Florch: challenges on developing a new social network accessible for senescent users

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ABSTRACT

Brazilian senescent population can grow three times the actual number in the next 20 years [18], being over 88 million people in 2035. This senescent growing number brings new challenges on quality of life for Brazilian society. How to promote digital inclusion to this profile of user is still a challenge in the literature. We believe that a social network focused on senescent users can enhance the digital inclusion for them. However, it's essential that the social network be designed for senescent users. This study aims to create a project with this characteristics. We analyzed a successful social network (*WhatsApp*) in order to propose a new one (Florch) for senescent users. We developed a high fidelity prototype of Florch and tested it. Our findings show usability and accessibility problems faced on the project's development. In addition, a Hierarchical Task Analysis of our social network showed that it has less and simpler tasks than the successful social network (*WhatsApp*).

CCS Concepts

•Human-centered computing → HCI design and evaluation methods; Accessibility design and evaluation methods;

Keywords

Accessibility; usability; senescent users; social network

1. INTRODUCTION

The term senescent comes from biological sciences [6]. It means the process of getting old [22]. The senescence is the natural human process of getting old. Individuals that are in this process are called senescent. In this study, we consider people with more than 60 years old a senescent.

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The population of Brazilian senescent was 22.9 million in 2014. It and can be three times higher in 2035, reaching 88 million people [18]. In year 2000 1.6 million senescent (17.9% of senescent population) lived alone at Brazil[17]. This number is growing very quickly. In 2012, the number rose to 3.7 million senescent living alone at Brazil [18].

A process of disengagement occurs during the aging process. [8] show this process as the process "*in which many of the relationships between a person and the other members of society are broken and those that remain are modified qualitatively*".

The sum of these facts makes the senescent social life smaller and leaner. It turns life of senescent more difficult because of the distance between the senescent caregivers, family and even himself. That distance can bring emotional and psychological problems to the person.

According to [11], the technology can be a possibility to reverse this scenario. He shows technology as something of great value to this public communication with their relatives - besides its contribution for distance help care. With this in mind, we researched about the senescent interest in using of a social network. And the interest exists. However, they face difficulties on using the present options, such as *WhatsApp* and *Facebook*.

We believe that a social network focused on senescent users can enhance the digital inclusion of these people, helping them to keep in touch with family, relatives and caregivers. The purpose of this study is to develop a new social network, named Florch, aiming senescent users. We developed a prototype of high fidelity and investigated whether it's accessibility is better than the accessibility of a current popular social network. We used the *WhatsApp* application as an example of current social network. Our study is based on the perceptions of [9] about the importance of studding the interaction of older people with new technologies, and on [3] which shows that the guidelines of WCAG (Web Content Accessibility Guidelines) [1] are important, but not sufficient for elderly people.

To develop the new prototype we conducted a User Centered Design [27] and we included think aloud tests, cognitive walk-through and heuristic evaluation to evaluate the new prototype. We used a Hierarchical Task Analysis (HTA) [28] to compare the new social network with *WhatsApp*.

[1] http://www.w3.org/WAI/intro/wcag

Our results are a new social network prototype for senescent users. The comparison of Florch's HTA against the *WhatsApp*'s HTA showed that our prototype has fewer and simpler tasks, as expected. We believe that our findings provide new options to the literature on how to promote the digital inclusion of senescent users.

The following sections of this paper show a literature review, methods and materials of this study, our results, discussions on our results and conclusions.

2. SOCIAL NETWORKS FOR SENESCENT USERS

Technologies that already implement social network focused on senescent users are only a few yet. At the best of our knowledge "famatic" [13], the iPad for senescent [2] and "cubigo" [7] are the most popular social networks focused on senescent users nowadays.

"famatic" [13] is a social network made in Netherlands. It works with a specific tablet. This tabled was also made for senescent users. The purpose of "famatic" is to join different generations with the technology. The creators of "famatic" believe that technology is separating different generations nowadays.

Apple and IBM have been working together for an iPad model for senescent users [5]. This project has been done specifically for senescent users at Japan. They intend to keep classical features as iMessage and Facetime. However, the public information about this project is still reduced.

"cubigo" [7] has been developed at Belgium. The portal "cubigo" [7] presents in the "cubes", features made specifically for senescent users. It is a multi-platform social network, with many features as: list of contacts, text messages, calendar and text notes.

The social networks provide many characteristics and have been developed specially to elderly. In order to investigate the challenges of Brazilian older people, we designed an specific social network to share photos among elderly. We would like to observe the issues regarding specific aspects of their interaction.

3. METHODS AND MATERIAL

The goal of this study was to create a new social network for senescent users share photos. We named the new social network as Florch. We applied a User Centred Design to develop a high fidelity prototype for this new social network. The steps of process development were:

1. To understand the users.
2. To compare *WhatsApp* and Florch tasks based on Hierarchical Task Analysis (HTA).
3. To choose witch usability criteria to prioritize.
4. Prototyping.
5. Evaluating the prototype.

3.1 Understanding the users

We applied a questionnaire[2] to 22 Brazilians, between 56 and 82 years (with an average age equal to 69 years), from individuals with incomplete primary education to individuals with complete doctorates. Nine (9) volunteers were man and thirteen (13) were woman. Those users accepted to take part in this study as volunteers, accepting a consent form attesting it.

[2]https://www.dropbox.com/s/ei12vp4l115hbyi/TestePiloto.pdf?dl=0

3.2 Hierarchical Task Analysis (HTA): WhatsApp in comparison with Florch

WhatsApp is the system of photo sharing that the volunteers (senescent users) use the most (63.6% of the volunteers use it). For this reason, we compared the tasks of *WhatsApp* with the tasks of Florch.

We applied HTA to compare both systems. We considered specific tasks for this HTA. Five tasks of *WhatsApp* were evaluated and designed for Florch:

task 1. Add a contact.

task 2. Remove a contact.

task 3. Visualize a photo.

task 4. Comment a photo.

task 5. Send a photo.

3.3 Prioritizing usability criteria

We chose to focus on three specific usability principles because it is known as very difficult to focus on every principle. We deeply studied the usability principles we chose to focus. These principles were: Predictability, Substitutivity and Observability [4]. The choice was made mainly because we had in mind the understanding of the senescent users, gathered in the previous step.

We focused on Predictability because we wanted a simple and predictable interface for the senescent. Predictability is a specific principle of Learnability. We need a system that make the user to predict the result of your action in the system.

We focused on Substitutivity because we wanted that the users could choose how they want to comment the photo: audio or text. Substitutivity is a specific principle of Flexibility. It is important for the user to feel comfortable to use the system as he/she prefers, according to what is familiar and pleasurable to him/her.

We chose to focus on Observability because it is important that the user knows what is happening in the system by it's interface. It is important that the user feels he/she is doing the right thing in the system. Observability is a specific principle of Rubustness.

3.4 Prototyping

3.4.1 Functional requirements

We listed the functional requirements of Florch based on common features of popular social network as *Facebook* and *WhatsApp*. After an analysis, we have specified the following 14 functional requirements to be provided by Florch:

1. Log into the system.
2. Search a contact.
3. Add a contact.
4. Remove a contact.

5. Visualize a photo.
6. Comment a photo using text.
7. Edit the text comment of a photo.
8. Read a comment of a photo.
9. Comment a photo using audio.
10. Listen to an audio comment in a photo.
11. Delete a comment (audio or text).
12. Send a photo (to share it!).
13. Remove a photo.
14. Log out of the system.

We decided to develop Florch for mobile phones because the most part of the volunteers use it instead of tablets. We designed the Florch for a mobile systems of 7 inch, to be in accordance with the results of de Motti, Vigouroux e Gorce (2013) [23].

Figure 1 shows some of the screens of the final prototype of Florch. We used the software Justimind [19] to produce the final prototype.

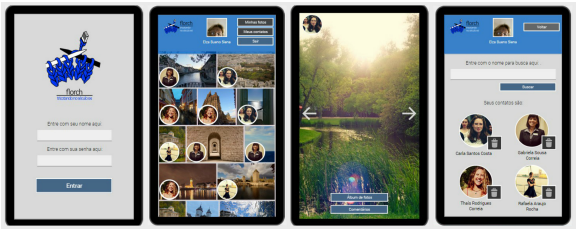

Figure 1: Screens from the implemented prototype.

Kienitz [20] kindly provided the photos of landscape to our prototype. The other images have Creative Commons [1] licence accessed via Flickr [14]. We used Fake Name Generator [12] and Lorem Ipsum [21] to create examples of names and texts.

3.5 Evaluating

3.5.1 *Cognitive Walkthrough*

Three evaluators conducted the Cognitive Walkthrough on Florch. They were three volunteers. These evaluators had familiarity with social network as *Facebook*, *WhatsApp* and *Instagram*. They also had familiarity with mobile device as smartphones. All these evaluators had previous knowledge about senescent users.

In the first phase of the Cognitive Walkthrough we provide the evaluators with explanations about Florch and it's profile of users. In sequence, we gave the prototype to the evaluators. At this phase they were able to perform the evaluation. We ask the evaluators to follow the same script to conduct the evaluation. In addition, we asked them to answer a questionnaire. The mean time of evaluation was 23.7 minutes.

3.5.2 *Heuristic Evaluation*

We chose to apply Heuristic Evaluation because it has been widely used to evaluate usability of mobile devices [10].

Three evaluators conducted the Heuristic Evaluation. They were volunteer in our study. The evaluators were experts in usability with a bachelor degree in Computer Science area and at least two years of research experience in usability area.

First, we provided the evaluators with an explanation about Florch and it's profile of users. In sequence, they used the ten heuristics of Nielsen [25] to evaluate the system. The mean time of evaluation was 75.7 minutes.

3.5.3 *Think Aloud*

Three real users took part in Think Aloud tests as volunteers. The three users were students of the São Carlos Educational Foundation (FESC - *Fundação Educacional de São Carlos*) at the Unity Open to Elderly (UATI - *Unidade Aberta da Terceira Idade*). The age of the users were 67, 69 and 71 years old. One user were woman and two were men. The mean time of the tests was 16 minutes.

One of the authors conducted the tests. First, she configured a mobile device. In sequence, she gave the mobile device to each user, one at a time, and asked them to perform the following ten (10) tasks:

1. Log into the system.
2. Visualize a photo in full screen mode.
3. Comment a photo using text.
4. Comment a photo using audio.
5. Edit a specific comment of a photo.
6. Remove a comment.
7. Add a specific contact.
8. Remove a specific contact.
9. Send a new photo.
10. Log out of the system.

In order to better understand the senescent interactions, we decided to record the following metrics of the performance of the users during the tests:

- Number of errors of the user - we have named "errors" the mistakes that users presented;
- Number of tasks executed with success in comparison with the number of tasks we purposed them to execute;
- Number of favorable feedback and critics;
- Number of times that the user diverted from the goal of the task;
- Number of times that the user ask for help to use the system.

4. RESULTS AND DISCUSSION

Studies about how to empower the digital inclusion of senescent users are becoming more important. The number of senescent in Brazil tend to be three times greater in twenty years. The digital inclusion of senescent users is still a challenge in the literature. It can become even more challenging in the next twenty years. We purposed to develop a new social network (named Florch) aiming senescent users. We believe that a new social network can increase the digital inclusion of these citizens.

The first step of the development was to understand the users via a questionnaire. In sequence, we conducted three different evaluations on Florch: Cognitive Walkthrough, Think Aloud tests and Heuristic Evaluation. The following subsections present the results of these evaluations.

4.1 Understanding users

The results of the questionnaires showed that 86.4% of the volunteers have a mobile device. In addition, 54.5% of the volunteers said they access Internet everyday.

Figure 2 shows data on how the users usually visualize photos. 54.5% of the volunteers use paper to see photos. 59.1% of the volunteers use a computer device to see photos. 36.4% of the volunteers use a mobile phone to see photos. 13.6% of the volunteers use a tablet to see photos. These numbers can indicate that digital photos have been disseminated in an irreversible way. We think that the mobile phones have achieved an increasingly acceptance by the people in all the ages.

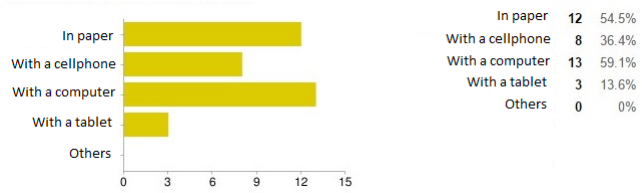

Figure 2: Ways that end users "view" photos.

We decided to develop the project for mobile phone devices because it is device that our volunteers most use to share photos, according to Figure 3. It also shows how users share their photos.

We believe that the photo sharing is more capable to promote communication among elderly than the other activities. More than 72.7% of the volunteers share their photos with relatives and friends. And 63.6% of the volunteers use *WhatsApp* to share photos with a mobile phone.

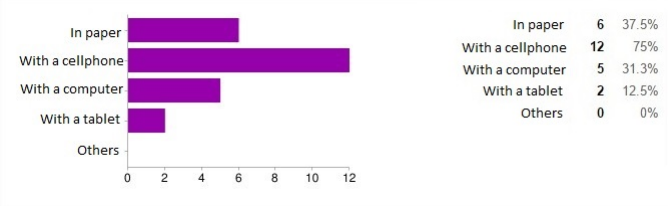

Figure 3: Ways that end users "share" photos.

Figure 4 shows which social network the volunteers use. The majority (72.7% of the volunteers) use some social network. 63.6% of the volunteers use WhatsApp. 45.4% of the volunteers use Facebook.

27.3% do not use social network because of different reasons as: do not know the social networks, fear of losing privacy, do not agree with privacy policies, consider the timeline as confuse (in case of *Facebook*), do not have time, fear of defaming themselves, do not know how to use, and do not have someone to teach them how to use.

Table 1: Number of tasks per system

Task	WhatsApp	Florch
Add a contact	6	6
Remove a contact	12	6
Visualize a photo	9	2
Comment a photo	8	5
Send a photo	12	5

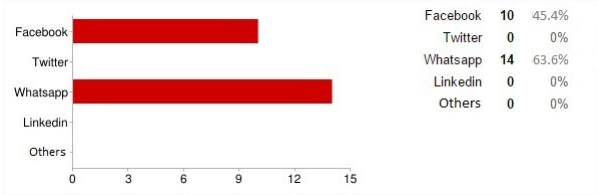

Figure 4: Social Networks that end users use.

4.2 HTA: WhatsApp in comparison with Florch

Table 1 shows the summary of results from the HTA of *WhatsApp* and Florch. The table shows that the number of operations for a task using Florch is always less than *WhatsApp* number of operations. Specially, Florch presents 50% less operations to remove a contact, 78% less operations to visualize a photo, and 58.3% less operations to send a photo.

As an example, Figure 5 shows the HTA of the function "Visualize a photo" of WhatsApp. Figure 6 shows the HTA of the same function in Florch.

Based on the results of HTA we can assume that Florch is easier to send, to visualize and comment photos in comparison to *WhatsApp*, which are the main features of sharing photos.

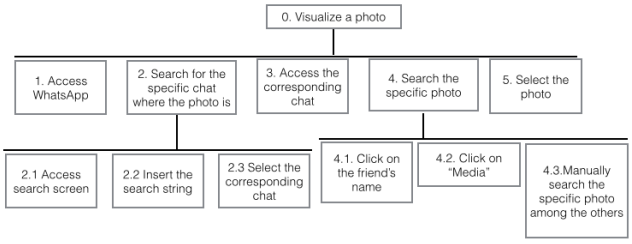

Figure 5: HTA of the function "Visualize a photo" of WhatsApp.

The results of this HTA have demonstrated that Florch would be feasible, and the development of a prototype for a new social network, with an easier and shorter HTA, would attend to senescent expectations.

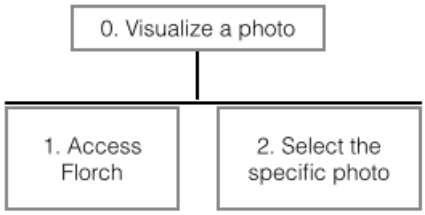

Figure 6: HTA of the function "Visualize a photo" of Florch.

Table 2: Problems found by evaluators during Cognitive Walkthrough in conformity with the heuristics of Nielsen

Problem	Heuristic	Degree of Severity
Lack of icon in the buttons, describing it's actions.	Match between system and the real world	*Cosmetic*
Small size of the font to write a comment.	Aesthetic and minimalist design	*Major*
The function "Expand photo" is not referenced in any place.	Match between system and the real world	*Minor*
The icon of a pencil does not represent well the function to edit a comment.	Match between system and the real world	*Minor*
The function "Add a contact" is not well visible.	Match between system and the real world	*Catastrophic*
The message to confirm action after adding or removing a contact disrupts the simplicity of the task.	Visibility of system status	*Cosmetic*

We cannot ensure that the difficulties that the elderly had in our studies will be the same that elderly people will have in twenty years from now. However, shorter HTA can be fundamental to the development of usable software for senescent users because of their tax of memory decreasing. We believe this indicate to the literature the existence of market opportunities to invest in development of better social networks for senescent users.

4.3 Cognitive Walkthrough

We organized the results of Cognitive Walkthrough evaluation in Florch using the heuristics of Nielsen [25] to summarize it. And we allocated the degree of severity as made up in the literature [26, 16]. Table 2 shows the summarized results of the cognitive Walkthrough evaluation.

Regarding to these usability problems gathered from Cognitive Walkthrough, there are strong matters related to font size and visibility of a function, that are specially relevant for senescent people. Thus, after the evaluation, the evaluators suggest to:

- Increase the visualization of photo at the first access. An animation could help to explain the use of the system.
- Put a feedback as "editing" while the user tries to edit a comment.

Table 3: Number of tasks executed with success in comparison with the number of tasks we purposed them to execute

User	Number of tasks executed with success
User 1	11/11
User 2	10/11
User 3	7/11

Table 5: Number of times a user strayed from the task goal.

User	Number of times a user strayed from the task goal
User 1	1
User 2	0
User 3	2

4.4 Think Aloud Tests

We organized the results of the Think Aloud test in tables and graphics. Table 3 shows the number of tasks executed with success in comparison with the number of tasks we purposed them to execute. We could observe that users have accomplished more than 60% of the goals.

Table 4 shows the comparison between the number of times each user had made a mistake and the number of times the respective user asked for help. From these data we observe that user 1 asked for help every time he/she made a mistake. In contrast, user 2 only asked for help in two of the five times he/she made an error, even he/she having the highest number of errors. Future studies must explore the behavior of user 2 in order to discover what made him/her take the decision of not asking for help.

The users also provided us with favorable and critical comments about Florch. The most critical comments to the system were:

- It's unpleasant having to click the "back button" repeatedly to return to the home screen, when you leave the comments screen.
- The way to find how to do the tasks is complicated.
- Find some buttons is hard.

The favorable comments were:

- Buttons have good size.
- It's possible to learn how to use the system only reading it.
- The system is easy to use.

4.5 Heuristic Evaluation

The Heuristic Evaluation provided a list of 51 usability problems. Figure 7 shows the number of usability problems found by the Heuristic Evaluation in accordance to the heuristic that each problem affected.

Table 4: Comparison between the number of times each user had made a mistake and the number of times the respective user asked for help.

	User 1		User 2		User 3	
Task	**Number of errors**	**Times he/she asked for help**	**Number of errors**	**Times he/she asked for help**	**Number of errors**	**Times he/she asked for help**
1. Log into the system.	0	0	1	0	0	0
2. Visualise a photo in full screen mode.	0	0	0	0	-	-
3. Comment a photo using text.	0	0	1	0	0	1
4. Comment a photo using audio.	0	0	3	1	-	-
5. Edit a specific comment of a photo.	2	1	2	0	0	0
6. Remove a comment.	1	1	0	0	0	0
7. Add a specific contact.	0	0	0	0	1	1
8. Remove a specific contact.	0	0	0	0	2	0
9. Send a new photo.	1	1	7	0	-	-
10. Log out of the system.	0	0	0	1	-	-

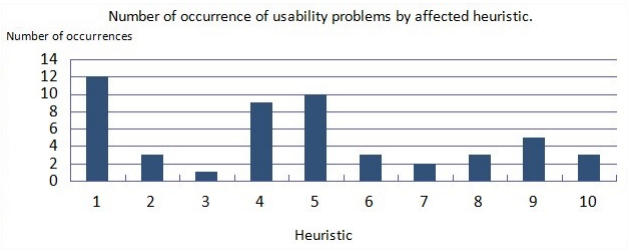

Figure 7: Number of occurrence of usability problems by affected heuristic.

It is worth to notice that the most usability problems have occurred, regarding to the following Nielsen [25] heuristics:

Heuristic 1: *Visibility of system status* - the system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

Heuristic 4: *Consistency and standards* - users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

Heuristic 5: *Error prevention* - even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

Figure 8 shows the number of occurrence of each degree of severity among the usability problems reported by the Heuristic Evaluation. The numbers of degrees of severity represent the following meanings: (0) no problem; (1) cosmetic problem; (2) minor usability problem; (3) major usability problem; and (4) usability catastrophe.

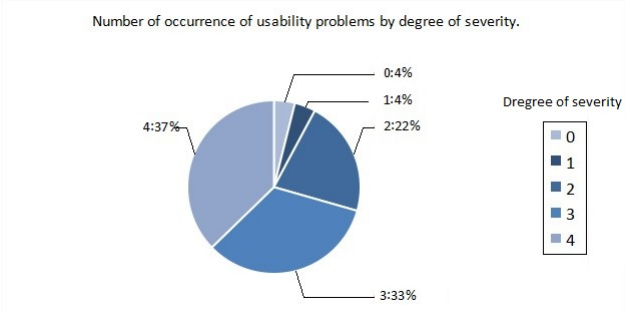

Figure 8: Number of occurrence of usability problems by degree of severity.

We found many usability problems of major and catastrophic severity (3 and 4) with the Heuristic Evaluation. They were more than 70% of all reported problems. Eighteen (18) usability problems were of severity 3. Twenty (20) usability problems were of severity 4. These results mean that our prototype still have many points to be corrected.

We followed the User Centered Design (UCD) process and based the development on scientific studies [24] e [23], but our results of the Heuristic Evaluation are still not as expected. We believe that it shows how challenging it is to develop software for senescent users. This can indicate that the traditional UCD process need to be adapted to the development of software for senescent users.

Despite the number of usability problems of high severity found by the Heuristic Evaluation, users completed 84.54% of tasks during the think aloud test. The users did not need help in 40% of the tasks. In 44.54% of the times the users had some difficulty, asked for help, and did not waive of

doing the task. Only in 15.46% of time the users waived of doing some task because of some difficulty. We believe that younger profile of users would have waived more times.

We also believe that this indicate that the loneliness context of the senescent may have motivated them to keep trying, which can be associated with the affirmations of [8]. We also believe that the learnability of Florch is well developed. However, our results are still not sufficient to affirm this. We suggest future studies to investigate these measures considering a larger sample of users.

4.6 Summarizing the results of all evaluations

We used Grounded Theory [15] to summarize possible solutions for all usability problems from all evaluations we applied. The sample of volunteers that took part in this study was not sufficient to allow other methods.

We believe that all usability problems could be solved by:

- Increase the size and contrast of the fonts and buttons of the system.
- Create a tutorial for beginners to learn how to use the system. This tutorial must focus on the features: zoom, fullscreen and help for the users to understand that he/she can slide up the screen to see more content.
- Modify the buttons of removing and editing comments. The pencil icon was not sufficiently intuitive.
- Highlight the feature to add a contact. The magnifier glass icon confused the users.
- Develop a clear way to comment photos using audio. Animations about the system status (continuous feedback) can possibly help to solve this.
- Develop undo buttons that take the user to the very last state of the system.
- Display data about date of the comments.
- Display name of users in the comments.
- Increase the difference between buttons "Yes" and "No".
- Change the button "Photo Album" to "Home" because it was not intuitive to users.
- Create a feature to visualize a photo in fullscreen before sending it to the system.
- Put the feature to add/send new photo at less steps from the beginning of users' interaction. Highlight it in earlier steps at the HTA.

After the UCD process, with senescent, we have learned that their concerns are related to be engaged with technological resources. They want to be joined with all the people they like. They also believe that IT could help them on this matter. Other characteristics of their interactions could be evidenced: they prefer simpler tasks and quicker feedbacks to be aware of their actions; and shorter HTA to contribute to their limitations of memory. Future studies can replicate our method in order to validate these findings.

5. CONCLUSION

The population of senescent people is increasing in large scales at Brazil. The challenge of promoting digital inclusion for these people can be even greater in twenty years. The Brazilian government expect to have more than three times the number of senescent citizens in 2035. This study was aimed to develop a new social network (Florch) focused on the profile of senescent users in order to contribute with the digital inclusion of these people.

A HTA showed that social networks more usable for senescent users are possible. One of the most popular social network among senescent users nowadays still have many steps to complete simple tasks considering features related to share photos. Our results showed indications that to develop software for senescent users developers must aim the shortest possible HTAs. This indicates to the literature an opportunity to invest in development of more usable social network for senescent users.

We conducted a User Centered Design to develop a prototype of Florch. Evaluations of this prototype show that many major usability problems still remains to be solved. However, test with real users showed that in most times users did not waive of completing a task because of major usability problems. This can indicate that senescent users tend to have a special motivation to complete difficult tasks. This can be due to their loneliness and need for communication, which would be in accordance with the affirmations of [8].

The UCD process with senescent allowed us to learn that senescent concerns are very related to be engaged with technological resources. Older people believe that new technologies can help them on loneliness challenges.

Future work is intended to analyze additional characteristics of senescent interaction with new technologies as: simpler tasks; quicker feedbacks; and shorter HTA. We believe that these characteristics can be related to the decreasing of memory capability of the senescence process [9].

More studies should be done based on our method in order to generalize the expectations and difficulties involved in elderly interaction with new technologies. These studies are needed because technological devices and applications keep on innovative development.

6. ACKNOWLEDGMENTS

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