

Application and analysis of the affinities diagram on the examination of usability problems among older adults

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Abstract. Older adults have been facing usability problems every day, and with the increasing of life expectation those issues will be more and more frequent. The study of this group capacities and limitations could help designers to project systems more usable to everyone.

Keywords: usability, older adults, capacities, limitations.

1. Introduction

Older adults are having problems using mobile devices, mainly mobile phones, because the interfaces are not designed for this particular group of users, thus the elderly are not able to have a satisfactory interaction with the device. Those interfaces are poorly designed, mostly serving only to those people who have some knowledge of computers or Internet. This undermines their social relationships and causes embarrassment, frustration and inconvenience.

This article investigates the use of new technologies by the elderly in Brazil, especially in the use of cell phones, which indicates barriers related to physical, psychological and cognitive changes that may impair the efficiency, effectiveness and satisfaction during the use of new technologies [1] and discusses the predisposition of older people to learn and use new products.

1.1. Literature review

During years of field researches it was possible to observe that certain guidelines could be applied to any design that aimed the satisfaction of older adults. According to [1], those products have to consider the cognitive and perceptual capabilities and limitations of these consumers, and also have to pro-

vide the optimal training, select the appropriate input and output devices and structure the interface to ensure a usable system. Since older adults do not represent a homogeneous group any product that will be designed for them should take this guidelines into consideration since the beginning of the project and after that has to go through some testing to ensure their likely successful application. Thus, the product could be a health care system or a mobile device.

However, second [3], training and well-designed systems are not enough for the older adults to start using a new technology. To adopt a new technology the elderly must be convinced that there is a relative advantage of the technology, in comparison with previous methods of accomplishing the same task, and also, there should be a degree to which the innovation is compatible with one's values, experiences and needs [4].

Another researcher, [6], is working to improve learnability for older adults, which according to the study is impaired because many of them have less skills with computers and mobile devices than young adults, which decreases a positive transfer between the interfaces. They also have more difficulty in acquiring new computer skills. Their ability to learn is hindered by natural declines in processing speed, and in verbal and visual-spatial working memory.

Through considerations of the capabilities and limitations of elderly users, [5] studied the senses involved in the interaction with computers: touch, sight and hearing, to develop guidelines that could assist the user in communication with the system. It was also done a study on the limitations of the senses and memory in the Senior Citizens. From the characteristics, capabilities and limitations of these elements, recommendations were made, such as higher figure-ground contrast, to compensate the neuropsychological disintegration suffered by the elderly.

2. Methodology

Older adults have interest in learning new technologies when its benefits are clear to them and meet their needs [3]. This way of thinking is very enlightening because during years it was believed that older adults could not have a meaningful, rewarding and fun experience with technology. Since technology is everywhere it is almost impossible to affirm that a 65 years old person or older would be unable to use an electric toothbrush, for example. Also as every human being the elderly desire to have an independent and dignified life, make their own choices without compromising safety and security and this ideal life is more and more attached to technology.

A valuable starting point to understand the difficulties that older adults encounter when using technologies is by asking them [3]. Based on presets like these, 30 older adults, amidst 60-70 years, were interviewed about the use of the most universal handheld device, the cell phone.

The interviewing process was divided into two parts, with a comprehension icon test in between. In the first part, the questions were for simple collecting of socioeconomic data such as: age, sex, instruction degree, if they are still working or not, area of residence, if they live alone, with family or caregiver, etc. This way the elderly could prepare get comfortable to the next part, the comprehension icon test.

The icon test was crucial to understand how the older user responds to these interface elements. The icons were representing five different functions, corresponding to five distinct categories: a) contacts; b) music; c) messages; d) calendar; e) photos. Since there were no title to expose their related functions, the results showed how they were perceived only by what they looked like to them.

To build a controlled situation for the test, a metal board (22x17cm) was provided and all the icons were printed in adhesive paper. Afterwards the information could be more easily organized and the test could be performed under natural conditions, such as strong wind.

After each comprehension test the interviews were conducted to survey usability problems identified by older people on mobile devices. In addition, we asked questions such as: "Who do they ask in case of doubt about using cell phones?"; "How often do they use the mobile phone?"; "What does impel them to change phone?" There were also questions about proficiency with cell phones and computers and suggestions for the device improvement.

Several opinions and aspirations were obtained about the phones. It was studied the perception and behavior of individuals facing the need to learn how to use the phone, as well as: a) the concern of keeping up with new technologies, b) the acceptance of technological innovations, and c) how this technology now facilitates the interaction with the user. It was also desired to know if those technologies had added any advantage in the elderly daily life and promoted more social integration.

To gather all the data in those comprehension tests it was used the Affinity Diagram, a very dynamic tool to quickly create relations between all the results collected. The method consists basically in writing down on post-its all the quotes and impressions of the users about the icons, such as: what they look like to them, the main elements of the icons that helped them to recognize the related functions, etc. After that all this post-its were organized under categories and super-categories, thus, the result could be easily observed.

3. Critical review of existing works

In every work about this specific topic published to date, some similarities were observed. The physical changes that occur in the elderly were explored in each of these aforementioned studies and the guidelines proposed were always based on these aspects. This method is very reliable and the guidelines were correct but imprecise. Designing for older adults can be very challenging, since this is a very diverse group of people, and vary great deal in capabilities, limitations, and experience with technology.

The guidelines resulted from those observations were very similar. To compensate the losses in

visual acuity, they recommended: enhancement of figure-ground segregation, reduction in clutter, prohibition on using short-wavelength colors as blue, increasing of the font size, diminishing of menu options and items, and also using an antiglare filter on the LCD display for the brightness not to interfere on the visualization of the information [1,5]. It was also recommended to increase readability: black and thicker letters in a white ground [5].

Most of those guidelines to compensate the visual losses were confirmed during the comprehension test with the icons. The most easily recognized ones had the following characteristics: simpler illustrations, higher contrast between the figure in the center and the background, the use of yellow color. Furthermore, the icons that closely resembled a real-world object or were depicting something familiar were also more often correctly classified, as affirmed by [6]. These icons were all under “messages” and “calendar” categories.

The LCD brightness problem - viewed in [3] - were also cited, the older adults affirmed that when the screen is reflecting the sunlight it is impossible to see what is in it. Problems with font sizes were also presented [5], one elderly suggested that the mobile should have a zoom mode, so the augmentation of the text could be possible.

The losses on the touch and movement aspects are in the sensation of various parts of the body including the feet, lips, fingers, and the fleshy area below the thumb [3]. Also the pressure, vibration, spatial acuity and the perception of roughness, length and orientation are affected in the aging process. A larger keyboard with: keys more distantly placed, embossed center points are the best recommendations according to [5].

Since the motor control is fundamental to perform fine movements of the cell phone and this capability could be decreased as a consequence of some diseases as Arthritis and Parkinson, more prevalent among the older population, these recommendations might not be enough to accommodate those needs.

The 30 older adults also answered questions about the usage of the cell phone when performing daily tasks: sending messages, bluetooth and internet were the three more often reported problems as observed in the Table 1.

Table 1 – Usability problems reported in interviews

Source: Data taken from interview about usability with 30 old adults (April, 2011)

	Reported usability problems Older Adults (60-70 age)
Performing tasks	
Users reporting problems (%)	56,7
Message (%)	16,7
Internet (%)	13,3
Bluetooth (%)	3,3
Calculator (%)	6,6
Contacts (registration of new ones) (%)	13,3
Calendar (%)	3,3
Physical features	
Users reporting problems (%)	53,3
Small print (%)	33,3
Ringtone volume (%)	3,3
Display brightness (%)	13,3
Small and hard keyboard (%)	3,3
Interface problems	
Users reporting problems (%)	123 ¹
Navigation (%)	40
Functions hard to find (%)	33,3
Icons are not representative (%)	10
Guidelines are unclear (%)	26,7
More indicative titles (%)	6,6
Lack of a ID caller for non-registered contacts (%)	6.6

Most of the older adults said the use of the cell phone is restricted to answering and making calls. The alarm was cited as very useful especially when there is a possibility of setting more than two reminders and having different tones, as most have to self medicate at least twice a day, this way, it would not be possible to forget taking the medicines in time.

A manual, with a simpler, clearer and easier to understand language were also cited as a good improvement, since many of them consult it before asking the children, grandchildren or co-workers.

Some very interesting suggestions for specific problems were also observed such as creating a system to trace a profile of a non-registered number for the safety of the elderly, often targets of scams and other criminal acts. Most seniors keep and use older handsets because they still work.

Table 2 – Ease of handling

Source: Data taken from interview about usability with 30 old adults (April, 2011)

Possible Answers	Frequency	(%)
Yes	24	80
No	6	20

As for the easiness of the handling of cell phones, as shown in Table 2, most said it was easy, because they did not use it in an advanced way, some pointed out that the simpler devices, their preferred, are not difficult but can not say the same about the new models.

Table 3 – Tasks performed on cell phones

Source: Data taken from interview about usability with 30 old adults (April, 2011)

Tasks	Frequency	(%)
Looking phones on the agenda	25	83,3
Listen music	9	30
Receive and send message	18	60
Register names and phone numbers	20	66,6
Alarm	14	46,6
Photograph	15	50
View photos on phone	18	60
Calendar	11	36,6
Make and answer calls	30	100

When it came to the question about the registration of new contacts, we attempted to find out how the task was performed, and as a result some answered they recorded directly on the phone, while others admitted the need to write down on paper and only then copy to the cell.

On the task of looking up numbers on the agenda, many reported using it (83.3%), but some still prefer to have it on paper, fearing losing the numbers in case the phone breaks down or gets stolen. Additionally, many said they were able to remember all the numbers they dialed routinely and therefore did not use agendas of any kind.

After this process of gathering data, all the usability results in the comprehension test were organized under categories of the Affinity Diagram. In this study nine categories were created: a) "Elements of the icon did not help the classification", b) "Recognition of the function from elements of the icon", c) "Adaptations of the tools/functions of the cell-

phone", d) "Recognition of only day-to-day functions", e) "Considering subtitles self-sufficient" f) "Confusion between the appearance of the icon and external elements", g) "Non-recognition", h) "Confusion between the function of the icon and other phone functions" and i) "New categories". In addition, two super-categories were created: "Interference from elements of the icon in the user interpretation" (including categories 'a' and 'b') and "Use of creativity to interpret the icons that were not understood" (with the categories "f", "h" and "i").

Under the category "Confusion between the function of the icon and other phone functions", are arranged all the cases when a musical icon is misunderstood and classified as a message icon, for example, as happened with the iPod icon several times.

Under the category "Elements of the icon did not help the classification," are arranged the moments in which the interviewee acknowledged, for example, a bell, on the calendar icon, but was unable to classify it as such. On the other hand, when the recognition of an element helped its classification it was listed under the category "Recognition of the function from elements of the icon." There are cases such as when an elderly recognized the function "music", only because of the clef of the icon.









Within the category "Considering subtitles self-sufficient" are statements made by some seniors who said they had difficulty sorting the icons, because they always paid more attention to the subtitles, which most phones have on their menus.

In the category, "Recognition of only day-to-day functions," are listed statements as the 60 years old public hospital administrator: "I recognize the date, message and agenda, not the rest."

In the category "Non-recognition" are listed all the icons that older people reported not being able to classify since none part of the icon was recognized.

Table 4 – Older Adult’s Quotes with Cellphone Icons Indicate Usability Problems

Source: Data taken from interview about usability with 30 old adults (April, 2011)

Icon	Age	Occupation	Quotes
	65	Entrepreneur	“This is a library, right?”.
	70	Retired	“Is that a mansion?”.
	64	Retired	“This is the Holy Bible”.
	66	Retired Housewife	“What is that, my God? A cotton flower? I have no idea”.
	64	Retired	“It’s seems like a magnifying glass”.
	63	Government employee	“The Moon, a photo, a television, I don’t know. A balloon? A lamp?”
	66	Retired Housewife	“I don’t know if I am seeing right or wrong, but I am seeing the saline of Macau”.
	64	Retired	“What is that? Seems that I am in Macau... two saline”.
	66	Retired Housewife	“I’ve never seen something like that, It seems like a lock”.
	66	Retired Housewife	“I don’t know what it is. It seems like a lampshade”.
	64	Retired	“This is a bell, something about Santa Claus”.
	70	Government employee	“It seems like a box. I would classify it in “Music”.
	63	Government employee	“A sunflower, a rose. I guess a rose is something that you give to someone, something good, so for that reason I would classify it as a message icon”.

Sometimes the icons induced unexpected results, being associated with real-world objects different from what they were actually representing. Every time it happened, all the quotes were reserved to the Table 4 “Users Quotes” and under the category “Confusion between the appearance of the icon and external elements” of the Affinity Diagram.

4. Conclusion

The study of the characteristics, capabilities, concerns and competences of older adults, is a valuable starting point to understand the usability problems that the elderly face, not to mention it can lead us to a more age-friendly work environment. However more recommendations still need to be studied and more tests have to be done, until the decrease of human capacities can be compensated by technology.

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