, the authors quickly identified another very useful finality: to enhance social interaction, which the users keen to avoid.

After some prototype development and its discussions, the users found a neat way to design the system’s display, representing a calendar view, in which the residents would book the days they were planning to go out by car and where to. This way, the users could see the days in which trips were already planned and could join the event if the destination satisfied them.

User tests showed acceptance to the system, as it was easy to understand and simple to interact with. Once more, it is proven that the right planning and development of the interface can benefit the senior users.

2.3.3 Colorado Care Tablet

This study resulted in the construction of an application, a Personal Health Assistant that was made especially for the seniors with very limited computer experience. Colorado Care Tablet (CCT) [Khan et al., 2010; Siek et al., 2010] is an answer to all the seniors that need assistance in managing medication regimes. The authors of this work explored and developed the behavior of the system to meet the requirements of the users’ medication issues. However, and even though this was their primary concern, they explored the design and usability of each action carefully. In the context of this dissertation, our main focus will be on the interface design, so we can understand what are the issues and the main advantages.

The seniors can work with simple screens and flattened transitions. Thus, it is important for them that all the main tasks are represent very clearly in the main screen. Also, each main task has a series of smaller tasks and those can be performed using navigation. All the transitions and steps needed in these intermediate phases are clearly identified and are performed in a simple way, as it can be seen on figure 2.4. Also, indications about what needs to be done in a certain step are provided.
As described before, and as it can be seen in the previous figure, all the steps have proper assistance, which allows the users to successfully complete the tasks.

User tests were made, to test the implementations of the Colorado Care Tablet, whose results showed that the design simplification and the tips that appear throughout the tasks concretization were a massive help to the users, who found the system very easy to work with. They also appreciated a simpler screen with few, but effective action calls. However, the older seniors (80+) declined to use any electronic device, or found it difficult to operate, which shows that even within the seniors’ age layer, there are significant differences regarding the use of technology.

2.3.4 TableTalk Poker

TableTalk Poker is an online social gaming environment [Shim et al., 2010] created for seniors. In this study, the authors describe the importance of online interaction in the senior age, thus they created an environment in which seniors can enhance their communication skills with others, while have fun, playing.

Like in previous interfaces’ analysis, we are focusing on the principles applied to the design of the user interface.

The authors considered the limitations that seniors have, as they might be consequences of the advancing of the age. As so, they design an interface as clear as possible - which it is not easy to find when searching for online poker games. They had the caution to remove all unnecessary information and focus on advising the user (with hints) and minimizing the number of steps when important decision-making was crucial. Also, they felt that using larger fonts and increasing the size of important targets was fundamental.
When decision making is required, all the information that is not directly connected to it, is dimmed. This makes the process cleaner and easier to perform. The interface is shown on Figures 2.5 and 2.6.

![Figure 2.5: TableTalk Poker main screen.](image1)

![Figure 2.6: Decision-making in TableTalk Poker.](image2)

When user studies took place, the users felt that the visual differences between TableTalk Poker and usual online poker games were much appreciated. All the gameplay was more fun as the users were not concerned about the difficulties on operating with an online game. All the challenges they faced were directly connected with the game, and not with external aspects. This environment proved once more that some directives should really be followed, when designing for seniors.

### 2.4 Organizing and Displaying User Activity

This section is meant to present all the relevant work regarding the organization and display of user activity. Some of these works will not directly relate to user activity but will, instead, show a few examples of how the visual display of lists of contacts can be made. If this happens, we will compare the author’s solution to what we are trying to produce, and then, conclude whether it would work or not, in the context of our own work.
2.4.1 Social Translucence

Sometimes, in the digital world, people think it is very difficult to perceive one another's presence. The authors of Social Translucence [Erickson and Kellogg, 2002] also know that a lot of effort is needed to perform simple actions – such as talking and seeing who responds to whom – when within the digital world. Because of that amount of effort, people usually feel lonely when browsing on the web, even if they know that their friends are online on a chat. To surpass that feeling, the authors developed the idea to build systems that support actual collaboration amongst all the participants, over the networks. They came up with the definition of ‘social translucence’, which is the design of digital systems that support social information and makes it visible to all the participants. Those systems need three basic properties: visibility, awareness and accountability, because they are requirements for well supporting all types of communication.

Many systems were created having these properties as a solid base. Some of them are described in the following sections.

2.4.2 Visual Representations of People and Groups

[Ozenc and Farnham, 2011] studied and explored some natural ways of displaying visual representations. Each representation shows a different way of organizing and visualizing lists of contacts.

Figure 2.7 "shows" us what kind of representations we have nowadays, when it comes to represent people and groups of people within social environments.

There are the common lists, which are one of the most used ways of displaying sets of people, usually by their names (or usernames).

Secondly, there are the pie charts, which are usually used to categorize people according to some criteria. In the figure we are aware that the three main categories are ‘work’, ‘family’ and ‘social’.

The third representation is one that we most care about in this work as it shows the different levels of time and activity in each section in an understandable, readable manner. Each category is represented in a timeline way, which allows us to see what is the activity on each sector. Of course this could be applied in other ways, and not only regarding these kinds of categories. However, it would not be easily applied if we were taking into account individuals instead of groups of people. Drawing a line for each person would make the design very confusing and nothing would be understandable.

There is also the geomap representation. This is useful to display groups of people regarding their physical location.

Similarly to the timeline, there is the treemap representation. This one draws simple squares, each one meaning one category. Then, by the amount of people inside each category – or by the content those people produce – the

Figure 2.7: Different visual representations of people and groups.
squares become bigger or smaller, showing whether the group is active or inactive, respectively. This is another very useful representation that can be easily adapted to be used in our work, regarding not the amount of people in each category, but the activity the group has. Also, if we replaced the squares by the avatars of the contacts, the solution would still represent the contacts’ activity individually by showing those avatars bigger or smaller, representing the activity of a contact.

Finally, we can see the network representation. In this representation, similarity and connectedness are the two most important features.

This work compared these and other ways of organizing and displaying groups of people, giving us an interesting overview of some of the most used representations.

2.4.3 A Conversational Model to Display User Activity

The main purpose of this study [Deiml-Seibt et al., 2009] was to display the users’ activity so that it would become a way of stimulating users’ participation.

There are already ways to display users’ activity, for example, based on rankings and badges’ attribution; however, the authors identified a problem with these approaches. As rankings are very hierarchical, some of the users may never get to the top, as they are always falling behind others that participate more. That would discourage those less active users and may lead them to stop participating at all. Also, if this last situation takes place, the most active users would become disappointed too, as they would not feel they had any competition.

On the other hand, the badges’ attribution is also not good enough because it is not very effective and the personalization is not much – equal badges mean equal profiles – and people do not like that equalization.

The authors thought about a new way of displaying the users’ activity without letting anyone feel bad for being less active – to prevent anyone from quitting. Also, they thought about personalized profiles, so each user is unique. This is not exactly the main idea on this dissertation’s context, but the display is important, so it should be studied.

They created IntroText, a new way of displaying the users’ activity on a community.

![IntroText profile description](image)

Figure 2.8: IntroText profile description.

This interface is based on multiple actions, such as posting, commenting, rating, tagging, etc. – it captures all the interactions that can be performed on a certain online community. Apart from that, other activity patterns are analyzed: number of visits, day of last action, number of rated comments and many more. Based on those indicators, sentences are formed to let the users know how active a certain
contact is. “[Username] is a loyal visitor” and “[Username] eventually shows up” are just a couple of examples of how the activity can be showed. This way, the users are confronted with the exact kind of activity their friends have. With the “no ranking” system, competition problems are less likely to occur and no one feels like being left behind. Also, with these sentences, there are a very high number of different profile descriptions, and personalization is not a problem anymore.

However, and based on the dissertation’s context, such sentences may not be the best option to the senior users. They perceive fewer details, as studies referred in section 2.1, and this way we would be obliging them to read the sentences and conclude the activity from that, which may not be the best and easiest option.

2.4.4 The ‘Babble’ Timeline

The widget presented in figure 2.9 is called ‘Babble’ [Erickson and Laff, 2001] and it provides cues about the presence and activity in an online conversation. The ‘Babble’ is a circumference that contains a circle on the center of it and several other colored, smaller circumferences - dots - (each one of the latter representing a contact). The proximity of the dots to that centered circle is a representation of how recently the person has spoken to the user, which means that the closest a dot is to the center of the ‘Babble’, the most recently that person has talked to the user. The dots outside the ‘Babble’ indicate idle users, that are not currently active in the conversation.

This way, each user can see what are the most active contacts, and what are the contacts that have not been talking much. Of course this could be applied to a list of contacts regarding several other online communities, where users participate in some way. However, this approach may not work as well to the context of our work. On one hand, if a user has a large amount of contacts, the ‘Babble’ would be extremely crowded and the ability to see who is more and less active would be much less effective. On the other hand, the dots are really just that – colored dots – and at first sight, users cannot tell who is who, as no other visual representation is provided.
2.4.5 Automated Awareness and Visualization of Online Presence

[Morikawa and Aizawa, 2012] propose a system to facilitate awareness of people’s contactability and online presence. Although the study was only based on chat activity, the idea can be used to show people’s presence in all types of social interaction.

One of the problems that were identified was that, normally, contacts are shown based only on their chat names and a term to identify their availability (or colors that represent those terms). The other problem was that, a list of contacts is usually a long list of names or usernames, which can be difficult to read and analyze. Of course, it makes the process of interaction with a given person much more difficult.

The framework proposed (figure 2.10) by this study tries to solve the problems described above by displaying the contacts in an innovative way (which would bring out more details), including a new way to let the users know that a certain contact is actually on the computer (again, this specific feature’s implementation is only applied in this framework’s context, but its display could be applied in other fields). Also, the study suggests a notification system, to let the user know when a contact becomes active and contactable.

In the solution proposed by the authors, the names of the contacts are not displayed; however, the contact’s avatar is what the user sees. The pictures are displayed in front of a colored background, which indicates the current status of that contact. On top of that, the avatars are not just the raw images. Each avatar has its own opacity, whether its owner is in front of the computer or not. If an avatar is opaque, it means that its owner is sitting in front of the computer. As time passes, and if the user leaves its position, the avatar starts to fade out and becomes more transparent. Of course, something like this could be applied, not regarding the availability of the contact at the moment, but regarding its activity. If a contact is very active, its avatar would be opaque, and if is less active, the avatar would be more transparent, just like described. This way, the activity would be shown in an accurate way.

This approach has some problems, though. The framework itself is not yet very used and was not subject of many tests. Also, the transparency of the avatars may not be very noticeable by the senior users, who tend to see fewer details and lose visual perceptiveness, with the ageing process.

2.5 Discussion

In this section, we are going to compare all the different technologies according to some parameters that we thought were relevant.

In Table 2.1, we can evaluate the main technology components described in section 2.4. In here, we are evaluating whether the solution is appropriate for many contacts - if it is understandable if many contacts are currently active (or online); if the solution can display the contact’s activity, because some of the
works we studied were chosen because the display itself, and not because it addressed user activity; if it allows the upload of a descriptive avatar, allowing the user to immediately identify the contact; if it contains very small details, for example, small icons and/or pictures, small areas of interaction, intensive text, etc., as these represent an addition of difficulties for seniors who, according to what we studied and is described on section 2.1, perceive much fewer details; and then if the color scheme of the solution seems appropriate to the senior users – as we know, they see less colors and are less sensitive to light changes, so a nice color scheme is imperative.

Only Timeline, IntroText and Babble display contacts’ activity, whether the other two are considered because of their visual representations. Timeline and Babble seem to work well in the display of user activity because they use visual representations that are understandable. Babble displays contacts’ activity by representing the more active contacts closer to the center of the widget, whether the less active contacts are displayed away from the center. However, it is not appropriate when a user has many contacts, because if the Babble had a large number of dots inside the widget, it would get very confusing to distinguish which contact is which. Also, Timeline works well if it displays the activity of large groups, because if groups were not created, it would be impossible to tell all the lines apart. Although IntroText seemed very promising, because it has thousands of different ways to display how active a certain contact is, the visual representation isn’t the best, as it displays only text. Senior users perceive fewer colors and details, and some of them find reading a complicated task. Also, Treemap could display contacts’ activity, as it is described in section 2.4.2, but as the original solution does not, we only described it in that section.

Only three of the solutions clearly allow an avatar upload, which is an important feature to help users understand immediately who is the contact and relate that contact to the correct person. Those three solutions address this feature, but two of them fail to address the user activity issue.

Other important features we thought would be relevant to this work were if the solution contained very small details and if the color scheme of the solution was appropriate. Timeline and Treemap are represented with few colors, which seems appropriate for the senior users understanding, if the number of groups remain low. IntroText displays only text – not considering the user’s avatar -, which we already stated as being difficulty perceived by the senior users. Also, the interface’s background is black and some words are blue, two aspects that the senior users would have difficulty in understanding. As stated before, the Babble solution has very small dots, each representing each contact, which becomes very difficult for the seniors (and even for younger people) to perceive the dots and distinguish the contacts. The framework for automated awareness and visualization of online presence [Morikawa and Aizawa, 2012] allows avatars but they become more transparent as the contact goes away. If we thought about using this idea to the users’ activity issue, we would have to be aware if the transparency still allowed the immediate identification of the contact, without any effort.
<table>
<thead>
<tr>
<th></th>
<th>Timeline</th>
<th>Treemap</th>
<th>IntroText</th>
<th>Babble</th>
<th>Awareness Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is appropriate for many contacts</td>
<td>if divided into groups</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td>yes</td>
</tr>
<tr>
<td>Displays contact's activity</td>
<td>line diagram</td>
<td>text</td>
<td></td>
<td>closeness to widget's center</td>
<td></td>
</tr>
<tr>
<td>Allows a descriptive avatar</td>
<td></td>
<td>yes</td>
<td></td>
<td></td>
<td>yes</td>
</tr>
<tr>
<td>Contains very small details</td>
<td></td>
<td>text is extensive</td>
<td></td>
<td>dots are extremely small</td>
<td></td>
</tr>
<tr>
<td>Color scheme is appropriate</td>
<td>few colors</td>
<td>few colors</td>
<td>very black and blue</td>
<td></td>
<td>avatars become transparent</td>
</tr>
</tbody>
</table>

*Table 2.1: Match between features and technologies.*
2.6 Implications

We studied all the possibilities to create a new solution that addresses the contacts’ activity issue, as it represents most of the work on the context of this dissertation, and also, incorporate in those solutions some other features to address all the parameters stated, especially, the ones that concern the design principles for seniors. It is important to refer that these implications take into account all the sections described, meaning that they are based not only on the preferred solutions, but also, and very importantly, on the needs of the senior users and their limitations, and the aspects related on section 2.3, as many of the implications would not fulfill the older user’s needs and others would not be relevant to them.

In this section we will present a list of features that our system should include, inferred from all the sections of the Related Work and some requirements of the PAELife Project itself (requirements R1 and R5 to R7), in which our work is included.

R1: Contacts’ activity must be displayed, as it represents the main technological feature on the context of this dissertation:

- It should be shown on the main screen of each user;
- The list of contacts must be organized accordingly to the contacts’ activity;
- Each contact must display activity in four different sources of communication:
  - Facebook;
  - Email (Gmail);
  - Twitter;
  - Skype;
- Apart from the sources, the general activity (the activity from the four sources, together) of a contact should also be displayed;

R2: The system should be able to display the avatars of the contacts, allowing the users to immediately identify them.

R3: The interface should be informative and that information should be displayed in a simple way. As described in sections 2.1 and 2.2, senior users do not perceive details very well and find using technology a difficult task. As so, some aspects, already mentioned on section 2.3 are taken into consideration:

- Activity display should not be overwhelming;
- It should provide graphic cues about the users’ activity, instead of extensive text;
- It should not have many small details;
- Important items should be visually well identified:
  - Elements should be large;
  - They should be properly labelled, about on what is it’s action;
- The color scheme should be appropriate:
- Having few, substantially different colors;
- Having good contrast;
- Avoid transparency;

**R4: The system should be appropriate to work with an extensive list of contacts.** Some users have few contacts, but others may have many, so the system should be able to easily display a smaller list as well as a larger list.

**R5: The ability of making groups of contacts must be included,** as it facilitates the understanding of the activity of those different groups of people.

**R6: Displaying the activity on different time periods must be a feature,** as the users might want to see their contacts’ activity in various moments.

**R7: The contacts’ activity module must be integrated with the AALfred,** because it will be one of the features of the application.
3 Contacts' Activity Visualization

The contacts' activity visualization development was processed in several steps, in order to correctly identify the users’ needs and build the visualization prototypes incrementally. To achieve that, we started by making a set of non-functional (low-fidelity) prototypes that were meant to evaluate several alternatives, properly described in section 3.1.

Later, we made the first functional prototypes, which are described in detail in section 3.2, taking into account the conclusions and feedback from the first user tests. In this phase, we used a predetermined set of contacts, so that users would try out the prototype under the same conditions, which allowed us to draw more uniform conclusions.

Both these set of prototypes (and the final one, described in detail in section 4) were developed using some of the methodologies described on section 2.2.

One of them is the USID (User Sensitive Inclusive Design) methodology. This technique focus on having a great variety of users, even though they might belong to same target group, and study their particularities very well, to get to know them (and their differences) even more. As we studied before, no two people are alike, mainly when we consider seniors, whose limitations might increase these differences even more. As so, we studied our sample of users very deeply, before we started to build any solution, thus using USID’s concepts.

Another used approach was the one described on section 2.2.2, which was centered on letting the users participate in the study since the beginning. As we are about to describe on detail, we talked to the users before starting to create any functional prototype, which allowed us to understand that not all the alternatives we though about in the first place were appropriate. This saved us a lot of time, as we listened to the users first. Of course that having the users around more often would benefit us, but that was not possible, which is also a problem of this methodology.

Finally, we presented OASIS (section 2.2.3) that is a technique we did not use entirely. OASIS’ main goal is to gather with the users and show them real-life situations in which they might benefit using technology. After this, the designers and developers talk to the seniors in order to create all the requirements needed, strongly based on the users’ needs and limitations. We did not use OASIS because the requirements to our work were imposed on us, as a result of the main project's own requirements. However, by gathering with the users in an early stage of the development, we could show them the benefits of our work and let them understand that technology might somehow help them.

In this section we will describe the two set of prototypes briefly defined before and the ideas behind them; the protocol used for user testing and the results gathered from those tests; and finally, the conclusions we took from the analysis of the results that allowed us to make decisions and move forward, producing the next set of prototypes.

3.1 Low Fidelity Prototypes

The first set of prototypes was made based on some of the implications described in the previous section. They incorporate all the features we want to include in the final prototype – general activity, specific activity regarding the different sources and the indication of new/direct messages from each source – but each of those features is specified alone, not only to not overwhelm the users, but also to understand exactly what the users expect from each feature and if they make sense, which would not be possible if they were all displayed together.
For the general activity, we proposed two different visualizations, which are presented in Figure 3.1 and 3.2. Figure 3.1 shows the activity apart by increasing or decreasing the sizes of the avatars, as the activity is higher or lower, respectively; Figure 3.2, instead, changes the transparency of the pictures, in a way that pictures with lower transparency are the ones that have the highest amount of activity. This makes sense because higher transparency makes pictures less obvious, which is an indicator that the contact is not around much. The choice behind the changing in the size of the avatars is closely related to the fact that these changes are easily perceived. Even though humans cannot accurately estimate area values very well, the point is not to analyze the avatars in detail, but to perceive that some avatars are bigger and others are smaller. The transparency was another way that we thought would be interesting to test with the users. Even though we know that transparency changes are not well perceived by older users, it was something we felt we needed to try out, as it could be interesting to realize that users could easily identify more active contacts, as they would be the ones who could be seen with more detail.

![Figure 3.1: Representation of the activity levels by distinguishing the sizes of the avatars.](image1)

![Figure 3.2: Representation of the activity levels by distinguishing the transparency of the avatars.](image2)

Regarding the activity from the sources, we designed nine different ways of displaying this information. The first two, represented by Figures 3.3 and 3.4 only differ in the shape of the avatars. The first one has a squared representation, as it is the most used and the rounded one was also an alternative because, unlike the square form that only has four sides available, has the possibility of containing more sources, even tough that is not happening in the current phase of this project.
Figure 3.3: Squared representation of the sources’ activity.

Figure 3.4: Rounded representation of the sources’ activity.

The next two figures are very similar to the ones just presented, as they just have a way to display availability in each source. This approach was considered by us because it allows the user to know whether the contact is (or not) available at the moment.

Figure 3.5: Squared representation of the sources’ activity, with availability status.

Figure 3.6: Rounded representation of the sources’ activity, with availability status.

Figures 3.7 and 3.8 show another way of visualizing the activity from the sources, that is similar to the one showed in Figure 3.3 and that are represented on the next two figures. The approach on Figure 3.7 is similar to the one on Figure 3.3, but with the bars condensed in only one place, and horizontally. This approach was conceived because it is cleaner than the one on Figure 3.3, and as so, we needed to test if it was better. Figure 3.8 is also a similar alternative, but with the bars on the middle, instead of around the avatar. This approach was created because it is simpler to compare the activity from sources this way, as the bars all start in the same place and the changes are immediately perceived: bigger bars are the ones that represent higher activity levels.
The three remaining options are very similar between them, as they differ only in the shape of the representation of each source, and are represented on Figures 3.9, 3.10 and 3.11. These three last approaches were created to show the users something quite different. We already suspected that these final alternatives might not be the best approach: as said before, areas are not the best way to show changes, as humans find it more difficult to perceive. However, as we already had several alternatives where this concern was tackled, we decided to try the approaches represented on the next three figures. The squares were the simplest representation of the three, thus, an important alternative. The circles were another alternative that we decided to add, because it is another simple shape. Finally, the semi-circles were considered because they occupied less space than the circles.
Figure 3.11: Representation of the activity levels displaying semi-circles for each source.

Where notifications are concerned, the representations with glow, saturation change and numbers are very used nowadays, which is why we opted to create them in these first prototypes. The representation of the small dots was created because it could be simpler for seniors to count the dots. We designed four alternatives that are presented in the next four figures.

Figure 3.12: Representation of the notifications with a glow.

Figure 3.13: Representation of the notifications with a small dot per notification.

Figure 3.14: Representation of the notifications with a change in the saturation of the color of the source.
After producing all these alternatives, we needed to figure out which of those would be the most understandable and interesting for the users. Therefore, we defined a protocol to use in the user testing sessions that is described in the next section.

3.1.1 Protocol for User Testing

To find out what could be the best way of displaying the contacts’ activity, we performed preliminary user tests with seniors and evaluated the results of those tests. This way, we could compare the results that came from actual user feedback with the requirements specified before. Also, these tests are a way to engage seniors in the design of the framework, which increases the chances of its acceptance by the users.

The first session was made in the beginning of December 2013 in Centro Psicogeriatrício de Nossa Senhora de Fátima, Parede, Lisbon and a second one took place in February 2014 in Centro Social Paroquial de São Jorge de Arroios, Lisbon, as the number of interviewees was not enough with only one session. We interviewed 20 people, 13 of whom were female, from 60 to 96 years old without cognitive disabilities, that were able to read, and with none to low knowledge of computers, social networks and other technologies or tools. Each test was performed individually, in a room were the users could sit, analyze the alternatives and answer our questions. Before the tests’ start, the users were asked to sign a consent form, as one of the institutions made that point an imposition. The form can be seen in Appendix 1. In that form, the users declared to understand the context of the tests and that it was anonymous and cost-free. After that, the survey was performed and answered and the total amount of time spent with each person did not exceed 15 minutes.

The survey used is described in the Appendix 2.1, and it is divided into four categories: general information about the user, the users' perception about the general level of activity, their perception about the activity from each source and their perception about the notification system. The figures described in the survey are related to the figures already presented in this section, which are representations of what was shown to the users. We made all the questions verbally, and the users replied to those questions in the same way. We took notes of the answers and other feedback the users might have given to us. These questions represented everything we needed to know from the users, in order to understand what prototypes we should use and which ones clearly do not work for seniors. They are very simple and straightforward just so we can know if the seniors understand the conveyed information and also to know what are their preferences in some design options.
3.1.2 Results

Analyzing the information collected from the user test sessions of the low-fidelity prototypes, which is available in Appendix 2.2, we were able to gather results in order to make conclusions. To understand which alternatives the users preferred, we applied a non-parametric chi-square test, where we determined that, for each set of alternatives, the expected result for each alternative is the total amount of users over the number of alternatives on that set (all things being equal, if there is no preference, then the same proportion of users should choose each of the alternatives). There were also a few questions where we just needed to perceive if the users understood the concept. The information gathered by those questions was analyzed differently, in a more qualitative way.

We did not find statistically significant differences between the two alternatives to represent the general contact’s activity ($p=0.371$). However, and even though the result was not statistically significant, the preferred alternative was the one represented on Figure 3.1, as 60% of the users found it slightly easier to understand.

Also, and taking into account the visual impairments seniors might have, the alternative that represented activity by the changes in transparency could present higher difficulties in being perceived, which was actually verified in the tests.

When analyzing the information about the perception of the users regarding the different sources of activity, we based our questions in the comparison of the different approaches. Firstly, we compared the representations with the bars and with the circles. Although the chi-square test did not reveal statistically significant differences ($p=0.655$), we understood the users took much longer in analyzing the rounded representation. Also, the users commented that the rounded representation was not very easy to understand. As it is known, in the information visualization field, humans are better in analyzing straight lengths than rounded ones. Also, the squared representation is more appropriate to be implemented in the general solution of the project, as the rest of the interface is based on squares.

Then, we analyzed the comparison between the visualization represented on Figure 3.3 (the simple bars) and on Figure 3.7 (the bars in an horizontal line, at the bottom). The differences were not also significant ($p=0.655$) but the users were confused about Figure 3.7, as they did not understood where each bar started (if all from the beginning or if each one represented the total length). Then, in the comparison of Figures 3.3 and 3.8 (the alternative wit the vertical bars over the avatar), the result was
not significant again (p=0.655), but Figure 3.8 revealed to be hard to understand as the bars covered a relatively large part of the avatar. After this, we analyzed the information collected regarding Figures 3.3 and 3.9. Differences were statistically significant (p=0.025) which showed a preference for Figure 3.9. Similarly to this last one, where Figures 3.9, 3.10 and 3.11 were compared, the chi-square test showed us a clear preference (p=0.004) for Figure 3.9.

Finally, and when questioning the users about the availability issues on Figures 3.5 (squared representation) and 3.6 (rounded representation), more than half of them did not understand that the color grey in the bars meant that the contact is not currently online.

Figure 3.17: Perceptibility of the availability feature.

However, many of those who did not understand that, at first, were the ones that never had any contact with computers, while others who worked with them already found it easier to understand.

Regarding the notification system, the analysis of the results was much simpler, as the great amount of the users was almost unanimous in the understanding of the alternatives. Less than 10% of the users were able to understand (or see) the notifications with the glow and with the saturation changes.

Figure 3.18: Perceptibility of the notifications with the glow and saturation.

Also, only 25% of the users could perceive the notifications on Figure 3.13 - the one with the dots for notifications. The only approach that was well received by the users was the one that had the notification counter, which got a percentage of understanding of 65%.
Even though the results about this approach were not very high, we observed that the people with no access whatsoever to computers and technology were the ones that had more difficulty in understanding this last approach.

3.1.3 Conclusions

Analyzing the results portrayed previously allowed us to make choices by accepting some alternatives and discarding some others.

Regarding the general level of activity, we opted to choose the representation on Figure 3.1 - the one that represented higher activity by increasing the size of the avatar. Even though the result of the test was not significant, the alternative with the transparency could impose a problem in the correct understanding and analysis, since the changes in the transparency of the pictures might be high. Also, even if some contacts might be less active, it does not mean the users do not want to see them as easily as the contacts that are more active. The transparency did not allow this.

The approaches about the activity on the different sources revealed some tricky results. We were able to discard the rounded representation and the one represented on Figure 3.7, as they would not be well incorporated in the rest of the system or were not very obvious. Although there was a preference for the representation with the squares for the activity, we decided to implement the one with the bars as well, as it was preferred when compared to other approaches. The representations with the circles and semicircles were also discarded, as there was a clear preference by the one with the squares, reinforcing the decision to choose it. Finally, and even though we could also choose the representation with the vertical bars, we decided not to, because most of the picture would be covered by the bars and the picture’s transparency changes could be a problem for the seniors’ vision. Thus, we decided to implement only, for the next study, and regarding the sources of activity, the alternatives from Figures 3.3 and 3.9.

When it came to choose an alternative for the notification systems, the choice was obvious: the representation with the notification counter was the only one that had a proper level of acceptance and was the only one the users could see and understand correctly, which made it the one to implement.
3.2 First Functional Prototypes

The first functional prototypes are the result of the tests and feedback collected from the users that was obtained in the low fidelity prototypes’ test session. By analyzing the conclusions from the first tests, we were able to understand what were the options that can best fit the users’ needs and interests. In these first functional prototypes we decided to maintain the several types of visualization separated, but incorporated the notifications in the sources’ visualization, as there was only one preferred option for that element. Also, we produced a prototype that gathers all the alternatives combined, in order to understand if it is perceptible by the users.

Regarding the general level of activity, we implemented the preferred alternative, as it can be seen in Figure 3.20.

![General Level of Activity](Figure 3.20: Functional representation of the general level of activity by the size of the avatars.)

As far as the representations for the different sources are concerned (with notifications), we implemented the two alternatives described before. Both alternatives are represented in Figures 3.21 and 3.22 and both of them have the notification system.

In these prototypes’ creation, even though they are static, and do not show real information, we decided not to continue with the idea of including the availability feature for the sources. It was clear to us that, apart from Skype, no other source had a synchronous communication, which makes this issue unimportant and with little meaning. Thus, we decided to abandon this idea, and it can be seen that no prototypes, from this phase on, have the availability feature.

Even though the information was fictitious, thus the squares, bars and notifications were static, the prototype was functional. We could swipe left and right to show more contacts.
Finally, we merged these alternatives and created a single view that maps what we are trying to create from the beginning. As before, there's an alternative with bars and another with squares, represented in Figures 3.23 and 3.24, respectively.
These first functional prototypes display information created by us that represent the contacts’ activity in the several sources. Each contact is fictitious and its information represents a few activities a person can perform on each source: number of posts on Facebook, number of tweets, number of friend requests, emails sent to the user and others. Each of these elements helps composing the length of each bar and, together, they compose the size of the avatar – in the alternatives where that happens. Detailed information about the algorithm behind the visualization is properly described in section 4.3.2.

To perceive if the visualization with many contacts was understandable for the users, we decided to create four distinct scenarios: the first one with 20 contacts – a relatively low number of contacts, which is likely the case of most seniors – and just a few contacts that are highly active; a second one with also 20 contacts, but with contacts that have a more uniform level of activity; a third one with 100 contacts, similar in activity as the first one; and a final scenario with 200 contacts, as it is the average number of Facebook friends per user\(^3\). By creating these different scenarios, we are able to test each alternative

\(^3\)http://www.pewresearch.org/fact-tank/2014/02/03/6-new-facts-about-facebook/
with each scenario, making it possible for us to understand if the visualization was not reliant to a small number of contacts. Also, it was possible for us to identify if the packing algorithm used worked with different scenarios. Proper and detailed description of this is on section 4.3.2.

3.2.1 Protocol for User Testing

After performing the preliminary user tests with seniors and evaluating the results of those tests, we came up with the implementations described before. With these intermediate prototypes complete, we also needed to do another session of user testing, in order to understand if these representations made sense and are well perceived by the users, and also, to make a final inquiry on which of the two alternatives for the activity in sources is better, so we are able to choose a final one.

This session took place in April 2014 in Centro Social e Paroquial Nossa Senhora da Conceição de Olivais Sul, Olivais, Lisbon, where we were able to interview 15 people, 9 of those were female and 6 were male, from 68 to 90 years old without cognitive disabilities, that were able to see and read, and with none to low knowledge of computers, social networks and other technologies or tools, which are roughly the same characteristics of the participants of the preliminary user tests. Each test was performed individually, in a small room were the users could sit and interact with the device, and we made sure to the users that their participation was anonymous and cost-free. The questions were made and answered and the total amount of time spent with each person did not exceed 15 minutes.

The survey is described in the Appendix 3.1 and it is divided into six categories: general information about the user, the users’ perception about the general level of activity, their perception about the activity from each source, their perception about the notification system and two new categories that were not present in the first preliminary test survey: perception about the total amount of activity (general and sources) and a few conceptual questions regarding actual tasks that can be performed using our solution. Note that the names of the alternatives from the survey are the same than the ones represented in Figures 3.20 to 3.24. We made all the questions verbally, and the users replied to those questions in the same way. We took notes of the answers and other feedback the users might have given to us. These questions focused on the perception of the activity of the users and were meant for us to know if the prototypes chosen previously are working correctly and are well adapted for the users’ needs. However, the main goal of this session was to identify which of the alternatives of the sources activity was best to the users’ understanding. To achieve that, we focused on identifying which of the two alternatives better represented the contacts’ activity and which of the two made the comparison easier.

It is also important to say that the language used in the prototype and the survey was Portuguese, as the tests were all made in Portugal, as described.

3.2.2 Results

In these tests’ results, we decided to adopt the same method we used in the low-fidelity prototypes’ tests. We applied a chi-square test to analyze the preferred options when we asked for comparisons and analyzed the general understanding in each alternative. The detailed results of the user testing are available in Appendix 3.2.

In the perception about the general level of activity, and as we only had one option, we asked the users if they understood the concept correctly. More than 65% of the users were able to understand the concept and make the comparison of the general activity between two contacts correctly. Some of them
found it confusing, as it is not a concept that is commonly used, but after a simple explanation, most of them understood it correctly.

Regarding the perception about the sources of activity, more than 90% of the users were able to perceive both approaches. However, the comparison of the activity between two contacts was well perceived in Figure 3.21, as 93% of the users were able to compare easily and correctly, while only 33% could identify who was most active on Twitter on Figure 3.22.

![Figure 3.25: Comparison of activity between two contacts, with the bars alternative.](image)

This happened because humans are better in perceiving changes in length than changes in areas. Also, the results from the preference of the users supported the difficulties they had in analyzing the sources’ squares. The result of the chi-squared test was statistically significant (p=0.004) as the users showed a clear preference for the option with the bars.

Both alternatives from the notification system (the same approach chosen from the previous user testing, but represented inside the bar and inside a small rounded circle) were well accepted and interpreted by the users, as over 85% of them understood both alternatives. However, the chi-squared test was statistically significant, although with a lower confidence (p=0.071), which showed us a preference by the representation of the notification’s number inside the bar (Figure 3.21).

Finally, we asked the users about their perception about the total activity (general, from each source and with notifications), which is a representation of what the contacts’ visualization will probably look like in the final prototype. As expected, the representation with the bars was preferred to the one with the squares (test showed p=0.004, a preference for Figure 3.23) and the understanding was higher in the alternative with the bars – 80% - than the one with the squares – only 40%.
Figure 3.26: Preference for the alternative with the bars than for the one with the squares, regarding the sources of activity.

3.2.3 Conclusions

As we only had one alternative to represent the general level of activity and it was well accepted by the users, we are going to continue to use it in the final prototype. The same goes for the notification system, that was incredibly well perceived; to represent the notifications, we will choose the option that has the number of notification inside the bar, as it was the preference of the users, and it makes the matching (notification to source) more immediate.

Regarding the activity from each source, it was clear that the users had a preference for the representation with the bars, and it was also clear that this representation made the comparison of the activity of the contacts much easier. Because of all this, on the final prototype, we will implement only the representation with squares, as shown on Figure 3.23.

3.3 Discussion

Considering everything that was discussed before, there are a few guidelines that should be taken into consideration when designing interfaces for seniors. Their visual impairments, and the advancing of the age, make many simple features that are perfectly understandable for the other ageing groups, very difficult and confusing for seniors.

We perceived that rounded visual elements are not the best if there is a need for comparison, as the circle may confuse lengths and areas. In this case, simple, clear, squared representations are proven to work best. Also, subtle or small elements do not work for senior users, for example, small target areas, small elements where important information is, or soft colors. Color saturation changes and transparencies are difficult to perceive, as well as changes in areas instead of lengths.

As said before, important informational areas should be displayed larger than others, or large enough to be well seen and understandable. Also, the interfaces should have few, neutral colors and not contain many details. Finally, and as been proved by the discarded prototypes, the graphical elements should be simple, as most complex ones are not well interpreted by the users.
3.4 Conclusions

We created a visual representation for the contacts’ activity that is suitable for seniors. We built a first set of low-fidelity prototypes that contained all the elements we wanted to include – general level of activity, activity from each source and notifications of new/direct messages – and created a few different alternatives for each of those elements. After that, we made two sessions of user testing so we could understand which of the alternatives created would be better suited for our users. With the tests’ results from the low-fidelity prototypes, we were able to choose the most promising alternatives for each element.

Then, taking into account only the prototypes that were most understandable and preferred by the users, we built the first functional prototypes, with the several activity elements separated, but also with a solution that already integrated all three of them. This time we made a similar session of user testing, not only to choose a final representation of each element, but also to perceive if the representations chosen before were still accurate and understandable. We were able to choose only one representation for each of the elements.

After analyzing the feedback from the users and after choosing one final prototype to implement, we were able to correct a few inconsistencies these last prototypes may have and make only one solution that integrates all the elements (with the chosen alternatives from the last user testing). The elements were: the alternative with the changes in the size of the avatars for the general perception of activity; the bars alternative for the activity representation on the different sources and the already chosen notification counter. After that, we could start to fetch real information from the users’ accounts to show it in the visual solution, as we will explain in detail in the next section, instead of showing information created by us, as it was at this point. The final prototype briefly described here can be found described in detail on the next section.
4 Implementation

The final implementation of this work is a result of everything analyzed and created before. First, we created low-fidelity prototypes, considering the studies from the related work and the implications collected from their analysis. These prototypes were tested with real users, which allowed us to verify that not all the features were reasonable to implement, and that there might be others that could make sense in the context of the work. As so, it was imperative to build a first functional prototype of the system, in which we excluded all the components that would clearly not work for the seniors. On the contrary, we implemented the features that were previously well received, even though we were still having some alternatives for the same approach. Of course, to know what final, solid alternative we should implement, we required the help of our target end-users once more. They helped us understand which alternatives worked best in a functional environment, allowing us to proceed to the next level once more.

In this chapter, we will describe all the implementation process, including the architecture behind the system, the technology used and the implementation approach, regarding the contacts' activity visualization itself and the module for the groups' management, which we knew now we really had to implement, for the final phase of the work. All these aspects will contain relevant details and possible compromises - and their evolution towards the final solution.

4.1 Architecture

In previous phases of this work, already described in section 3, we had a single solution that could work all by itself. In those prototypes, we did not have any real data, which allowed us to develop a unique solution.

However, our work is part of the PAELife, AAL (Ambient Assisting Living) project that, as described before, aims to develop a multimodal personal assistant for the seniors to facilitate their communication and interaction. As so, we had to integrate our module to work alongside all the project's modules so we would be able to fetch real information from the social networks of each user.

Image 4.1 is a representation of all the modules that compose the AALfred application.

![Architecture diagram for the AALfred application, using the Contacts' Activity Module.](image)

Figure 4.1: Architecture diagram for the AALfred application, using the Contacts' Activity Module.
The application is primarily divided in two big components: the **backend** and the **frontend**.

The backend is responsible for all the computation required and is composed of many modules (Social Networks API, Text-To-Speech Service, Gesture Recognition, etc.), each of them responsible for a single service. The component that we used in our work was the Social Networks API. This module fetches information from the web, about the social networks used in this project. In this case, it gathers information (details on section 4.3.3) from Facebook, Gmail and Twitter, and makes that information available to access from frontend’s modules. Let’s focus on the fact that Skype is not present from now on: a technical problem due to the change of Skype API, no longer allowed access to Skype information (making calls from within other apps, etc.) from the Social Networks API module. This fact forced us to abandon the Skype source on our work, as information was no longer accessible from the Social Networks API; which left us with the other three. The final prototype, presented later on this section, already contains this update.

The other main component is the frontend. The frontend is responsible to gather the information collected in the backend and display it in a visual way, to the user. There are several modules on the frontend, and each one corresponds to a module in the application. Our module is the Contacts’ Activity Module. In here, we are responsible to fetch information from the Social Networks API and display it in a visual way. The prototypes created in previous phases of the work showed us how the information is going to be presented. However and as described, the previous prototypes (even though the last one was already functional) did not show any real data, as they displayed information that was stored on text files. Our work on this last phase of the implementation was to update the visual display accordingly to the feedback from the users, gathered on the last user test session, whose conclusions were already presented on section 3.2.3, but also, and most importantly, to change the way in which we fetched for data. From now on, as our module was already incorporated with the system, we needed to access information from the Social Networks API, which would allow us to get real information, from real users, through a login.

### 4.2 Technology

The technology used to develop our module had to be consistent with the technology used in the application.

As so, we had to create a project (via Visual Studio) using a development template: Windows Store App. These kind of apps allow the developer to create **items** that are composed of two files: a XAML (eXtensible Application Markup Language) and C# file, as it can be seen on Figure 4.2. The XAML file is the one responsible for the design of the page, and the C# file is a standard C# class where logic can be applied to the components created in it’s XAML element.

![ContactsActivityPage.xaml](image_url)

**Figure 4.2:** Item on a Windows Store App, Visual Studio.

In the XAML files, we are able to create all the design components of the page: buttons, text blocks, scroll viewers, popups, and so much more. Apart from the XAML code editor, it is possible to see how is the design, using the Design tab.
The C# class in the Item can access the elements on the XAML page on the same Item. It is in these files that all the logic stands, enabling the components on the XAML file to perform actions (e.g.: when a user clicks a button that was created on the XAML file, its action is performed based on the code written on the C# file).

As a project, it might be necessary to create extra-logic, that is not attached to any screen. It is possible to do that, by simply creating a C# file and writing code in it normally.

4.3 Contacts’ Activity Visualization

In this section, we will present all the details about the Contacts’ Activity Visualization itself, as the Group Management will be discussed in another section (section 4.4), because it's implementation was done afterwards and it is not an element that needs to work alongside the activity visualization (i.e. the groups’ management component can be applied in another context and the visualization of the contacts can work alone, without the groups).

Ideally, in this final stage of the work, our module should be working only inside the application. Even though the module - which is going to described in detail in the next sub-sections - works with all the other modules in the AALfred application, we had to maintain our single solution from the previous stage, which was properly updated accordingly with the feedback from the users, as said before. This is because of the fact that senior users might not have data of their own (accounts on Facebook, Gmail or Twitter). Because of this, and as we wanted to perform final user tests, not only to make sure, once more, that the visualization chosen worked for our target users, but also because we needed to test the new Groups’ Management component, we had to maintain a version - visually identical to the one already used in the AALfred application - with fictitious contacts.

4.3.1 Displaying Contacts

First of all, and when we started to build the first functional prototypes (still with more than one alternative for the sources’ display), we had to think about how to design our contacts’ avatar. Of course that an image was mandatory, so that immediate recognition was possible. Also, the name of the contact felt like a very important element to incorporate. Designed on XAML, we created the Contact Item, which was the base element of all contacts, as it can be seen on Figure 4.3.

![Figure 4.3: The simple contact display.](image)

After that, and as we needed to represent the sources of activity, we designed the bars (and squares, during some time), around the contacts’ avatar, so that the user could perceive that the activity repre-
sented was connected to that certain contact. Also, the notification system had to be implemented and, as so, we created that element as well. We first created a solution that is represented on Figure 4.4.

![Figure 4.4: Contact with sources’ activity and notifications over the bars.](image)

However, this last approach revealed that the notifications occupied too much space on the canvas, which reduced the amount of space that the pictures might take. As so, we decided to maintain the notifications, but place the number of notifications per sources inside it's bar, as it can be seen on Figure 4.5. This way, the space issue was resolved and people might find it easier to associate the notification with the corresponding source. A problem might be that the users could be confused, associating the number that appear on the bar with its length. We took this in consideration and tested this issue in the second user test session. No users considered this issue as a problem, thus we maintained this last approach regarding the notification system.

![Figure 4.5: Contact with sources’ activity and notifications inside the bars.](image)

Each of these bars (and squares) and notifications are elements that were designed in a XAML file, as said before. As so, it is possible to access those elements in order to change them, for example, increase or decrease the size of the Facebook bar. The same applies to the total area of the avatar. The explanation about the assessment of the activity that made the bars bigger and smaller (as well as the area of the contact) and notifications counter appear or disappear - as well as change its number -, will be detailed in section 4.3.4.
4.3.2 Packing Algorithm

After the creation of the contact element (with and without available sources), another very important detail we had to think about was on how to pack the squares (contacts’ avatars and the sources’ representation) on the canvas.

We first studied a solution in which we would divide the canvas area equally and then place the contacts in those appropriate spaces, previously divided. We could easily know what was the size of the biggest contact, and then, divide the area regarding that size. Very quickly, we abandoned this idea. The size of the avatars might be very different from each other and we would have ended up having many empty spaces. For instance, if a contact with very low activity existed, it would be placed just like a bigger avatar, which would result in tremendous empty spaces.

As so, as described before, the size of the avatars is not always the same (even though they are all squares they might have different areas because of the different level of activity each contact may have). As a result of that, we needed to create a packing algorithm that packed the squares in the available empty area (initially, all the canvas), accordingly to each contacts’ size. To achieve this, we based our algorithm into another existent one, which tackled the problem of packing blocks into a fixed rectangle\(^4\).

Our solution was based on setting the maximum height size of the canvas’ grid to the computers’ screen resolution and its width with no maximum value, as we needed as much width of canvas available as the number of contacts to pack, which most certainly would not be stable all the time, not only because the user might want to add a new contact, but also because the contacts’ activity is not always the same, thus affecting the avatars’ size. Also, we set a minimum value for each avatar size: an amount in which the name and avatar of the contact would still be visible and perceptible, roughly \(1/5\) of the size of the canvas. The maximum size of an avatar is the maximum height size of the canvas, which already represents an high level of activity. The first step is to gather all the contacts to put in the canvas, create a contact’s structure, with all the contact’s information, and place it in a list structure of contacts. In the first prototype the contacts’ information was placed on a text file, which we read before inserting its info in the structure mentioned, but then, when we collected the sources’ information from the Social Networks API, it was this last information on the contacts that we added to the list structure. In section 4.3.3 we will explain in more detail which kind of information was placed in our text files and what was the information collected from the API. After having the contacts’ information placed in the structure, we sort the contacts accordingly to their sizes - so the biggest ones are the first to be executed - and, for each contact, we create an element like the one presented on Figure 4.5, so that the contact is visible on the canvas. After that, we take into account the algorithm we based ourselves on, and place a contact on the first empty space it finds. Then, and instead of horizontally dividing the empty area into two, we do it vertically, so our biggest contacts are placed on the left side on the canvas. Each new contact is then placed in the leftmost empty area available where it fits. We do this recursively until we have no more contacts to place on the canvas. This way, we know that the biggest contacts are the first ones to appear and the smallest ones are either in the end or placed in the bottom, under some bigger ones. After this, the canvas would look like the image on Figure 4.6

\(^4\)http://codeincomplete.com/posts/2011/5/7/bin_packing/
This approach also works in extreme situations: when there are few contacts with very high activity and many with very low activity (Figure 4.7); when all contacts have very high levels of activity, and when many contacts have lower levels of activity, represented in Figures 4.8 and 4.9, respectively. Of course, an average scenario also works, as it has been shown from section 3.2 on, and particularly, on Figure 4.6.

These scenarios were already tested in the first functional prototypes user test session, as described then.
In early stages of the prototypes' design, we had the three components to be displayed all separated, as it was described on section 3.2.

In the final stage of the prototype, we had the three components to be displayed all gathered into a single solution, because that is the way it is supposed to be shown to the users. This way, and even though they were separated most of the time, we will describe them as a whole, together, because, on the last stage, that is the approach we took.

### 4.3.3 Information Collection

The information collection was processed differently in the two stages: in the first functional prototypes, we had all the contacts’ information stored on text files; regarding the final functional prototypes we had a version that worked based on a text file’s information and another one that used the information collected from the Social Networks API.
At first, as we did not yet know what kind of information we would have access to, we decided to come up with a few variables that we thought would be close to the real ones, so we could start testing the visualization with data from different sources. This text file's template for each contact was as follows:

{<Contact's name>; <Contact's picture path>; <Number of Facebook posts>; <Number of Facebook comments>; <Number of Facebook likes>; <Number of new friends>; <Number of Facebook notifications>; <Number of emails sent>; <Number of emails received>; <Number of tweets>; <Number of retweets>; <Number of Twitter notifications>; <Number of Skype calls>; <Number of Skype missed calls>}

An example is as follows:

{Allana Moore;[path-to-picture]/photo4.jpg;40;39;36;20;4;43;0;21;19;3;36;1}

Each contact would have a line like this, in which we would parse its contents (by the ';') and store their value in local variables that were a composition of the Contact structure. After that, the activity assessment is done, based on the values stored on the variables created, but that is properly explained in the next section.

On the very final stage of the work, we had access to the Social Networks API, in which we could retrieve the actual information that we would be able to use in our work. After analysing the API, we were able to understand that we had less information than what we initially though. The information we could retrieve was:

- **Facebook Private Messages**, which are the private Facebook messages the contact sent to the user;
- **Facebook Public Messages**, which are the public Facebook messages the contact posted on the user's wall;
- **Facebook Unread Messages**, which are the number of unread Facebook messages the contact sent to the user;
- **Facebook Likes**, which are the number of Facebook likes the contact made in the user's messages/posts;
- **Twitter Private Messages**, which are the private Twitter messages the contact sent to the user;
- **Twitter Public Messages**, which are the public Twitter messages the contact posted;
- **Emails Sent**, which are the emails that the contact sent to the user.

The information collection from the API was quite simple: we had access to a function that collected the messages of each contact, by the contacts’ ID, from a certain period of time, which, by default is one week long. We only had to give the ID of the logged user as a parameter to that function and it returned all the messages described right before. After that, it was only a matter of calculating the number of messages in those attributes.

Given the new parameters described before, we had to update, not only our Contact structure, to be able to receive the new parameters, but also our text file - in our static version - to be similar to the final version in the project.
As so, next, we have an updated version of each contact’s template on the text file:

{<Contact’s name>; <Contact’s picture path>; <Facebook Private Messages>; <Facebook Public Messages>; <Facebook Unread Messages>; <Facebook Likes>; <Twitter Private Messages>; <Twitter Public Messages>; <Emails Sent>}

This way, both our versions - the one using the text file and the final one, integrated with the other project modules - would be working the same way and the contacts’ activity would be the same on both of them, whose assessment we will describe in the next section.

4.3.4 Activity’s Assessment

The activity assessment was also made in two different stages (first functional prototypes and final prototypes), because we felt the need to evolve from our first attempt, which means we had a different approach for each stage. Let’s start with the first of those: the first functional prototypes.

In the first functional prototypes we came up with the variables already described in the previous section. As so, we had everything we needed to map those values into the display of the bars and the notifications, for each source. Also, we could use those values to change the size of the contact, which is the result of the activity of all the sources combined.

Each source bar has two components that can be accessed within the application: its visibility and its width (or height - for the Twitter bar). This way, it is possible to set its value to a new one, which we did, using the variables collected from the text file. This way, we could read the variables and assign their value to the components of each bar. If there was no “activity” for some source, we made the bar disappear as opposed to the fact where the variables contained positive values, in which we would assign its value. For each bar, we opted for a simple solution, as we could manipulate the values on the file as much as we wanted. Also, the purpose of these prototypes were to get the understanding of the display and to eliminate alternatives for the same component, and not to evaluate whether the activity on the sources was accurate: that was an issue to discuss later. All the variables that were connected to a single source were summed up, and their total amount was assigned to the length of the bar they were connected to.

The same applied for the notifications. When no notifications were found, no number was showed to the user. On the contrary, whenever there was at least one notification (missed calls, received emails and/or standard notifications) we displayed its value.

Finally, we needed to calculate the size of the contact, based on the information from all the sources. Once again, we opted for a plain solution: the side size of the avatar is the sum of all the activity from each source, combined.

After this, we were ready to perform user tests because our prototype was functional, and it presented all the features that we though about when designing the low fidelity prototypes. We also knew what were the aspects we needed to improve, so that the activity visualization would map accurately the actual activity of a contact.

After this, and on the second (final) functional prototype, we were ready to calculate the activity in a different way.

As the contacts may have very low activity levels, it might become tricky to analyze the activity levels on those types of contacts. For example, if the contact posted a few times on the users’ Wall, the contact would have activity, but the display of this activity would be very small or even invisible, as Figure 4.10
shows. Anna Smith posted a few times to facebook and the activity presented there can hardly be seen.

![Facebook Icon](facebook.png)

**Figure 4.10:** Contact with a very low amount of activity.

Of course, this poses a problem. Also, as we are more interested in showing if the contacts have any activity instead of how much activity they have been having, this approach is not very good.

We then decided to adopt a different strategy when calculating the contacts’ activity, on the final prototype. The contacts with low levels of activity would impose a problem, as seen before, as their activity might not reach the levels in which it would be shown to the user. As so, we decided to change the activity (in the bars and in the total size of the avatar) to a new one: the original activity level multiplied by a factor that would change accordingly to the contacts’ level of activity. Regarding each source of activity (that is displayed in the bars around the contacts’ avatar), we used the factor in a way that is represented in Figure 4.11.

![Multiplying factor variation](multiplying_factor.png)

**Figure 4.11:** Multiplying factor variation regarding the variation of the activity on the sources.

The X-axis represents the amount of activity that a contact might have - in each source. These values were determined empirically, accordingly to the total length of the bars, and are here translated from “Very Low” to “Very High”, in which “Very Low” represents a bar that is little filled and “Very High” an almost (or totally) filled bar. The multiplying factor was, as well, determined empirically. We tested the values to use in each situation many times, and with very different values until we reached an optimal
solution, that is the one represented by the values in the previous figure. This solution allows us to determine several circumstances. The first one is to prevent the problem described previously, in which we might have contacts that appeared to have no activity at all, when that might not be the case, and the problem that it was possible that a contact may have to had a very high level of activity for it to be shown in the visualization. Also, with these precise values we can prevent one issue that might arise by using these factors, which is that, the contacts with a lower amount of activity, by the fact that they are multiplied by a bigger value than the ones with higher activity than them, might appear with bigger bars, as a result of that multiplication. We tested this issue, alongside with the factor determination and, this way, we can guarantee that no contacts with lower activity on a source might appear with a more filled bar.

A similar approach was used to the calculation of the general activity, which is translated by the total area of the avatar. Figure 4.12 shows the variation of the multiplying factor regarding the total area of the avatar.

![Figure 4.12: Multiplying factor variation regarding the variation of the general activity.](image)

In this case, the factors are quite different. Because of the fact that the area of the avatar is already the result of all the sources’ activity combined, its amount of activity is always higher than the amount of each source. This way, a lower value for the "Very Low" activity contacts is a good result.

### 4.3.5 Visualize Activity Since...

Another requirement was added to the project, at this point. It was to being able to show the contacts activity in different time periods: from the past day, the past week, the past two weeks, the past month and up until the time of the last visit (when the user last logged in the system). A screen to being able to choose the time period in which to see the activity was created as Figure 4.13 represents. To get to this screen, the user must pull up the hidden bar from the bottom of the device. The bar that appears, and the options that the user can choose from are more detailed in the next section, Figure 4.18 particularly.
The information collected from each period is quite simple: we downloaded the messages from the API that were more recent than the date we inserted (the one the user selected). This way, we were able to see the activity of the contacts on other periods of time. It is important to remember that the default value is one week, which means that, if the user does not select any other time period, he will always see the activity of its contacts from the past week. If the user chose to see the activity from the last visit, we would check when did the last login occurred, in order to perform the same action we just described for the other time periods.

This new feature, although very interesting, made us think of another issue we might want to tackle. It is not the same for the users if the activity shown is from the past month or if it is from yesterday; if we are looking at the activity from the past month, we probably have more activity on each contact than if we are analyzing activity from the past day. Thus, it might seem that a user that had some activity in the past day had nearly nothing compared to activity of a whole month. However, this is not what we want to show the users. We are not interested in letting the users know exactly what activity a contact had in a certain time period. The goal is to show the activity based on the time period selected, allowing the user to check the general changes in the activity of the contacts based on the time period selected. It is important to the user to understand smaller changes in activity since yesterday, but those small activity variations are not so important if the user is seeing the activity of the contacts since last month.

To achieve that, we used the same approach that we adopted to represent activity in its various levels (from "Very Low" to "Very High"). We used another multiplying factor, that varied as it is represented on Figure 4.14.
This time, the X-axis shows us the different time periods the user can select and how the factor varies accordingly to that. In the implementation, each level of activity differs, not only because of the factor applied directly to it, as described before, but also regarding each time period; however, the values showed for the factor, in the image, are an average of all the values used for each level of activity in that time period. Again, these values were found empirically and were tested many times, with the data from the several activity levels. Using this approach, the contacts maintain their average size in all the time periods, which would not happen if we did not use it. This allows the user to identify the contacts’ activity evenly, not depending on the current time period. Although the figure is only related to the bars in the contacts, the same method was applied to the size of the avatar. Also, when the user wants to see the activity from the last visit, we check when did the last login occurred and used the approach just described.

4.4 Group Management

As said before, the groups’ management, which was optional, at first, became a required functionally in the last phase of this work.

First of all, we needed to know the requirements regarding the groups management, that were an imposition of the research. They are:

- **R1**: There must be the ability to create a new group;
- **R2**: There must be the ability to rename an existing group;
- **R3**: It should be possible to delete a group;
- **R4**: There should be the possibility to move contacts to a new group;
- **R5**: There should be the possibility to remove contacts from a group;
- **R6**: All the contacts should be in a standard group - "All Contacts", which cannot be deleted;
- **R7**: The newly created contacts and the ones removed from a previous group, should be present on the "All Contacts" group;
Given this, we had two main components to think about, which were the visual component (the way in which the groups - and their management would be presented to the user) and the data persistency component that was required as much as the data from the contacts. Both these components will be present in the next two sections.

4.4.1 Group Visualization

We decided to represent the groups in two different ways, and evaluate these alternatives in a later user test session.

A first approach was to display the groups in an horizontal line, right above the contacts, just as presented on Figure 4.15.

![Figure 4.15: Visualization of the groups in an horizontal list.](image)

Another alternative was to represent the groups in a dropdown list, just as displayed on Figures 4.16 and 4.17.

![Figure 4.16: Visualization of the groups in a dropdown list.](image)

![Figure 4.17: Visualization of the “Friends” group in the dropdown.](image)

The first approach seemed the best to us because it only takes one tap to change the group. However, in this alternative we had to confine the number of groups to be created. The second approach might allow a larger number of groups, but it requires two taps to change to the view of another group. As so, we decided to maintain both alternatives and let the users choose what they liked the most.

In terms of all the features we needed to implement, already described in the requirements, we created new screens, only accessible by the users who wanted to manage their groups. This means that anyone who does not know how to work with the groups or do not find it interesting, can use the contacts’ activity module as well.

The bottom app bar represented on Figure 4.18 allows the user to perform three actions: the first one opens a new screen to manage groups, a second one opens a screen to manage contacts and a third one opens a screen regarding the visualization of activity in different time periods, as described in the previous section.
4.4.2 Managing Groups

In the groups management, we are able to perform three operations: create, rename and delete a group, as seen in the next figure.

If we create a new group, a popup screen appears, in which we have to insert the name of the group (Figure 4.20. The same applies when the user wants to rename a group (figures 4.21 and 4.22). Exceptions like empty name or the group already exists are handled, and in those cases a warning is displayed to the users.
Similarly to the rename group option, there is an option to delete a group (which removes all the contacts from that group and maintains them in the "All Contacts" group). The user can select the groups to delete, like shown on Figure 4.23 and a warning that the action cannot be undone - and that the users will be remove from the group - is shown and the user can decide what to do.
4.4.3 Managing Contacts

Regarding the contacts management, there are also some options that the user can consider. In the first place, the user needs to select which contacts we wants to apply changes on, like Figure 4.24 shows. After that, the options are shown to the users as on Figure 4.25.

![Figure 4.23: Delete Group displays all the groups that can be deleted.](image)

![Figure 4.24: Select Contacts screen, in which the users select the contacts they want to change.](image)
The "Move to Group" option displays another screen (similar to the one on Figures 4.21 and 4.23) in which the user can choose the group to move the contacts to. "Remove from Group" option removes the contacts from the groups they were in, leaving them only in the "All Contacts" group. The "Delete Contact" is an option to remove the contact from the application.

The reason why we decided to implement the group features this way was mainly to maintain consistency throughout the application. With the use of squares, we use the same visual approach as we used on the contacts. Apart from that, the big squares allow the users to read bigger text and to click the buttons easily. Also, the swipes used to see more buttons are the same than the ones the user needs to see more contacts. This way, we tackled the users’ poor visibility and interaction with the device issues, as we maintained coherency in the application.

4.4.4 Data Persistency

In order to keep the contacts in their groups after the application is shut down, we had to find a way to maintain the groups’ data persistent.

At first, we considered storing the information in a text file, which would be read when the application came back up. However, the Windows Store App has restrictions in the way developers use writing operations, which became difficult to overcome, as common access to the path where the file is located is forbidden. Also, storing a file in each users’ log might not be the best approach, as it occupies more disk space.

As so, we use a variable from the Windows.Storage.ApplicationDataContainer that is accessible throughout the application and does not lose its content unless the application is uninstalled. This way, we were sure that the users groups and the contacts in the groups would be persistently stores.

The way we stored the groups’ information in the variable was very simple. Inside each group line the information is stored as follows:

\{<Group’s name>:<Contact-1 ID>,<Contact-2 ID>,<Contact-3 ID>,...,<Contact-n ID>\}

This way, not only the groups are stored, but the application runs this variable and quickly finds out which
contacts are in which group. We needed to implement this persistency feature, as the Social Networks API did not allow writing permissions. Thus, and even though this issue would not be an actual issue in the AALfred application, because the partners would have read and write permissions to the groups, we had to implement it, so we would be able to test it.

4.5 Final Display

In this section we want to present the display of the module - in both versions of the work - so the final result can be clearly seen.

4.5.1 Contacts’ Activity Visualization

This section presents the final result of the Contacts Activity Module, as we have been describing in the whole section, but in here we can see the final result where the groups are incorporated. Figure 4.26 represents this.

![Contacts' Activity - All Contacts](image)

**Figure 4.26:** Contacts’ Activity Visualization final display, with fictitious data.

4.5.2 AALfred

In here we are able to see a part of the main screen of the AALfred's application - Figure 4.27 - and our module integrated with the platform.

As we were working nationally (in Portugal) all the application had to be in Portuguese, thus the changes in the contents, from the previous stage.
This last image shows us real contacts that were added by the user that is currently logged in the application. Figure 4.28 presents the three contacts that the user added, and we can easily perceive that only the first contact had any activity (on the email), thus it is bigger than the others and the red bar at the bottom is fuller.

In the integration with the AALfred application we had to incorporate only the contacts’ activity component and the visual part of the Group Management. As described before, we used the data persistency feature so we could test the groups’ management in our user tests, but we already knew that this issue was already dealt with inside the application.
5 Evaluation

In this section we will explain all the procedures that we followed during the last user test session (the first two are already described in sections 3.1 and 3.2).

Firstly, we will describe the protocol that we followed in the user test session, that allowed us to evaluate the users in performing certain tasks. The results gathered from that analysis will be detailed in section 5.2, and the conclusions from this study can be found in the last section of this chapter.

5.1 Protocol

After implementing the final functional prototype, we needed to perform another set of user tests. This time, it was important for us to validate all the work that was done in our module of the application, which had a few more functionalities than the previous prototype, as described in the previous section - group management, visualize activity from other time periods and the addition of another way of visualizing the groups. Also, this time, we hoped we could test the application with real data, to evaluate the users performing in a known environment, that is familiar to them.

This final session, similarly to what happened with the low fidelity prototypes, was divided into two small sessions. The first one took place in September 2014 in Centro Social Paroquial de São Jorge de Arroios, Lisbon; the second one was performed also in September 2014, in Casa de Repouso Cilinha da Amadora, Lisbon. Together, we were able to interview 15 people, 6 of whom were male and the rest were female, from 70 to 91 years old without cognitive disabilities, that were able to see and read, and had none to low knowledge of computers, social networks and other technologies or tools, which are the same characteristics of the participants of previous user tests. Each test was performed individually, in a room where the users could sit and interact with the device, and we made sure to the users that their participation was anonymous and cost-free. The questions were made and answered and the total amount of time spent with each person did not exceed 20 minutes.

The survey is described in the Appendix 4.1 and focuses on two main aspects: perception of the users about the contacts’ activity using fictitious data and their perception of the contacts’ activity regarding their own contacts; thus, with real data. Apart from that, in this final session of user testing, we decided to include some tasks in the survey, that required the interaction of the users with the device, because all the new functionalities needed to be tested. Also, we opted to incorporate, in this final survey, some debriefing questions, that were meant to evaluate qualitative issues, like preferences, easiness of performing some tasks and some other questions regarding challenges or learning experiences the users might have had.

Note that the names of the contacts mentioned on the survey are the same than the ones represented in the Figures of section 4.

We made all the questions verbally, and the users replied to those questions in the same way, except for the questions in the Tasks category, in which we measured not only the response from the users, but also the amount of time they took in answering - or in performing the tasks, when that applied.

It is also important to say that the language used both in the prototype and the survey was Portuguese, as the tests were all made in Lisbon, Portugal.
5.2 Results

First of all, we analyzed the results in terms of how comfortable were the users with the use of technology. We found out that more than 60% of the users never had, or had very little contact with technology, whether it is computers, smartphones, tablets, or even typewriters. Of course, this influenced the results and the completion of the tasks, as we are about to see.

Another very important issue is that none of the users had any social networks accounts. Thus, it was not possible for us to test the application with real data, as we wanted to. We already had though that this might be a limitation, which ended up being verified. Even though this aspect revealed to be impossible to test with the users, we were able to test the Contacts' Activity Module with the fictitious data we created for the situation. The evaluation of those results is described next.

We used task completion results to evaluate some of the tasks. However, the more detailed results in each question only take into account the number of users that actually answered or finished the task. The first two questions regarding the perception of activity when comparing two contacts had a task completion of 9/15. This means that 6 of the users were not able to compare the activity between two contacts. It is important to state that the users that could not answer those questions were some of the ones that never had any contact with technology. Also, in those questions we measured the time that the user took in answering the question and give an answer. As the first question was usually asked first, the average time to complete the answer was 28 seconds, and the second one (very similar to first) took only 18 seconds, in average, as the users already knew what to search for. So, for the first question we estimated a standard deviation of 30.76 seconds and for the second one, 22.03. Thus, for a level of confidence of 95%, the confidence interval is [7.904,48.096] for the first comparison and [3.6,32.4] for the second. The same applied to the next two questions, in which we asked the users about the contact with higher and lower level of activity. This time, the task completion was lower (6/16), because the users found it difficult to identify the biggest and the smallest avatar. However, the users that could identify them found the task easy. The average response times were 17 seconds for the first question and 14 for the seconds. The confidence intervals for 95% were [3.1,30.9] for the identification of the biggest avatar and [5.62,22.38] for the smallest.

After this, and as none of the users could perform the section that evaluated the prototype with real contacts, we went on to analyze the results from the tasks. In here, we checked whether the users could (or could not) complete the task successfully, and in that case, how much time did they take and the number of errors that they made.

The first task that asked the users to create a new group had a completion of 7/15. The average time to perform the task was 62 seconds (the time in which the users were writing the name of the group were not taken into consideration, as they were not a key point of the task), with a standard deviation of 39.48. As so, for a level of confidence of 95%, the confidence interval for this task is [32.76,91.24]. Even though it was the simplest of the tasks, it was the first one to be tested, which created some confusion on the users, as it revealed new features and ideas they were not expecting, thus the high average time. However, the users found the task quite easy to perform: the average number of errors was only 1. The next tasks (all of them had a task completion of 6/15) were performed without major difficulties and were all quite similar. The tasks that only required group management (task 3 and 5) were performed with fewer average times than the ones that involved contacts management. Tasks 3 and 5 (renaming and deleting groups) had an average time of 54 and 51 seconds, respectively. Using the standard deviation calculated for those results - which is 33.1 and 38.2, we were able to calculate the confidence intervals of [27.52,80.48] and [20.5,81.5] for 95% of confidence. The average number of errors for these two tasks
was also very low: 1.2 for the renaming of a group and 0.8 for its deleting. Once more, typing times were not considered. Finally, the results for tasks 2 and 4 (move and remove contacts from a group) were analyzed. These revealed some higher average times in performing those tasks, when considering the ones with only group management: the average times were 107 seconds for moving contacts to a group and 77 for removing them from a group. These results are also explainable: the users sometimes clicked the wrong contact when they had to choose it, which made them deselect the contact and select the right one. Also, when managing contacts, more taps are required, which undoubtedly increases the completion times.

Finally, we analyzed the results from the final task, in which the users had to visualize the contacts’ activity from another period. This task showed good results: all the users performed the task with 0 errors and the average completion time was 23.67 seconds, which translates to a confidence interval of [13.17,34.17] for 95% of confidence.

After this, we could analyze the information that we collected from the debriefing questions and from informal conversations with the users.

When asked about the preference of the two ways of visualizing groups, 33% of the users said it was irrelevant to them. For the users that actually had a preference, we applied a non-parametric chi-square test, where we determined that, for each alternative, the expected result for each alternative is the total amount of users that preferred one of the options over 2 - the number of alternatives available. The result of the test was not statistically significant (p=0.205), but there was a preference for the alternative with the list, even it was by a small margin.

![Figure 5.1: Preference for the list view, in the groups visualization.](image)

The remaining debriefing questions allowed us to collect some more informal feedback from the users. The main challenges they had were indeed related to the use of a new technology which was a fundamental problem throughout the test session. Also, some users did not know where to start when they were asked to perform a task. Even though they were able to work with the application before the test's start, they said that small details quickly escape their minds, which influenced the results. Also, another common response was that if they were given the chance to perform the test again, they would feel much more comfortable using the device and the application, which reinforces our idea that users with some knowledge about technologies tend to perform better on user tests.

Regarding the final debriefing questions - the ones in which the easiness of performing the tasks was evaluated, the results were satisfying: only around 12% of the users found any of the tasks difficult or very difficult.
The majority of the other operations had a fairly good level of acceptance - around 60% of the users found all the tasks medium to easy to perform. Also, more than 10% of the users said that comparing activity between two contacts, creating a group and visualizing activity from other time periods was considered very easy. This emphasizes the results collected in terms of time and number of errors for those tasks.

All the results described previously were analyzed accordingly to the completion of each task.

All the results portrayed were the result of the analysis of the data described in Appendix 4.2 of the Appendix chapter.

5.3 Conclusions

This final user test sessions allowed us to choose which of the two ways of visualizing the groups we should use. Of course that we opted to eliminate the dropdown, maintaining the very first approach we implemented: the horizontal list, as the results from the user tests - even having non statistically significant results from the chi-squared test, showed a preference for the horizontal list. This is the better approach, not only because the users preferred it, but also because it takes less taps to open a new group in the list view.

Also, and even though some users were not able to finish the tasks, we verified that a large majority of these users were the ones that had none to extremely low contact with any kind of technology. This, and the fact that all the users said that, if they had more time to interact with the application, they would definitely had done a better job in the tests, allowed us to conclude that the application poses a learning - and experience - curve. After that barrier is overcome, the users might want to use the application, and may use it without major difficulties. This is supported by the feedback that the more experienced users gave in the debriefing questionnaire: a very large amount of them found the tasks easy or very easy to complete.

Another interesting conclusion we took from this study was that, although the amount of users that were able to complete the tasks were roughly the same amount as the ones that could answer the first questions about the perceiving of activity, the response times were significantly high. The users struggled in opening the bottom bar, and many times they closed the application in the process of pulling the
bar up. Also, they felt confused by doing operations whose context is not familiar to them, as groups creation is not a very common action. Even though the results were not very good, we were not extremely concerned: the main focus of the application is to visually show the activity of the contacts, in which many users succeeded in analyzing. The group management was an extra feature that we included in the application due to the addition of the requirements to the project. However, and as described earlier, both the contacts’ visualization and the group management tool can be used separately, and none of them influences the normal operation of the other. This means that the users can use the contacts’ activity module without ever creating any group of contacts, eliminating the struggle that was verified in the user test sessions.

Of course that a main component of the test session could not be evaluated - the component with the real data from the users - because the users did not have accounts in which they could login and test the application. This shows us that, probably, only a very small amount of seniors will use the application due to the fact of having accounts on Gmail, Twitter or Facebook. However, and as many of the users from our session performed surprisingly well in the tasks they were asked to execute, they might have seen the benefits that the application could offer them, and as they did not struggle much, they would not feel scared to use it. Maybe, in a near future, we are able to see these users creating accounts on the social networks so they can use the application and connect with their loved ones easily and more interactively.
6 Conclusion

As it is known, humans are using technology in a daily basis. Computers and other devices are now indispensable for many people whose work requires the use of those technologies. Also, many people use technology to play games, casually search on the web, watch multimedia content and communicate. Another issue is that the population is growing old in many countries. With the recent expanding of the technologies, the senior population is being forced to use technology to communicate: family and friends are often away, and physical presence and communication is not possible. However, the seniors tend to exclude technology from their lives, as they do not want to adapt to new unknown environments, and are often afraid to attempt and fail. Even though this is a concern, it is proven that communicating is a real benefit for seniors. Of course that, when physical presence is impossible, people have to appeal to the technology to help them communicate.

To solve this issue, the PAELife research was created, with the main objective of fighting isolation and loneliness among seniors, promoting new ways of interaction. To achieve that, and focusing on our own contribution, we developed an application that displays the contacts’ activity of an user, in order to allow the users to identify their active contacts easily. This way, the users will know with whom they can readily interact with, by the means of the activity analysis.

In the context of this work, we studied the behaviour and the limitations of the senior citizens, to understand how they perform tasks in their lives, so we can better adapt our work to them. We learned that the senior users may experience some physical impairments that arrive with the growing age and prevent them of living a full life. For example, vision loss is one of the most common problems that the senior citizens may have to deal with, as they perceive fewer details and confuse colors and color saturations. Because of impairments like these, the seniors tend to adapt their lifestyles to these conditions, harming family and social interaction and communication, as described before.

Apart from the users’ limitations, we studied interfaces designed especially for these special users. This was a real benefit for us to understand what features we should use, and the ones we should avoid, regarding the senior’s limitations and impairments. An example of this is to avoid transparency, focus on producing high contrasts and keep important actions detailed.

After that, we produced a first set of prototypes that map all the features we needed to include in our system – general activity of the contacts, activity from sources and new/direct messages to the user. These prototypes included as features the changes in the size of contacts, display of activity bars to represent the activity from each source and alternatives to this option, as displaying squares of activity or condensing the bars into one. Those features were tested with users, and the results collected showed us what were the options we clearly needed to discard, like the sources of activity displayed in vertical bars. Other options, such as the changes in the size of the avatars for the general activity were well accepted, thus chosen to be implemented.

Then, and taking into account the prototypes previously produced, we chose the alternatives that were most understandable and preferred by the users. With those options in mind, we built the first functional prototypes, with the several activity elements separated, but also with a solution that already integrated all three of them, as this was the way the final solution would work. This time we made a similar session of user testing, not only to choose a final representation of each element, but also to perceive if the representations chosen before were still accurate and understandable. We were able to choose only one representation for each of the elements.
In the final work of this project we only had one alternative for each component (changes in the size of the avatars from the general activity; bars around the contact representing each source of activity; notification counter inside the bar for the notifications). Finally, a final session of user testing was required, in which the users would be able to visualize their own personal information, if they had any accounts on the social networks that were available on the project. As that was not the case, we performed the final user test session only with fictitious data. Apart from questioning the users about the perceptibility of the activity on the three components of the application - that was mainly what we did in the first two sessions of user testing - we asked the users some qualitative questions, and performed a debriefing questionnaire, in order to perceive and collect feedback in a way that no answer to a task could. The results of the final user test session showed us that the users could interact with the system with relative easiness, with exception of the interaction with the groups. However, and as described before, this specific issue is not a problem, as the users do not need to use the groups in the application, if they do not find it interesting, or cannot even use it at all. Also, many users were able to correctly perceive activity on the fictitious contacts we showed them, which proved that they could benefit with the use of the application.

If we could continue with the work, in terms of time, we would have wanted to explore more ways of visualizing the activity, regarding each source and the general activity. This would allow us to determine if there were still better solutions to display the contacts’ activity to the users, even though we explored several alternatives in the context of this work. Also, it would be interesting to develop new ways of displaying the management of the groups and contacts. The most difficult action for the users (taking into account their own comments and our observation of the tasks completion) was to pull up the bottom bar that displayed the available actions regarding groups and visualization of activity on other periods of time. Even though these actions are not mandatory, and the application can work entirely without them, we believe that many users would operate more in the managing tasks if they could more easily find the way to them.
References


Appendix

Appendix 1 - User Consent Form for the Low Fidelity Prototypes

CONSENTIMENTO INFORMADO, LIVRE E ESCLARECIDO

O meu nome é Ana Almeida, estou no último ano do Mestrado em Engenharia Informática e de Computadores e encontro-me actualmente a desenvolver um estudo de investigação (“Multimodal Interaction in a Personal Life Assistant for the Elderly” – Interacções Multimodais num Assistente de Vida Pessoal para o Idoso) que tem por objectivo desenvolver uma plataforma que ajude o idoso na sua vida diária. Um dos módulos do trabalho é o de perceber a actividade de uma lista de contactos de um utilizador da plataforma, que é o objecto de estudo actualmente. Venho desta forma pedir a vossa colaboração para realizar este estudo, que apenas terá como objectivo mostrar aos idosos um conjunto de protótipos em papel e avaliar a sua percepção sobre os mesmos. Este estudo não implica gastos financeiros ao participante, uma vez que todos estes serão suportados pela responsável do projecto. A participação neste estudo é de carácter voluntário, não existindo danos para a utente, caso recuse participar. A confidencialidade relativamente aos dados recolhidos ao longo do estudo é salvaguardada, bem como o anonimato da identificação pessoal da utente.

Agradeço a disponibilidade e colaboração neste estudo,
(assinatura do investigador).

Assinatura/s: ..............................................................................

Declaro ter lido e compreendido este documento, bem como as informações verbais que me foram fornecidas pela pessoa que acima assina. Foi-me garantida a possibilidade de, em qualquer altura, recusar participar neste estudo sem qualquer tipo de consequências. Desta forma, aceito participar neste estudo e permito a utilização dos dados que de forma voluntária forneço, confiando em que apenas serão utilizados para esta investigação e nas garantias de confidencialidade e anonimato que me são dadas pela investigadora.

Nome: .........................................................................................

Assinatura: ................................................................................ Data: .... / .... / .........
Appendix 2.1 - Script used in the User Tests for the Low-Fidelity Prototypes

This work intends to show what is the activity of a user’s contacts in various sources, like e-mail messages, tweets and Facebook messages.

The test will be comprised of two main tasks: a first task will be that the users will see the options that we designed to represent the contacts’ activity, and then – a second task – they will be asked about the perceptibility of the prototypes and/or their preference about some alternatives. The session will take about 10-15 minutes per user.

The questions will be asked in the order in which the groups are presented in this survey, however, within each group, the questions will be asked randomly.

General Information

1. What’s the gender of the user?
2. What’s the user’s age?
3. What is the user’s comfort, in terms of technology utilization and with social networks/contacts in particular (none/uses frequently/is expert)?

Perception about General Level of Activity

1. In Figure 3.1, what’s the most active contact? And the less active? (identify if the user understood the concept)
2. In Figure 3.2, what’s the most active contact? And the less active? (identify if the user understood the concept)
3. Comparing Figure 3.1 with Figure 3.2, which of them is preferred to map the level of activity?

Perception about Sources of Activity

1. In Figure 3.3, what’s the most active contact on Facebook? And on Twitter? (identify if the user understood the concept)
2. What’s the meaning of the color grey on some sources of figure 3.5 (see if the user understood the concept)?
3. Analyzing Figure 3.3 and Figure 3.4 which of them better expresses the activity in the different sources? Which is the most appealing?
4. Comparing figures 3.3 and 3.7, which of them better represent the activity of the contacts?
5. Which is the most appealing and easier when it comes to the comparison of activity? Figure 3.3 or Figure 3.8?
6. Comparing figures 3.3 and 3.9, which of them better represent the activity of the contacts?
7. Comparing figures 3.9, 3.10 and 3.11, which of them is the most appealing?

Perception about New/Direct Messages
1. In Figure 3.12, what are the sources that are the most perceptible? (identify if the user can see the differences)

2. In Figure 3.13, how many people have notifications? (identify if the user can see the differences)

3. Who has notifications in Figure 3.14? (identify if the user can see the differences)

4. How many notifications does the first contact have, on Figure 3.15? In which sources? (identify if the user can see the differences)
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A5
Appendix 3.1 - Script used in the User Tests for the First Functional Prototypes

This work intends to show what is the activity of a user's contacts in various sources, like e-mail messages, tweets and Facebook messages.

The test will be comprised of two main tasks: a first task will be that the users will see the options that we designed to represent the contacts' activity, and then – a second task – they will be asked about the perceptibility of the prototypes and/or their preference about some alternatives.

So that these tasks can be carried out successfully, we will explain to the users what the system is for and it will be shown briefly so that users get used to it (for example, what do the bars around each contact mean). Although the system does not comprise a great variety of interactions, it will be allowed that the users experience the system before initiating the test, so they can fit in. After these brief explanations and experiences the test starts, and it will take about 10-15 minutes per user. The questions will be asked in the order in which the groups are presented in this survey, however, within each group, the questions will be asked randomly, except for the general tasks' group.

All interactions with the platform will be made on a tablet, via touch.

General Information

1. What's the gender of the user?

2. What's the user's age?

3. What is the user's comfort, in terms of technology utilization and with social networks/contacts in particular (none/uses frequently/is expert)?

Perception about General Level of Activity
(identify if the user understood the concept)

1. In “General Level of Activity”, what's the name of the contact with most activity?

2. In “General Level of Activity”, what's the name of the contact with less activity?

3. Who has more activity? Allana Moore or Anna Smith?

Perception about Sources of Activity

1. In “Activity with Sources - Bars”, who is most active on Facebook? (identify if the user understood the concept)

2. Who is most active on Twitter? Ada Williams or Paul Thomas? (identify if the user understood the concept)

3. In “Activity with Sources - Squares”, who is most active on Facebook? (identify if the user understood the concept)

4. Who is most active on Twitter? Ada Williams or Paul Thomas? (identify if the user understood the concept)

5. Which of the alternatives seemed easier in comparing? “Activity with Sources - Bars” or “Activity with Sources - Squares”?
Perception about New/Direct Messages

1. In “Activity with Sources - Bars”, how many emails from Ruth Johnson do I have to read? (identify if the user understood the concept)

2. In “Activity with Sources - Bars”, how many missed Skype calls from Alice Adams do I have? (identify if the user understood the concept)

3. In “Activity with Sources - Squares”, how many emails from Ruth Johnson do I have to read? (identify if the user understood the concept)

4. On “Activity with Sources - Squares”, how many missed Skype calls from Alice Adams do I have? (identify if the user understood the concept)

5. Which of the alternatives seemed easier? “Activity with Sources - Bars” or “Activity with Sources - Squares”?

Perception about the Total Level of Activity

1. In "All Activity - Bars", who has more activity in email? Anna Smith or Ruth Johnson? (identify if the user understood the concept)

2. In " All Activity - Squares", who has more activity in email? Anna Smith or Ruth Johnson? (identify if the user understood the concept)

3. Which was easier? "All Activity - Bars" or "All Activity - Squares"?

General Tasks
(identify if the user understood the concept)

1. Which friend of mine has been away?

2. Which of my friends spends more time on Facebook?

3. Which of my friends spends the largest amount on time on the social networks?
# Appendix 3.2 - Detailed Results of User Tests for the First Functional Prototypes

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Appendix 4.1 - Script used in the User Tests for the Final Functional Prototype

This work intends to show what is the activity of a user's contacts in various sources, like e-mail messages, tweets and Facebook messages.

A first phase of testing will ask the users about the perception of the activity of their contacts with no real data. A second phase of testing will be to understand the activity of actual contacts with personal data, which is familiar to the users. Finally, certain tasks will be proposed to users in order to understand if they are simple, natural and of easy concretization, and two ways of displaying the groups will be shown to the users, so we can know which is preferred.

So that these tasks can be carried out successfully, we will explain to the users what the system is for and it will be shown briefly so that users get used to it (for example, what do the bars around each contact mean). Although the system does not comprise a great variety of interactions, it will be allowed that the users experience the system before initiating the test, so they can fit in. After these brief explanations and experiences the test starts, and it will take about 15-20 minutes per user. The questions will be asked in the order in which the groups are presented in this survey, however, within each group, the questions will be asked randomly, except for the general tasks’ group. All interactions with the platform will be made on a tablet, via touch.

General Information

1. What's the gender of the user?
2. What's the user's age?
3. What is the user's comfort, in terms of technology utilization and with social networks/contacts in particular (none/uses frequently/is expert)?

Perception of Total Activity - Fictitious Data

1. What is the contact with more activity on Twitter? Rachel Kelly or Ruth Johnson? (identify if the user understood the concept)
2. What is the contact with less activity on Facebook? Bailey Anderson or Allana Moore? (identify if the user understood the concept)
3. What is the contact with more overall activity? (identify if the user understood the concept)
4. What is the contact with less overall activity? (identify if the user understood the concept)

Perception of Total Activity - Real Data

1. What contact has been around more? (identify if the user understood the concept)
2. Who is the most active contact in email? (identify if the user understood the concept)
3. Who is less present on the social networks? (identify if the user understood the concept)

General Tasks

1. Create a group named ”Social”.
2. Move Alice Adams and Allana Moore to the ”Social” group.
3. Rename the "Social" group to "Friends".

4. Remove Allana Moore from the group "Friends".

5. Delete the "Friends" group.

6. Visualize your contacts’ activity since last week.

**Debriefing**

1. Which of the two ways of representing the groups is preferred?

2. What did you enjoy most in this activity?

3. What was the biggest challenge?

4. During the test, what questions did you have?

5. If you were to repeat the test, what situations would you approach differently?

6. What did you learn from this experience?

7. Indicate, from 1 to 5, with 1 being very difficult and 5 very easy, the ease with which you viewed the most and least active contacts.

8. Indicate, from 1 to 5, with 1 being very difficult and 5 very easy, the ease with which you compared the activity between two contacts.

9. Indicate, from 1 to 5, with 1 being very difficult and 5 very easy, the ease of creating a new group.

10. Indicate, from 1 to 5, with 1 being very difficult and 5 very easy, the ease of moving contacts to a group.

11. Indicate, from 1 to 5, with 1 being very difficult and 5 very easy, the ease of renaming a group.

12. Indicate, from 1 to 5, with 1 being very difficult and 5 very easy, the ease in deleting a group.

13. Indicate, from 1 to 5, with 1 being very difficult and 5 very easy, the ease of removing a contact from a group.

14. Indicate, from 1 to 5, with 1 being very difficult and 5 very easy, the ease of viewing contacts in other time intervals.
### Appendix 4.2 - Detailed Results of User Tests for the First Functional Prototypes

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